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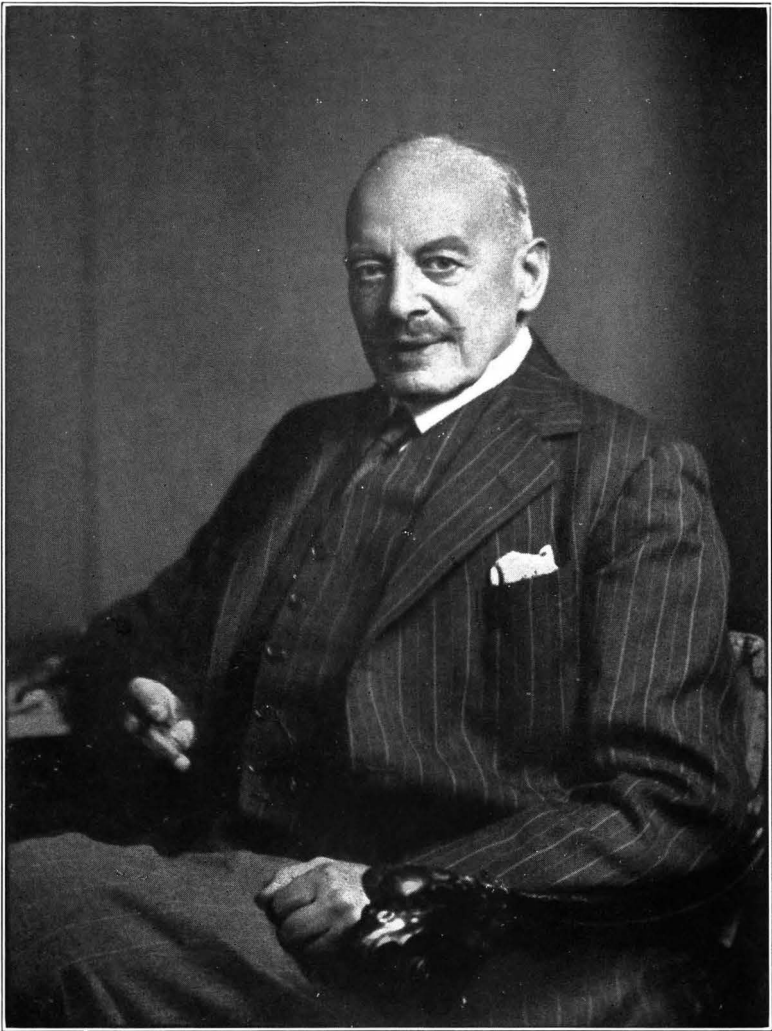
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JOURNAL OF THE TRANSACTIONS  
OF  
THE VICTORIA INSTITUTE

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VOL. LXXIII

1941



LOUIS EDMUND WOOD, M.B., D.P.H., F.R.S.A., VICE-PRESIDENT  
AND MEMBER OF COUNCIL.

BORN APRIL 21ST, 1857—DIED FEBRUARY 10TH, 1941.

For twenty years, full of quiet, unobtrusive labours, in singleness of mind and rare gentleness of disposition, DR. LOUIS WOOD served *The Victoria Institute*, beloved of his colleagues and of all who knew him.

JOURNAL OF  
THE TRANSACTIONS  
OF  
The Victoria Institute  
OR  
Philosophical Society of Great Britain

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VOL. LXXIII

1941



LONDON:

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**\*\* The object of the Institute being to investigate, it must not be held to endorse the various views expressed either in the papers or in the discussions.**

# VICTORIA INSTITUTE

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REPORT OF THE COUNCIL FOR THE YEAR 1940.

READ AT THE

ANNUAL GENERAL MEETING, MAY 26TH, 1941.

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## 1. *Progress of the Institute.*

Presenting the Seventy-Third Annual Report the Council first humbly record their gratitude to Almighty God for deliverance from damage of any kind to Institute property. Difficulties have inevitably been many and formidable; nevertheless, as the published Transactions show, it has been possible to put through in its entirety the programme envisaged for the Session, and we have to thank all concerned—authors, contributors and hearers alike—for their sustained interest in trying circumstances.

During the year under review important steps have been taken to bridge the gap between existing membership and the new generation of young professional and business men and women and university students. These measures are meeting with success sufficient to yield good promise of effective continuance of the Society's work.

## 2. *Meetings.*

War conditions having rendered it impracticable to hold ordinary meetings in January and February, the first four papers of the session 1940 were circulated to subscribers and discussed by written communication. Six ordinary meetings were then held. In all ten papers were published as follow :—

“The Influence on Human Conduct and Belief of Certain Scientific Hypotheses,” by SIR AMBROSE FLEMING, D.Sc., F.R.S. (President).

“Some Infallible Proofs of Our Lord's Resurrection,” by Rev. Principal H. S. CURR, M.A., B.D., B.Litt.

“Genesis and Pagan Cosmogonies, by Prof. EDWARD McCRADY, D.D.



- “The Wholesomeness of Christianity as Illustrated by British History,” by the Rev. P. H. SCOTT, B.D.
- “Deuteronomy. Its Antiquity and Mosaic Authorship,” by Chief Rabbi J. H. HERTZ, Ph.D., D.Litt. (being the Dr. A. T. Schofield Memorial Paper 1940).  
Lieut.-Col. F. A. Molony, C.B.E., in the Chair.
- “The Psychological Approach to Christ’s Teaching in the Gospels,” by the Rev. L. WYATT LANG, M.A.  
Wilson E. Leslie, Esq., in the Chair.
- “The Wholesomeness of Christianity as Illustrated by Recent Events in India,” by the Rev. G. F. CRANSWICK, B.A.  
Professor G. H. Langley, M.A., in the Chair.
- “The Stones Cry Out. Scriptural Confirmations often Overlooked,” by Rev. T. W. FAWTHROP, D.D., D.Litt., F.R.G.S.  
Sir Frederick Kenyon, K.C.B., G.B.E., C.B., D.Litt., LL.D., in the Chair.
- “On New Evidence Relating to the Reliability of Testimony,” by R. E. D. CLARK, Esq., M.A., Ph.D.  
Douglas Dewar, Esq., B.A., F.Z.S., in the Chair.
- “The Unity of Isaiah,” by the Rev. W. A. WORDSWORTH, M.A.  
The Rev. C. W. Cooper, F.G.S., in the Chair.

### 3. Council and Officers.

The following is a list of the Council and Officers for the year 1940 :—

#### President.

Sir Ambrose Fleming, M.A., D.Sc., F.R.S.

#### Vice-Presidents.

(Limited to seven.)

Lieut.-Colonel F. A. Moloney, O.B.E., late R.E.  
A. W. Oke, Esq., M.A., LL.M., F.G.S.  
Prof. A. Rendle Short, M.B., B.S., B.Sc., F.R.C.S.  
Rev. H. Temple Wills, M.A., B.Sc.  
Sir Charles Marston, J.P., F.S.A.

#### Trustees.

Alfred W. Oke, Esq., B.A., LL.M., F.G.S.  
William C. Edwards, Esq.  
Robert E. D. Clark, Esq., M.A., Ph.D.

**Council.**

(Limited to Twenty-four.)

*(In Order of Original Election.)*

|   |  |
|---|--|
| A. W. Oke, Esq., B.A., LL.M., F.G.S.              | Lieut.-Col. L. M. Davies, M.A., Ph.D., late R.A., F.G.S., F.R.S.E. |
| Lieut.-Col. F. A. Molony, O.B.E., late R.E.       | Wilson E. Leslie, Esq.   |
| William C. Edwards, Esq.                          | Rev. Charles W. Cooper, F.G.S.                                     |
| Louis E. Wood, Esq., M.B., D.P.H., F.R.S.A.       | Percy O. Ruoff, Esq.   |
| Lieut.-Col. T. C. Skinner, late R.E., F.R. Met.S. | Rev. W. J. Downes, M.A., B.D.                                      |
| Rev. Principal H. S. Curr, M.A., B.D., B.Litt.    | Robert E. D. Clark, Esq., M.A., Ph.D.                              |
| Douglas Dewar, Esq., B.A., F.Z.S.                 | Group Captain P. J. Wiseman, R.A.F.                                |
|   | W. H. Molesworth, Esq., C.E.                                       |

**Honorary Officers.**

W. H. Molesworth, Esq., C.E., *Treasurer.*  
 Lieut.-Col. T. C. Skinner, late R.E., F.R. Met.S., *Secy.*  
 Rev. Principal H. S. Curr, M.A., B.D., B.Litt., *Editor.*  
 Lieut.-Col. F. A. Molony, O.B.E., late R.E., *Papers Secretary.*

**Auditor.**E. Luff-Smith, Esq., *Incorporated Accountant.***Assistant Secretary.**

Mrs. L. L. M. E. Malcolm-Ellis.

**4. Election of Officers.**

In accordance with the Rules the following Members of the Council retire by rotation: The Rev. Principal H. S. Curr, M.A., B.D., B.Litt., Rev. W. J. Downes, M.A., B.D., R. E. D. Clark, Esq., M.A., Ph.D. Principal Curr and Dr. Clark offer (and are nominated by the Council) for re-election.

**5. Obituary.**

The Council regret to announce the deaths of the following Fellows, Members and Associates:—

Miss Georgina Biddulph, Ven. Archdeacon James Adams, Roland Crook, Esq., Lieut.-Col. Hope Biddulph, Rev. R. C. Oake, Captain R. T. F. Carr-Gregg, G. H. Johnson, Esq., Lieut.-Col. A. C. MacDonald, Dr. L. G. H. Sarsfield, Ven. Archdeacon G. Smith Winter, Sir Cecil Harrison.

**6. New Fellows, Members and Associates.**

The following are the names of new Fellows, Members and Associates up to the end of 1940:—

**FELLOWS:** Colonel the Rev. F. J. Miles, D.S.O., O.B.E., V.D., Rev. George Denyer, S. T. S. Martins, Esq., F.R.S.A., F.R.G.S., H. H. Nathanson, Esq., John A. Macgregor, Esq., P. F. W. Parsons, Esq., John H. Parker, Esq., M.I.E.E., Edgar H. Betts, Esq., B.Sc. (also from transfer from Member), Major H. B. Clarke, R.E. (retd.), R. E. D. Clark, Esq., M.A., Ph.D.

**MEMBERS:** Herbert W. Butt, Esq., B.A., Rev. Phillip H. Scott, B.D., B. B. Knopp, Esq., James Wilson, Esq., J. G. S. Thomas, Esq., M.A., D.Sc., Miss Bertha Molesworth, Albert O. Hudson, Esq., Albert G. Tilney, Esq., B.A., Dr. A. Hanton, M.B., Ch.B., Chas. J. Young, Esq. (from transfer from Associate), Arthur J. Stubbs, Esq., Ven. Archdeacon W. S. Moule.

ASSOCIATES : T. H. Anderson, Esq., B.Sc., George de Boer, Esq., Rev. George B. Molefe, M.A., Rev. Leon Lamb Morris, B.Sc., Th.L., Sydney N. Thornton, Esq., Rev. A. J. S. Mortimer Lowers, L.Th.

LIBRARY ASSOCIATES : The Jewish National University Library (Jerusalem).

ADDITIONAL CORRESPONDENT : Rev. Isaac Hartill, M.A., D.Litt., D.D.

### 7. *Membership.*

|                          |     |     |     |     |
|--------------------------|-----|-----|-----|-----|
| Life Fellows             | ... | ... | ... | 18  |
| Annual Fellows           | ... | ... | ... | 79  |
| Life Members             | ... | ... | ... | 35  |
| Annual Members           | ... | ... | ... | 245 |
| Associates               | ... | ... | ... | 33  |
| Library Associates       | ... | ... | ... | 41  |
| Total Nominal Membership |     |     |     | 451 |

### 8. *Donations.*

Constructor Lieut. W. F. Spanner, R.C.N.C., 4s. 6d. ; Rev. H. T. Rush, £1 17s. ; J. C. Scott, Esq., 8s. ; Miss A. C. Carpmael, £1 ; Brian P. Sutherland, Esq., £5 ; Dr. A. P. Moore-Anderson, £3 3s. ; Dr. Louis Wood, £7 ; W. H. Molesworth, Esq., £2 2s. ; A. Cowper Field, Esq., 10s. 6d. ; Miss Lilian Ovens, 5s. 6d. ; R. S. Timberlake, Esq., £1 ; F. R. Fry, Esq., 10s. 6d. ; Douglas Dewar, Esq., £1 1s. ; Principal H. S. Curr, £1 1s. ; E. Molony, Esq., £1 ; Brig.-Gen. H. Biddulph, £2 ; A. Norris, Esq., 3s. ; Lieut.-Col. L. M. Davies, £1 ; B. B. Knopp, Esq., 15s. ; Group-Capt. P. J. Wiseman, £2 2s. ; Albert Eagle, Esq., £1 1s. ; Colonel F. C. Molesworth, 10s. ; E. Gordon Lee, Esq., £1 ; V. C. H. Millard, Esq., £1 ; Rev. H. R. A. Philp, 3s. ; J. W. Laing, Esq., £10 ; H. H. Goodwin, Esq., 4s. ; Mrs. C. M. Craig, £10. Total, £56 1s.

### 9. *Finance.*

With regard to finance there is not much of importance to record. The promising drive for rapid increase of membership by broadcast of Institute literature having been interrupted by the war, further enrolments have been on a much more modest scale, while recruitment of younger men and women, so essential for the Society's permanence, being mostly on a basis of minimum subscription, cannot be expected to markedly affect the funds for some years to come.

It is a matter for thankfulness, therefore, that in these circumstances we are able to present the statement of accounts, the crisis having served to bring out the splendid loyalty of a considerable body of our membership who appreciate the value of the Institute and have come to its aid with generous donations. The Council feel they can face the future with confidence and good hope.

A. W. OKE,  
*Chairman.*

## BALANCE SHEET, 31st DECEMBER, 1940.

| LIABILITIES.                                    |     |    |          | ASSETS.                                 |     |    |           |
|---|-----|----|----------|---|-----|----|-----------|
|   | £   | s. | d.       |   | £   | s. | d.        |
| SUBSCRIPTIONS PAID IN ADVANCE ....              |     |    | 21 15 6  | CASH AT BANK :—                         |     |    |           |
| SUNDRY CREDITORS FOR EXPENSES ....              |     |    | 169 2 7  | Current Account ....                    | 41  | 9  | 7         |
| LIFE SUBSCRIPTIONS :—                           |     |    |          | “Gunning” Prize Account ....            | 49  | 7  | 4         |
| Balance at 1st January, 1940 ....               | 375 | 0  | 0        | “Langhorne Orchard” Prize Account       | 22  | 5  | 2         |
| Less Amount carried to Income and               |     |    |          | “Craig” Memorial Trust ....             | 8   | 14 | 10        |
| Expenditure Account ....                        | 15  | 0  | 0        |   |     |    | 121 16 11 |
|   |     |    | 360 0 0  | CASH AND STAMPS IN HAND ....            |     |    | 1 7 9     |
| “GUNNING” FUND ( <i>per contra</i> ) ....       |     |    | 508 0 0  | SUBSCRIPTIONS IN ARREAR :—              |     |    |           |
| Balance at 1st January, 1940 ....               | 84  | 1  | 0        | Estimated to produce ....               |     |    | 36 4 6    |
| Add Dividends and Interest received             | 23  | 14 | 4        | INVESTMENTS :—                          |     |    |           |
|   |     |    | 107 15 4 | “Gunning” Fund :—                       |     |    |           |
| Deduct Prize and Expenses ....                  | 58  | 8  | 0        | £673 3½ per cent. Conversion Stock at   |     |    |           |
|   |     |    | 49 7 4   | cost ....                               | 508 | 0  | 0         |
| “LANGHORNE ORCHARD” FUND ( <i>per</i>           |     |    |          | “Langhorne Orchard” Fund :—             |     |    |           |
| <i>contra</i> ) ....                            |     |    | 200 0 0  | £258 18s. 3½ per cent. Conversion Stock |     |    |           |
| Balance at 1st January, 1940 ....               | 13  | 2  | 11       | at cost ....                            | 200 | 0  | 0         |
| Add Dividends and interest received             | 9   | 2  | 3        | “Schofield” Memorial Fund :—            |     |    |           |
|   |     |    | 22 5 2   | £378 14s. 6d. 2½ per cent. Consolidated |     |    |           |
| “SCHOFIELD” MEMORIAL FUND ( <i>per contra</i> ) |     |    | 220 0 0  | Stock at cost ....                      | 220 | 0  | 0         |
| Balance at 1st January, 1940 ....               | 2   | 16 | 8        | “Craig” Memorial Trust Fund :—          |     |    |           |
| Add Dividends received ....                     | 9   | 9  | 4        | £200 Merchant’s Trust Limited 4 per     |     |    |           |
| Donation ....                                   | 0   | 10 | 8        | cent. Perpetual Debenture Stock         |     |    |           |
|   |     |    | 12 16 8  | at cost ....                            | 209 | 9  | 0         |
| Deduct :—                                       |     |    |          | £180 Trust Union Limited 4 per cent.    |     |    |           |
| Prize ....                                      | 10  | 0  | 0        | Debenture Stock at cost ....            | 188 | 11 | 6         |
|   |     |    | 2 16 8   |   |     |    | 1,326 0 6 |

"CRAIG" MEMORIAL TRUST FUND (*per contra*)

400 0 0

INCOME AND EXPENDITURE ACCOUNT:—

Balance at 1st January, 1940 .... 468 11 1

Add Excess of Expenditure over  
Income for the year 1940 .... 65 7 6

533 18 7

*Deduct:—*

Donations received ..... 56 1 0

Gunning Fund .... 10 0 0

66 1 0

467 17 7

£1,953 7 3

£1,953 7 3

I report to the members of The Victoria Institute that I have audited the foregoing Balance Sheet dated 31st December, 1940, and have obtained all the information and explanations I have required. I have verified the Cash Balances and Investments. No valuation of the Library, Furniture or Tracts in hand has been taken. In my opinion the Balance Sheet is properly drawn up so as to exhibit a true and correct view of the affairs of the Institute according to the best of my information and the explanations given to me and as shown by the books of the Institute. Rectification of the Craig Memorial Trust Investments is proceeding.

143-145, Abbey House,  
Victoria Street, Westminster,  
London, S.W.1.

8th May, 1941.

E. LUFF-SMITH,  
*Incorporated Accountant.*

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST DECEMBER, 1940.

| EXPENDITURE.                         |      |      |      | INCOME.     |          |          |  |          |          |      |     |    |    |    |
|--------------------------------------|------|------|------|-------------|----------|----------|--|----------|----------|------|-----|----|----|----|
|                                      |      |      |      | £           | s.       | d.       |  |          |          |      |     |    |    |    |
|                                      |      |      |      | £           | s.       | d.       | £  | s.       | d.       |      |     |    |    |    |
| To Rent, Light, Cleaning and Hire of |      |      |      |             |          |          | By SUBSCRIPTIONS :—  |          |          |      |     |    |    |    |
| Lecture Room                         | .... | .... | .... | 64          | 0        | 10       | Fellows  | ....     | ....     | .... | 183 | 3  | 0  |    |
| „ Salary                             | .... | .... | .... | 172         | 5        | 0        | Members....  | ....     | ....     | .... | 242 | 5  | 1  |    |
| „ Pension—A. E. Montague             | .... | .... | .... | 52          | 0        | 0        | Associates and Library Associates                                    | ....     | ....     | .... | 38  | 11 | 9  |    |
| „ National Insurance                 | .... | .... | .... | 3           | 5        | 0        | —————  |          |          |      |     |    |    |    |
| „ Printing and Stationery            | .... | .... | .... | 239         | 19       | 0        | „ Proportion of Life Subscriptions                                   | ....     | ....     | .... |     | 15 | 0  | 0  |
| „ Postages                           | .... | .... | .... | 30          | 10       | 0        | „ Sale of Publications   | ....     | ....     | .... |     | 30 | 3  | 6  |
| „ Audit and Professional Charges     | .... | .... | .... | 6           | 6        | 0        | „ Craig Memorial Trust Fund Income transferred                       | ....     | ....     | .... |     | 8  | 14 | 10 |
| „ Fire Insurance                     | .... | .... | .... | 12          | 0        |          | —————  |          |          |      |     |    |    |    |
| „ Sundry and Office Expenses         | .... | .... | .... | 14          | 7        | 10       | „ BALANCE, being Excess of Expenditure over Income for the Year 1940 | ....     | ....     | .... |     | 65 | 7  | 6  |
|                                      |      |      |      | 583         | 5        | 8        |  |          |          |      |     |    |    |    |
|                                      |      |      |      | <u>£583</u> | <u>5</u> | <u>8</u> |  |          |          |      |     |    |    |    |
|                                      |      |      |      |             |          |          | <u>£583</u>  | <u>5</u> | <u>8</u> |      |     |    |    |    |

THE ANNUAL BUSINESS MEETING  
OF THE  
VICTORIA INSTITUTE

WAS HELD IN ROOM 19, LIVINGSTONE HOUSE, BROADWAY,  
WESTMINSTER, S.W.1, ON MONDAY, MAY 26TH, 1941,

AT 4.30 P.M.

The Chair was taken by Group Captain P. J. WISEMAN, R.A.F., in the unavoidable absence of the President, Sir AMBROSE FLEMING, F.R.S.

The Minutes of the Meeting of May 20th, 1940, having been published in the 1940 *Transactions* and circulated to all, were taken as read, confirmed and signed.

The Report of the Council and Statement of Accounts for the year 1940, having previously been circulated to all, were taken as read and, after some comments by the Hon. Secretary, in brief review of the year's work (subsequently circulated for information and not here included), the Chairman called upon Mr. R. Duncan to propose, and Dr. J. Barcroft Anderson to second, the *First Resolution*, viz. :—

“ That the Report and Statement of Accounts for the year 1940, presented by the Council, be received and adopted ; and that the thanks of the Meeting be given to the Council, Officers and Auditor for their efficient conduct of the business of the Victoria Institute during the year.”

After opportunity for discussion, there being no amendment, the Resolution was put to the Meeting and carried unanimously.



The CHAIRMAN then called upon Mr. DOUGLAS DEWAR to propose, and Mr. W. E. LESLIE to second, the *Second Resolution*, viz. :—

“ That the Rev. Principal H. S. Curr, M.A., B.D., B.Litt., and R. E. D. Clark, Esq., M.A., Ph.D., retiring members of the Council, be and hereby are re-elected. Also that the election of Professor Samuel Nevin, M.D., B.Sc., M.R.C.P., co-opted to fill a vacancy in the Council be, and hereby is, confirmed. Also that E. Luff-Smith, Esq., Incorporated Accountant, be, and hereby is, re-elected Auditor at a fee of three guineas.”

After opportunity for discussion, there being no amendment, the Resolution was put to the Meeting and carried unanimously.

The title chosen by the Council for the Langhorne Orchard Prize Essay for 1942 was next announced, viz., “ Evolution and Entropy.”

There being no further business, the Meeting terminated with a vote of thanks to the Chairman, which was passed with acclamation.

War conditions having rendered it impracticable to hold an ordinary meeting on January 6th, 1941, the Paper to be read on that date was circulated to subscribers and is here published, together with the written discussion elicited.

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*THE VISIONS OF NEBUCHADNEZZAR AND  
DANIEL, AND THE SEVENTY SEVENS  
PROPHECY.*

By SIR AMBROSE FLEMING, M.A., D.Sc., F.R.S. (President).

THE subject of chronology, and especially Biblical chronology, has attracted the attention of an immense number of most able minds. One of the chief difficulties of the study is that the ancients had no single datum point from which to reckon time as we have in the nominal date of the birth of Christ; but there were many such points and hence uncertainty in the interconnection of them and correlation to our B.C. and A.D. reckoning.

There are, however, in the Bible a large number of chronological statements giving intervals between notable events and also prophetic forecasts which provide means for time reckoning. Those, therefore, who believe entirely in the inspiration of the Bible will give to these Biblical statements concerning times and events a special importance and preferential value as compared with those in secular literature. Amongst the most important of these Biblical forecasts are certain symbolical visions and predictions given to us in the books of Daniel and Revelation regarding the future history of mankind and the events which must take place before the complete establishment of the Kingdom of God on earth.

Three of the most important of these forecasts in the Old Testament are the dream of Nebuchadnezzar concerning the great Image, then the Vision of Daniel in which he saw four great beasts arising from the sea, and thirdly the prediction given

to Daniel by the Angel Gabriel in the so-called prophecy of the "Seventy weeks".

It is proposed to draw attention to some notable points in these great visions, treating them as having certainly happened and not as fictitious narratives.

Nebuchadnezzar had his vision in the hours of sleep, but when he awoke he could not recall its particulars except as a vivid and disturbing dream. He called to his aid the astrologers and magicians; but although they asserted they could give him the interpretation of it they could not revive his memory of the vision. Thereupon he threatened to destroy them as pretenders and frauds. Daniel, a young Jewish captive who had been placed for training in the College of Astrologers, begged for a delay and called on his companions to intercede with God to give him a power to recover the dream. His prayer was answered and he was given not only a knowledge of the King's dream but also the interpretation of it. He told the King that he had seen in his dream a great image of a man with head of gold, arms and breast of silver, belly and thighs of brass or copper, legs of iron, and feet partly iron and partly clay. He informed the King that these several parts denoted four great empires of which he, Nebuchadnezzar, was the first and the head of gold. Also he told the King that he had seen a stone cut out without hands which fell upon the image and broke it in pieces. This, Daniel said, denoted a kingdom God would establish which would succeed and destroy all the preceding kingdoms (Daniel ii, 36).

Daniel did not name the kingdoms signified by the silver, brass and iron parts of the image, but commentators have taken them to be those of the Medes and Persians, Greece and Rome in the pagan empire form, whilst the feet partly iron and partly clay are interpreted to mean the subsequent democratic and autocratic forms of human government.

Subsequently Daniel had a dream in which he saw four great beasts rise up out of the sea—a lion with eagle's wings, a bear with three ribs in its mouth, a leopard with four wings and four heads, and fourthly a strong and dreadful beast with great teeth, having ten horns and amongst them a little horn with eyes like a man and a mouth speaking great things. There is an agreement between many learned commentators that these dreams of Daniel and Nebuchadnezzar are parallel visions and refer to the same great empires ruling by force and craft and

therefore analogous to beasts of prey. In both of these visions the four-part great image and the four kinds of great beast are destroyed and succeeded by an ever-enduring direct Divine Government of the Son of Man, symbolised in the first dream by the stone cut out without hands.

In close connection with these visions of Nebuchadnezzar and Daniel and the revelation given to Daniel in answer to his prayers concerning the time of ending of the seventy years' desolations or captivity of his people foretold by the prophet Jeremiah, is the revelation commonly called the prophecy of the "seventy weeks", or as it should be called "the seventy sevens". This is given in the book of Daniel, chapter ix, verses 24 to 27, as follows by the Angel Gabriel: "Know therefore and understand that from the going forth of the commandment to restore and build Jerusalem unto Messiah the Prince shall be seven weeks and threescore and two weeks: the street shall be built again and the wall even in troublous times".

I shall make no excuse for accepting what is called the "Year-day" theory that in these scriptural predictions the term "day" stands for a calendar or prophetic year of 360 natural days of 24 hours and the word "week" for seven prophetic years. Suffice it to say that many of the most eminent students of prophecy have adopted that view. But the mean solar year is 365 days 5 hours 48 minutes and 49 seconds or 365.2422 days. Hence the solar year is longer than the prophetic year in the ratio of 1.0145 to 1, and to convert a span of time reckoned in mean solar years to its reckoning in prophetic years we have to multiply by 1.0145. Hence 483 solar years = 490 prophetic years.

Turning then to Scripture we find that in the book of Isaiah, chapter xliv, verse 28, there was a remarkable prediction concerning Cyrus, King of Medes and Persians, which said of him long before he lived, "That saith of Cyrus, He is my Shepherd and shall perform all my pleasure: even saying to Jerusalem, Thou shalt be built and to the temple thy foundation shall be laid". Now who said this? Clearly from the context God Himself, who alone can predict history.

Turn then to II Chronicles xxxvi, 22, for the fulfilment we find it written, "Now in the first year of Cyrus, King of Persia, that the word of the Lord by the mouth of Jeremiah might be fulfilled he made a proclamation throughout all his kingdom and

put it also in writing saying, Thus saith Cyrus, King of Persia, All kingdoms of the earth hath the Lord God of Heaven given me : and he hath charged me to build him an house in Jerusalem which is in Judah ". Nothing could possibly be more plain than this prediction and its fulfilment by Cyrus. With this unquestionable fact before us we ask, How is it that so many eminent commentators have endeavoured to find the starting point of the 69 weeks not at the first year of Cyrus, but at a much later date in the twentieth year of the reign of Artaxerxes Longimanus, a king of Persia ? The answer to this question is, because the accepted date of the first year of Cyrus is far too early to fit into the prophecy of the 69 weeks ; 69 times 7 are 483 prophetic years or 476 mean solar years. But the commonly accepted chronology asserts that the first solar year of Cyrus was 534 B.C., which is 54 years too early if we take the words " Unto Messiah the Prince " to be the date of the birth of Christ at 4 B.C. Hence some commentators have had to search for and assert they find the starting point of the 70 weeks at a date 457 B.C. and its termination at the crucifixion in A.D. 33. But this is entirely out of accord with the plainest statements of the prophecy. We ask, then, how comes it that this accepted date of the first year of Cyrus does not fit the facts. The answer several authorities have given is that these accepted dates are in error. They have been fixed chiefly by the so-called Canon of Ptolemy, who in turn depended on Eratosthenes. Ptolemy was an astronomer and geographer who lived about A.D. 70-161 at Alexandria and compiled a list of kings and their dates of accession. He was the author of the Ptolemaic system of astronomy which took the earth as the centre of the Universe and that the sun, moon and planets revolved round it. He was not a contemporary of the Babylonian and Persian Kings and his dates are not independently corroborated.

Nevertheless, some of the leading chronologists such as Clinton accept him as their guide, and others such as Grattan Guinness follow suit. A few, such as Martin Anstey in his valuable *Romance of Bible Chronology*, have disputed Ptolemy's datings, and Anstey gives arguments to show that all of Ptolemy's early dates are 82 years too early.

Ptolemy starts with the date of the accession of the Babylonian king, Nabonassar, which he gave as 747 B.C., and this is said to have been fixed by a total solar eclipse visible at Babylon in

February or March of that year. But Ptolemy had no means of fixing eclipse dates accurately and for the following reasons they are not an infallible guide.

A total solar eclipse occurs when the moon centre comes on to the straight line joining the centres of the earth and sun. The plane of the moon's orbit is not identical with that of the earth or else there would be a total or partial solar eclipse every month. The plane of the moon's orbit is inclined to that of the earth at an angle of about 5 degrees and intersects that of the earth along a line called the line of the lunar nodes and a solar eclipse can only happen when the line joining the centre of sun and earth is very nearly coincident with the line of the moon's nodes, and the moon also near one of its nodes. Owing to the slightly varying distances of the sun and earth and sun and moon and other causes, there may be two solar eclipses, or even five, in a year. Such eclipses may be partial, annular or complete, and the time of totality may vary from about two to seven minutes. Each solar eclipse has therefore a certain personal character by which it can be distinguished.

Chaldean astronomers had noticed that similar solar eclipses occur about every eighteen years. This period is called a *Saros* and its value is 18 years  $11\frac{1}{3}$  or  $10\frac{1}{3}$  days. A rather more exact period is three Saros periods of 54 years 1 month. After this last interval a similar solar eclipse takes place at very nearly the same longitude but about 600 miles difference in latitude. As such eclipse is only visible over a narrow path about 100 miles wide the eclipses at triple Saros intervals of 54 years are not seen at exactly the same places. Such small knowledge as Ptolemy possessed would not enable him to locate the paths of total solar eclipses. Nevertheless, if there was an eclipse visible at Babylon at the date of the accession of Nabonassar, said to be in 747 B.C., there must have been a similar eclipse visible at no very great distance in locality in 693 B.C. or 54 years later. It would be preposterous for the present writer to attempt to decide questions on which the most eminent chronologists have differed; but there is much evidence that Ptolemy's dates for the beginning of the Babylonian and Persian empires are in excess of the truth and to the writer an excess period of 54 years, or a triple Saros period, seem to have been probable. If so, then the accession of Nabonassar was 693 B.C. and not 747 B.C. The date for the rise of the last Babylonian empire is commonly given as 625 B.C.

or 626 B.C. when Nabopolassar, father of Nebuchadnezzar, began to destroy Nineveh, the capital of the Assyrian Empire. The seventy years of desolation for the Jews prophesied by Jeremiah (xxv, 11, 12) extend from 606 B.C. to 536 B.C., taking the usual datings for that event; the last date is that commonly given for the first year of the sole reign of Cyrus and hence the date of the beginning of the Medo-Persian empire. If, then, we turn to the Scriptures for guidance, the first question which occurs is that of the date of the Nativity of Christ. We all know that the A.D. and B.C. reckoning we now use was fixed by Dionysius, a Roman abbot, about the sixth century A.D., but modern knowledge has shown that the Nativity certainly took place before the meeting-point of A.D. and B.C. periods. The true date of it has been asserted to be in 2, 4, 5 or even 8 B.C.

It is to some extent determined by the actual date of the "Fifteenth year of Tiberius", mentioned in Luke iii. 1. It is generally agreed that Augustus Cæsar died on August 19th, A.D. 14, and was succeeded by his stepson Tiberius. We had a valuable paper read to us by Lt.-Col. A. G. Shortt in January, 1931, in which this date (the fifteenth year of Tiberius) was discussed and fixed as beginning on August 19th, A.D. 28, and hence the Nativity in September or October, 2 B.C.\*

In the discussion on Colonel Shortt's paper, various opinions were expressed about the true date of the Nativity. Dr. Norman S. Denham taking it as early as 5 B.C. and that Herod died in 3 B.C. Mr. G. Wilson Heath accepts 4 B.C. for the Nativity and A.D. 26 for the fifteenth year of Tiberius, dating this fifteenth year from the beginning of the co-regency of Tiberius with Augustus in A.D. 11. Without presuming to decide where doctors differ, I am inclined for the present to agree with the date of the Nativity being October, 4 B.C., and the death of Herod in 3 B.C.

Now the seventy weeks prophecy tells us that from the going forth of the commandment to restore and build Jerusalem unto Messiah the Prince shall be 69 weeks or 483 prophetic years or 476 mean solar years. If we take this to mean, as seems reasonable, that the interval from the decree of Cyrus in his first

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\* There has, however, always been a difference of opinion whether this fifteenth year should date from A.D. 11, when Tiberius began to act as co-rex with Augustus, or from the death of Augustus in A.D. 14. Colonel Shortt adopts this latter view and hence takes the fifteenth year as beginning in A.D. 28.

year of sole reign to the birth of Christ was to be 476 mean solar years, then, if we take the Nativity at 4 B.C., this implies that the decree must have been given in the year 480 B.C. The last Babylonian empire ended with the death of Belshazzar when Darius the Mede took the kingdom. Darius was co-rex with Cyrus and he was probably left in control of Babylon whilst Cyrus with his army searched for Nabonidus, the father of Belshazzar and the last king of Babylon, to capture him. Martin Anstey gives Darius two years' government before Cyrus assumed sole power. Hence the date of the end of the Babylonian empire must be placed at  $480 + 2 = 482$  B.C. But then the last Babylonian empire had endured 70 years, according to the prophecy by Jeremiah given in his book (Jeremiah xxv) as the word of the Lord. Concerning the apostate Judah it was said: "And the whole land (of Judea) shall be a desolation . . . and these nations shall serve the King of Babylon seventy years, and . . . when seventy years are accomplished I will punish the king of Babylon . . . and will make it [Babylon] a perpetual desolation". If, then, we add 70 years (prophetic) or 69 solar years to 482 B.C., we reach 551 B.C. But the Ptolemaic dates show that the last king of Assyria, viz., Ashurbani-pal, died in 625 or 626 B.C. and Nineveh was finally destroyed by Nabopolassar, the father of Nebuchadnezzar, in 606 B.C. We have then to add twenty years to 551 B.C. and we reach 571 B.C. as the most probable true date for the beginning of the last Babylonian empire, which was denoted by the head of gold. We see, then, that if these Ptolemaic dates are accepted as true they are quite inconsistent with the prophetic dates and are all 54 years too early. Thus, if we put them in parallel columns we have as follows:—

|  | Ptolemaic<br>Dates. | Revised<br>Dates. |
|--|---------------------|-------------------|
| Accession of Nabonassar . . . . .  | 747 B.C.            | 693 B.C.          |
| Death of last Assyrian king, Asshur-<br>bani-pal . . . . .                 | 625 B.C.            | 571 B.C.          |
| Final end of Nineveh and beginning<br>of last Babylonian empire. . . . .   | 606 B.C.            | 552 B.C.          |
| First year of sole reign of Nebuchad-<br>nezzar, King of Babylon . . . . . | 604 B.C.            | 550 B.C.          |
| Babylon besieged. Accession of<br>Darius the Mede . . . . .                | 536 B.C.            | 482 B.C.          |
| First year of Cyrus, sole reign and<br>beginning of the 69 weeks. . . . .  | 534 B.C.            | 480 B.C.          |



The revised dates are all put 54 years later than the Ptolemaic dates, in accordance with the view that Ptolemy made an error of three Saros periods in fixing the era of Nabonassar; this then makes them consistent with the prophecy of the 69 "weeks", that is an interval of 476 solar years or 483 prophetic years between the commandment to restore and build Jerusalem and Messiah the Prince would take place. The prophecy of the Seventy Weeks then passes on to say (Daniel ix, 26), "and after three score and two weeks shall the Messiah be cut off and shall have nothing".

The "62 weeks" ended, as we have seen, in the fifteenth year of Tiberius, when John the Baptist began his call to repentance and baptism. Christ, as the representative of humanity, presented Himself for Baptism and from that time His teaching and mediatorial work began. It is clear, therefore, that this was the starting-point for the seventieth "week" of the prophecy. The prophecy takes no account of the years between the Birth and Baptism of the Messiah, because this period covered His private life and formed no part of His official or mediatorial life-work. But the prophecy states that after three score and two weeks the Messiah should be "cut off"; that implies a violent and not a natural death. Verse 27 tells us that he would make a firm covenant with many for one week, that is, for a period of seven prophetic years, and during the half of that week he would cause the "sacrifice and oblation to cease". If we reckon the half-week to be  $3\frac{1}{2}$  prophetic years reckoned from the Baptism in the late summer or autumn of A.D. 29, then that brings us to the spring of A.D. 33. There is a considerable agreement that the crucifixion of our Lord took place in early April, A.D. 33. That voluntary sacrifice and oblation of Himself upon the Cross as the true Lamb of God, put an end to the necessity for the typical sacrifices ordained in the Mosaic law. Hence He caused the typical sacrifice and oblation to cease. Also after His ascension and the coming of the Holy Spirit he confirmed the covenant with many, for 3,000 persons embraced faith in Christ on the day of Pentecost and 5,000 more soon after (Acts ii, 41, and iv, 4). Also we read in Acts vi, 7, that the number of disciples multiplied and included a great number of the priests. Accordingly, we can reckon that the whole period of the "seventy weeks" extended from 480 B.C. to  $3\frac{1}{2}$  years beyond the date of the Crucifixion, that is, to the autumn of,

A.D. 36, which is a span of 515 solar years. But we have to subtract the time from the Birth at 4 B.C. to the Baptism in A.D. 29, or 32 years, for the reason already stated. The remainder is 483 solar years or 490 prophetic years or seventy "weeks".

In the above calculations we have taken the date of the Nativity as occurring in 4 B.C., and if the Baptism took place in A.D. 29 that would make our Lord 32 years old at his Baptism. But St. Luke tells us (Luke iii, 23) that at that time he was about thirty years of age. Accordingly, some have fixed the Nativity in the year 2 B.C. But that involves another difficulty, namely, that it would require the death of Herod to be pushed forward into the years 1 B.C. or A.D. 1. Herod was undoubtedly alive at the date of the Nativity and for some months after. His death date is commonly given as 4 B.C. If he lived until 3 B.C. that would remove one difficulty with regard to the Nativity in 4 B.C., but it still leaves another, the age of Christ at His Baptism. In any case the selection of the true date for the Nativity involves some difficulties, and all we can do in default of definite statements in the Gospels is to select that date which involves the least accompanying difficulties.

To continue then our dating of the rest of the Image. The Medo-Persian world empire was brought to an end by the conquests of Alexander the Great, whose accession was in 312 B.C. He died at Babylon in 300 B.C. and his empire was then divided between his four generals. His rapid conquests and this subdivision at his death makes the symbolism of the Grecian empire as a flying leopard with four heads significant.

But the Grecian empire was ended when Augustus of Rome won the battle of Actium, 31 B.C., and in 27 B.C. became the head of the Roman empire by a decree of the Senate of Rome. This empire endured for nearly 450 years, but was ended when Odoacer the Goth forced Romulus Augustulus, the last Emperor of the West, to abdicate in A.D. 476. If we reckon the time in solar years from the commencement of the last Babylonian empire in 625 B.C. to A.D. 476, we find it to be exactly 1,100 years; but taking the revised date of 571 B.C. the interval is 1,046 or 54 years less.

The fall of the Western Empire of Rome was succeeded by a period of invasion of northern tribes—the Ostrogoths, Visigoths and Vandals. The edict of Milan and the conversion of the Emperor Constantine about A.D. 313 made Christianity no

longer a proscribed, but a permitted religion, and this assisted the progress of the faith throughout the Empire and the creation of bishoprics in all civilised districts. In A.D. 533 the Emperor Justinian I decreed that the Bishop of Rome was the head of all the holy churches. In 606-607 the Emperor Phocas confirmed this headship to Pope Boniface III, and 56 years after the Bishop of Rome in A.D. 663 enjoined the exclusive use of Latin in the offices of all churches.

In Daniel's vision he saw grow out of the head of the fourth beast a "little horn", that meant small in political power at first, but having eyes like a man and a mouth speaking great things, which made war with the saints who were given into his hand for "*a time, times and the dividing of time*". To no institution in the course of history could these tremendous attributes be applied other than to the Church of Rome or the Papacy; assuming as it does divine prerogatives and position for the Bishop of Rome as Vicar (or representative) of Christ on earth with allocations, bulls, and infallibility. It was for over 1,200 years a persecuting power, making war against all who dissented from its teaching. It was not merely a Church, but an absolute government claiming control over all property and persons of all ranks and nationalities. It is agreed that the phrase "*a time, times and the dividing of time*" means 1,260 prophetic years or 1,242 solar years. Counting this time from the decree of Phocas in A.D. 606, we reach 1848 in which year revolutions broke out all over Europe and the reigning Pope had to flee from Rome and lost much of the temporal power he had gained in A.D. 756, and what remained was lost in 1870 when, after the Franco-Prussian war the French soldiers were withdrawn from Rome and the armies of Italy took possession of the Imperial City. Going forward 44 years, we reach 1914 and the opening of the Great European War. All who were alive then recognised that this date was epoch making in the history of the world and nothing has been the same since. The outcome of the War was that thrones, empires and dynasties fell into the dust. The Habsburg, the Hohenzollern and Romanoff dynasties which had existed for centuries governing Austria, Germany and Russia vanished. The Sultany of Turkey ended. There is one noteworthy fact about the date 1914 which ushered in this era of tremendous war. We have seen that the (revised) date for the beginning of the Babylonian final empire or the head of gold was

571 B.C., corresponding to the Ptolemaic date of 625 B.C. The span of time from 571 B.C. to A.D. 1914 is 2,484 solar years, but this is exactly equal to 2,520 prophetic years or to seven *times* where the time is 360 prophetic years.

This "seven times" for the duration of the "beast empires" is very significant when taken in comparison with the seven years' degradation of Nebuchadnezzar to a beast-like state. (See Daniel iv, 25.) A great week of such *times* has therefore rolled by and 27 years more have passed since 1914. We cannot yet say that human self-government or misgovernment or the era of beast government has come to an end. Russia and Germany have exhibited in the last 27 years conduct as inhuman as anything in the history of Babylon or Rome.

What of the future? We all know the futility of seeking to penetrate the mists and clouds that enshroud future human history. A further 59 years will bring us to the twenty-first century of this era and perhaps, according to accepted reckoning, to the end of the sixth millenium of human history. Is it too much to hope and pray that before that time the emphatic and numerous assertions in Holy Scripture may be fulfilled concerning a special Divine Government which shall replace all human government?

In Daniel's vision of the beasts typifying human empires he saw in the night visions and "behold one like the Son of Man came with the clouds of heaven and came to the Ancient of Days and they brought him near before Him. And there was given unto him dominion and glory and a kingdom that all people, nations and languages should serve him and his dominion is an everlasting dominion which shall not pass away and his kingdom that which shall not be destroyed" (Daniel vii, 13, 14).

These are not the words of hypothesis or imagination, but precise and certain predictions of Holy Scripture.

#### DISCUSSION.

MR. ALBERT O. HUDSON wrote: Upon the assumption that the Edict of Cyrus fulfilled the prophecy of Dan. ix, 25, the paper is a valuable contribution to an elucidation of the subject. One feels compelled to suggest, however, that Cyrus did in fact no more than authorise the re-building of the Temple—a different work altogether

to the re-building of the city—and that not until the twentieth year of Artaxerxes was there any command to “restore and build Jerusalem.” A careful reading of the books of Ezra and Nehemiah, and in addition the apocryphal book of 1 Esdras, amply confirms this point. It is true that Josephus couples the city with the Temple in his account of the order issued by Cyrus, but nowhere in the succeeding history of the period in Josephus is there any indication that the city was in fact being re-built by order of any Persian ruler until the command given by Artaxerxes in his twentieth year (recorded by Josephus as being in the twenty-fifth year).

Cyrus’ own words were that God had commissioned him to build Him an house at Jerusalem. Work was commenced in the second year of the return, under Zerubbabel and Joshua, but was hindered by the enemies of the Jews for fifteen years until the time of Darius Hystaspes. On a *false* accusation that they were re-building the *city* the work was stopped altogether in the days of Cambyses, but in the time of Haggai and Zechariah, after an appeal to Darius by the resident Persian governor, the temple-building was resumed. After the Temple’s completion and dedication, and in the days of Ezra, an attempt to build the walls of the city was stopped by Artaxerxes “until commandment shall be given from me.” In the twentieth year the city was still in ruins and the gates were still “burned with fire.” In that year Artaxerxes gave the long-sought command to build the city and set up its walls, the book of Nehemiah being in the main devoted to an account of the successful prosecution of this work.

One would suggest therefore that this twentieth year saw the fulfilment of the angel’s words to Daniel in Dan. ix, 25, and that this decree of Artaxerxes is the only one which can be said to meet the requirements of the case.

Students of history can see a definite relation between this event and the political adjustments which were then in progress between Persia and Greece. A series of Athenian victories had well-nigh broken the Persian authority, and a friendly fortified city in Judea became a desirable element of high policy.

The twentieth year of Artaxerxes has been variously given as 455 and 445 B.C., the earlier date being founded upon the History of Thucydides, who was contemporary with Artaxerxes, and other early

writers, whilst the latter date is based upon the Canon of Ptolemy, which is, of course, a much later composition. Without presuming to enter into a discussion of the purely chronological aspect of the subject, it may be remarked in passing that 483 solar years from 455 B.C. ends in 29 A.D. which is thought by many to be the date of our Lord's baptism. Jesus, of course, was not the "Messiah the Ruler" until He was baptised and had commenced His ministry.

Mr. G. ANDREW HEATH wrote : Our esteemed President has given his powerful support to the view that the "Seventy weeks" of Dan. ix indicate one unbroken period.

If this is seen, it will follow that much teaching, that has depended practically entirely on the supposed separation of the 69th week from the 70th by a 2,000-year gap, disappears and a clearer view of the prophetic panorama is obtained.

Sir Ambrose does not discuss whether Dan. ii and Dan. vii are "parallel visions"; he leaves it to "many learned commentators"! But do these two prophecies bear the same interpretation? There are apparent similarities, but the dissimilarities are so pronounced as to negative the view that they are merely repetitions of the same prophecy under different guises.

The following differences among others seem conclusive :—

1. In Dan. ii : the Image represents five powers typified by five materials, specified in verses 32, 33, 35 and again 45.

In Dan. vii : The Wildbeasts are four in number foretelling four great powers (verses 3 and 17).

2. In Dan. ii : the five powers are consecutive :

"Thou art this Head of Gold" (38).

"After thee shall arise another Kingdom (39)," etc.

In Dan. vii : the four powers are contemporaneous. There is nothing to suggest one Wildbeast succeeds another (on the contrary, see 11, 12).

3. In Dan. ii : the Image was dreamed in the days of Babylon's glory, and accordingly the *other* Empires foretold are spoken of in the future tense (39, 40 *et seq.*).

In Dan. vii : The Wildbeasts are seen in the closing days of Babylon's power (1). Yet *all the four Wildbeasts* are said to be still future, the first as well as the rest (17).

4. In Dan. ii : The Image is one whole symmetrical structure.  
There is a certain uniformity about the parts.  
In Dan. vii : the Wildbeasts are " diverse one from another " (3).
5. In Dan. ii : the stone falls upon the feet and pulverises the whole Image *simultaneously* (35). (N.B.—There must be a survival or revival of the various Image-Kingdoms for this to happen—already most are on the map.)  
In Dan. vii : the 4th Wildbeast is destroyed first (11) and the other three have " their lives prolonged for an appointed time."

I suggest that these two chapters cannot be " parallel visions." Undoubtedly the prophetic future is highly complex, but the present war may do much to clarify our vision and help us to " rightly divide the Word of Truth." We are deeply grateful to the President for his timely and important paper.

MR. JOHN H. PARKER wrote : The President has given us a very comprehensive review of this interesting prophecy of the Seventy Sevens. Its partial fulfilment has proved that the sevens are periods of seven years, so that the total range of the prophecy covers seventy times seven—490 years.

This period begins with the going forth of the command to restore and to build Jerusalem, and it is stated explicitly that between that date and the time when Messiah shall be cut off is 69 sevens.

The President has pointed out that the accepted date of the first year of Cyrus is much too early to fit into the prophecy of the 69 sevens.

Adopting his calculation of 480 B.C. as the first year of Cyrus and therefore the beginning of the 70 weeks' period, then 69 weeks brings the date to 4 B.C., a generally accepted date for the birth of Christ.

The difficulty which now arises is that, according to the Angel Gabriel the Messiah was to be cut off—not born, at the end of the 69 weeks.

Therefore it is necessary to bring forward the date of the first year of Cyrus by more than 30 years to get in the 476 prophetic years between the first year of Cyrus and the Crucifixion.

This necessary further reduction of the B.C. date for the first year of Cyrus leads to other chronological difficulties and this is the reason why some Bible students have scrutinised more closely the words used in the Scriptures and have come to the conclusion that there is something to be said for the date given in Neh. ii for the beginning of the 70 weeks.

Confining ourselves to the actual words used in the Scriptures we find that Cyrus' decree, reported in 2 Chron. xxxvi, 23, and in Ezra i, 2 and 3, makes no mention of rebuilding Jerusalem but only "that the God of Heaven . . . hath charged me to build Him an house at Jerusalem."

In further emphasis of this commission Cyrus handed over to the leader of the exiles 4,400 vessels taken by Nebuchadnezzar from the temple of Solomon.

The inhabitants of the land strongly opposed the work and the local governors challenged the right of the Jews to build "the house of the Great God." (Ezra v, 8.)

The Jews referred the local governors to the decree of Cyrus "to build this house of God" (Ezra v, 13) and drew attention to the fact that Cyrus had entrusted to them the temple vessels.

At the request of the governors Darius caused a search to be made in the house of the rolls and the decree was found "concerning the house of God at Jerusalem, let the house be builded . . . also let the gold and silver vessels of the house of God which Nebuchadnezzar took forth . . . and place them in the house of God" (Ezra vi, 3-5).

As a result of this discovery Darius decreed that the house of God should be finished, sacrifices be provided at the King's expense so that prayers might be offered for the life of the King and his sons (Ezra vi, 7-10).

It will be noticed that in all these frequent quotations from the decree of Cyrus there is no mention of rebuilding Jerusalem but only of the house of God.

It is not until we come to the reign of Artaxerxes that we read that Nehemiah, his cupbearer, requested the King, "to send me to Judah, to the city of my fathers' sepulchres, that I may build it" (Neh. ii, 5).

The King granted his request, gave letters to the governors of his domain to facilitate Nehemiah's mission and also a letter to



Asaph, the keeper of the King's forests, to provide the timber for the gates and the walls.

Nehemiah tells us that he received this commission in the month of Nisan (the passover month in which the Messiah was crucified), in the twentieth year of King Artaxerxes.

In addition to this there is indirect evidence for a later date for the commencement of the 70 weeks.

Jeremiah had prophesied that because the people had not heeded his warnings the Lord would punish the nation with servitude and the land with desolation for 70 years.

Nebuchadnezzar was to be the instrument of judgment, not only against Israel, but also against the surrounding nations, "and these nations shall serve the King of Babylon 70 years" (Jer. xxv, 11); but when the 70 years were accomplished God would punish the King of Babylon and his nation.

Actually we know that there was a long period between the beginning of the servitude under Nebuchadnezzar and the beginning of the desolation of the land when he destroyed Jerusalem and left the country a barren wilderness.

In the third year of his reign Jehoiakim, King of Judah, surrendered to Nebuchadnezzar, but was left in Jerusalem as a puppet king. It was at that time that Nebuchadnezzar took away part of the vessels of the house of God and also, as hostages for Jehoiakim's good behaviour, certain young princes, one of whom was Daniel (Dan. i, 1-3).

Jehoiakim reigned altogether for eleven years, but before his death he rebelled and his son Jehoiachin had reigned only three months when Nebuchadnezzar again descended on Jerusalem.

He took the King, all the nobles, Ezekiel the prophet and all the craftsmen of the land into captivity and set up the King's uncle, Zedekiah, as puppet king. Zedekiah also rebelled, and after eleven years' reign was captured, Jerusalem was destroyed, the land was left uninhabited and the period of the 70 years of desolations began.

In Dan. ix we read that in the first year of Darius the Median King, Daniel realised from the Prophecy of Jeremiah that the 70 years of servitude had ended and yet nothing had happened to free his people although the prediction of the destruction of the Babylonian Empire had been fulfilled.

In great distress he sought God, "by prayer and supplications, with fasting and sackcloth and ashes" (Dan. ix, 3).

In answer to his prayers the angel Gabriel was sent to cause him to "understand the matter" (Dan. ix, 23).

Although the 70 years of servitude had come to an end, the 70 years of the desolations of the land were not yet completed, as they did not begin until Jerusalem was destroyed.

Gabriel told him that the 70 years' punishment was to be followed by a further period of seventy times seven which was "determined upon thy people and thy holy city, to finish the transgression, to make an end of sins and to make reconciliation for iniquity and to bring in everlasting righteousness."

Daniel was also told that the seventy times seven period would begin when the command went forth to restore and to build Jerusalem.

As the 70 years of desolations began with the complete destruction of Jerusalem, it seems fitting that it should end with the command to restore the city.

If the sixty-ninth week ended at the Crucifixion of our Lord it is difficult to fit in the statements about the seventieth week with the known events of the following seven years.

It has been suggested that the seventieth week is yet future.

In support of this suggestion we have the statement of the Apostle Paul that, because of the rejection of their Messiah, God had rejected the Jewish nation for the time being and introduced a new era in His dealings with mankind.

This Dispensation of the Church of God was a new thing "which in other ages was not made known unto the sons of men" (Eph. iii, 5).

The Apostle also tells us that when this era is completed by the Church of God being caught up to meet The Lord in the air, Israel will again be restored to her privileged position of God's people on earth.

Then the last week of the prophecy will run its course, ending in the setting up of the Kingdom of God on earth with Israel as the premier nation and the once-rejected Messiah as King over all the earth with His capital at Jerusalem.

Of the glories of that golden age, which we call the Millennium, the Old Testament prophets have written :

“ with pens dipped in the rainbow.”

The Rev. F. W. PITT wrote : The year for a day theory, adopted by Sir Ambrose, is based on two passages of Scripture, one in Num. xiv, the other in Ezek. iv. But neither of these passages authorises interpreters of prophecy to turn days into years. The first states that God pronounced on Israel 40 years of punishment for 40 days of iniquity. For every day a year. In Ezekiel the prophet is told to lie on his side one day for each year of Israel and Judah's sin. A day for every year. So if prophetic interpreters are authorised to turn a day into a year, they are also authorised to turn a year into a day. But really there is no authority given to anyone, for any reason, to change times and seasons.

The learned President does not offer any scriptural authority for his advocacy of the year for a day theory. He is satisfied that “ many of the most eminent students of prophecy have adopted this view,” but he does not tell us that the predictions of all these “ eminent students ” have been falsified by time.

Coming to the 70 weeks, Sir Ambrose assumes that Cyrus issued a decree to restore and build Jerusalem. But this is not so. Cyrus said : “ The Lord God hath charged me to build him an house at Jerusalem which is in Judah (2 Chron. xxxvi, 23, and Ezra i, 2).

This was not a charge to build a city but to build a temple for those Jews returning from the captivity. “ Also Cyrus, the King, brought forth the vessels of the Lord which Nebuchadnezzar had brought forth out of Jerusalem and gave them to the Priests and Levites for the temple services.”

The house was not built immediately owing to opposition ; but an altar was erected and sacrifices were offered. Enemies wrote to the King of Persia and falsely accused the Jews of rebuilding the city. The King accordingly asked for a copy of the decree of Cyrus, which was found to authorise the building of the temple only. “ Cyrus the King made a decree concerning the house of God which is at Jerusalem. Let the house be builded, the place where they offered sacrifices, and let the foundation thereof be strongly laid,

the height thereof threescore cubits and the breadth thereof three score cubits, with three rows of great stones and a row of new timber, and let the expenses be given out of the king's house. And also let the golden and silver vessels of the House of God which Nebuchadnezzar took forth out of the temple at Jerusalem and brought into Babylon, be restored, and brought again into the temple which is at Jerusalem, every one to his place, and place them in the House of God " (Ezra vi, 3-5). " And this house was finished on the third day of the month Adar which was in the sixth year of Darius the King " (Ezra vi, 15).

This in no way fulfils the prophecy of the 70 weeks, which says : " Know therefore and understand that from the going forth of the commandment to restore and to build Jerusalem unto the Messiah the Prince shall be seven weeks and three score and two weeks, the street shall be built again and the wall (rampart) even in troublous times " (Dan. ix).

Cyrus never issued a decree or gave a commandment for rebuilding the city, nor did he say God charged him to do so. Implying otherwise, Sir Ambrose is bound to challenge the calendar of Ptolemy, although it is confirmed by our greatest chronologists, Fiennes Clinton, and Canon Rawlinson. Ptolemy's dates have never been disproved.

But as the accepted date of the first year of Cyrus is too early for his interpretation, Sir Ambrose suggests that it should be changed from 534 B.C. to 480 B.C., the latter being approximately the seven weeks and 62 weeks (483 prophetic years) from the going forth of the commandment to restore and to build Jerusalem unto Messiah the Prince. That is, he dates the building of the temple by Cyrus in the same year as the building of the city, the commandment for which was given to Nehemiah in the twentieth year of Artaxerxes. The book of Nehemiah tells the story in full detail and says nothing about the building of the temple, while Ezra tells the story of the building of the temple but says nothing of the building of the city. The difficulty arises from confusing the charge to build a house with the commandment to build a city.

Allowing the Scriptures to stand as they are there is no need to revise the generally accepted interpretation of the 70 weeks. It is

only necessary when we try to fit Scripture into our theories instead of fitting our theories into Scripture.

Further, taking A.D. 52 as the year Messiah was "cut off," if we count back 483 prophetic years of 360 days each and turn them into solar years of  $365\frac{1}{4}$  days each, the result will be 445 B.C., the year when Artaxerxes gave the *Commandment* to rebuild the city. This simple sum confirms Ptolemy.

DR. NORMAN S. DENHAM wrote: Sir Ambrose Fleming, in his able paper, has covered too wide a field to discuss in full, but in thanking him, gratitude is expressed for his bold departure from the debatable Ptolemaic system. He has suggested an adjustment by telescoping the Persian era by three Saros periods, or 54 years. Anstey's reduction was 82. Which is right? The true method of rectification is to consult the Scriptures.

After long consideration, the only supports for the "Year-Day" theory, Num. xiv, 34, and Ezek. iv, 6, seem inadequate for propounding a "prophetic year," and a basis of general interpretation, which has proved, on application, unsatisfactory and illusive. In the instance before us, Sir Ambrose must perforce accept A.D. 33 as the year of the Crucifixion, and A.D. 29 for the Baptism. In the discussion of Col. Shortt's paper to which the author refers, I drew attention to the fact that our Lord's ministry commenced in a *Sabbatic* year. It was a *Sabbatic* and *Jubilee* year, for the *Jubilee* synchronised with every forty-ninth *Sabbatic* year. This was the year of release from sin's thralldom as announced by our Lord in Nazareth when He referred to Isaiah's prophecy that it should come (Luke iv, 19, Is. lxi, 1).

That A.D. 26 was *Sabbatic* was fully demonstrated by Lt.-Col. G. Mackinlay in "Recent Discoveries in St. Luke's Writings." The epochs for the Seventy Sevens and the seventieth seven—Cyrus' first year and the Baptism, are the only Biblical data entirely satisfactory. It follows that the 70 weeks were *Sabbatic* Sevens. Therefore the author's revised date for Darius the Medes' second year should be *Sabbatic!* but 481 B.C. was not *Sabbatic*. Neither was Anstey's date, 455 B.C.

The *Sabbatic Year* test can be applied to all schemes deduced from Ptolemy's chronology. The epoch of the Seventy Sevens was

69 sevens or 483 years, inclusive, counting back from A.D. 26, a true *Sabbatic* year, to 457 B.C. Most Scripture references to time seem indeterminate, being qualified by the term "about." But, as Sir Wm. Ramsay has emphasised, "it lies in the genius of the [Greek] language to avoid positiveness of assertion." Mackinlay pointed this out, and assured his readers that when our Lord was "about" 30, the definite age of 30 was intended. From the data lying around Herod's death, our Lord must have been born about October, 5 B.C., and His year one counted from Nisan 1, 4 B.C. The wonderful significance of the Baptism year is lost if we do not recognise that it was a *Jubilee* year.

This solution is supported by the most exact of all sciences, Astronomy. We have found by Daniel's prophecy that the Persian era was 79 years less than the 205 accepted by the Ptolemaic scheme. The total Solar Eclipse seen by Xerxes at Sardis is usually dated 480 B.C., because it was signalled by the Olympic Games. But if Herodotus be accurately interpreted, the true Ptolemaic year was 481 B.C. Oppolzer and Ginzel show no such eclipse in either of these years, but exactly 79 years later, in 402 B.C., occurred the only total Solar Eclipse visible at Sardis over a period of 400 years, namely, on January 18, at a date precisely satisfying the time recorded by Herodotus (vii, 37). It may further be noted that 402 B.C. was an Olympic year, this being the first proof in the chain of evidence exhibiting that the accepted series of Olympic years is faulty.

With reference to the two great visions of Dan. ii and vii, the Image represented five, not four, historic powers, with geographic limits. The brittle hard-clay feet represent, I believe, the Jews, restored with sovereign rights to Palestine in the closing days, and attempting to intermingle unsuccessfully with Gentile powers by pacts and agreements. The greatest of these covenants will be made with the world-worshipped Antichrist, the mighty Little Horn of Dan. vii, under whose ægis the Jews will be restored and seemingly secured against world aggression. The identity of the Clay with the Jews is exhaustively developed in Mrs. M. E. S. Wingate's book, "The Jew in Daniel's Image" (1932).

Although Sir Robert Anderson adopted in exposition the view that the visions of Dan. ii and vii were of identical powers, he gave seven weighty reasons in his "Coming Prince," for questioning the

identity. "The four winds of the heavens broke forth from around the Great Sea (the Mediterranean)." Babylon, etc., did not arise from such world conflict (*cf.* Jer. xxv, 32). I believe that four final great powers, perhaps recrudescing, will arise together from this centripetal commotion. They bear all the characteristics presented by modern totalitarian states. Their identity can only be established by two- or three-fold Scripture witness. I suggest that the Lion with Eagle's wings indicates the Jews, who will gain ascendancy and autonomy among envious powers, and even by a covenant, be at peace for a while with the future world Ruler, the Antichrist, till he plays them false. Then this hard-clay Israel's heart will be broken, her wings will be plucked, and a man's heart be given her. Then will appear the *chomer*, the soft-clay Israel, on whom Jehovah has sworn to have mercy.

The Jews are often symbolised in Scripture by earthy materials, such as sand, pottery, dust, mire, clay, worms, etc. Just as ample Scripture witness shows that the Jew is set forth as "Clay," so equally conclusive proofs show that Israel alone is symbolised as both a Lion and an Eagle—an Eagle with wings. As yet it does not appear who represent the other three wild beasts of Dan. vii, but the Little Horn, the Antichrist, has his origin, I believe, in Asia Minor (*cp.* Rev. ii, 13), and becomes by aggression and astute diplomacy combined, king of Tyre and of future Babylon. This will explain, if considered, the many cryptic references to *Lebanon* in the Psalms and elsewhere, and to the *Assyrian* in Ezek. xxxi, and Isaiah xiv.

Mr. E. J. G. TITTERINGTON wrote: Any proposition that emanates from our President demands the most careful attention, and the present thought-provoking and stimulating paper is no exception. Nevertheless, the proposition that the accepted date of the Nabonassar Era, viz., 747 B.C., should be rejected in favour of a date some 54 years later, presents some difficulties which it seems very difficult to surmount.

Dr. Grattan Guinness, who regarded this date as one of the most fundamental in ancient history, says of it, "its precise chronological point is also more certainly ascertained than that of any other ancient date, because it is connected with a series of exact astronomical

observations given by Ptolemy" (N.B.—Not any one single observation). Neither does this writer accept Ptolemy's evidence blindly, but he quotes his reasons at length. If the date is determined by the occurrence of a particular solar eclipse, would another similar eclipse occurring at a later date, but visible on a line differing 500 or 600 miles in latitude, satisfy the necessary conditions?

Further, the Nabonassar Era does not stand alone. It is connected by one means or another with the chronology of almost every ancient land. Working forward to the time of Nebuchadnezzar, we have correspondences with the dates of the Captivity era. Working backwards again to the time of Solomon, or even earlier, we make contact with Egyptian chronology. Working forward once more, we are invited to accept the year 480.B.C. as the date of the first year of Cyrus. But this is the accepted date for the Battle of Salamis, when the throne of Persia was occupied by Xerxes. Can we thus revise the chronology of Greece, even supposing we can do so with respect to Israel and Judah, or of Egypt and Babylon?

When we come to the prophecy of the Seventy Weeks (or Sevens) another difficulty arises. Sir Ambrose's interpretation of the general meaning of Dan. ix, 24–27, is, I think, not open to any question or argument. This fixes the middle of the seventieth week at the time of the Crucifixion, and its commencement therefore at the beginning of our Lord's public ministry. Does this not also fix the termination of the sixty-ninth week at the same point, and is the reason valid for making a gap between the end of the one week and the beginning of the next, corresponding to the earlier life of our Lord, as we are invited to do?

Colonel A. H. VAN STRAUBENZEE wrote: I congratulate our President on the subject selected for his lecture and the excellent manner in which he has handled it.

I am glad that he believes in the inspiration of the dates given in the Bible, and that we look forward to seeing a Kingdom of God established on the earth before we reach A.D. 2000.

I believe that the second chapter of Daniel foreshadows five and not four kingdoms, namely a Mohammedan Power, which largely ceased in 1914. Chapter vii foretells the ruling powers at the end



of this age, possibly the last three and a half years only, acting not on earth, but as from Satan's Kingdom in the Heavenlies from which he is then about to be ejected.

But the point which I would mainly stress, is that the chronology of the Bible gives us the exact length of time from the Birth of Adam to the Birth of Christ, proving that God must be the author of every word in the original of the Old Testament, and the dates given are only those which give the line of descent along which the Christ of God was to come, convincing proof that He who sees the end from the beginning, recorded events only which were in some measure leading to the coming of the Redeemer.

Dr. J. BARCROFT ANDERSON wrote : During the last few years I have been studying the Hebrew words spoken by Gabriel to Daniel, recorded in the last three verses of the ninth chapter of the book of Daniel. The best translation of those words, I believe to be as follows :—

Verse 25. Know therefore and understand that from word going-out to restore and to build Jerusalem, unto Christ made-dominant, shall be seven sevens and sixty and two sevens. It shall be restored, and street shall be builded, and wall, in troublous times.

Note that the Hebrew word for seven, is never used of seven days, without the word day being expressed or implied. The rendering of this word by " week " is a misrepresentation of the Hebrew. The Hebrew word for " day " is according to Gen. i, 5, used always and only for a period of light following darkness.

The only instruction recorded in Scripture to build the city of Jerusalem, is that asked for by Nehemiah, and granted to him in the month Nisan in the twentieth year of Artaxerxes (Neh. ii, 5).

The coming of Christ was on Palm Sunday. From his baptism by John till then, He exercised the office of Son, or builder-up, of God. When Peter discovered that He was The Christ, then charged he the disciples that to no one should they say " He is the Christ " (Matt. xvi, 20). During that period He spoke of the Temple as His Father's House. But on Palm Sunday, Matthew states (xxi, 12), " The Jesus (in English, The Jehovah Saviour) entered into the Temple of God . . . and said : My House shall be called a " House of Prayer," but ye have made it—My House—" a den of

thieves." And when He left that House next day for ever, His doing so made it "desolate" (Matt. xxiii, 38). On Palm Sunday, the children in the Temple cried out: "Cause salvation, I pray, by The Son of David" (Matt. xxi, 15). So referring back to the words of 2 Sam. vii, 14, "I. I established the throne of his Kingdom for ever. I, I will be existing to him for Father, and He, he will be existing to me for Son, by whose caused injury, also I caused him to be subjected by blows of men, and by knocks of sons of Adam." Words, the fulfilling of which resulted in the assaults of Matt. xxvi, 67, and xxvii, 30. It was only on Palm Monday, in His Temple, that He is recorded as having called Himself "The Christ" (xxiii, 8 and 10).

Neh. iv, 16, records the troublous times of the rebuilding of Jerusalem:

Verse 26: And after the sevens, sixty and two, Christ shall be cut-off, and nothing to Him. And the city and the Temple, the coming made-dominant people will destroy. And His end by complete-removal. And at fightings end, decreed desolations.

The "his end" is the Temple's, which is masculine, city is feminine.

In the year King Uzziah died (Is. vi, 1) after the seraph in the Temple had shouted: "Jehovah of Hosts sanctified, sanctified, sanctified the fullness, the whole earth, his glory." That this sanctification of the fullness of the whole earth should come about, Isaiah was told to make the heart of the Jewish people fat, and their ears heavy, and to shut their eyes, lest they see with their eyes, and hear with their ears, and understand with the heart, and turn again and be healed. Isaiah then said: "Till when Jehovah?" And Jehovah answered, "Until cities be waste without inhabitant, and houses without man, and the land be utterly desolate." But Isaiah was not told when this desolation was to begin. Gabriel here states it was to begin after this war. It is the war of Matt. xxii, 7. "But the king was wroth, and having sent his armies, he destroyed those murderers, and he burned up their city."

Verse 27: And Desolator, he caused to strengthen covenant to many one seven, and half the seven he is causing to cease sacrifice

and gift, and down to canopy, abominations; and till completion, and till decreed thing is pouring itself out upon desolating-one.

The second half of the seven is that of Rev. xiii, 5, "and there was given to him an outcoming-existence (exousia) to act (poiein) forty and two months."

The Hebrew word canopy means that which is spread out, and refers to the wings of the cherubim, which would be over the abominations.

Desolator is "the man, the one against-written-word-of-God (anomia) of 2 Thess. ii, 4, "the son (or builder-up) of destruction, who is opposing, and grasping a position above everything called God, or venerated, so that he, in the Temple of God, is seated, exhibiting himself, that he is God"—"And he prospered till completion of insult, which decreed thing must be done" (Dan. xi, 36).

The work of the late Sir Robert Anderson, K.C.B., entitled "The Coming Prince," gives the dates of the 69 sevens, as follows:—

|  |                |
|--|----------------|
| The 1st Nisan of twentieth year of Artaxerxes was March 14th, 445 B.C., and Palm Sunday, April 6th, A.D. 32. This is a period of 467 years of 365 days, and amounts to | 173,740 days   |
| It includes 116 leap years   | 116 „          |
| March 14th to April 6th, both inclusive  | 24 „           |
|  | <hr/>          |
| And $360 \times 69 \times 7$   | = 173,880 days |

#### AUTHOR'S REPLY.

Although my paper on the Visions of Nebuchadnezzar and Daniel and the seventy sevens prophecy has received some kindly-worded criticisms from contributors to the discussion, I think that this is on the whole no disadvantage, as it at least shows how different can be the conclusions drawn by students of Holy Scripture when dealing with the subject of prophecy and its interpretation. That these differences of opinion can exist is in part due to the fact that these prophetic statements are seldom made in the simple, exact wording of scientific language but intended to be understood only as the time of fulfilment approaches, or to stimulate very careful and prolonged searching of the Scriptures for their exact meaning.

Also another difficulty is because the dates of certain very important events such as the Nativity, Baptism, and Crucifixion of our Lord are not precisely known, and the proof of this is given by the existing differences of opinion between equally earnest students of prophecy. Also there is no general agreement on the date of the 15th year of Tiberius some dating it from the death of Augustus and others from the beginning of the co-regency of Tiberius with Augustus. Hence when we are attempting to expound chronological prophecies which involve a knowledge of these dates, we are like mathematicians seeking to solve an equation in which the constant quantities are not exactly but only approximately known within limits.

This fact renders any dogmatic statements as to interpretation inadmissible, yet how often we find confidence in commentators that their own solution of the problem is the only correct one and those of others unquestionably wrong.

To take a few of the debated items in this discussion: First, as to the Year-day theory. My confidence in its correctness is based essentially on its acceptance by many learned students of prophecy such as T. R. Birks in his "First Elements of Sacred Prophecy," E. B. Elliott in his "Horæ Apocalypticæ," and H. Grattan Guinness in his book "The Approaching End of the Age." Moreover, our Lord unquestionably used it in his message to Herod (*see* Luke xiii, 32), "Go ye and tell that fox. Behold I cast out devils and do cures to-day and to-morrow and the third day I shall be perfected." This is an obvious reference to the three years' earthly ministry of our Lord and He therefore employed the year-day principle in speaking of future events. I am therefore unable to agree with the view of two of our contributors to the discussion who do not accept the theory as valid in the case of the prophecy under consideration.

Then, next, with regard to the true terminal dates involved in the seventy sevens prophecy. The decree issued by Cyrus in his first year is rejected as the initial date or starting point of the 69 weeks on the ground that Cyrus was only commanded to rebuilt the Temple and not to "restore and build Jerusalem." But I ask what purpose could have been achieved by building a Temple unless there were people to worship in it, and how could there be worshippers unless there were inhabitants or inhabitants unless there were dwellings

and houses and therefore a city. There is no evidence that Cyrus was commanded to build *only* a temple amidst the ruins of an uninhabited city. This error is disproved by the clear statement in Is, xliv, 28, "That saith of Cyrus. He is my shepherd and shall perform all my pleasure; even saying to Jerusalem, Thou shalt be built; and to the Temple, Thy foundation shall be laid." This text is the clearest proof that the command to Cyrus was not merely to build a Temple but "to restore and to build Jerusalem."

Then in the next place as regards the Ptolemaic Chronology. I have been acquainted for years with Anstey's remarkable book. Ptolemy's dates are based on the conjectural chronology of Eratosthenes which is not independently confirmed. Ptolemy lived about 900 years after the beginning of the era of Nabonassar, and it may be doubted whether he had the knowledge required to fix the date of that era with the accuracy claimed by some chronologists. I have not been able to find scientific facts to confirm the statement of Anstey that Ptolemy's datings are 82 years too early. My suggestion of a pre-dating of 54 years has at any rate a basis in the triple Saros period which is not unlikely.

I think there is no need to follow out in detail all the other criticisms on my paper as it is clear that not all of the contributors to the discussion have paid sufficient attention to the arguments I have laid before them in my paper.

War conditions having rendered it impracticable to hold an ordinary meeting on January 22nd, 1941, the Paper to be read on that date was circulated to subscribers and is here published, together with the written discussion elicited.

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*AN ARGUMENT FOR THE VERBAL INSPIRATION OF  
THE BIBLE.*

By the REV. PRINCIPAL H. S. CURR, M.A., B.D., B.Litt.

THE verbal or plenary inspiration of Holy Scripture may be concisely, if crudely, defined as the Word of God in the Words of God. The Bible thus contains a corpus of truth regarding God, and man, and the world at large, unattainable by research or reasoning. Such wisdom can only come down from above. There is a general agreement amongst Christian theologians that the claim just stated is valid, a claim, which it should be very carefully noted, that the Bible makes for itself. When its authors have occasion to refer to what they may have said or written, they never hesitate to asseverate that they are the spokesmen of God. Flesh and blood have not revealed the things which they speak or write. Their origin must be sought in the ministry within their hearts and minds of that Divine Spirit Who has been appointed by God to lead the spirit of man into the knowledge of all truth. A claim so tremendous must be true, or it proclaims its authors as irresponsible individuals. The latter hypothesis seems to be barred by the nature of the teaching for which such exalted claims are made. If its ultimate source be not God Himself, it is certainly worthy to be so described. It may be fairly said that this contention regarding the Bible as the vessel containing the truth of God, and the demonstration which such a claim furnishes by its very audacity, would be freely conceded by all orthodox scholars even in this present age.

When we turn to consider the records of Divine revelation, there is considerable divergence of opinion. The majority of modern Biblical students would doubtless accept Dr. Stanley

Cook's brief description of Holy Writ as man's story of God's doings. The substance is Divine, but the narration is human. The soul is of heaven but the body of earth. This implies that the written account of the revelation is attended with all the limitations and drawbacks associated with the work of man, especially in such ancient times as saw the production of the literature which has been incorporated in the Bible. In fairness and justice, it ought to be added that this definition leaves room for human genius. The achievements of the race in the literary sphere must also be considered as well as its handicaps. It is then regarded to be a sufficient explanation of the literary miracle which we know as Holy Scripture that it represents the human story of God's dealings with the sons of men along certain lines with redemptive intent for the whole human family. In any case it must be admitted that this story is told by individuals of such spiritual and intellectual eminence that they constitute a class by themselves. Lord Macaulay has said of Boswell's Johnson that we do not compare other biographies with it. We test and estimate the lives of famous men by reference to Boswell. In the same way, the books of the Bible are not compared with other books. Other books are evaluated by reference to them. I do not think that sufficient emphasis is laid on the natural ability of the Biblical writers, quite apart from all supernatural considerations. Plato and Shakespeare are unspeakably great, but even they must be placed in a different category from the authors of the Old and New Testaments.

The doctrine of the verbal inspiration of Holy Scripture, however, is based on the conviction that no human genius could ever have produced such a body of writings as the Bible comprises. The purpose of this paper is to adduce evidence based on the actual words of Scripture to prove that a supernatural explanation will alone fit the facts. Before that is attempted, it may not be inappropriate to refer to the relation of ideas and words. In some quarters it is maintained that we think in words. I have no intention of arguing that point. It is merely mentioned as an illustration of a dictum which cannot be gainsaid that the relation of thought and language is as intimate as that of body and mind. Whether ideas can exist without words, it is impossible to say. We are on surer ground when it is asserted that the supreme method for the communication of ideas can only be words. Signs, and sounds, and sights, and

colours are all capable of serving as channels of communications, but only as aids and auxiliaries to words. Without verbal assistance other methods are futile. They serve as an admirable commentary on the text, but they can never be substitutes for the text itself. These observations emphasise the importance of words. Indeed, the protagonist of verbal inspiration would argue that the words in which the Word of God is conveyed to the mind of man are not far removed in importance from the truths which they embody. In that connection, reference may be made to an unexpected and unsuspected confirmation of that proposition. I refer to the science of textual criticism. It is remarkable that while the doctrine of verbal inspiration is largely discarded, the investigation of the text of the Old and New Testaments is prosecuted with a thoroughness which would not misbecome those who still think that the diction of the Bible is such as to demand a superhuman origin. Particles and prepositions are considered worthy of minute study. The jots and tittles of the law are studied in a fashion which might even make the Massoretic scholars envious.

The argument of this paper is that the wording of the Bible is in itself evidence of the Divine authorship. That observation takes full account of the unsatisfactory state of the text, a problem which is not confined to Holy Scripture by any manner of means. It is shared in common with all ancient literature, and, in lesser degree, with the words of authors whose careers only date a few centuries before the present hour. The difficulty is not disputed. It is only urged that the text of the Bible maintains an adequate average for certain conclusions to be based upon it. The validity of these is independent of textual uncertainties.

One such argument is that the Bible exhibits an example of the creation of a special vocabulary for the conveyance of certain truths. That is most easily and clearly perceived in the New Testament. When its twenty-seven books were written, the Greek language had become the finest vehicle for the expression of abstract ideas ever known. The problem of the authors was to find words in which to clothe unique ideas. That was accomplished not by coining new terms, except in a very limited degree, but by performing the literary miracle of putting new wine into old bottles without spilling the precious fruit of the vine. Reference need only be made to such a key-word as



“ grace ” to appreciate that point. Whatever good and gracious significance it had for philosophical paganism, it was transfigured before it appeared in the pages of Romans or Ephesians. Another striking illustration is the idea which is represented in English by such words as “ meekness ”, “ humility ”, “ lowliness of mind ”. The Greek expressions, used by the authors of the New Testament to indicate this virtue of which Augustine said that it was the first, and second, and third thing in true discipleship, is found in classical writers but with a very different significance. For them the term does not refer to the habitual self-abasement which is the result of walking with God, but its caricature. Thus Aristotle employs some of these characteristic New Testament expressions, signifying meekness and lowliness of heart, to describe servility of the most contemptible kind, the behaviour of the sycophant cowering and cringing before some exalted personage. That has neither part nor lot in that true humility with which all believers are bidden by the Bible to be daily girded. The reclamation of the word, and its adaptation for the highest uses, thus furnishes another instance of what is meant when it is said that the writers of the New Testament had practically to create a vocabulary in which to convey the heavenly truth, as it is contained in the Gospel of Christ.

I am not unmindful of the debt which the New Testament authors owe to the Septuagint, the great translation of the Old Testament into the Greek, completed not less than one hundred and fifty years before the Advent of Our Lord. It is often quoted in the New Testament, and there can be no doubt that it materially aided in the solution of the problems presented by the clothing of Christian doctrine in words ; but when full allowance has been made for the debt under which it placed the New Testament writers by providing them with a terminology, it must be acknowledged that there is still left ample room for a literary miracle. The doctrines of Christianity were stated in language which leaves nothing wanting in adequacy or felicity. That observation will be more deeply appreciated if the task of a missionary who is trying to translate the New Testament into some rude and barbarous tongue be called to mind. The narratives can be rendered with more or less ease ; but when it comes to finding an equivalent for such a phrase as “ justification by faith ”, the difficulty becomes most acute. But the task of the New Testament writers was incomparably harder, since the Gospel of Jesus Christ was then a new thing in the world.

Their success in achieving what verged on the impossible is surely evidence that it was due to the power and demonstration of the Holy Spirit.

Turning to the Old Testament, it is much more difficult to speak with confidence. It is written in Hebrew and Aramaic, although the amount which appears in the latter tongue is so small as to be negligible for our present purpose. Unlike the New Testament, which was written during the life-time of the Apostle John, the Old Testament occupied several centuries in its composition. Our knowledge of the history of the Hebrew language is not sufficient to warrant any statements regarding the sanctification of words by their use in connection with Divine things, as in the case of Greek, the tongue of a pagan people, and there is no need to go more deeply into this aspect of the subject. The evidence furnished by the New Testament is amply sufficient to justify the claim made that the creation of a Christian vocabulary is a feat, so mighty and marvellous, as to require supernatural aid.

The arguments, which have so far been urged, will not perhaps carry the same conviction as those based on the use of the words which have been chosen to serve as the means whereby the message of salvation could be imparted to the minds of men. The words had to be made into sentences, and paragraphs, and books, and when we begin to contemplate the literary fabric, we are so struck with its simplicity and felicity that the verbal inspiration of the Bible does not seem to be so incredible as many are disposed to think. The combination of limpid simplicity with literary excellence, offered by Holy Scripture, is of such a kind as to demand that the inspiration of its writers must differ in degree and in kind from the inspiration of all other authors. They must have been inspired by the Spirit of God Himself. There is a passage in Mr. Gladstone's book, *The Impregnable Rock of Holy Scripture*, which puts the argument very effectively. "John Bright has told me that he would be content to stake upon the Book of Psalms as it stands, the great question whether there is or is not a divine revelation. It was not to him conceivable how a work so widely severed from all the known productions of antiquity and standing upon a level so much higher, could be accounted for except by a special and extraordinary aid calculated to produce special and extraordinary results; for it is reasonable, nay needful, to presume a due correspondence between the cause and the effect. Nor does

this opinion appear to be otherwise than just. If Bright did not possess the special qualifications of the scholar or the critic, he was, I conceive, a very capable judge of the moral and religious elements in any case that had been brought before him by his personal experience" (page 131). If such a claim can be made on behalf of an Old Testament book, how much more does it apply to the New Testament which surpasses the Old as gold to silver, or the sun to the moon.

Both the simplicity and felicity of diction which characterise the pages of Holy Writ in such abundance and variety as to demand a supernatural explanation, are illustrated in the Psalter, especially in those psalms which are known and loved by all believers. Attention, however, may profitably be concentrated on its simplicity, a feature which it shares in common with all the Books of the Bible, most notably the Johannine writing. As a general rule, the language of Holy Scripture is so simple that anybody of intelligence can understand something of what the words mean. This point may be exemplified in a very effective way by reminding ourselves that, in learning a foreign language, there are few easier texts for the beginner than the translation of the Bible into the tongue which is in question. The Scriptures have been rendered into an enormous number of languages and dialects, and they serve the double purpose of providing the reader with that knowledge of God and Christ wherein standeth the secret of everlasting life, and also of furnishing simple sentences with ordinary words whereby the learner can gain an acquaintance with them.

The exquisite simplicity of the Bible's language is indeed a thing to be wondered at, and all the more so because it is the vehicle of truths whose sublimity and profundity must ever defy adequate analysis, or even appreciation, on the part of men. In a few artless words the Bible will convey information whose full significance it is impossible to grasp. It is only necessary to mention such passages as "God is light" (I John i, 5), or "I am that I am" (Exodus iii, 14) in demonstration of that claim. In the pages of Scripture the most familiar words are made the channels for the conveyance of the most unfamiliar ideas. Indeed, one can apply to the words of the Bible, often so common and commonplace, the lines of Wordsworth:—

To me the meanest flower that blows can give  
Thoughts that do often lie too deep for tears.

If anybody feels disposed to doubt this contention, let him read the Parable of the Prodigal Son, either in Greek or in English, and he will find again the simplest words used to tell the love of God which passeth knowledge in a way that cannot be bettered.

The felicity of the Bible is even more remarkable. Not only do we find in its pages the truth of God set forth in words which even the wayfaring man can understand and remember, but the beauty of the words and sentences and passages is like nothing on earth. The opening verse offers an excellent instance. George Gilfillan wrote that when he first read the first words of Genesis in Hebrew, he was almost speechless with wonder and delight. To him not only the words used but their sound when pronounced seemed to be wholly worthy of the fact of which they testify. That is saying a good deal, for the reader is informed in the first verse of the first chapter of Genesis that in the beginning God created the heaven and the earth, a discovery unattainable to the mind of man except by revelation from God, and yet the Bible states the fact in a way which of itself bears the imprint of a Divine source. All through the scriptures similar passages may be found. It is invidious to compare them as to their majesty or sweetness, for one star differeth from another in glory. There are, of course, sections where the style does not soar to such heights, but those in which it does are so many that the reader must be troubled in spirit to find an adequate explanation of such verbal wizardry apart from such a theory as plenary inspiration by the Holy Spirit.

This argument is all the more telling because the Bible is the work of several authors. It was composed in three languages. Its facts were committed to writing in different centuries and in vastly different places. Jerome only did it justice when he referred to the Scriptures as the Divine Library. It is a literary museum, and still one finds amidst their bewildering diversity of date and origin evidences in the language which seem to prove conclusively that those who were responsible for literary monuments of such enduring glory must have been aided from above in a unique way, and in a unique measure.

In passing, it may be observed that this is an outstanding case of God's loving wisdom. It might have been His good pleasure that the Bible should have been written in the simplest words, but in a fashion which lacked distinction or literary power, or charm. Students of the Koran inform us that its pages are as

dull as the desert to all but Arabs, who seem to find pleasure as well as profit in its perusal. It is far otherwise with the Bible. The truth that cometh down from heaven is clad in a vesture of words which may be compared to the lilies of the field in all their glory. The golden apples are preserved in baskets of silver. The Bible is not only profitable to read but also enjoyable, and that is due to the supreme skill with which the old, old story of Jesus and His love is told.

It only remains to emphasise one other aspect of this line of argument for the verbal inspiration of the Bible. I refer to the influence which the latter has exercised through its translations. Indeed, the suggestion might be hazarded that Holy Scripture has accomplished more in its renderings into divers tongues and languages than in the original. The mere mention of some great translations should suffice to give colour to that observation. There is the Vulgate, the celebrated rendering of the Bible into Latin. Its influence has been almost immeasurable. Great although it has been, it pales before the Authorised Version of the Bible so far as its effects on the minds and hearts of men go. To my thinking, one fact alone needs be mentioned by way of evidence. The supreme English classic is the Authorised Version, and yet it is not an original work. It is only a translation, and there is a Spanish proverb that translators are traitors. Nevertheless, the language which was native to Shakespeare, and in which he wrote, boasts as its supreme achievement the incomparable translation of the Bible, known as the Authorised Version. That is no free paraphrase of the originals but a rendering which is as close as is compatible with the literary excellence for which it is so justly famous. I am perfectly well aware that exceptions to that statement must be admitted, and that a multitude of minor reservations and qualifications must be made, but in the main it can be said that the Authorised Version is a faithful translation of the Hebrew and Greek Scriptures. When we think again of its inexhaustible grace and truth, it is surely impossible to deny that there is more significance in the words of the Bible than attaches to those of any other literary composition.

In conclusion, it may be noted that the Bible itself has something to say about its own diction. That observation applies both to the Old and New Testaments, more especially to the former where there are several passages in which the experience

of Divine inspiration is described in a way which seems to leave little room for dispute that it consisted in something more than instilling certain truths into the mind of man. Not only the thoughts but the words in which they are clothed and conveyed are ascribed to Divine agency. *A propos* of Mr. Gladstone's reference to the Psalter, these verses in the second book of Samuel are worthy of quotation. "Now these be the last words of David. David the son of Jesus said, and the man who was raised up on high, the anointed of the God of Jacob, and the sweet psalmist of Israel said, The Spirit of the Lord spake by me, and his word was in my mouth" (xxiii, 1-2). In the same strain, we may recall the mysterious saying of Our Saviour that the words which He spoke were spirit and life (John vi, 63). Even more clear is the testimony of the Apostle Paul when he declares that the things which he spoke, were not in the words that man's wisdom teacheth, but which the Holy Ghost teacheth (I Corinthians ii, 13). These and similar passages appear to lend support to the theory that even the words of the Bible were inspired of God. That is corroborated by the nature of the words themselves in their breadth, and length, and depth, and height. Buffon's dictum that style is the man himself is often quoted. It can be verified from the Bible. The style of Amos accords well with the herdsman of Tekoa, and that of Luke with the beloved physician. But the style of the Biblical books accords still more with the Divine author so that we may vary Buffon's remark and say, "The style, it is even God Himself".

#### DISCUSSION.

Colonel A. H. VAN STRAUBENZEE wrote: Our Lord has told us Satan is the Prince of this Age, his enmity being specially directed against the word of God as "written"; he has always set men's minds against the inspiration and divine character of Christianity while there is no such enmity shown against the religion of Mahomet, and no such anxiety to disprove it.

Many men make the great mistake of supposing the "Word" is made to satisfy man according to his thoughts, and not to communicate to man God's will and thoughts. Many things are related in the Scriptures, such as the malice of Satan, the mistakes and evil thoughts of men. All these are given by inspiration, that we may

know man, and the ways of God. At the same time God's own thoughts are communicated to us, to enable us to judge all this according to His judgment.

When men spoke by inspiration, they uttered a revelation which was absolutely true because from God. This did not make them infallible, but only perfectly true and divine in what they utter, because inspired.

What does the Scripture say for itself? Let us read 2 Peter i, 19-21: "And we have more sure the prophetic word, to which ye do well that ye take heed (as to a lamp shining in a dark place, until the Day dawn and the Morning Star arise) in your hearts, knowing this first that any prophecy of Scripture never came of its own unfolding (or sending forth) for not by the will of man was prophecy at any time brought, but, being moved by power from on high, men spake from God."

Many teachers tell us that prophecy is a dark place and we do well to avoid it, but this Scripture declares that the world is (spiritually) a dark place, and we do well to take heed to the prophetic word, as being the only light that shines in it, and illumines us in the darkness.

The Scope of this passage does not speak of what Scripture *means*, but whence it came. It refers not to the sense of Scripture, but its source; not to its interpretation, but to its origin.

Scripture never came from its own sending forth, because it never at any time came by the will of man and therefore not from the prophets' own inner consciousness.

The word "God" is emphatic here and points to the fact that He Himself is the sole source of Holy Scripture.

2 Tim. iii, 16: "All Scripture is God breathed, and it is God who spake by the prophets—the words were God's, the mouth and the pen were the prophets'; and as trees under a strong wind each give forth their own peculiar sound, so men under the power of the heavenly wind gave forth things which were typical of the writer.

On at least seven occasions the Christ of God between His Baptism and Crucifixion, stated clearly that His Words, all of them in the fullest sense, were the words of God:—

1. John vii, 16. "My doctrine is not mine but His that sent me."

2. John viii, 28. "As my Father hath taught Me, I speak these things."
3. John viii, 47. "Why do ye not believe Me? He that is of God, heareth God's words."
4. John xii, 49. "The Father which sent Me, He gave Me a commandment what I should say and what I should speak."
5. John xiv, 10. "The words that I speak unto you I speak not of Myself."
6. John xiv, 24. "The Word which ye hear is not Mine, but the Father's which sent Me."
7. John xvii, 8. "I have given unto them the words which Thou gavest Me."

So in the Old Testament to Moses, Deut. viii, 18: "I will put my words in his mouth," and to Is. ii, 16: "I have put my words in thy mouth."

How did individuals like Hezekiah, Joseph, David, Isaiah, Daniel, Mary, Simeon, treat the Word and act in the face of Scripture, which must have been hard to understand, though clear now to us? We are told in 1 Peter i, 10-12, "Of which salvation the prophets have enquired and searched diligently, who prophesied of the grace that should come unto you, searching what, or what manner of time the Spirit of Christ, which was in them did signify, when it testified beforehand the sufferings of Christ and the glory that should follow . . . which things the angels desired to look into."

Dr. J. BARCROFT ANDERSON wrote: The word "inspiration" is a Latin word, and means "blown-into." It is used only twice in "The Bible," that is the Authorised Version of the Hebrew and Greek Scriptures.

In Job xxxii, 8, the words spoken by Elihu, the Buzite, are given as: "The inspiration of the Almighty giveth them understanding." But the Hebrew word here translated "inspiration" is the ordinary Hebrew word for breath, a Hebrew word that occurs exactly 24 times, and is 17 times translated "breath."

The other place where the word "inspiration" is found is in 2 Tim. iii, 16, where The Bible says: "All Scripture is given by



inspiration of God." But in so translating the Greek, it completely misrepresents the Greek, the translation should be "entire writing god-spirited." Words written by Paul of the Hebrew Old Testament words that describe, not how the Hebrew Old Testament came to be, but which describe the nature of its words. Even as in John vi, 63 we find: "The sayings I have spoken to you, they are Spirit."

Consequently I think we would be wise to get rid of the word "inspiration" when speaking of what is written in the Hebrew and Greek Scriptures. All these Scriptures themselves explain how they came to be. In Ezra vii, 6, The Book of Moses (Mark xii, 26) is stated to have been given by Jehovah, God of Israel. Its entire structure implies this. Its permanent place was beside the Ark, inside the Veil, where the sons of Aaron alone were allowed to enter. It contains words spoken on this planet before its solid matter was raised above sea level. Not a mere translation of such words. Words exclusively divine. A language from which all other languages have come. Josephus records how, when the King of Egypt in exchange for great wealth was allowed to borrow this book to be translated into Greek, he was surprised at the quality of its papyrus. All its letters were gold. The Author of this book guaranteed it correct to the smallest letter and to every one of the horns that were on some of the letters, when He said: "Until the heaven and the earth may have passed, one I and one horn by no means may have passed from the instruction (nomos) until all may have come to be" (Matt. v, 18). Ginsburg, in the marginal notes on the Hebrew manuscripts of this book, found 1,722 letters of this "Book of Moses" recorded as having 1, 2, 3, 4, 5, or 7 of these horns attached to them. And a record of the particular part of the letter to which each horn was attached. A record which seems to imply that the original form of Hebrew letter used, was the same as that of printed Hebrew to-day. This belief is not now held by the theologians. They presume that the creator of All-things, must, in His Tabernacle in the Wilderness, to which He admitted nothing of human initiative, have used an alphabet of human design.

One recent exhaustive Hebrew English dictionary distinguishes throughout, between the Hebrew of the Sacred Scriptures, and all other Hebrew.

## AUTHOR'S REPLY.

I have to thank Colonel van Straubenzee and Dr. Barcroft Anderson for their communications. They hardly deal with the precise phase of inspiration which it is the purpose of the paper to discuss, but they are none the less interesting and instructive as throwing light on a large subject. The list of seven sayings of Our Lord, bearing on the whole question, is specially welcome.

## The Rev. S. Runsie Craig Memorial, 1941.

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In accordance with the terms of the Trust, the Council have selected for the 1941 Memorial the Paper on "Divine Intervention in Historic Fact and Prophetic Anticipation," presented to the Society on February 3rd, 1941, by the Rev. W. S. Hooton, M.A., B.D., as affording strong confirmation of the genuineness of the "Faith once delivered to the Saints."

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War conditions having rendered it impracticable to hold an ordinary meeting on February 3rd, 1941, the Paper appointed to be read on that date was circulated to subscribers and is here published, together with the written discussion elicited.

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### *DIVINE INTERVENTION: IN HISTORIC FACT AND PROPHETIC ANTICIPATION.*

By THE REV. W. S. HOOTON, M.A., B.D.

#### HOW IS THE KINGDOM OF GOD TO COME ?

**T**HIS question, a challenging one at all times, has become tenfold more so through the events of recent years. Far from advancing to a golden age, the world has seemed to be galloping to ruin. Hopes based upon the spread of education and the progress of science have been proved to be delusive; science itself has been turned to wicked, inhuman ends. Theories looking for the triumph of a leavening Christian influence have met with a startling set-back in the reversion to paganism and atheism which casts a dark cloud over Europe to-day. It is not to be denied that the teaching of Christ our Lord has had powerful effect in raising the standard of human ideals throughout the centuries, nor must we for a moment ignore the fact that the Spirit of God is still mightily working, amid all the turmoil; but a challenge has been offered by the powers of darkness which is almost unprecedented in violence, and altogether unequalled in its world-wide extent.

Can any inferences be drawn, from the past ages of the world's history, as to the way in which the wisdom and power of God deal with the affairs of men—inferences leading to a reasonable forecast as to the likely future of this harassed world ?

#### PAST STAGES OF HUMAN HISTORY.

Those who have hitherto neglected or even questioned the evidence of the Biblical records and pronouncements are probably, in many cases, now wondering whether the astounding developments seen in current events call for more careful attention to what Scripture has to say of past human history, and what it foreshadows in the future. It is to Scripture alone that we owe any knowledge we possess as to the earliest ages of mankind ; and, for this and other reasons, it is from Scripture alone that we can gather a solid basis for a philosophy of history.

It tells of a series of historical stages, *marked by acts of divine intervention*. Man was put on his trial in various ways ; and every time there was manifested a fatal drift away from God and from right living. History demonstrates the impossibility of recovering lost direction and forfeited standing, apart from God, and faith in Him.

Thus, the universal corruption of primeval times led to the universal judgment of the Flood—an act of divine intervention ; not merely, indeed, in judgment, but also in mercy. Humanity was provided with a fresh start, in an earth cleansed of intolerable wickedness. But the fatal taint breaks out again ; and further intervention follows, in the scattering of the nations at Babel—this also being an act of judgment with a merciful purpose in view.

God again intervened in the choice of Abraham, as the head of a race which should represent Him, and His truth, and His laws, among men. But open manifestations of the rebellious spirit proved, again and again, in the history of that very race, that evil is ingrained even in those most favoured by spiritual privileges and spiritual light. The dispersion of the race, and their partial return, led to no radical change ; nay, there followed a fearful culmination of iniquity and apostasy, in the worst crime of history, the rejection and crucifixion of the King and Redeemer Himself.

But here comes the greatest of all examples of Divine intervention. That awful crime was itself overruled, by the mighty

power of God, for the actual fulfilment of the purpose of redemption, in preparation for the Kingdom. The Cross was the preliminary to the opening of the most enlightened dispensation of all hitherto experienced. The bright light of Pentecost provided for humanity the most glorious of all its opportunities. But how does the world stand now, after nearly two thousand years of this exalted privilege? Far be it from us to underrate the real triumphs of the Redeemer in every land, or even the more general influence of Christian ideals. But what is the true position, either in the world at large or (alas!) within the visible Church itself, after these many centuries of the most favourable conditions possible within the limits of human freewill? The events of the past two or three decades have revealed the complete bankruptcy of human efforts at world-governance. The fearful disclosures of human depravity in the present world-crisis have shown afresh the inescapable reality of that depravity. The gigantic tasks which will await treatment after the power of our enemies shall, by the grace of God, have been broken, and after any further complications—which seem only too likely—have been met, will certainly prove too much for human skill and wisdom. “Who is sufficient for these things?” The only hope for mankind is *that God should intervene again*. For “our sufficiency is of God,” and of Him alone.

#### HUMAN NEED AND DIVINE MERCY.

We see, then, that under every kind of test to which man has been put, he has failed; and we turn to enquire as to *the origin of the trouble*, and to discover *the principles of Divine intervention*. The hinge of the Bible comes very near its beginning. There is nothing surprising in this; it is the same with the hinge of a gate. And everything “turns upon” the hinge! Man, as created, was in all respects “very good.” His moral condition was one of innocence, with capacity for full development, and with the quality of free will—a priceless gift. But man took the wrong path. The tragedy of the Fall altered everything; and the whole of Scripture which follows the account of it in Genesis iii is a revelation and a record of the way in which the mercy and justice of God dealt with the altered situation, with a view to redemption, restoration, and the coming of the Kingdom of God. Thus the whole of the

revelation "turns upon" the Fall. Here is the explanation of the ingrained tendency which has produced consistently dire results. But just here comes what we might at the outset with logical accuracy have described as the first Divine intervention, in the promise of the woman's Seed who was to bruise the serpent's head. We have already said that the *fulfilment* of this promise constituted the greatest of all examples of such intervention. In it is the very heart of the revelation of the ways of God with men. While the Fall is the *hinge* of that revelation, Calvary and the Resurrection are its *centre*.

As we review those past stages of world-history, what can be gathered with regard to *the reasons which call for the direct intervention of God*? Three such reasons have been suggested; and they appear to cover all the cases which we have recalled. It would seem that He intervenes (a) when a state of affairs has arisen which might frustrate His purposes if not corrected; (b) when corruption reaches a stage beyond the power of man to cope with it (c) when the possibility of godly living for future generations is menaced. Every one of the above examples comes under one or more of these heads.

#### THE PRESENT NEED, AND THE REMEDY.

How far does the present situation correspond to such conditions? Christianity, indeed, is still, as ever, the saving salt of the earth. But the Christian message, always widely rejected or neglected, is now confronted by special attacks, and in particular by vast world-movements absolutely incompatible with its essence. Meanwhile, the increase of knowledge—divorced from a supply of Divine wisdom—has tended to pride in the imagined sufficiency of human resources, and has even been perverted to the invention of diabolical devices for human destruction. Forces inspired from hell are bent upon frustrating the purposes of God, and bid fair, if unchecked, to render godliness in future generations impossible. And human statesmanship, for all its striving, has been powerless to cope with the growing power of evil. No remedy is within sight. But the Word of God shows us where to look for it.

*The resources of God* are not exhausted. We have not yet reached the final stages of Divine intervention that are revealed in the Scriptures. It is not for us to say exactly when the time

for them will arrive. But the fact of decisive coming action by the direct intervention of God is as plainly declared as any other fact. It is this, which will introduce the world-wide establishment of His Kingdom that is guaranteed by the promises of Holy Writ. Divine intervention is the one sure hope of the Church, and for the world—Divine intervention, with Divine governance to follow.

The Second Coming of our Lord Jesus Christ is as clearly foretold as was His First Coming. The prophecies with regard to that First Coming were fulfilled with a literal and wondrously detailed exactness, familiar to all Bible students. Why should anyone doubt that those which foretell His Return will be fulfilled with equal literalness ?

It is not true to say, as is sometimes said, that the subject is shrouded in obscurity. Confusion has been introduced by the unwise handling of some controversialists, but the main outlines of the revelation are as clear as daylight, and, in actual reality, are agreed upon by all who accept its plain teaching, whatever differences there may be on points of detailed interpretation. Let us try to summarise the main facts. Scripture references which either declare or imply them are, in most cases, very numerous ; we can, of course, only quote a limited number here.

1. *The Lord Himself is coming back in personal and visible reality.* "Then shall they see the Son of Man coming in a cloud with power and great glory." "This same Jesus, which is taken up from you into heaven, shall so come in like manner as ye have seen Him go into heaven."<sup>1</sup>

2. *His Coming will be at a time of world unrest and terror.* "Upon the earth distress of nations, in perplexity for the roaring of the sea and the billows ; men fainting for fear, and for expectation of the things which are coming on the world ; for the powers of the heavens shall be shaken."<sup>2</sup>

3. *The world will be as preoccupied with its own affairs, as in the days of Divine visitations long ago.* "They did eat, they drank, they married wives, they were given in marriage . . . They ate, they drunk, they bought, they sold, they planted, they builded."<sup>3</sup>

<sup>1</sup> Luke xxi, 27 ; Acts i, 11, Cp., e.g., 1 Thess. iv, 16. Rev. i, 7.

<sup>2</sup> Luke xxi, 25, 26 (R.V.).

<sup>3</sup> Luke xvii, 26-30.

Observe the remarkable suggestiveness of the wording.<sup>1</sup> Those referred to (in the days of Noah and Lot) are among the most appalling examples of human corruption. Yet our Lord does not seem definitely to select their gross iniquities for reference, but their complete obsession with secular pursuits, not in themselves unlawful. And is not that precisely the primary sin of our own day?—*leaving God out.*

4. *The Advent of the Lord will be unexpected*—certainly by the world; there are solemn suggestions that it may take by surprise even many Christians. “Therefore be ye also ready; for in such an hour as ye think not the Son of Man cometh.”<sup>2</sup>

5. *His Coming will be as sudden as it will be unexpected.* There will be no silent, unrecognised approach, as there was in the case of the first Advent. “As the lightning cometh out of the east, and shineth even unto the west; so shall also the Coming of the Son of Man be.” “Watch ye therefore . . . lest coming suddenly He find you sleeping.”<sup>3</sup>

6. *The day and hour of His appearing are known to no one* “Of that day and hour knoweth no man, no, not the angels of heaven.” “Ye know not when the Master of the house cometh, at even, or at midnight, or at the cockcrowing, or in the morning.”<sup>4</sup>

7. *He is coming to receive and to transfigure His own people.* “I come again, and will receive you unto Myself; that where I am, there ye may be also.” “The dead in Christ shall rise first: then we which are alive and remain shall be caught up together with them in the clouds, to meet the Lord in the air: and so shall we ever be with the Lord.” “Our citizenship is in heaven; from whence also we await as Saviour the Lord Jesus Christ: who shall fashion anew the body of our humiliation, that it may be conformed to the body of His glory, according to the working whereby He is able even to subject all things unto Himself.”<sup>5</sup>

8. *He will require of all an account* “We must all be made manifest before the judgment-seat of Christ; that every one may receive the things done in the body, according to that he

<sup>1</sup> Similarly in Matt. xxiv, 37, 38.

<sup>2</sup> Matt. xxiv, 44; Cp. 2 Pet. iii, 3, 4.

<sup>3</sup> Matt. xxiv, 27; Mark xiii, 35, 36; cp. 1 Cor. xv, 52.

<sup>4</sup> Matt. xxiv, 36; Mark xiii, 35.

<sup>5</sup> John xiv, 3, R.V.; 1 Thess. iv, 16–18 (cp. 2 Thess. ii, 1); Phil. iii, 20, 21. cp. Titus ii, 13.



hath done, whether it be good or bad." "This is He which is ordained of God to be the Judge of quick and dead."<sup>1</sup>

9. *He is coming to right all wrongs.* "The Son of Man shall send forth His angels, and they shall gather out of His Kingdom all things that cause stumbling, and them that do iniquity, and shall cast them into the furnace of fire; there shall be the weeping and gnashing of teeth. Then shall the righteous shine forth as the sun in the Kingdom of their Father."<sup>2</sup>

10. *He will set up a Kingdom which will never be overthrown.* "His appearing and His Kingdom." "The Kingdom of the world is become the Kingdom of our Lord and of His Christ; and He shall reign for ever and ever."<sup>3</sup>

Here, then, are at least ten clear and positive facts of Divine revelation, regarding the Coming and Kingdom of the returning Christ.

#### SCEPTICISM—AND CONTROVERSIES.

It is, of course, widely known that the literal interpretation of His Coming has been challenged; also that considerable discussion and controversy (in matters of detail only) has arisen between the chief schools of interpretation. Something must be said on both these matters.

It would carry us too far to deal here with the most objectionable form of the challenge—that which questions the Scripture record. But a different line is adopted by those who suggest that the promises were fulfilled in the Coming of the Holy Spirit, and must be understood in an entirely spiritual sense. Anyone who will glance over the passages we have quoted (and there are many like them) will scarcely think this a natural explanation; but as St. John himself has been claimed as an exponent of the view (writing after early hopes of the Lord's personal Return had not yet been fulfilled), a little more must be said about it.

Surely, here is strange exegesis! It is certainly St. John who records in special fulness our Lord's promises of the Holy Spirit's Coming. But consider these words, in the very context—"I go to prepare a place for you;" and further, "I come again, and will receive you unto Myself; that where I am, there ye may

<sup>1</sup> 2 Cor. v. 10; Acts x, 42, R.V.; cp. Rom. xiv, 10-12; Matt. xxv. 14-33.

<sup>2</sup> Matt. xiii, 41-43, R.V.

<sup>3</sup> 2 Tim. iv, 1; Rev. xi, 15-18, R.V.; cp. 1 Cor. xv, 25; Rev. xix, 11-16.

be also."<sup>1</sup> The first words, "I come again," may indeed *include* the spiritual coming, especially as the tense is present, and the same discourse speaks of the Father and the Son "coming" to the believer who proves his love by his obedience.<sup>2</sup> But it is incredible that the rest of the promise should have this meaning alone; obviously it could have no full explanation apart from a literal Return to "receive them" to the "prepared place." And (especially in view of this) it is only reasonable to conclude that the words "I come again" must themselves find their final and most perfect fulfilment in a literal Return.

Almost more extraordinary does the proposed exegesis appear, when it is remembered that the very same discourse consistently represents the Holy Spirit as "another" Comforter, thus distinguishing Him from the Lord Himself, who is speaking.<sup>3</sup> Again, it is St. John's Gospel which has the further saying, "If I will that he tarry *till I come*";<sup>4</sup> it is St. John who, in his First Epistle, speaks as plainly as anyone of the *Parousia* of the Lord.<sup>5</sup> A strange witness, surely, to call in evidence for an unnatural and evasive theory!

Some, again, have held that the Lord fulfils his promise by coming to His believing people at death. But in one of the fullest revelations about the Second Coming a distinction is made between dying and being received at His Return.<sup>6</sup> Nor can the promise have been fulfilled at the destruction of Jerusalem. For some of the Biblical references to the Second Advent were written after that event.

The long delay (according to our estimates) is the subject of explanation by St. Peter. Human measurements of time have no comparison with the Divine estimates; what, indeed, are centuries, or even millenniums, when set over against eternity? And especially, the delay is the expression of His longsuffering mercy and concern for men's souls.<sup>7</sup>

#### DIVERSE INTERPRETATIONS.

With regard to discussions and controversies—the second of the two subjects mentioned at the beginning of the preceding

<sup>1</sup> John xiv, 2, 3, R.V.

<sup>2</sup> John xiv, 23.

<sup>3</sup> John xiv, 16, 26; xv, 26; xvi, 7, 13, 14, 15; cp. Acts ii, 33.

<sup>4</sup> John xxi, 22.

<sup>5</sup> 1 John ii, 28.

<sup>6</sup> 1 Thess. iv, 16, 17.

<sup>7</sup> 2 Peter iii, 8–15.

section—not much need be said on this occasion. It is not our present purpose to discuss different schools of interpretation, but to set forth the salient facts of prophecy concerning the promised Return of our Lord and His coming Kingdom—the greatly needed and clearly foretold *Divine intervention*.

Yet, inasmuch as these differences of view have given rise to much unhappy controversy, which has—without reason, indeed, but in regrettable fact—discredited the subject in the eyes of many, it is important to call attention to the leading considerations which govern this aspect of the matter.

First, as has already been mentioned, these controversies do not affect the *facts*, but only the manner in which the foretold events will be fulfilled, and the order of their development. And besides this, none but the last four of our ten points can be held to be affected even to this extent.

Further, it is of the highest importance to remember that our Lord's Return is not the only Christian doctrine which the Enemy of souls has made the subject of confusing and unedifying controversy. Every one of the chief credal truths has suffered in the same way; yet no-one pleads that *these* should be ignored! It is only when the Second Advent is mentioned that the plea is raised that the topic is confused and controversial. How unreasonable, when this is as plainly revealed as anything else! Whatever may be said about the absurdity of extreme insistence upon disputed points of detailed interpretation, any such absurdity is capped by this extraordinary excuse for neglecting an essential part of Christian truth.

Incidentally, it may be pointed out that the very existence of these diversities of interpretation on points of detail, between equally devout and true Bible students who are agreed on the main facts, should make everyone wary of adopting an attitude of undue dogmatism regarding such details. And, above all, it should rule out any uncharitable erection of a particular view of them into a standard and test of orthodoxy.

One favourite excuse for avoiding the subject is the falsification of confidently predicted dates for the Second Advent. But it must in all fairness be acknowledged that date-fixing has fallen into disrepute among students. It is not reasonable to pour scorn upon a method so generally abandoned. And it is the height of folly to remain aloof, refusing to face a large part of Divine revelation, on so inadequate a plea.

## THE COMING KINGDOM.

There is, however, *one* of the four points referred to as affected by diverse interpretations, which demands some special reference, because it closely touches our main topic of Divine intervention and the coming Kingdom.

It is a revealed fact that our Lord will set up a Kingdom which will never be overthrown. But will it include a reign *on earth* of righteousness and peace? In other words, are we to look for a literal millennium?

Many among us do think that Scripture points to such a coming reign. The "thousand years" of Rev. xx. 2-7 might, indeed, be as symbolical as so much else in that wonderful Book. But that is not the point. It has to be recognised that other passages, by no means so likely to be symbolical, appear to indicate a literal earthly reign. And, in particular, the positive notes of time in that particular passage seem to have no meaning apart from an earthly reign—the double reference "*until* the thousand years should be finished"; the phrase "*after that*"; and the fact that during the period indicated (whatever its exact length, literal or symbolical) Satan should "*deceive the nations no more.*" At all events, the present is the last of all times concerning which that could be said!<sup>1</sup>

But let it be supposed, for the sake of argument, that the promised Kingdom is to be entirely spiritual, and that all passages referring to it are designedly symbolical. That would not diminish the importance of the matter. In one way or another, the vindication of our Lord will be made unchallengeably manifest to all created existences. To Him, every knee shall bow.<sup>2</sup> By His visible and acknowledged victory, the results of the Fall will be more than nullified; a creation in bondage will be set free, once for all, and irreversibly; redemption, already won, will be brought to its full fruition.<sup>3</sup>

This is an essential part of the Christian Faith and the Christian message. Obviously, it is its culmination. And what will be the decisive means of its accomplishment? Holy Scripture leaves us in no uncertainty. *It is the Second Coming of our Lord, the Redeemer, in a mighty act of Divine intervention. Redemption, won on the Cross, guaranteed by the Resurrection,*

<sup>1</sup> Rev. xx, 1-7, especially 3, 5, 7; cp., e.g., Psa. lxxii and Isa. xi, 4-10.

<sup>2</sup> Phil. ii, 10.

<sup>3</sup> Rom. viii, 18-23; Matt. xiii, 41.

will be completed at the Return. Scripture does not foreshadow a gradually improved world ultimately acknowledging its King; it tells of a world in itself hopelessly tainted and helplessly corrupt, of humanity finally proved bankrupt after the most favourable test; yet, in the abounding mercy of God, and on the sure guarantee of His inviolable promise, to be cleansed of "all things that offend," and gloriously delivered, through *His own decisive act of saving intervention*. Whether the Kingdom be earthly or not, it is *His intervention* that will establish it.

#### A MESSAGE FOR THE TIMES.

Here is a message for the times. Indeed, it might be said, *the* message for the times, with uniquely special appeal in the amazing conditions of our own day. That it should be scoffed at by the sceptic was foretold<sup>1</sup> (incidentally, this remarkably testifies to the inspiration of Scripture so long ago); but that it should be overlaid and ignored just when it is most needed is a tragedy indeed.

Think of the effect it would have, through the power of God, upon men and women asleep in indifference, numbed by scepticism, or halting between two opinions. Think of the ensuing awakening, among lukewarm Christians, to personal witness and sacrificial gifts in their Master's cause. Think, again, of the relief to earnest souls, saddened by the woes of the Church and of the world.

It is sometimes supposed that the study of prophecy is unpractical. Why, it is one of the most practical of all! In the teaching of our Lord and His apostles, it is ever linked with the call to watchful readiness, holy living, zealous service.<sup>2</sup> So far from leaving us "in the clouds," this subject brings us face to face with the hard facts of earth, while it calls us to abandon idle dreams of humanly organized improvement, and the "wishful thinking" which has marred so much in the Church's earnest efforts.

And can it come to pass in our own time? Why not? Date-fixing is folly, or worse; but our Lord did give *general signs*

<sup>1</sup> 2 Pet. iii, 3, 4.

<sup>2</sup> Matt. xxiv, 42-xxv, 30; Rom. xiii, 11-14; 2 Pet. iii, 11-14; 1 John ii, 28, iii, 3, R.V.

by which the approach of the great Day might be anticipated. And as He blamed His own generation for not discerning the signs of His First Advent, He is not likely to commend us if we refuse to ponder the signs of His Second Coming. Certainly, there never has been a time which looked *so much* like the period that He and His followers thus foretold.<sup>1</sup> What shall we say, if He should return and demand *our* account for never witnessing of all this to a dallying Church and a heedless world—perhaps even for never heeding it ourselves ?

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<sup>1</sup> See especially Luke xxi, 25-28.

#### DISCUSSION.

Rev. Principal H. S. CURR wrote : On the general principle which underlies Mr. Hooton's admirable paper there can surely be no room for dispute. It is a matter of general agreement amongst philosophical historians that nations can only be quickened by the incursion of some external influence. A people cannot lift itself by its own waistbelt any more than an individual. Thus the East slumbered until it was brought into vitalizing contact with the West. The American continent remained in a state of stagnation until settlers from Europe landed on its shores. What is true of the effect of nations upon each other, applies with equal force to Divine intervention. It is the only way whereby the human race can be rescued from decline and decay and made to walk in newness of life.

The First Advent of Our Lord is the proof. The world of that day had come to the end of itself. It was plunged in despair. But man's extremity proved to be God's opportunity, and by means of the Incarnation and Passion of the Son of God man received a new and glorious lease of life. The centuries which have passed since the beginning of the Christian era have no parallel in the world's history for progress of every kind, spiritual, mental, and material, that being due to God's act in sending His Son in the likeness of sinful man that He might do for the children of men what they could never by any chance do for themselves.

The Second Advent of Christ is necessary on the same grounds, unless it can be proved that the First Advent of Our Lord has been adequate for all that may be required. Will mankind now be able

to work out its own salvation without further intervention on the part of God ? The clear and explicit teaching of the Bible forbids such a hypothesis. Both the Old and New Testaments make it plain that Christ must return to reign upon the earth before evil will be fully and finally overcome by good. But may it not be argued that the Old Testament Dispensation makes that probable, and even certain, by analogy ? Between these world events the Flood and the Cross the chosen people enjoyed Divine guidance and blessing in remarkable measure, but they proved to be insufficient. God Who at sundry times and in divers manners spake in time past unto the fathers by the prophets was constrained in the fulness of time to speak unto men in His Son. He could do none other, for all the expedients tried had proved to be failures. My contention is that, just as man failed to conquer his spiritual foes until there came a Second Adam to the fight, despite all the instances of Divine intervention which the race has received, so he will fail again, despite the immeasurably superior resources to which he has access in Christ. The reason lies in the strength of sin. Nothing but the Second Advent of Our Lord will vanquish it for ever. The Kingdom of God will never come on earth as it is in heaven until its King should first come in great power and glory. History has got a way of repeating itself, and that applies to the history of redemption. The combination of causes which made the First Advent imperative will make the Second an equally clamant necessity.

Mr. G. A. HEATH wrote : Mr. Hooton's very important paper is most refreshing reading. It seems to me to be exactly the right kind of teaching to counter the prevailing, appalling, but pleasant error, described in the paper as "dreams of humanly organised improvement." On every hand, from pulpit, platform and religious periodical, comes a flood of this "wishful thinking." *We*, the self-sufficient *we* ; we men of good-will are after the war going to bring in the Kingdom of God by *our* efforts ; missionary, educational, cultural and what not !

Mr. Hooton skilfully leads us to the Scriptures and suggests that God summed up man as an impossibility away back in Genesis vi. He reminds us that Scripture is almost vocal in insisting that only through the *personal* intervention of Christ, the One "in whom all

things subsist," can peace, order and righteousness have sway in the earth—and these things shall be—in God's due time.

I am glad Mr. Hooton has called attention to the unwisdom of fixing dates. God's mercy allows postponements, and yet there is no delay to His appointments. In Gen. vi, He says, "My Spirit shall not always strive with man" then mercy says "Yet his days shall be 120 years"; and after that time of long-suffering, only eight entered the ark!

To Nineveh of old came the message "Yet 40 days and Nineveh shall be overthrown." But the men of Nineveh repented at the preaching of Jonah and the 40 days stretched out 170 years.

When Christ came there was the wonderful incident of the comma (Luke iv, 16-19). He deliberately paused at a comma, when quoting the prophecy, the fulfilment of which *He was*; and that comma has become 2,000 years of Mercy—yet the prophesied judgment must come. Because of these hiatuses which are so frequent in God's dealing with Man it is impossible to foretell the moment of His coming, even though the signs abound. Let us remember too, that although the believer has the sure hope of the wonderful consummation of reaching his Lord's presence by transformation, rapture, or resurrection, yet the World itself is preparing for the advent of the Antichrist who will undoubtedly precede the parousia of Christ. None of the many antichrists who have worked wickedly down the ages have reached the dimensions of the great and powerful personality who shall arrogate World-dominion and World-worship to himself, as limned in lurid outline in the Scriptures—a veritable masterpiece of Satan. Such are some of the *unpopular* facts to which one's thoughts are drawn by a perusal of this searching, timely paper. May the people of the Lord rise to their privileges and proclaim the truth.

Finally, I would like to commend the skill with which Mr. Hooton has avoided the controversies of various schools of interpretation, while sacrificing nothing of the truth of his main theme.

Colonel A. H. VAN STRAUBENZEE wrote: Having read the lecture, with great interest, I think its subject should be changed to—"The Kingdom of Christ on Earth." But before this comes, our present administration of Grace will be closed to be followed by a



short administration of Judgment before we enter Christ's millennial Kingdom on earth for 1,000 years.

Paul, as the pattern of a saved sinner under grace, teaches us that, if dead when the Body of Christ is completed, we shall be raised by an out-resurrection from the majority of the dead. If alive, we shall be called on high by translation, and in this manner shall we ever be with the Lord.

Mr. E. H. BETTS wrote : Mr. Hooton's paper is not only of great intrinsic interest but adumbrates a philosophy of divine intervention of the greatest attractiveness, the pursuit of which would be too lengthy for a mere discussion. I submit only the following remarks for Mr. Hooton's consideration.

The "three reasons which call for divine intervention" would seem to be applicable to a broader range of divine action than that which could be strictly styled direct personal intervention. An examination of divine "interventions" leads to the following rough classification :—

I. *God's inscrutable providential manipulation* of all things, good and evil, which constrains all things for good according to His purpose (Rom. viii, 28, with Eph. i, 11). This kind of action uses no "miraculous" means and yet is most miraculous in that it gives to events a direction that is totally contrary to the design of the evil beings, men or higher, who set them on foot. It is no "intervention" and yet surely prevents the frustration of God's purpose (reason (a)) and operates in a groaning creation where corruption (Rom. viii, 21) is surely beyond man's power to correct (reason (b)).

II. *More unusual action* involving (i) exceptional phenomena (*e.g.*, Writing on the Wall), (ii) common natural forces (*e.g.*, seismic or meteorological) operating in exceptional degree (*e.g.*, Deluge) coupled with a declaration through one of God's servants that the action is His and for what purpose He is acting (*e.g.*, Elijah's demonstration on Carmel (1 Kings xviii); denunciation of Belshazzar (Dan. v); the Deluge (Gen. x)). This class of action (which is doubtless capable of further sub-division) is hardly "intervention" in a sense comparable with that of the *epiphaneia* of Christ at the time of the destruction of the Man of Sin (2 Thess. ii, 8). It nevertheless

would seem to be covered by Mr. Hooton's condition (c) (maintenance of the possibility of godly living) in almost every case, and condition (b) (corruption beyond human power to control) in other cases. For instance, the possibility of godly living in the fear of Jehovah was preserved to the godly remnant by God's action through Elijah on Carmel ; and corruption had reached at the Flood a degree beyond the power of man to rectify.

III. *Direct, personal intervention* in government, grace or judgment. This took place *inter alia* in Eden (intervention in Government, Gen. iii, 8, *et seq.*) and at the first Advent (intervention in Grace) and is to recur (intervention in Judgment) when sin reaches its climax (2 Thess. ii, 8 and elsewhere). This type of intervention is thus characterized :—

- (1) It is direct (without employment of intermediary).
- (2) It is personal.
- (3) It inaugurates a new era and closes up an old one in the history of mankind in general.

A little examination will show that in Class III the three " reasons for intervention " come into force, and in the intervention in Judgment all three simultaneously and clamantly.

Now I submit that the reasons that call for the final direct personal intervention which is to inaugurate the Kingdom of God on earth in its fully public character are stated in Scripture to be :—

- (1) The banding of kings and rulers against God and Christ,
- (2) public rejection of God's restraint and God's authority, and
- (3) the recognition of a rival authority in the place of God and the worship of this substitute.

These are the long-known characteristics of the Great Apostasy (2 Thess. ii, 3, where in A.V. it is called the " falling away " ; Ps. ii, where it is described as the Great Rebellion against God and Christ). 2 Thess. ii, 3, informs us that the Day of the Lord (so read all the best editors) *cannot come until this apostasy first come* ; Ps. ii is even more definite in its time-note : " THEN shall He speak unto them in His wrath and vex them in His sore displeasure." 2 Thess. ii, 7, 8, adds the information that the present secret working of iniquity is to be tolerated though restrained, but that when the Man of Sin is

*revealed*, the restraints having been removed, he is destroyed by the public appearing of Christ, being first consumed by the breath of His mouth and then annulled by the *epiphaneia* of His coming. The force of the passages seems to be clearly that only in the form of concerted and openly avowed rebellion against God is sin publicly dealt with by direct personal intervention of God (*sci* : in the person of the Son, Ps. ii).

I suggest that the relation between Mr. Hooton's "three reasons which call for divine intervention" and the three conditions stated above is that *the latter provide the conditions under which the former reach their universal final fulness of measure*. God is a God of measure (2 Cor. x, 13, Gen. xv, 16, Matt. xxiv, 32, etc.) The fullest possible measure of sin is filled up when men stage a world-wide, publicly proclaimed rebellion against God fully-revealed. Under such conditions Mr. Hooton's "three reasons" would be in full universal cry : not, as possibly now, merely forming the partial subject-matter of the Spirit's "intercession according to God" (Rom. viii, 26, 27) calling forth from Him who worketh all things according to the counsel of His will that miraculous though unseen co-ordination of all things (good and bad) for the *secret* forwarding of His purpose ; nor calling for a more direct judgment on individuals (Dan. v, 1 *et seq.*) or on men more generally when sinning against a God revealed less fully than under Christianity (Gen. vi, 9-13) ; nor invoking a drastic visitation of certain localities (Gen. xviii, 20 *et seq.*). On such occasions the measure of sin has been filled up individually, locally or temporarily. But here all three "reasons" work together crying out on (i) corruption to the full (2 Thess. ii, 9-12, and elsewhere), world-wide acceptance and worship of Satan's rival to God (Rev. xiii, 3, 4 and 7) leading to (ii) a threatened end of *all* godly living (Matt. xxiv, 22, Rev. xiii, 7) and thus (iii) entire frustration of God's purposes. *Then* shall the Lord appear in Person (*with His Saints, let us note well !*), and first consume and then annul him in whom all this full measure of evil is headed up : *then* shall the Kingdoms of this world become the Kingdom of our Lord and of His Christ and He shall reign for ever and ever.

It further suggests itself that an illuminating study would be provided by a research into the extent and manner in which at

various interventions the measure of sin as represented by reasons (a), (b) and (c) has been filled up.

Major R. B. WITHERS wrote : One point in this paper strikes me as requiring special comment : the allusions to interpreting prophecies in a spiritual sense. I have never been able to get anybody who speaks in this way to give a clear definition of what the word "spiritual" means when used thus. It seems that "spiritual" is regarded loosely as the opposite of "literal," though it is never explained why literalness should be unspiritual.

Then, again, there is the supposition "that the promised Kingdom is to be entirely spiritual, and that all passages referring to it are designedly symbolical." It is a pity the author of the paper fails to make the point that this supposition simply equates "spiritual" to "unreal," to put it bluntly.

The antonym of "spiritual" is not "literal" or "real," or even "fleshly" or "physical," but simply "unspiritual." All true interpretation of Scripture is "spiritual" in the true sense, but that does not mean that it must not be literal, or that spiritual things are not absolutely real. Never was there a more pernicious practise than "spiritualising" Scripture in the sense of explaining it away, and only when we have collectively rid ourselves of this deadly spiritual poison will we come to any real agreement in the understanding of prophecy.

We have got to face the fact that we have no hope of making the study of prophecy "cut any ice" among ordinary people until we have come to a reasonable measure of agreement about it among ourselves. We are far, indeed, from this goal. The first paper this year, on the Daniel prophecies, makes our differences only too plain to those who know anything of the subject. There is hardly a single point of interpretation about these prophecies concerning which all competent translators and expositors are in complete agreement. Why is this ? I suggest two reasons. The first is that we are not agreed regarding the translations of the text, particularly the Hebrew text, of the relevant passages. The second is that we all, even the most enlightened of us, tend to "spiritualise" passages which do not harmonise with our preconceptions.

The golden rule for Scripture study is "Literal if possible." Very seldom is there any real difficulty in determining whether any statement is literal or figurative. The trouble is not so much that we cannot believe a statement in the Scriptures when we understand it, as that we do not understand it because we cannot divest ourselves of our preconceptions and prejudices about it. Here is where the use of several versions is so valuable in study, though even then translators too often write what they *think* a passage means instead of what it *says*—but that is another story.

J. J. BARCROFT ANDERSON wrote: "And shall be heralded this, the gospel of the Kingdom, in all the inhabited earth, for testimony to all the races, and then shall it come, the purposed-end," Matt. xxiv, 14.

"And from time the continual is caused-to-be-suppressed, and abominable Desolator tolerated, days thousand, two-hundred, and ninety" ( $3\frac{1}{2}$  years and 30 days). Blessed is he that is being restrained and being caused to reach to days, thousand, three hundred, thirty and five. And thou. Go to end. And thou shalt be resting. And thou shalt be standing-up. At thy appointed-place. The Right-hand side." Dan. xii, 11.

Immediately prior to the abomination that maketh desolate being set up, the record is: "And I will give to the two witnesses of me, and they shall prophesy days, thousand, two-hundred, sixty, wrapped in sackcloth. . . . And when they shall have accomplished the testimony of them, the beast that cometh up out of the abyss shall make war with them . . . and kill them . . . and after the three days and a half, spirit of life out of God went into them." Rev. xi.

Prior to that period, Rev. xvii, 1-13, records the destruction of the "one" woman of Zechariah v, 7, after her wickedness had come to the full.

While the commanded blindness of Isaiah vi, 9, was operating upon the twelve tribes of Israel, but before the decreed desolations of Isaiah vi, 11, and of Daniel ix, 26 ("and at end fighting, decreed desolations"), Paul had a different hope. He then wrote: "The seen-things for appointed-times, but the not-seen-things eternal.

For we know that if the house of the tent of us on earth be destroyed, Built-house out of God have we, house not made with hands, eternal in the heavens. 2 Cor. v, 1.

#### AUTHOR'S REPLY.

Not a great deal seems to be called for in the way of reply to the kind comments upon the paper on "Divine Intervention in Historic Fact and Prophetic Anticipation." Most of the writers either amplify and illustrate special points, or enter briefly upon matters of detailed interpretation which are suitable for general consideration, but were of set purpose excluded from the paper itself for reasons then given; so that I shall doubtless be excused from entering upon them now.

Principal Curr's helpful contribution calls special attention to the great central example of Divine intervention, through "the Incarnation and Passion of the Son of God," amplifying the subject by some important considerations; and the other writers speak for the various points they deal with. Mr. E. H. Betts' very careful analysis in connection with the three reasons for Divine intervention which were mentioned gives me the opportunity to acknowledge that much in the earlier part of the paper is the fruit of suggestions received in the course of correspondence and criticisms from leading members of the Institute: it may be remembered that the three reasons themselves were definitely stated to have "been suggested."

With reference to Major Withers' criticism of the use of the word "spiritual" by contrast with "literal," in connection with the Coming of our Lord, or with the general interpretation of prophecies, it is perfectly true that what is "spiritual" is also in the truest sense "real" and "literal." No one would suggest, for example, that the spiritual Coming of our Lord to the believer is not also literally real. But I venture to suggest that two things need always to be borne in mind in our use of words: (1) that their main purpose is to make one's meaning plain to the reader, and (2) that the ideas now generally suggested by them are not always such as correspond to their original etymology; in fact, we have to take things as they are, and not as strict usage would demand. I am not quite clear, too, what alternative Major Withers would suggest for the term

“spiritual”: perhaps “visible” and “invisible” would represent the distinction between the two interpretations of our Lord’s Coming more exactly *from one point of view*; but “invisible” does not cover all that is desired to be expressed, and I venture to think that the term “spiritual” is more generally understood and is also substantially adequate; especially, perhaps, as I qualified it, twice over, by the word “entirely.” Surely there is no need to assume that it expresses anything not literal! I am inclined to think, moreover, that I am in good company in the matter; for I recall that in one of the Thirty-nine Articles it is stated that “The Body of Christ is given, taken, and eaten,” in the Lord’s Supper, “*only after an heavenly and spiritual manner.*” Is not that a parallel usage of the term “spiritual”?

I should like to add my hearty agreement with Major Withers’ brief reference to preconceptions and prejudices. It seems as if a very large number of people hold their views (on whichever side) in the matter of the interpretation of prophecy, simply because excellent men, whom they have known as teachers and guides, have taken that particular line. The times seem more than ever to call for earnest reconsideration of the whole matter.

War conditions having rendered it impracticable to hold an ordinary meeting on February 17th, 1941, the Paper to be read on that date was circulated to subscribers and is here published, together with the written discussion elicited.

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## GENESIS AND THE GOSPEL.

By E. J. G. TITTERINGTON, Esq., M.B.E., M.A.

GENESIS, the Book of Beginnings, introduces the whole body of revealed truth contained in the Scriptures. It contains within itself the germ of all subsequent revelation. If it be true that "*novum testamentum in vetere latet*," this is specially so of the Pentateuch in general, and Genesis in particular.

We can go further than this. The opening chapters of the Book bear a relation to the Book as a whole, similar to that which the Book itself bears to the Old Testament. In the first three chapters already we find the foreshadowing of the great cardinal doctrines of the Christian faith concerning God and man, concerning God in His relation to man, and man in his relation to God. Here we have clearly set forth man's place in nature, and the purposes of God toward him; his fall from his first estate, and the promise of a Saviour Who should restore him to the condition he had lost.

The importance of these chapters has caused them to be singled out (just as the prophecies of Isaiah, St. John's Gospel, and other parts of the Scriptures which possess special doctrinal significance have been singled out) for special attack by those who have constituted themselves enemies of the Cross of Christ. These include both the avowed and openly professed opponents of the Gospel, and many others, alas! who profess themselves to be Christians, but follow a gospel of their own devising. This has not been wholly a disadvantage, for one inevitable result has been that the defenders of the truth have rallied to the threatened citadel. There are thus few parts of the Scriptures which have been subjected to so intense and prolonged a



scrutiny, and the main points of attack have been vindicated again and again. There is, however, some danger that in the examination of individual matters we may fail to see the wood for the multiplicity of trees, and that in directing attention now to one, now to another detail, we may fail to obtain a co-ordinated view of the controversy as a whole.

It is not the purpose of the present paper to attempt the well-nigh impossible task of making some new and original contribution to the consideration of the contents of the chapters referred to ; still less to go over again the ground which has been so often and so adequately covered in the past, not least in the Transactions of this great Institute, but rather to endeavour to collate some of the conclusions which have been arrived at so as to present them in their relation to one another, and indicate their significance in relation to the great foundation doctrines of our Faith, in the hope that perchance some one with more adequate resources at command may pursue this line of thought to its conclusion.

### SCIENCE AND REVELATION.

There is one important point that calls for notice at the outset of our enquiry. There is a favourite form of argument used by those who find a difficulty in reconciling the teaching of Scripture with certain hypotheses of natural science. These endeavour to draw a distinction between what may be called the "natural" and "spiritual" contents of the Bible. They tell us in plain words that "the Bible is not a scientific text book," and they claim the right to judge the contents of the Book where they relate to matters of natural science or secular history or the like by purely human criteria, whilst yet retaining the doctrinal teaching of the Book. This argument possesses some show of plausibility, but is, I think, wholly and demonstrably fallacious. It postulates first of all that our knowledge of the phenomena of nature and of the facts of history, and that the inferences—hypotheses and the like—drawn therefrom, are sufficiently accurate and complete to enable us to bring the Bible to the test by their means, rather than the converse. That the Bible was not given in order to teach us science, or anything else which we are able to find out for ourselves, is true as a matter

of fact; it is not true, but completely false, as regards the inference intended to be drawn from the statement.

We cannot deal with questions of science and theology in this way in watertight compartments, so that we can safely arrive at conclusions in the one sphere wholly irrespective of considerations drawn from the other. Truth is one, and there is an inextricable interweaving, an essential inter-dependence, of its varied aspects that we cannot safely ignore. Further, if we are unable to rely upon the record where we can apply the check of our own experience or knowledge, our confidence will and must be shaken in those regions where we cannot do so. Our opponents are well aware of this, and concentrate their forces against those parts of the record which seem most open to attack, anticipating that once they have succeeded in making a breach in the defences, the breach will quickly be widened and the remainder will soon crumble or crash into ruins. The very imperfections of our knowledge, which should safeguard us from questioning where we cannot know, are turned into a weapon for the overthrow of the truth. The sources of our knowledge are twofold—reason and revelation. We can know because we have discovered for ourselves, or because something beyond our ken has been communicated to us from a source of greater knowledge. It surely behoves us to recognise our own limitations, and to refrain from exalting into a dogma any ideas which are not securely based upon one or both of these criteria; above all, when they may run directly counter to what is revealed.

Again, if we believe (and I do most firmly believe) that the Bible is the Word of God, its pronouncements carry equal weight of authority in relation to every matter with which they deal, whether of theology, philosophy, history or natural science, or of any other matter. If God, in revealing to man matters of faith and doctrine, finds it necessary to connect this revelation with other matters which lie within the purview of our own knowledge or observation, and thus to touch upon questions of natural science and the like, it is inconceivable that His references to these minor questions should have been left to the vagaries of human error and imperfection, or accommodated to conclusions vitiated by our ignorance. We must believe that He Who is the Author and Creator of things spiritual and things temporal alike has cast over his references to material things the same mantle of infallibility that rests upon the teaching on things

eternal, or else we have no sure and safe ground for our confidence at all.

### MAN'S POSITION IN NATURE UNIQUE.

Having thus cleared the ground and stated our attitude towards the Scriptures, we have now to examine these Scriptures themselves, and in particular the stories of the Creation and the Fall, in order to discover what truths they enshrine; our final task will then be to show how these truths bear upon the cardinal doctrines of the Faith. And first, in the account of the Creation in the first two chapters of Genesis, we note the unique position which is there assigned to man, both in his nature and in his destiny. This is brought out even in the structure of the chapters (Ch. 1 leading up to the creation of man as a climax, and Ch. 2 expanding and developing this theme), and in the space devoted to it. This uniqueness is not only expressly stated, but is corroborated by many additional details. Man is shown as not merely forming a part of the physical universe, but as standing above it, and to some extent even apart from it.

In Gen. 1. 26-28 we have both man's unique *nature* defined ("and God said, let us make man in our own image, after our likeness . . . So God created man in His own image, in the image of God created He him"), and also his supreme *position* ("God said . . . let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth . . . and God blessed them, and God said unto them, be fruitful and multiply, and replenish the earth, and subdue it; and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth." There is no need for us to attempt to define the exact meaning of the phrase "in the image of God," which has already been dealt with very fully in the Transactions of this Institute, and I have no wish to repeat what has been so well put forward before. Suffice it for the moment to say that it implies at the least that man possesses a nature which is not shared by the lower animals, however high in the scale of creation, but which *is* shared with His Maker Himself, so that his true affinity is with God rather than with the beasts of the field, his life is not limited to the material plane, and a possibility exists of communication between God and His creature.

The whole account of the creation of man is consistent with itself, and there are a number of corroborative details in the story. We have, for instance, the thrice-repeated use of the word **בָּרָא** (*bara*), "create," in Gen. 1. 27. The word is not employed indiscriminately, and apart from Ch. 1. 1 and 2. 3, where it is used of the creation in its entirety, and the verse quoted, in relation to man, it only appears in Ch. 1. 21, of the commencement of animal life. It is not used of any step in creation which involves only the use of elements already in existence, as in v. 6, of the firmament (or "expanse"), v. 9, of the separation of land and water, or v. 16 of the heavenly bodies. Nor is it used of light, in v. 3, or, curiously, where we might have expected it, of vegetable life in v. 11. It would appear, in fact, to be limited to steps which involve the introduction of a fresh element, a new order into the creation. If this is so, its use, not once, but three times in one verse, of the creation of man, becomes very significant indeed.

It may perhaps be objected that the meaning of the word **בָּרָא** cannot thus be restricted, and that therefore it is not legitimate to attempt to draw conclusions from its use in this way. If the argument stood alone, it would be very unsafe to build too much upon it; but it does not stand alone, and its corroborative force should not be overlooked. As to the meaning of the word, this is not a mere question of etymology, but is to be fixed by a reference to its usage. Its meaning in Scripture is to be determined by its use in Scripture; its meaning in any context by reference to that context. Even a superficial examination of the passages where it occurs will suffice to show that its use is not indiscriminate, and many passages can be quoted where it is employed to express some action that is without precedent, *e.g.*, Exod. 34. 10, "I will do marvels, such as have not been done in all the earth, nor in any nation"; Num. 16. 30, "If the Lord make a new thing"; Ps 51. 10, "Create in me a clean heart"; Is. 65. 17, "I create new heavens and a new earth"; Jer. 31. 22, "The Lord hath created a new thing in the earth."

There appears to be an economy in God's working so that He does not employ new powers or new materials where the existing ones suffice; even in the feeding of the multitudes, our Lord did not create food out of nothing, but made use of what was already to hand. So in the Creation; when matter could

be moulded to His purpose into new forms, there was no necessity to create fresh matter. But in the creation of man, there was this necessity: matter, organic structure, sentient life did not suffice. Man is not simply an improved animal, he is more than animal—no product of evolution, but a special creation. To the three traditional “kingdoms”—mineral, vegetable, animal, we should add a fourth, the human. “Man doth not live by bread only (as the animals do); but by every word that proceedeth out of the mouth of the Lord doth man live.”

Verses 18–20 of Gen. 2 lead to the same conclusion: “The Lord God said, It is not good that the man should be alone; I will make him an help meet for him. And out of the ground the Lord formed (? had formed) every beast of the field, and every fowl of the air; and brought them unto Adam to see what he would call them: and whatsoever Adam called every living creature, that was the name thereof. And Adam gave names to all cattle, and to the fowl of the air, and to every beast of the field; but for Adam there was not found an help meet for him.” Does this passage appear to us inconsequential? Do we enquire, what is the connection between Adam naming the animals, and his search for a mate? To ask the question is to answer it. The giving of names implies superiority, but it also involves scrutiny. Adam examined in turn every beast of the field, every fowl of the air, and summed up each in a word; but not to one creature “formed out of the ground” (note the phrase) did he give the name “help meet”; he found no affinity there, nothing that could answer to his nature.

### THE UNITY OF THE RACE.

Another fact that emerges from the Genesis story is that the human race is one, as Paul affirmed at Athens (Acts 17. 26): “God . . . hath made of one blood all nations of men for to dwell on all the face of the earth.” Whether there was ever a quasi-human race, as some have postulated—of human or quasi-human form, with a degree of intelligence, but lacking the human soul—is idle to speculate; the race as we know it is a single pure race. There were never several separate creations or various origins of man, and despite the great diversities of the several races of which mankind is disposed—diversities of colour, of physical form, of intelligence, of mode of existence or outlook

on life, they are all to be traced to a common origin, and all share a common nature. The differences are superficial, the unity is fundamental. So far does this principle extend that not even were the two individuals who formed the origin of the race created separately. Whatever may be the precise meaning of Gen. 2. 21-22, it at least teaches that the woman's nature was derived from the man's, and is therefore the same as his. Their descendants therefore inherited a single nature from their first parents, and not a dual.

### THE FALL.

Seeing therefore that man was created in the image of God, and given a position of supremacy; and that God, when He had completed the work of creation, including the creation of man, pronounced it "very good," we are immediately faced with a great problem. The picture presented to us does not correspond to present-day facts. Either it never did correspond to facts, or else some tremendous catastrophe must have taken place, of universal operation. The Bible at once faces this problem, and provides the answer. This is exactly what did happen: an alien element was introduced, through an external agency; moreover, it was introduced at the very fountain-head of the race, both our first parents were affected alike by it, and so the infection extends to the whole human race in like form and without exception. To this element the Bible gives the name of "sin." By it the original divine element became marred, distorted and obscured. That this could be, arises paradoxically from the very fact that man was made "in the image of God"; for this postulates amongst other things that he must be endowed with free will. The expression could not apply to a mere automaton. God requires from man love, faith and obedience. Love cannot be love, faith faith, nor obedience obedience, unless it be freely rendered, and this implies the power to withhold it, as well as the power to render it. God was not—could not be—taken by surprise; He knew that the time would come when man would exercise his free will apart from, and in opposition to, the will and command of God.

The story of the temptation and the fall of man demands close attention; it shows both the nature of sin, and its consequences, and enables us, in viewing the consequences, to trace them back to their origin. First, as to its nature. It was not,

and is not, a mere venial transgression of a trivial command, but something much more fundamental and revolutionary. There was a doubt suggested, and entertained ; a doubt of God's love and goodness, and of the truth of His word. There was a desire to be independent of Him, the assertion of man's right to choose and act for himself, apart from the will of God concerning him. In thus asserting his independence, man was false to his own nature (" in the image of God "), in spite of the paradox to which we have called attention, that his power to act independently was inherent in that nature ; and the harmony between him and his Creator was broken, the fellowship interrupted. His action involves guilt, and is not a mere psychological disorder ; it calls not only for treatment, but for punishment. The characteristics of sin as summed up by the apostle in 1 Joh. 2. 16 are all contained in the Genesis story : " the lust of the flesh (' the tree was good for food '), the lust of the eyes (' it was pleasant to the eyes '), and the pride of life (' a tree to be desired to make one wise ')."

The story also brings us face to face with the existence of an evil personality in opposition to God. The ultimate problem of the origin of evil yet remains ; a hint concerning it is given much later (Ezek. 28), but what concerns us to know and understand is how it entered into our race, and by what agency it is nourished and sustained. Man is not a being in process of evolution from a lower to a higher form (current events provide commentary enough on this theory !); the statement which has been made that " if there has been a fall, it was a fall upward " is contrary to Scripture and to reason alike. The nature of sin is ever the same, in all its varied manifestations ; its leading characteristic is self-will, in rebellion against the will of God. " We needs must love the highest when we see it," sings the poet. The tragedy is that we do not love it, or if we do, we singularly fail to follow it, and all too often we fail even to see it.

So much for the nature of sin ; what of its consequences ? These consequences were partly, and inevitably, judicial ; but they were not only judicial, they were largely inherent in the sin itself. They were both subjective and objective, internal and external. They affected man's nature, and his surroundings ; his heredity, his environment and his destiny. We see therefore how mistakenly we shall interpret these factors unless we take account also of the fact of sin, and how futile are all attempts at

reform which are based on paying attention to these factors where sin is ever present. This is not to deny that some particular forms of sin's many manifestations may be checked, nor that efforts in this direction are to be discouraged, but they do not touch, much less solve, the real problem.

Further, as neither circumstances in themselves nor the sin that has shaped them are original elements in creation, they can be regarded in part as temporary aberrations. This is not in any wise to diminish from their gravity, but only to indicate that there is a hope of salvation; that sin in man and its consequences can be dealt with, not only without doing violence to his nature, but in full conformity with his nature. Man and the world he lives in are far removed from what God intended them to be, and what in the ages to come they may yet be again, when the devil is destroyed, sin eradicated, and man in both his nature and surroundings brought back once more into full harmony with his Maker.

#### RIVAL THEORIES.

It will be convenient at this point to sum up our conclusions so far as we have gone. These are :—

1. The uniqueness of man's nature, his supremacy in the scheme of creation, and his affinity with the Divine.
2. The unity of the race.
3. The existence of a personal Devil.
4. The universality of sin, which is a perversion of our nature, and not a part of it; and of its consequences in ourselves and in our surroundings.

To which may now be added :—

5. The promise of a Redeemer.

The whole account as we have it in Gen. 1-3 hangs together as one consistent whole, and fits the facts as we are able to observe them. Deny the historicity of these chapters, and what have we to put in their place but a congeries of theories, mal-adjusted and incomplete? What alternative can be put forward that does not raise far more difficulties than it purports to solve? Does the evolutionary theory of man's origin satisfy us, with the psychological view of sin which is its concomitant? Do these views not rather tend to hopelessness, as we see how little we have progressed (?) in the few thousand years of our existence, and



how great is the distance still to be traversed ? No. The denial of the account given us in the Bible, direct or inferential, or the substitution of rival theories is, as we shall seek to show, inconsistent with the Gospel revelation. It is therefore of supreme importance that we retain our hold of these early chapters of the Bible, and extremely dangerous to relegate them to the realm of allegory.

Fortunately, men do not always follow their beliefs logically to the end, and they do sometimes succeed in holding the truth of the Gospel whilst yet clinging to false theories of science or the like, without realising, or else ignoring, the fundamental incompatibility of the two ; but always with the danger that the weakness of the foundation may one day lead to the collapse of the superstructure. It is no accident that the theory of man's organic evolution has been adopted with enthusiasm by the enemies of the Cross of Christ ; they at least have grasped whither their theory leads, and have utilised it to the full to undermine and overthrow the faith of many.

#### THE GOSPEL IN RELATION TO GENESIS.

We have now to see what all the foregoing has to do with the Gospel revealed in Christ Jesus our Lord ; how intricately interwoven are the stories of ruin and regeneration as given in the Scriptures. The first beginnings of the Gospel are found already in the story of the Fall, where the promise of a Deliverer actually precedes the pronouncement of judgment. This Deliverer was to be the Seed of the Woman, Who was to bruise (crush) the head of the Serpent, who should bruise His heel. Sin had to be dealt with, its author destroyed, its consequences annulled. If sin had been an integral part of our nature, our hope would lie in education and improvement. This is the doctrine of salvation by works, so beloved of the natural man, so universal in the religions of the world, but so abhorrent to the Gospel. Such a hope could only lead to despair, as we survey our progress hitherto. If on the other hand sin is what the Scriptures affirm it to be—an alien element—then it may seem possible to hope for its ultimate eradication, to reverse its effects, and to guard against its re-introduction. But how is this to be accomplished ? Man himself is helpless here, for all his efforts are tainted by sin, and

salvation can only come through One Who does not share that taint. God himself is thus the only Saviour.

But here we face a further difficulty. God is so far above us, so remote in His holiness : how could He reach us in the "horrible pit and miry clay" in which we find ourselves ? A Mediator is, required "to bridge the gulf 'twixt man and God," One Who, linked on to God by the one hand, can reach with the other down to fallen man and bring them together again. Thus God Himself must become man ; here is the mystery of the Incarnation and the Virgin Birth, and the secret of His sinless life. But how could such a thing be ? How is it that we read, "He took not on Him the nature of angels ; but He took on Him the seed of Abraham ?" We are led back once again to the fact that man was made in God's image. Apart from this, the Incarnation is inconceivable. God could not else so identify Himself with the creature. In the fulness of time, according to the Scriptures, Christ was born, "the Lamb slain from the foundation of the world." But not only did He thus identify Himself with man ; at His baptism (which, be it noted, was a baptism of *repentance*), He identified Himself with *sinful* man ; and thus was He "made to be sin for us, Who knew no sin, that we might be made the righteousness of God in Him." So He fulfilled His appointed course, until at Calvary He bore the full penalty and burden of our sin, and by His resurrection opened up to us the gate of life.

It was to the Apostle Paul especially that it was given by the Spirit to expound the doctrine of salvation in and through Christ Jesus. Once and again in his writings does he link the Gospel with the story of the Fall in Gen. 3. Thus in I Cor. 15. 22 : "As in Adam all die, even so in Christ shall all be made alive." As the ravages of sin affect the whole human race, so to the whole race is opened the door of salvation : one in our origin, one in our degradation, we are yet one in the field of redemption. Again, in Rom. 5. 12, "by one man sin entered into the world, and death by sin . . . much more the grace of God, and the gift by grace, which is by one man, Jesus Christ, hath abounded unto many . . . Where sin abounded, grace did much more abound." So that where all are "concluded under sin," through Christ sin is destroyed, its effects annulled, and man once more takes the position to which he was originally destined—and more. These passages we have quoted, which are key passages, refer back to Genesis and build their argument thereon. Take away

these first three chapters of this Book, and the whole argument collapses.

Finally, if Genesis is not true, and man is a product of evolution, then God never became man, and Christ, being man, could not be God. There is no Incarnation and no Atonement ; we are yet in our sins. But if He be not God, His life of spotless purity and power is without explanation. Christ Himself is the ultimate evidence against evolution ; the final proof that the Bible is true.

#### WRITTEN COMMUNICATION.

Rev. Principal H. S. CURR wrote : Mr. Titterington has opened up an interesting and profitable field of study in restricting his discussion of the Gospel in Genesis to chapters I-III. Discussions of the subject are accustomed to range over the whole fifty chapters comprised in a book which so fitly and worthily begins the Bible, as Revelation, which is its counterpart, so adequately concludes it. The Gospel is to be found everywhere in Genesis in a vast variety of forms. In promise and prophecy, in type and symbol, the Divine plan of salvation through faith in Christ is constantly foreshadowed. There is, however, a unique significance attaching to the unique narratives of the Creation and the Fall with which the book begins.

Thus these chapters suppress all suggestion of dualism as an explanation of the distressing fact that the time is chronically out of joint. The entrance of sin, which is responsible for the dislocation of human history, is traced to the machinations of a supernatural being, described in the narrative as the serpent ; but it is made very plain that this mysterious factor is wholly subordinate to the Maker of heaven and earth. He is in no sense his rival. He may be described as a rebel, but the sentence pronounced upon him proves indubitably that here we have nothing faintly resembling the dualism which is so characteristic of certain pagan faiths, such as Zoroastrianism.

Again there is no hint of pessimism in these chapters in the philosophical sense of the term that things are incurably and irretrievably ruined, so that there is nothing better for a man than to reconcile himself to the task of making the best of a bad business. On the contrary, the radiant optimism of the opening chapter,

where the reader learns that God saw all that He had made to be very good, pervades all three chapters. That is not due to any attempt to evade the full force of such a racial tragedy as the Fall. It is based on the knowledge that, where sin abounds, grace can much more abound.

A third reflection which might be noted, is the continuity of the natural and the spiritual in the sense that the same God made the world, and also redeemed it. Modern science has revolutionised our outlook on the material universe, and it is easy to overlook the truth that the Infinite Intelligence, whose existence must be postulated by science as the basis of its conclusions, is none other than the God and Father of Our Lord and Saviour Jesus Christ. But the student of Holy Scripture is not allowed to forget that, since the stories of creation and redemption are so closely interwoven in Genesis I-III, they cannot be put asunder. Their ultimate unity is made as clear and plain as one could wish. They harmonise perfectly with the great words which tell us that in the beginning was the Word, and the Word was with God, and the Word was God. The same was in the beginning with God. All things were made by Him, and without Him was not any thing made that was made. In Him was life; and the life was the light of men. And the light shineth in darkness; and the darkness overcame it not.

Colonel A. H. VAN STRAUBENZEE wrote: The Fall of Man was not the result of an act of disobedience, but the result of unbelief, and that especially in the Word of God. This is brought out by Satan's mode of approach to Eve. We have his first utterance in Scripture: "Can it be that God hath said." This is not a question, but opposition to God's word, which is the special sphere of his activity.

The second utterance, "Ye shall not surely die," is contradiction of God's word, and has become the foundation of Spiritism and the Traditional belief as to death.

The third utterance, "Ye shall be as God," is another lie, that "the immanence of God exists in man."

We are all now faced with the question asked by Job long years ago: "How can man be just with God?" The answer is given in

the first Book of Instruction in the Gospel of God, namely Romans, where we are told :—

- (1) How “ Sin ” is dealt with, the name given to the Old Adam nature.
- (2) How “ Sins,” the fruit of Sin, are dealt with.

The epistle deals first with the problem of sins in this fashion :—

- (A) Rom. i, 16, 17. The *power* of God and the Righteousness of God declared in the Gospel of God, revealing a Righteousness *from* God.
- (B) Rom. i, 18. The *wrath* of God revealed against all ungodliness.
- (B) Rom. i, 19,—iii, 20. The wrath of God described and set forth.
- (A) Rom. iii, 21—v, 11. The *power* of God and the Righteousness of God described and set forth, imputing a righteousness from God on faith-principle. The last verse, v, 1, is as follows : “ Having been justified therefore by faith, we have peace with God through our Lord Jesus Christ, by whom we have obtained and possess access also by faith, into this grace in which we stand, and we rejoice in hope of the glory of God.”

The second problem concerned with “ sin,” the old tree of death, is handled in this way :—

- (A) Rom. v, 12—21. Condemnation to death through a single sin of one man, but justifying unto life through a single righteous act of one man.
- (B) Rom. vi—vii, 6. We are not in “ sin ” because we died with Christ.
- (B) Rom. vii, 7—25. Sin is in us, though we are risen with Christ.
- (A) Rom. viii, 1—39. No condemnation to those who are alive unto God in Christ Jesus, because of condemnation of sin in the flesh.

The last verses of this section are as follows : “ Who shall impeach God’s elect ? Is it God that justifies ? For I am persuaded that neither death, nor life, nor angels, nor principalities, nor powers,

nor things present, nor things to come, nor height, nor depth, nor any other created thing will be able to separate us from the love of God, that is in Christ Jesus our Lord."

Man in Eden clothes himself with (perishable) leaves.

God provided him with skins, obtained by the death of an animal.

Man enters naked into this world, he arrives in glory clothed in a resurrection body.

A saved sinner in glory is in a far greater position than an innocent man in a garden of Eden.

Dr. R. E. D. CLARK wrote : It has become the fashion nowadays to assert with Mr. Titterington that " we cannot deal with questions of science and theology . . . in water-tight compartments." Yet there is surely something to be said for the opposite point of view. If we knew all there was to know of both theology and science it would certainly be relevant to reply that " truth is one " and cannot be self-contradictory. But may not one, who is deeply conscious of his utter ignorance of the great world, explore one stream to its source, and after that another and yet another, ignoring for a time the inconsistencies in the maps he so laboriously prepares ?

Has not even modern science itself done much to vindicate the way of " water-tight compartments " ? Are there not many instances in which apparently *false* theories, at variance with our knowledge of nature, have proved essential signposts in the way of discovery ? The doctrine of evolution itself may one day turn out to be one of these. How would modern physics have arisen if physicists had not boldly allowed that sometimes a wave was a particle and sometimes a particle was a wave ?

We may agree with Mr. Titterington that the Scriptures show the marks of Divine Inspiration. That being so, we may trust them to the full. Yet to use them in such a way as to trample upon speculative inquiry in other fields is surely to use them wrongly. It often happens that a child can only learn what is right through methods of trial and error : the thoughtless educator who prevents every mistake at its inception merely serves to discourage and finally to kill enthusiasm. Surely progress in many branches of science might be seriously impeded if scientists were to allow their

thinking to be dominated by the teaching of the Bible or by any other authority. And the only way of avoiding the difficulty, and yet remaining true to the Bible is, surely, to challenge the view of "water-tight compartments" which Mr. Titterington has put forward.

Consistency and the one-compartment mind are ideals to be aimed at—of that we are all agreed; but can we fairly expect them to exist from the start? The healthy, unified mind is not, surely, the mind in which free speculation has been curbed by superior knowledge from above, but that in which two or more lines of inquiry, unconnected and even opposed for a time, are seen at last to merge and reinforce one another. Until that happens, so it seems to me, we do well to heed the words of a modern philosopher: "Consistency is the vice of little minds."

#### AUTHOR'S REPLY.

There is little for me to say in reply to Principal Curr, beyond thanking him for his remarks, with which I need hardly say I am in complete agreement. I see that he notes, as I do, that there is a uniqueness attaching to the narratives of the Creation and the Fall as distinct from the remainder of the Book of Genesis; and whilst, as he so justly remarks, the Gospel is to be found everywhere in the Book in a variety of forms—in promise and prophecy, in type and symbol—it does seem to me that the opening chapters stand in a position by themselves, and that whilst the succeeding chapters richly illustrate the Gospel, and give the beginnings of its development, these chapters enshrine what one may perhaps term the fundamental axioms essential to the understanding of the whole.

I am in general agreement with Colonel van Straubenzee also; but I do not know why he says "the Fall of man was not the result of an act of disobedience, but the result of unbelief." There certainly was unbelief in Eve preceding the act of disobedience, but not in Adam; for we are distinctly told (1 Tim. ii, 14): "Adam was not deceived." The emphasis is always on the act, as in Rom. v, 19: "By one man's disobedience (*παρακοή*, the antonym of *ὑπακοή*, or obedience) many were made sinners." Unbelief and disobedience are, however, so intimately allied that it is not always

easy to separate them. I am not quite sure, either, that I should have expressed the contents of Rom. vii, 7-25, exactly as Colonel van Straubenzee has done ; but this is a large question, and rather outside my present province. I heartily concur in his concluding sentence, and I tried to cover the point raised in the penultimate paragraph of my paper (" and more," line 15).

I do not find it very easy to reply to Dr. Clark, for I am not sure how far he wishes his argument to be carried. I think, however, he would not object if I were to state my point of view like this : whilst it would be condemned as unscientific to embark on any enquiry or investigation with preconceived notions or prejudices, it is equally unscientific, if not more so, to disregard any evidence bearing on the subject in hand, from whatever source derived. The different branches of natural science are becoming so interdependent that it is doubtful whether any can to-day be studied in a water-tight compartment. The case is not altered when a statement appears in Scripture relating to some fact of natural science ; it is evidence, and must be treated as such. The weight attached to the evidence will, of course, vary according to the weight the investigator attaches to the Scriptures as a whole. But it is important to be careful always to distinguish between a statement and an inference or interpretation—between what the Bible says, and what we may think it to mean. The persecutors of Galileo made this mistake when they thought the Bible taught a geocentric universe. The categorical statements of Scripture on matters of scientific import are not so numerous, or generally of such a nature, that I think we need fear lest they should stifle investigation, and when such a statement is made it is usually because it carries with it an implication far outside the domain of what we term " science." When I first attended the lectures of the late Dr. Marr, one-time Professor of Geology at Cambridge, he told us that the Book of Job contained a multitude of scientific facts which we were only now in process of discovering. This seems to me the right attitude to adopt. I am strongly inclined to think that if research workers were to follow out clues indicated to them in Scripture, they would be helped rather than hindered in their investigations (as I believe, for example, certain important astronomic cycles were discovered from a study of



numbers contained in the Book of Daniel), and would at the same time be saved from pursuing such a blind alley as I believe the doctrine of organic evolution to be. I sometimes wonder whether this particular doctrine would have been greeted so enthusiastically, or would be clung to so tenaciously, did it not seem to offer an escape from the requirements of the Divine Law. My paper, however, is only concerned with this doctrine as it applies to the human race, and not with the general theory.

## 839TH ORDINARY GENERAL MEETING.

HELD IN COMMITTEE ROOM 19, LIVINGSTONE HOUSE,  
BROADWAY, S.W.1, ON MONDAY, MARCH 3RD, 1941,  
AT 4.30 P.M.

WILSON E. LESLIE, ESQ., IN THE CHAIR.

The Minutes of the previous meeting were read, confirmed and signed.

The CHAIRMAN then called on Sir Frederic Kenyon, K.C.B., D.Litt., LL.D., to read his Paper entitled "Ras Shamra, Mari and Atehana."

The Meeting was then thrown open to discussion in which the following took part: Dr. N. S. Denham, Major H. B. Clarke, Colonel F. A. Molony, Mr. F. S. Short and Mr. W. E. Leslie.

A written communication was received from Rev. Principal H. S. Curr.

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### *RAS SHAMRA AND MARI: RECENT ARCHÆOLOGICAL DISCOVERIES AFFECTING THE BIBLE*

By SIR FREDERIC G. KENYON, G.B.E., K.C.B., D.LITT., LL.D.

THE contact between archæology and the Bible may be said to have begun over a century ago with the discoveries of Layard at Nineveh, which constituted the first revelation of the monuments and records of the kings of Assyria; but it is only within our own generation that such discoveries have become plentiful. The spade of the archæologist has been busy in Palestine, in Syria, in Asia Minor, in Crete, in Mesopotamia, and in Egypt; and some of his results have important bearings on the Biblical narratives. It is not possible for anyone who is not something of a specialist to keep track of them all; still less is it possible for the ordinary Bible student to estimate their character and importance accurately. Moreover, the guidance which he gets from those who write about these discoveries is apt to be confusing. Some, with a prejudice against the Bible, are quick to point out discrepancies and to argue that these impair the trustworthiness of the Bible record,

and even discredit the Christian religion. Others, whose prepossessions are in favour of the Bible, are equally eager to seize upon any point which appears to confirm the Bible record, and to claim that "archæology proves the Bible."

The point of view which I wish to present in this paper is rather different. No convinced Christian needs to have the Bible—that is, the essential truth of the Bible—"proved." He knows it already. It is interesting to know that the wrecked walls of Jericho have been found, and that documents have come to light at Lachish belonging to the last years of the kingdom of Judah; but his faith does not need buttressing by such discoveries, and they will not by themselves convince the unbeliever. It is necessary to distinguish between essentials and inessentials. It does not matter whether "Jehoshaphat was thirty and five years old when he began to reign, and he reigned twenty and five years in Jerusalem; and his mother's name was Azubah the daughter of Shilhi." If it should prove that the author of the first book of Kings, writing after the fall of the monarchy, had copied incorrectly some figures in the records from which he was compiling his history, there is no need for us to be disturbed. What does matter is that Jehoshaphat "walked in all the ways of Asa his father; he turned not aside from it, doing that which was right in the eyes of the Lord; nevertheless the high places were not taken away, for the people offered and burnt incense yet in the high places." This is of importance, for it shows that Jehoshaphat was one of the slender chain of rulers who kept alive the true monotheistic worship of Jehovah in the midst of the idolatry and polytheism, which affected his own people as well as the surrounding nations.

To my mind, the true and valuable thing to say about archæology is not that it proves the Bible, but that it illustrates the Bible; and Bible students, who do not need to be told that the Bible is true, may legitimately rejoice in the fact that archæological discoveries give them fuller information as to the circumstances amid which the books of the Bible were written, and as to the conditions under which God's chosen people were trained for their special mission in the world. From them we learn something of God's methods in educating His people—something which we could not know so long as the only records which we had were those of the Old Testament itself. While those stood alone, it was natural to accept them indiscriminately.

The lesson of archæology, as I see it, is to teach us to discriminate ; to realise that God used human agents to convey His lessons ; that just as our Lord accepted the normal conditions of contemporary humanity during His life on earth, so the historians, prophets and poets, whose works are preserved in the Old Testament, lived and thought and wrote under the normal conditions of their times. It is of these conditions that archæology has something, perhaps much, to tell us ; with the essentials of the lessons conveyed, with all that makes the Bible uniquely precious, it has nothing to do.

Against those critics, therefore, who use the results of archæological discovery to discredit the Bible, we have every right to fight. We know they must be wrong ; the only thing to do is to find out where they are wrong—whether in their statements of facts or in their interpretation of them. They must be met on their own ground. But it is important to be sure whether what they discredit is really the Bible itself, or only a preconceived view of the way in which the Bible came into being. Do they touch the essential truth of the Bible, or only some unessential fringes of its record ?

I do not propose to survey the whole record of archæological discovery since the days of Layard, but only to refer to the most outstanding additions to our knowledge, and especially those of the last few years, with which some of you may be less familiar, though some, no doubt, know more about them than I can claim to do. Of the discoveries of the nineteenth century the most important, for our present purpose, after the initial discoveries of Layard, Rassam and Smith, was that, made in 1887, of the Tell el-Amarna tablets. These had a two-fold importance. They furnished overwhelming proof of the common use of writing in Palestine and Syria at a time approximately contemporary with Moses ; and they provided a picture of the conditions prevailing in those lands at about the time of the invasion of the Hebrews under Joshua.

The proof of the early use of writing in the Near East is of vital interest to Bible students, because it shows that the earliest Old Testament records, whether of historical facts or of legislation, whatever the literary evidence may be as to their date and manner of composition, can perfectly well have been based upon contemporary written documents, and not merely on oral tradition. The fact now admits of no dispute. From

Mesopotamia, from Asia Minor, from Syria, from Egypt, we have ample evidence of the habitual use of writing from at least the third millennium B.C. ; and our treatment of the early Hebrew literature must take account of this as established and uncontested fact.

It is to actual texts, brought to light by archæological research, rather than to sculptures, metal-work and pottery, important though these are from other points of view, that we have to look mainly for the illustration of the Bible. These are in a few instances inscriptions carved on stone, such as the Moabite Stone and the Laws of Hammurabi ; but by far the greater number are documents inscribed on clay tablets, mostly in some form of cuneiform script. Clay was the material of record from the Tigris valley to the Halys, from the Caucasus to the Arabian desert, as papyrus was in Egypt ; and it is the discovery of collections of such tablets that is the most valuable, though perhaps not the most spectacular, triumph of the explorer. For historical purposes, the libraries of Nineveh, which Layard discovered without knowing it, are more valuable than the colossal bulls and lions. Such discoveries have become more plentiful in recent years. The discoveries of Layard, Rassam and George Smith in Assyria were followed by those of de Sarzec at Telloh in 1877-81, and an American expedition at Nippur from 1889 to 1900, which brought to light great archives of Babylonian kingdoms and relics of Sumerian literature. After the turn of the century came the discovery of the Hammurabi stelé at Susa in 1902, and a German excavation at Ashur between 1903 and 1914, which produced some tablets, and the highly important excavation of Boghaz-keui in 1906, which revealed the records of the Hittite empire ; but it was only after the war of 1914-18 had released Mesopotamia and Syria from Turkish control that trained excavators had full scope for their researches. It is with the results of these that we mostly have to do. They include notably the excavations at Ras Shamra, in northern Syria ; at Mari, on the middle Euphrates ; and at Kirkuk and Nuzi, east of the Tigris. Of these much the most important up to date for our present purpose are those of Ras Shamra.

Ras Shamra lies on a little bay on the north Syrian coast, opposite Cyprus. A chance discovery directed attention to the site, where excavations have been conducted since 1929 by M. Claude Schaeffer. He had the good fortune to light almost

at once on a great hoard of clay tablets. These proved to be the library of the kingdom of Ugarit, constituted in the reign of a king named Nigmed, who reigned soon after the middle of the second millennium B.C. A recently discovered letter shows him to have been contemporary with the Hittite king Shubbiluliuma, about 1400 B.C. The writing is cuneiform; not however the cuneiform of Babylonia, but in an alphabet of cuneiform letters, 28 or 29 in number. The language of these is Semitic, and is alternatively described as proto-Phœnician or Canaanite. This adaptation of the cuneiform script to alphabetic writing is unique. Other tablets are in the Sumerian, Babylonian and Hurrian languages, several of them being dictionaries of some of these tongues. They include public and private documents of all sorts, but what gives them their special interest is the fact that they include a large number of religious texts. It is in fact a real library that M. Schaeffer has discovered, comparable to that of Ashur-bani-pal at Nineveh, but of much earlier date and even more full for us of Biblical interest. An archive of diplomatic and economic documents, mostly written in the same alphabetic cuneiform, was discovered in the excavations of 1938-39.

In these texts we have a full picture of the religion of Ugarit, that is, of the Canaanites inhabiting northern Syria at the time when the Israelites were entering it in the south. There is a pantheon of deities, among whom El is supreme, like Zeus among the gods of Greece. He lives in a region of the west known as "the fields of El." Canaan is described as "the whole land of El," and he claims supremacy over both Crete and Egypt. He has a consort, Asherat, whose name in a plural form, Asherim or Asherah, occurs repeatedly in the Old Testament, though disguised from us in the A.V. by being translated "groves." The plural is a plural of dignity, just as El frequently appears as Elohim, and their son, Baal, as Baalim. Other gods mentioned are Mot, the opponent of Baal, Anat, who appears later as Astarte, Aleyan, the son of Baal, Dagon and his son, Ben-dagon, who accompanies Baal on a hunting expedition, in which both are slain by "the Devouring Gods"; also Nikal, Koser, and a goddess Kosarot, Latpon, the messenger of the gods, and many more. Their adventures and conversations are the subjects of a series of poems. One of these describes the building of a temple for Baal, who had previously been houseless, on the representa-

tions of Asherat. Hin, the god of metal-working, makes the ornaments for the temple, which is presumably the temple actually found at Ras Shamra. In another, the same in which the encounter with the "Devourers" is described, Baal records his victory over Lotan (a name which recalls the Hebrew Leviathan), who is described as a serpent with seven heads. In another Koser rebels against Baal, and is apparently aided by Aleyan; but Baal is victorious, and Anat blames Aleyan.

Some of the narratives are plainly agricultural myths. This is especially clear in the case of the poem which describes the war between Baal (this time aided by Aleyan) and Mot. Every spring Baal and Aleyan, the gods of vegetation, fight against Mot, the god of the heat of summer. Baal roars and thunders, as in the spring rains of Syria, but eventually Mot triumphs, and Baal and Aleyan are slain. But then Anat, Aleyan's sister, intervenes, and when Mot refuses to restore her brother to life, she seizes him, cuts him open with a sickle, winnows him, scorches him, grinds him, and scatters the fragments over the fields—the seed for next year's harvest. Then Baal and Aleyan are restored to life, and the cycle begins again.

Yet another poem describes how Anat massacres the people on the Mediterranean coast; and another, entitled "The Birth of the Beautiful and Gracious Gods," prescribes agricultural rites, including the seething of a kid in milk—a practice forbidden in the book of Exodus.

In some of the texts the narrative takes on a quasi-historical form. The most intriguing of these is the legend of Keret, which describes how El placed Keret in command of the "Army of the Negeb," three million strong, and tells him to march against the Terachites, who had captured five Canaanite towns. Keret very reluctantly and tearfully accepts the mission, drives back the Terachites, and proceeding southwards enters into negotiations with the king of Edom, who sends gifts to avert the expedition from his country. Keret agrees, and asks for the king's daughter in marriage. The conclusion of the narrative is mutilated, but it appears that the Terachites succeeded in settling in the Negeb. Are the Terachites the descendants of Terah, Abraham's father, and is Pebel-Melek, the king of Edom, the same as he who refused the Israelites passage through his land?

When the Ras Shamra texts were first published, there were

some who were quick to claim that the beliefs represented in them were those actually held by the early Israelites, which appear in the Pentateuch in a later and sophisticated form. A dispassionate consideration gives, I think, a very different view. The Ras Shamra texts represent the religion of northern Syria, which may well have extended over Palestine as a whole, about the fourteenth century, that is about the time when, according to the chronology now generally in favour, the Israelites under Joshua entered Palestine. It is a religion by no means wholly evil. It has been described as manifesting "a high moral tone, tempered with order and justice." It is a literature also of poetry and imagination. But it has nothing of the elevation of the Hebrew religion, even in the earliest forms in which we have knowledge of it. It is more on a level with the religion of the Sumerians, which we know from the Mesopotamian tablets. It is polytheistic, with stories of the gods on a crude and anthropomorphic plane, with violence and bloodshed and undignified details. It is the type of religion from which Abraham made his escape when he left Ur, and into which his descendants came when they entered Palestine; but these texts tell us nothing of what the Hebrews themselves believed. They had been for many generations absent from Syria, and in Egypt and in the wilderness they had had time to develop in their own way.

But what these texts do give us—and this, I think, is their prime value—is a picture of the beliefs amid which the Israelites lived throughout the period of the judges and kings, and by which they were so profoundly affected. The narrative of the books of Samuel and Kings is full of the struggle between the higher religion and the lower, in which often the lower predominates and the higher hardly keeps its head above water. The kings who did that which is right in the sight of the Lord are few; the kings who did evil are many. Again and again comes the refrain: "Howbeit the high places were not taken away; the people still sacrificed and burnt incense in the high places." Baal is throughout the rival of Jehovah. Even in Josiah's time we hear that the temple at Jerusalem had to be purged of the vessels that were made for Baal and for the Asherah and for all the host of heaven. These are the Baal and the Asherah of whom we hear in the Ras Shamra texts, and from them we can obtain an unbiassed, or indeed a favourable, view of the Canaanite religion, and can see how far, even on its own



representation, it fell short of the religion of Jehovah. We know now what was the religion to which the children of Israel, until they were purged by the Captivity, were continually drawn, and can compare it with the religion preached by Elijah, Amos, Isaiah and their successors.

But Ras Shamra, though the most important by reason of its wealth of religious texts, does not stand alone. At a site on the middle Euphrates, named Tell-Hariri, the ancient name of which has been found to be Mari, excavations have been carried on since December, 1933, by a French expedition under M. André Parrot. The main buildings hitherto found are a temple of Ishtar, or rather a succession of temples, dating back to at least 3000 B.C., and a palace building comprising more than 200 rooms. Mari was evidently a flourishing place at the beginning of the third millennium, but was crushed by Eannadu or Sargon about 2700 B.C. It revived again, and was flourishing in the early part of the second millennium under its last king, Zimrilim, who was eventually overthrown by Hammurabi of Babylon. Its history has emerged from a hoard of tablets, more than 20,000 in number, found in three or four rooms of the great palace. These are the archives of Zimrilim, and comprise accounts, contracts, texts of divination, and letters, including some from Hammurabi. They are written in the usual Babylonian cuneiform, and in the Accadian language, which appears to have been the language of diplomacy and commerce throughout Mesopotamia. Many place-names occur, which will assist the geography of the area between Mesopotamia, Syria and Asia Minor, which until recently has been almost a blank; also many names of local rulers, to whom gifts were sent. Among other names mentioned are the Habiru and Ben-iamina, which, in view of the fact that the date of these texts is about 2000 B.C., shows that great caution must be exercised in recognising identifications with Bible names. Of the Habiru, in particular, it is clear that the name was of very wide application; and although the Hebrews eventually came to appropriate it, there must have been many people called Habiru who were not Hebrews.

The country of Mari was Amorite, but the population was mixed, and included a large Hurrian element, of which there will be more to say in a moment. Ugarit also is mentioned, together with Cyprus and the country of the Keftiu, generally identified with Crete. Connections with Mesopotamia appear

in texts written in Sumerian and Accadian, and in temples bearing the names of Ningal and Ninharsag, well known as Babylonian deities; while connections westward are equally established by the Hurrian texts and a temple dedicated to Dagon. The Hurrian texts are the earliest hitherto known. So far, religious and historical texts are scanty, but it may be hoped that further excavations will disclose a library as well as a record office.

The discovery of the importance of the Hurrians, whom in the Bible we know as Horites, is one of the most recent successes of archæological research. Horites are mentioned in Gen. 36 and Deut. 2 as a people dwelling in the land of Edom; but it appears that Horites is the true form of the name which appears as Hivites in the familiar list of the peoples whom the Children of Israel were told that they would find in the Promised Land: "the Canaanites and the Hittites and the Amorites and the Perizzites and the Hivites and the Jebusites." It is extraordinary how these names, once a mere list with almost no connotation, are assuming life and substance as the result of archæological research. The Hittites have been known since 1884 as a great empire with its seat in eastern Asia Minor, which once dealt with Egypt and Assyria as an equal. The Amurru or Amorites are frequently mentioned as located in northern Syria; and now the Hurrians emerge from obscurity as a people that once covered a vast stretch of country westwards from northern Mesopotamia. Their name occurs frequently in the archives of Ras Shamra, Boghaz-keui and Mari, but the main information comes from excavations conducted by American expeditions at Kirkuk and Nuzi, east of the Tigris, the results of which have been published by E. A. Speiser.

Dr. Speiser assigns a very extensive role to the Hurrians. He believes them to have entered northern Mesopotamia from the north, not later than 3000 B.C., and to have brought with them what is known as the Second Æneolithic culture, which includes the decorative pottery known by the name of Jemdet Nasr. They used a semi-pictographic script, differing from that found at Ur and Lagash. Their country was first known by the name of Subir, in Akkadian Subartu, and is said to lie between the lands of Elam and the Amurru, corresponding roughly with northern Mesopotamia. While the Sumerians occupied southern Mesopotamia, the Hurrians combined with the Semites in Akkad,

and form the main non-Semitic element in the composition of the Assyrians. They also spread south-westwards as far as Palestine before the coming of the Hebrews, and may have formed the medium whereby elements of Babylonian mythology reached the Hebrews. Included in their area was the kingdom of Mitanni, between the Khabur and the Euphrates, known from Egyptian and Hittite records. Mitanni itself is a political name, brought in by a ruling class of Indo-European origin, which established itself in this area until it was overwhelmed by the Hittites. It has even been suggested that the hitherto undeciphered Hittite hieroglyphs may in fact be Hurrian.

The Kirkuk-Nuzi records are of about the middle of the second millennium, and one special feature of interest lies in the resemblance of some of the Hurrian laws to some of those of the Pentateuch. Thus one law provides that if a woman has children, her husband will not have the right to take a second wife; but if the woman has no children, then she will give her own handmaid to her husband, and she will have children through her; in which event, the wife will not be entitled to cast out the child of the handmaid. The parallel with the story of Abraham and Jacob is obvious; it will be remembered that Abraham at first demurred to Sarah's demand for the expulsion of Hagar's child, but was overruled by a divine command. Again, it appears that by Hurrian law possession of the family's gods entitled the holder to a son's share in the father's inheritance. This explains the theft of Laban's teraphim by Jacob and Rachel, and the importance attached to the matter by Laban. Yet again, Hurrian law prescribed the duty of a man to marry his brother's childless widow, which was a feature of Israelite law, and also the right of daughters to inherit when there were no male heirs—a principle laid down by Moses in the case of the daughters of Zelophehad (Num. 36). It also appears (though the precise meaning of the terms used is not firmly established) that the institutions of the sabbatical year and the year of Jubilee (which some have regarded as late) were known to the Hurrians of Nuzi. These laws, which come much nearer to the Mosaic legislation than anything in the Code of Hammurabi, are an impressive warning against easy assumptions that the legal provisions of the Pentateuch are later than the time of Moses. As against the earlier contentions of destructive criticism, we now know (1) that writing was in

common use all over the Near East long before the arrival of the Hebrews in Palestine ; (2) that elaborate codes of law were in existence long before the age of Moses ; (3) that provisions in the Mosaic law can be paralleled from the codes in force among other nations at the same time. This does not prove that the Pentateuch was written in the form in which we have it in the fifteenth century B.C. Other conditions would have to be taken into account to establish such a proposition ; but it does prove that the Pentateuch may rest on contemporary records and may be in substance a contemporary record of facts, and that provisions in it which have been confidently claimed as late are in fact early. This obviously imposes caution in assuming the lateness of other provisions.

Another direction in which archæological research may enrich our knowledge of the Bible is that of chronology ; but here it must be recognised that most of the results are far from certain. The date of the fall of Nineveh has been definitely fixed as 612 B.C. by a tablet in the British Museum ; but evidence as to the dates of Abraham and of the Exodus, at one time thought conclusive, have been brought into doubt. Archæologists, not very long ago, held confidently that the Amraphel mentioned in Gen. 14 among the four kings who fought with Abraham could be identified with Hammurabi, the great king of Babylon, whose date was generally placed about 2100 B.C. More recent scholars have strongly questioned the possibility of this identification ; and on the other hand, there is a tendency to lower the date of Hammurabi. Professor Sidney Smith, who has always been in favour of a more contracted time-table, has shown strong reasons for placing his reign in the first half of the eighteenth century (1792-1750 B.C., *Alalakh and Chronology*, 1940, p. 29). Similarly, at one time it was argued that since the Israelites in Egypt built the store-city of Raamses, the Pharaoh of the oppression must have been one of the kings bearing the name of Rameses. The Exodus was accordingly placed in the reign of Menephtah (1233-1223 B.C.). The subsequent discovery of an inscription of that king recording a victory over the Hebrews, seemed to show that they were by that time established outside Egypt ; and Professor Garstang's excavations at Jericho appeared to show that the destruction of that city took place somewhere about 1400 B.C., which would bring the invasion of Joshua into the period covered by the

Tell el-Amarna letters. These instances serve to show that archæological evidence is not always decisively clear, and that one must accept the affirmations of archæologists with caution, and always keep one's mind open for new evidence.

In general, and to sum up, one may say that the contribution of archæology to Biblical study has been to widen and deepen our knowledge of the background of the Bible narrative, and especially of the Old Testament. We are gaining a far fuller picture of the conditions under which the training of the Hebrew people to be the leaders of religious thought to the world was, under God's providence, conducted. The trend of all this increased knowledge has been to confirm the authority of the books of the Old Testament, while it illuminates their interpretation. Destructive criticism is thrown on the defensive; and the plain man may read his Bible, confident that, for anything that modern research has to say, the Word of our God shall stand for ever.

#### DISCUSSION.

Mr. W. E. LESLIE said: Sir Frederic has greatly added to the interest of his paper by connecting the purely archæological matter with the general principles of Divine Revelation. On page 1 he speaks of the essentials and inessentials of inspiration. But how are we to know what is essential and what is not? There is too great a tendency to lay down, *a priori*, how God must have inspired the Scriptures. Doubtless this method is an inheritance from the Schoolmen. Instead, we should ask how, in fact, God has seen fit to reveal His will.

Again, Sir Frederic dwells on the importance of the historic background of Scripture. Sometimes this is so important that it might almost be said to form part of the sacred text, since the text is unintelligible without it. The ancient method of making (Hebrew "cutting") a covenant by the parties to the covenant passing together between the pieces of the covenant victim is an example. God makes use of the custom in Gen. xv, and a right understanding of it determines the translation of *diatheke* in Hebrews ix.

#### WRITTEN COMMUNICATIONS.

Rev. Principal H. S. CURR wrote: In common with all who may happen to read Sir Frederic Kenyon's paper, I have greatly enjoyed

it, as well as finding it to be very useful as providing valuable information which only a specialist in the subject can give. It is not possible for me to make any useful observations on the discoveries which are described in the paper. I wish rather to associate myself with the contention of the paper in regard to the assistance which the study of the Bible may obtain from archæology. Sir Frederic Kenyon makes it very clear that excavations and discoveries in the Near East are chiefly valuable, not because they confirm the statements in the Scriptures, but because they explain them, and clarify them in a way which makes the light thus thrown of the greatest importance. The saying of John Robinson, the Puritan preacher, to the effect that God has always more light and truth to break forth from His Word is emphasised by the wealth of information for which the Christian Church is indebted to archæological investigations.

To my thinking, too much stress is laid on the corroboration of the Old Testament narratives by such discoveries as those described in the paper—not because these are unconvincing, but because the testimony of excavation is not always so favourable to the Bible as we might suppose. In that respect it is like the evidence furnished by physical science. It does not invariably support the teaching of Scripture. In these circumstances it is unwise and unsafe to rest the credibility of the Bible on such foundations. Its truth depends on the claims which it makes for itself. These are so tremendous that they must be accepted or we must face the alternative of regarding the inspired writers who made them as being hopelessly mistaken. That is not the only basis, but it is one which is far from negligible.

On the other hand, the detailed information which archæology has brought to the notice of Bible students removes many obscurities, and reveals a new significance in many familiar passages, as instances quoted in the paper will show. Many readers of the Pentateuch must have been puzzled by the ordinance that a kid must not be seethed in milk. The paper makes it clear that the practice had such close associations with contemporary paganism that it had to be forbidden as far as the Israelites were concerned. Another interesting instance is the light thrown on the theft of Laban's idols by Jacob and Rachel. The paper shows that possession of these entitled one to a son's share in the father's inheritance. The more

we can understand the Bible, the easier will it be for us to believe that it is all that it claims to be, and much more.

Group Captain P. J. WISEMAN, R.A.F., wrote: I regret my inability to be present when Sir Frederic Kenyon read his valuable paper. Our thanks are due to him for his clear statement that the truth of the Bible is not dependent upon archæological discoveries. In it he wisely insists that we should use the results of archæological research in a scientific, and not in a partisan way. His reminder that we should differentiate between a discovery that *proves* the accuracy of the Bible and one that *illustrates* it is timely.

I submit that we must read both the Old Testament and the Ras Shamra and Mari tablets in a realistic way. I say this because obscure details in these tablets have been used (both by "destructive critics" and those who seek to defend the Scriptures) by the one to impugn and the other to verify the Old Testament narrative in an unfair way. Both have snatched at a resemblance between words which are common to the tablets and the Bible, in order to show that the Bible must be right or wrong on some particular matter. For instance, on one of the tablets (Virolleaud, Un Poème Phénicien De Ras Shamra, I, line 8) the words "*ab šnm*," "the father of years," appear. Notwithstanding the polytheism which saturates these tablets, where none of the gods stand alone, this "*ab šnm*" is compared with the passage in Isaiah ix, 6, "the everlasting Father." Another instance may be cited. One of the goddesses mentioned in these tablets is named "*adm*": attempts have been made to make this goddess and Adam one and the same!

In the religious realm the Ras Shamra tablets have provided us with much material for comparison. It has shown how polytheistic and mythological were the beliefs of people near Canaan in the period 1500 B.C. They tell us of more than 50 gods and goddesses. We read how in some instances they hate and maliciously scheme to destroy each other. In this they are similar to the Mesopotamian pantheon.

One other contrast should be mentioned. The Ras Shamra tablets give their version regarding the *birth* of these gods and goddesses—a sharp contrast to the lofty monotheism of the earliest narratives of the Bible.

The discovery of these tablets has been of considerable linguistic value, in that many of them, though in cuneiform, use an alphabet. In many respects the language closely resembles Biblical Hebrew.

For this reason I welcome Sir Frederic Kenyon's wise restraint and warnings. We should be reluctant to make hasty identifications. It may result in dragging down the Old Testament narratives to the level of these mythological and polytheistic poems.

NORMAN S. DENHAM, D.Litt., said: We have to thank Sir Frederic Kenyon for a thoughtful Paper, one of several recent contributions to our Society which should give hesitance to those who go out of their way to adversely pre-judge the "ancient things" of the Bible.

It would be of interest to know the standard of comparison by which the Kirkuk-Nuzi records may be dated at about the middle of the second millenium B.C. Professor Garstang's date for the Exodus, 1447 B.C., does not appear to be based on any appraisal of subsequent chronological problems which affect precision (*cf.* his *Joshua-Judges*, p. 344).

The determination of the period specified in 1 Kings vi, 1 (*i.e.*, whether the 480th year "Anno Dei" reckoning must be increased by 114 years, as Anstey claims, to agree with Acts xiii) and the true epoch and scale of the 70 *Weeks* of Daniel ix (*i.e.*, whether the sevens are 70 *Sabbatic* sevens of calendar years dating from the Decree of Cyrus) would affect considerably the schemes adopted by such authorities as Sir Flinders Petrie and Sir Charles Marston. Unfortunately, few students give adequate attention to these basic data.

I am therefore interested in enquiring if the sequence of *Jubilee* years known to the Hurrians was every 49 or every 50 years. The authoritative epoch for this sequence, as far as the Jews were concerned, is in Lev. xxv, 2—at *The Entry* into Canaan. The instructions show that the Jubilee fell in the 50th year ordinal, but 49th year cardinal—the Jews, by their system of inclusive reckoning, counting the period from Jubilee to Jubilee. The Hebrew Jubilee, therefore, fell every 49 years. Taking the Entry as B.C. 1493, in close but not absolute agreement with Martin Anstey's scheme, the first Sabbatic year fell in B.C. 1487 and the first Jubilee in B.C. 1445.



Remembering that every seventh Sabbatic year coincided with the Jubilee year, the year of the Baptism, A.D. 26, was the 31st Jubilee.

A late member of this Society, Lieut.-Colonel G. Mackinlay, has clearly demonstrated that A.D. 26 was Sabbatic, while another member, Mr. William Edwards, stated at a meeting on January 7th, 1929, that whenever the Jew hears the words "acceptable year" read in the Synagogue, he understands by them a Jubilee year. When our Lord, therefore, read from the Lectionary in the Synagogue at Nazareth in A.D. 26, "This day is this Scripture fulfilled in your ears," he was reading from that solitary prophecy in Isaiah lxi, which foretells the coming of a unique and special Jubilee—of the One Who was anointed to fulfil at that time that very prophecy.

If Anstey's scheme were amended in one or two essential items, we should have a standard scheme of chronology as the necessary bench mark, or background, against which could be placed the sundry archæological, literary and earthenware remains which are so frequently brought to light, and compared with vague and varying schemes now current.

We should find that more probably the Hurrians borrowed their Jubilee observance from the Hebrews, than that the opposite took place. I would suggest that the series of Sabbatic and Jubilee years, of which precise and numerous historic records exist, coupled with the frequent references to the three-year tithing sequence (Gen. iv, 3; Deut. xxvi, 12; Amos iv, 4), would constitute a scientific basis for forming a standard scheme of chronology, which is the prime essential for all true history.

#### AUTHOR'S REPLY.

I have nothing to add, since those who have commented on my paper have expressed general agreement with it.

I am sorry that I cannot answer Dr. Denham's question with regard to the Hurrian year of Jubilee. Owing to the closing or dispersal of the libraries I have been accustomed to use, I cannot now lay hands on the article on which my statement was based. If I should be able to find it, I will communicate with him direct.

## 840TH ORDINARY GENERAL MEETING.

HELD IN COMMITTEE ROOM 19, LIVINGSTONE HOUSE,  
BROADWAY, S.W.1, ON MONDAY, MARCH 17TH, 1941,  
AT 6.0 P.M.

DOUGLAS DEWAR, ESQ., B.A., F.Z.S., IN THE CHAIR.

The Minutes of the previous meeting were read, confirmed and signed.

The CHAIRMAN then called on Mr. B. D. W. Morley, F.Z.S., F.R.E.S., to read his Paper entitled "Biology in Figures. A Study in Mathematical Biology."

The Meeting was then thrown open to discussion in which the following took part: Dr. F. T. Farmer, Mr. W. E. Leslie and Mr. Douglas Dewar.

A written communication was received from Dr. W. T. Marshall.

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### *BIOLOGY IN FIGURES.*

#### *A STUDY IN MATHEMATICAL BIOLOGY.*

By B. D. W. MORLEY, F.Z.S., F.R.E.S., ETC.

**N**EARLY two thousand years ago Empedocles began to develop the equivalent of the modern Atomic theory, by means of pure reasoning unsupported by known facts. This was followed up by Lucippus, the real author of the Greek Atomic theory which Democrates put forward with all the glorious reasoning of the old Greek philosophers.

The amazing correlation between the modern Atomic theory and that of the Greek philosophers points out what could be done to aid the biologist if reasoning governed by established laws was to be applied to the immense number of facts which the biologist accumulates, without being able either to correlate them one to another, or to proceed to further researches without an enormous waste of time and labour in following unfruitful lines of investigation.

Pure mathematical biology fulfills this function.

Before proceeding to the discussion of pure mathematical biology, however, I intend to deal, at some length, with the manner in which mathematics has become more and more essential and widely used in everyday biology. That is, I am now going to deal with mathematical biology in the widest sense of the term.

MATHEMATICS IN EVERYDAY BIOLOGY.

Everyone is familiar with the plain straightforward biological statistics such as those concerning birth and mortality rates. Most people are familiar also with the fact that the chances of

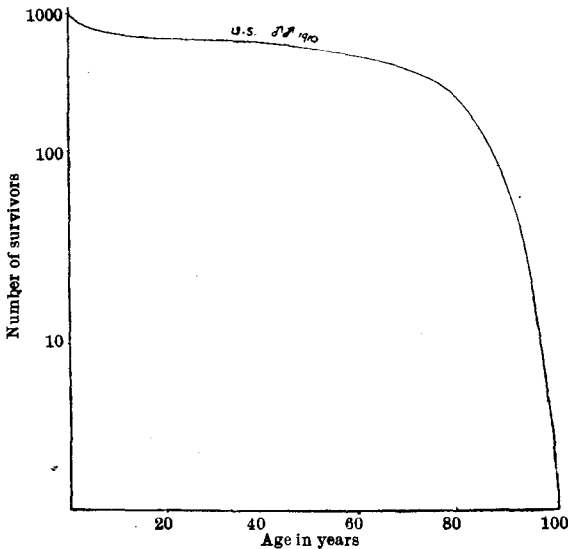


FIG. 1.—(After Lotka.)

survival decrease with increasing age. Statistical biology can, however, take the matter further. Take, for example, the survival curves of males in the United States of America for the year 1910 and plot them on a logarithmic scale (Fig. 1). The resultant curve will give the "Force of Mortality" in man throughout his life. From this curve it will be seen that the Force of Mortality is very great during the first three or four years of life and then gradually decreases until the age of twelve

or thirteen years is reached, finally increasing again continuously until death is achieved.

If similar life curves be plotted for the rotifer *Proales decipiens* and for a fruit fly *Drosophila* (Fig. 2), and the length of life be brought to a common base an interesting comparison can be made.

Actually, in making this comparison, it is simplest to omit the first twelve years of life in man from the curve, thus ridding

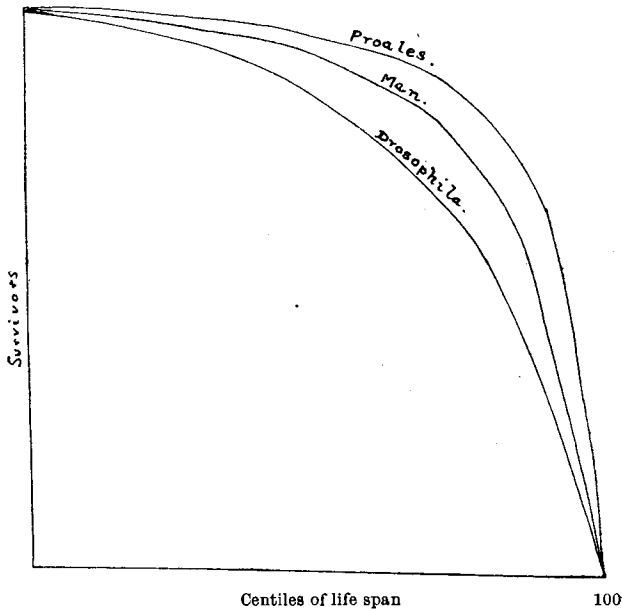


FIG. 2.—(After Lotka and Pearl.)

it of its inflexion. It will be seen that the curves planned on this basis are extraordinarily alike, that of man being intermediate between those of *Proales* and *Drosophila*.

Mathematical curves are very necessary in biology, since they demonstrate most clearly the inter-relation between different types of data. To take an example from my work on Ants.\* It appeared to me that there was probably some

\* "The Kinetics of Ants and the practical uses of such a study." VIIth Int. Cong. Ent., Berlin, 1938.

relation between the length of leg of an ant and its speed and I therefore measured both the length of leg and the speed of a number of different species of ants. Now to procure any value from the data obtained it is obviously necessary to measure also the total body length of the ants concerned and express the length of their legs in proportion to the length of their bodies, at the same time bringing, by simple mathematics, these proportions to a common base.

Next another difficulty was encountered in that the speed of an ant is known to increase or decrease, corresponding to the increase and decrease in temperature of its surroundings. The actual proportions are a fifteen-fold increase for every thirty degrees centigrade rise in temperature. The temperature, therefore, must also be calculated to a common proportional mean.

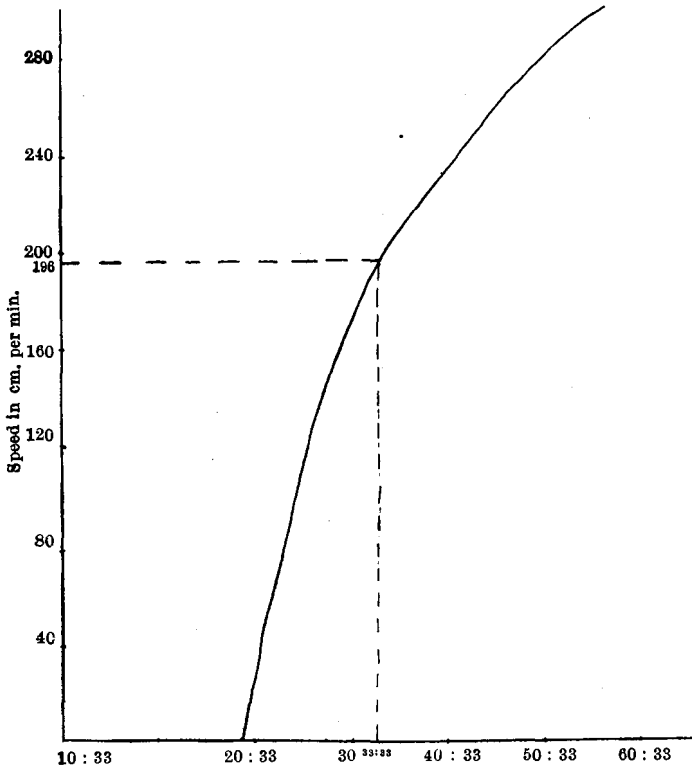


FIG. 3.—Length of leg when length of body brought to common number 33.

It is now possible to plot the graph correlating the speed of an ant to its length of leg and a nice curve (Fig. 3) is obtained which fully demonstrates the interdependence of the two phenomena.

Now without mathematics such a conclusion could never have been reached.

I have shown above how mathematics may be useful to the biologist in helping him to make accurate comparisons, where comparison would be impossible without the aid of mathematics. Also how the correlation between biologically apparently isolated factors and a known result may be brought to form a logical series of interlinked factors leading to a result that can be accurately forecast by means of mathematics. The use of mathematics to forecast biological results is both extremely important and, if the data supplied to the mathematician be correct and complete, extremely accurate.

To return for a moment to the population of the United States, Kostitzin has shown that by using the logistic law

$$p = \frac{197,273,000}{1 + e^{-0.0134(t-1913.25)}}$$

the population of the United States can be forecast with amazing accuracy, as the following table demonstrates.

| Year. | Observed Population. | Calculated Population. | Year. | Observed Population. | Calculated Population. |
|-------|----------------------|------------------------|-------|----------------------|------------------------|
|       | millions             | millions               |       | millions             | millions               |
| 1790  | 3.9                  | 3.9                    | 1870  | 38.7                 | 39.4                   |
| 1800  | 5.3                  | 5.3                    | 1880  | 50.3                 | 50.2                   |
| 1810  | 7.2                  | 7.2                    | 1890  | 63.1                 | 62.8                   |
| 1820  | 9.6                  | 9.8                    | 1900  | 76.1                 | 76.9                   |
| 1830  | 12.9                 | 13.1                   | 1910  | 92.3                 | 92.0                   |
| 1840  | 17.1                 | 17.5                   | 1920  | 106.5                | 109.4                  |
| 1850  | 23.2                 | 23.2                   | 1930  | 123.2                | 123.9                  |
| 1860  | 31.5                 | 30.4                   |       |                      |                        |

That this is so is the more amazing, for, as Kostitzin says\* :—  
 “Since 1790 the United States have waged five major wars, conquered new territory, colonised vast spaces, developed a formidable industrial organisation, and have received and absorbed a mass of emigrants from all parts of the world.”

\* Kostitzin. “Mathematical Biology.” London, 1939.

Similar work by Verhulst on the populations of France and Belgium has shown almost, if not quite, equal agreement between the calculated and observed populations.

The application of mathematics to population increase is not, of course, confined to man, but in lower animals, more especially in the invertebrates, the problem is complicated by the greater importance of the inter-relationships between predators, parasites and prey.

Genetics is undoubtedly the branch of biology in which mathematics has gained the greatest foothold, indeed there can almost be said to be two kinds of geneticists, the entirely mathematical and theoretical geneticists and the experimental or practical geneticists.

[As this paper is intended to make survey of the various ways in which mathematics has entered and has been accepted as essential to the various branches of biology, space cannot be wasted in explaining the fundamentals of the various branches of biology concerned. A knowledge of the bases of genetics, etc., is therefore assumed in the following pages.]

#### MATHEMATICS IN GENETICS.

A simple and basic example of mathematics in genetics is the chromosome map (see Fig. 4). To take an actual example,\* two *Drosophila* are crossed :—scute and cross-veinless  $\times$  echinus.

|       |                                  |                  |         |   |  |
|-------|----------------------------------|------------------|---------|---|--|
| $F_1$ | $\frac{+ \ ec \ +}{sc \ + \ cv}$ | and in the $F_2$ | give :— |   |  |
|       |                                  |                  |         | $\left\{ \begin{array}{l} + \ ec \ + \ .. \ .. \ 810 \\ sc \ + \ cv \ .. \ .. \ 828 \end{array} \right\}$ |  |
|       |                                  |                  |         | $\left\{ \begin{array}{l} sc \ ec \ + \ .. \ .. \ 88 \\ + \ + \ cv \ .. \ .. \ 62 \end{array} \right\}$   | $7.6\% \left( i.e., \frac{150}{1,980} \right)$ |
|       |                                  |                  |         | $\left\{ \begin{array}{l} + \ ec \ cv \ .. \ .. \ 103 \\ sc \ + \ + \ .. \ .. \ 89 \end{array} \right\}$  | $9.7\% \left( i.e., \frac{192}{1,980} \right)$ |
|       |                                  |                  |         | $\left\{ \begin{array}{l} + \ + \ + \ .. \ .. \ 0 \\ sc \ ec \ cv \ .. \ .. \ 0 \end{array} \right\}$     |  |
|       |                                  |                  | Total   | ..  | <u>1,980</u>                                   |

[*sc* = scute ; *ec* = echinus ; *cv* = cross-veined ; + = normal.]

Now these figures show that it is only possible to get echinus and scute if there are two crossovers simultaneously, since the

\* Waddington.

percentage would be about 50 if only one crossover were necessary.\* Therefore echinus must be placed between scute and cross-veinless and their distances apart determined by the percentage of times *sc* and *ec* and *ec* and *cv* appear together. The crossover frequency is, of course, determined by observation, but as can be seen, the length of the map in genetic units can be calculated from this, while the actual plotting of the genes on the map is largely mathematical. Very simple mathematics, such as everyone can understand, can be of great use in considering problems of inheritance.

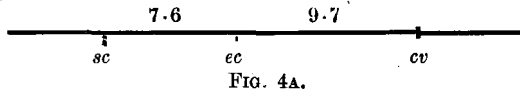


FIG. 4A.

The inheritance of the nest-odour of ants, coupled as it must be, since it is sex-linked being inherited through the X chromosome, with the sex determining mechanism is extremely difficult to understand. Yet the use of simple mathematics clarifies the problem immensely.

In ants the ♂♂ are usually unfertilised (see Fig. 5), though if two Y chromosomes come together (a very unusual event) a super ♂ is formed. It is not yet certain whether the difference between the ♀♀ and the true fully developed ♀♀ is genetical or merely a matter of feeding, but it would seem probable that the XX ants are the fully developed ♀♀ and the XY ants the ♂♂ (see Fig. 5).† Now the problem to be considered is the inheritance

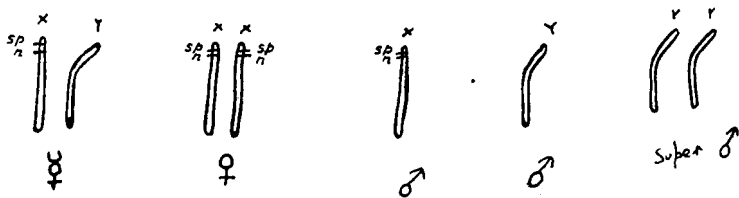


FIG. 5.—Sex chromosomes of ants. (Diagrammatic.)

\* A chiasma (crossover) frequency of 1.0 means that in an average two out of four chromosomes have one crossover, i.e., crossing over takes place in 50 per cent. of the cases between two points situated at opposite ends of a chromosome. From this it will be seen that a bivalent having a crossover frequency of 1.0 has a length of 50 genetic units.

† If this method of sex-determination is correct the haploidy of the X and Y ♂♂ cannot be due to lack of fertilisation but must be due to reduction division after fertilisation. Otherwise there could not possibly be any Y ♂♂. It seems certain there is a genetic, or at any rate a pre-natal difference between ♂ and ♀ and it is difficult to imagine this without XY ♀ and XX ♀.



and spread of any particular nest odour, call it  $z$ , throughout an area inhabited by a certain species of ant.

[Actually both the species odour and the nest odour are inherited on the X chromosome (the reason for coming to this conclusion cannot be gone into here), the nest odour being provided by a gene differentiating the species odour.]

There are three kinds of ♂♂ (Fig. 5), one of which possesses the gene for the nest odour.

Now let  $a$  be the number of X chromosome ♂♂ in a colony. Then  $a$  is the number of Y chromosome ♂♂ in the same colony.

The number of YY chromosome ♂♂ is very small and is probably in the region of  $a^{-a}$ , but since this may not be always accurate, let their number be  $a^{-a'}$ .

Then let  $c$  be the number by which the ♂♂ exceed the ♀♀. Then  $2a + a^{-a'}$  is the number of ♂♂ in the colony

$2a + a^{-a'} - c$ , " " " " ♀♀ " " "

Then  $a + a^{-a'}$  is the number of ♂♂ with Y chromosomes and  $a$  the number with X chromosomes.

Now there are more ♂♂ than ♀♀ and though a ♀ may copulate with several ♂♂ only one will count in considering the nest odour; further a ♀ may be copulated by only Y♂♂. This latter feature has already been expressed by dividing by two, but the former feature may be brought in as follows:—

$$\left(\frac{a}{c} + \frac{2a + a^{-a'} - c}{2}\right)d.$$

Where the latter is the number of ♀♀ produced by the colony and their chances of being fertilised by an X male; and  $d$  is the coefficient of mortality of ♀♀ before colony foundation after copulation.

Then because the ♀ or ♂ copulated or effecting copulation may have a gene of a different nest odour:

$$\left(\frac{a}{2c} + \frac{2a + a^{-a'} - c}{4}\right)d - e$$

where  $e$  is the number of ♂♂ and ♀♀ fertilised in the nest. Now if the data worked on, namely that the nest odour of ants is inherited on the X chromosome, be correct, then two conclusions can be drawn from the above expression which gives the spread of the nest odour  $z$  from one colony in one year. The first is that although the ♀ may be copulated by several ♂♂ only two count, one with X chromosomes and one with Y chromosomes. Secondly, the ♂♂ always copulate with ♀♀ of a different colony,

unless forced to copulate with one of their own colony by the workers (this sometimes occurs when the colony is in danger of dying out, or else to bring about the formation of interlinked polycalic colonies as in *Formica exsecta*, L). It seems highly probable that both these conclusions are correct, though it would be extremely difficult to verify the first one.  $e$  may, of course, be nought.

$$\left\{ \left[ \left( \frac{a}{2c} + \frac{2a + a^{-a'} - c}{4} \right) d - e \right]^2 \right\} \left\{ \frac{\text{Average fertility of } \text{♀ } \text{♀}}{\text{Fertility of } \text{♀} \text{ or } \text{♀ } \text{♀} \text{ of first nest.}} \right\}$$

would represent the number of nests at the end of the next year from a genetic point of view, though actually some of the nests of the year before would have been destroyed by enemies, climate or accident; which would have to be taken into account to get a really accurate result. Further  $d$  and  $e$  are variables. Indeed it would be a very difficult world for us if all ants squared the number of their colonies each year, but it does demonstrate what might and sometimes does occur under ideal conditions or when the balance of predators, parasites and prey is disturbed and  $d$  and  $e$  are nil, or very small.

In a rather different sphere of genetics, that of breeding for a special character, simple mathematics is also useful.

Suppose, for example, in a cross between two animals or plants, a dominant is the character wanted. Then for breeding purposes only dominants would be selected. In the  $F_1$  the progeny would be 3 dominants to 1 recessive. The recessives would be discarded and breeding continued with the dominants. On account of the segregation of the recessives by heterozygotes the proportion of dominants would only rise slowly.

|       |                            |        |         |                      |
|-------|----------------------------|--------|---------|----------------------|
| $P_1$ | $Xx \times Xx$             |        |         |                      |
| $F_1$ | $XX \quad Xx$              | $xx$   |         | $\frac{3}{4}$ dom.   |
|       | ↓                          |        | discard |                      |
|       | $X \quad X \text{ and } x$ |        |         |                      |
|       | ↓                          |        |         |                      |
|       | $(2X + x)^2$               |        |         |                      |
|       | ↓                          |        |         |                      |
|       | $4XX \quad 4Xx$            | $xx$   |         | $\frac{8}{9}$ dom.   |
|       | ↓                          |        | discard |                      |
|       | $(3X + x)^2$               |        |         |                      |
|       | ↓                          |        |         |                      |
|       | $9XX + 6Xx$                | $+ xx$ |         | $\frac{15}{16}$ dom. |
|       | ↓                          |        |         |                      |
|       | etc.                       |        |         |                      |

Thus the number of generations it will take to get an almost, if not quite, true breeding stock for the dominant character  $X$  by means of selection can be estimated. Such estimation is of great use to breeders.

Having shown how simple and statistical mathematics is of use to the biologist in a variety of ways in interpreting statistics, correlating data and foretelling the results of such important processes as increase in population, etc., I now intend to conclude this survey by touching very briefly on what might be termed pure mathematical biology.

#### PURE MATHEMATICAL BIOLOGY.

Pure mathematical biology may be said to be the application of mathematical reasoning to biological data expressed in mathematical terms. There has always been some repugnance among biologists to reasoning about figures. They admit that figures (*e.g.*, statistics and correlating graphs) have a right of entry into biology and are invaluable in facilitating and foretelling results and in correlating data, as shown above; but when it comes to using mathematical reasoning as distinct from simple mathematical calculation, their backs go up. Mathematical reasoning frightens and startles many biologists because they are used to verifying every step. In ordinary reasoning this can be done, but in mathematical reasoning the steps are taken too quickly for this to be so, also the results often appear (and often are) arbitrary or untrue. One of the reasons for this is the distortion caused by sacrificing a number of factors or details for simplification purposes, which errors or omissions very soon get multiplied many fold and cause arbitrary or untrue results.

The chief workers on this branch of biology have been Lotka, Volterra, Teissier and Kostitzin, though Haldane should also be mentioned on account of his work on Natural Selection.

It should be mentioned that the fundamental ideas such as the variables and co-efficients of the equations, which I don't intend to go into in detail in this paper, are founded on the results of long statistical elaboration. Though the logical, or reasoning, apparatus is purely analytical.

The equations nearly all belong to the type of differential or integro-differential equations of the first order. This field of the study being opened up by Lotka and Volterra.

Numerical results are not always reached, but qualitative results, the only ones capable of verification, owing to the heterogeneousness of the biological data, are obtained.

In order to illustrate the working of mathematical biology I am going to set out below a simple and classical example, worked out by Kostitzin, as being easy to understand.

### THE NITROGEN CYCLE.

The nitrogen in the atmosphere is assimilated by living organisms with the help of microbes in the soil. It is also liberated in certain processes of decomposition. For the purpose of this study and to simplify the equations it is assumed that the micro-organisms which are capable of fixing atmospheric nitrogen live in symbiosis with plants.

Now in considering this problem there are six variables to be taken into account :—

- (1) The total weight of free atmospheric oxygen.
- (2) The total weight of carbon dioxide in the atmosphere and ocean.
- (3) The total weight of free nitrogen.
- (4) The total weight of nitrogen, carbon dioxide and oxygen in animals.
- (5) The total weight of nitrogen, carbon dioxide and oxygen in plants.
- (6) The total weight of nitrogen, carbon dioxide and oxygen in the earth's crust.

Let these be represented by  $x$ ,  $y$ ,  $z$ ,  $u$ ,  $v$  and  $s$  respectively. Then the relation between these variables may be expressed by either Fig. 6 or by the following differential equations :—

- (1)  $x^1 = -\alpha_{14}u + (\alpha_{51} - \alpha_{15})v.$
- (2)  $y^1 = \alpha_{42}u - (\alpha_{25} - \alpha_{52})v.$
- (3)  $z^1 = -\alpha_{35}v - \epsilon.$
- (4)  $u^1 = -(\alpha_{42} + \alpha_{46} - \alpha_{14})u + \beta uv.$
- (5)  $v^1 = (\alpha_{15} - \alpha_{51} + \alpha_{25} - \alpha_{52} + \alpha_{35} - \alpha_{56})v - \beta uv.$
- (6)  $s^1 = \alpha_{35}u + (\alpha_{45} - \alpha_{65})v + \epsilon.$

Equation (1) shows that  $O_2$  is consumed by the respiration of animals  $-\alpha_{14}u$ , and of plants  $-\alpha_{15}v$  and that is liberated in the process of assimilation by plants  $+\alpha_{51}v$ .

Equation (2) shows that the atmosphere receives the  $\text{CO}_2$  evolved by animals  $+ \alpha_{42}u$  and by plants  $+ \alpha_{52}v$  in the process of respiration and decomposition of living matter, and that plants assimilate  $\text{CO}_2 - \alpha_{25}v$ .

Equation (3) deals with the assimilation of nitrogen by the earth's crust and by plants,  $-\epsilon$  and  $-\alpha_{35}v$ , respectively.

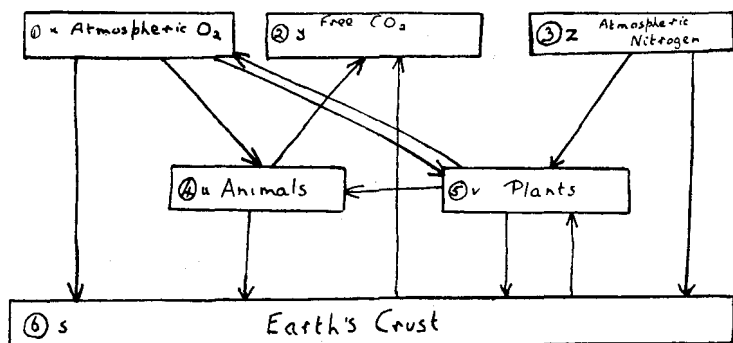


FIG. 6.—(After Kostitzin.)

Equation (4) concerns the amount animals add to or extract from the atmosphere  $+ \alpha_{14}u$  and  $-\alpha_{42}u$ .  $-\alpha_{46}u$  represents the fertilisation of the soil by the products of animal metabolism and  $\beta uv$  shows that animals live at the expense of plants and that the process is regulated by the encounter between predators and victims.

The remaining equations can be similarly explained.

The point to remember is that each term represents an arrow in the diagram (Fig. 6).

Now suppose that if plants were absent, the balance of animal life will diminish; an obvious fact.

This will give:—

$$\lambda = \alpha_{42} + \alpha_{46} - \alpha_{14} > 0$$

and similarly:—

$$\mu = \alpha_{15} - \alpha_{51} - \alpha_{52} + \alpha_{35} - \alpha_{56} > 0.$$

In this case the variable  $z$  is always decreasing and equations (4) and (5) have periodic solutions.

Add the equations for the atmospheric gases (1) and (2).

Then:—

$$x^1 + y^1 + z^1 = u(\alpha_{42} - \alpha_{14}) - (\alpha_{15} - \alpha_{51} + \alpha_{25} - \alpha_{52} + \alpha_{35})v - \epsilon.$$

Integrating this equation for  $t$  from  $t$  to  $t + \omega$  and the average rate of disappearance of the atmosphere is given:—

$$\frac{x(t + \omega) + y(t + \omega) + z(t + \omega) - x(t) - y(t) - z(t)}{\omega} = \frac{\lambda\alpha_{56} + \mu\alpha_{46}}{\beta} - \varepsilon < 0.$$

This shows that the atmosphere and the nitrogen in it are gradually disappearing though at a very slow rate.\*

### IN CONCLUSION.

Though this paper is written by one who is no expert on the subject, I hope enough has been said to show the value to biologists of a study of mathematics. There seems little doubt that, in future, mathematics will be as important to the biologist as to the physicist. *It is to be hoped, therefore, that our universities will recognise this and will insist on students of biology possessing a sufficient knowledge of mathematics and its application to their problems to enable them to make full use of the great new field of research opened up.*

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\* It is calculated from this that the atmospheric nitrogen will last about another 2,000,000,000 years.

### DISCUSSION.

The Chairman (DOUGLAS DEWAR, Esq.) said: Mr. Wragge Morley's paper is most interesting. With much of it I agree, but I do not agree that the use of mathematics to forecast biological results is extremely important. It is often dangerous. I am not impressed by Kostitzin's forecasts of the growth of the population of the U.S.A., a young and expanding nation. I should, however, be much impressed if given a formula whereby the fluctuations of the population of the United Provinces of Agra and Oudh could have been foretold, as I worked as an official for many years in those provinces. Here are the census figures in millions: 1881, 44.1; 1891, 46.9; 1901, 47.7; 1911, 46.8; 1921, 45.4; 1931, 45.4. Is it possible accurately to forecast the figures for 1941 and 1951?

As regards Mr. Morley's curve relating to the speed of ants. Am I right in thinking that it purports to enable anyone to know the exact speed of any species of ant, given the length of its leg and of its body? Thus, will the speed of any kind of any of which the ratio is 33 : 33 be 196 cm. per minute? If so, I hope that Mr. Morley will give details showing the number of species measured by him.

In my view, mathematics are invaluable to the biologist, provided they are used with caution, and not to make wild forecasts.

I agree that biologists are often averse to reasoning about figures. I think there are two main reasons for this—one legitimate and the other not. The legitimate reason is that mathematical results are misleading unless based on complete and accurate data, and in the present state of biology such data are rarely available. Take, for example, Kostitzin's calculation that in about 2,000 million years atmospheric nitrogen will have disappeared. Now, two of the data on which this estimate is based cannot be ascertained with anything approaching accuracy, viz., the amount of N, CO<sub>2</sub> and O in plants and animals. The estimate of 2,000 million years cannot, therefore, be taken seriously. Moreover, it is based on the assumption that during this immense period there will be no adventitious addition or subtraction of N. from the atmosphere. A classic example of the mistake of applying mathematics to incorrect data is the calculation by Lord Kelvin of the age of the earth on the assumption that its sources of heat are limited to its original heat, and that derived from the sun. The illegitimate reason why biologists are repugnant to reasoning about figures is that to most of them the doctrine of evolution is a creed, and such reasoning often shows that the doctrine is false. This theory must stand or fall by the testimony of the fossils. Admittedly none of the requisite fossils have been found linking the phylas and classes, and connecting such peculiar forms as whales, bats and turtles to their supposed generalised ancestors. This means either that the theory is untrue or that the geological record and our knowledge of it are extremely imperfect. Now, there are data available which, if collected and dealt with mathematically, enable us to ascertain whether or not the record is fragmentary. Incredible though it seems, the late Mr. Levett-Yeats and I seem to be the only people who have collected such data, which are scattered about in hundreds of scientific journals, *i.e.*, the only persons to

make any attempt to ascertain the extent to which animals and plants are fossilised.

Among the data we collected are (1) the number of genera of mammals now living in the world ; (2) the number of these of which fossils have been found. Clearly, if fossils have been found of every genus, the fossil record of mammals is complete. If fossils of only ten per cent. have been found, our knowledge of the record is imperfect ; so, probably, is the record itself. Here are the actual figures : of the 215 genera of bats, fossils of 17·67 per cent. have been found ; of the 408 genera of land mammals, fossils of 57·6 per cent. ; and of the 41 genera of marine mammals, fossils of 70·73 per cent. have been found. These percentages represent the degree of the completeness, not of the fossil record, but of our knowledge of it. This is shown by taking the data for land mammals by continents. The percentages of genera of which fossils have been found are : Australia, 45·85 ; Africa, 49·65 ; Asia, 70·15 ; South America, 72·09 ; North America, 90·14 ; Europe, 100.

Thus the percentage increases with the extent to which a continent has been explored geologically, and that is why the figures are highest for Europe and lowest for Australia. The figures for Europe indicate that in the course of its existence every genus of land mammal yields fossil remains. The low percentage for bats is largely due to the fact that, as they can fly, they, like birds, are less likely than ordinary mammals to meet with accidents of a kind likely to result in fossilisation of the victim. The figures demonstrate that in the case of land animals that cannot fly the fossil record is practically complete, and in the case of others nothing like so incomplete as evolutionists imagine. In other words, they are subversive of the evolution theory, and they are so unpalatable to transformists that the Zoological Society of London refused to publish the paper in which they are set forth ; the reason given for this refusal was : this kind of evidence leads to no valuable conclusion. Had our data shown that only a minute percentage of mammals had left fossil records, the data would have been deemed to lead to a very valuable conclusion ! These data have been briefly set forth in vol. 64 of the Transactions of this Institute.

Later I made a similar enquiry regarding the molluscs of the British Isles. The results are published in the *Landenberg Review*



for 1938 : they are that of the 248 genera of British molluscs, fossils have been found of 178, or 70 per cent. In the case of bivalves the percentage is 100. The low grand total is due to the fact that many members of two families of univalves lack shells or other hard parts, and such are comparatively rarely fossilised. Of these two families, fossils of only 20 and 23 per cent. of the genera have been found. The above figures, then, indicate that the fossil record is nearly complete in the case of animals having skeletons or shells, and far from complete in the case of those lacking hard parts.

These conclusions can be checked by other data, such as the number of genera of mammals now living in any continent, and the number of genera, living and extinct, of which fossils have been found in that continent at any given point of geological time as evidenced by their known fossils. Such data for Europe and North America are set forth in the above-mentioned volume of the Victoria Institute *Transactions*. Both sets of data lead to the same conclusion.

The above percentages, being based on data consisting of accurate statistics, are accurate but not complete, because the data are incomplete. They are actual percentages, to which must be added an unknown quantity  $x$ . Thus they illustrate the limitations imposed on the mathematical calculations of the biologist. Although incomplete, these percentages suffice to overthrow the theory of evolution, at any rate in the form in which it is being taught in our universities and schools. The refusal to take notice of these percentages, which is retarding biological progress, is the result not of dislike of mathematical reasoning, but of prejudice. I therefore do not agree that universities should insist on biological students possessing a knowledge of mathematics. Such knowledge is of course useful, nay, indispensable, in some branches of biology ; but to make it compulsory on all biological students would choke off many who have neither taste nor aptitude for mathematics, but are deeply interested in the world of life. In my view ability to weigh evidence, lacking in so many biologists, is for the naturalist far more necessary than knowledge of mathematics.

In conclusion, I ask you to pass a hearty vote of thanks to Mr. Morley for his interesting paper.

Dr. F. T. FARMER said : The application of mathematics to biology is a branch of science which has only very recently come to the fore, yet one which has opened up new and important possibilities in the study of natural and living things. Much credit is due to Mr. Morley for tackling this out-of-the-way subject as he has done, and presenting us with a survey of the field which it embraces.

There are one or two points I should like to refer to. The first arises from his work on ants, and the relation he finds between the size of leg and the speed of their movement. Such an experiment is, I suppose, typical of scientific research : it takes a set of observations from Nature, and derives from them what may be called a natural law. In this case the law is represented by a curve drawn through the experimental points. But in every investigation of this type there is inevitably some spread of the experimental points on either side of the curve, and it is from this spread that the reliability of the law must be judged. For this reason I would have liked to see the points shown on the figure. The spread is not a sign of inaccuracy of the observers : their observations may be dead accurate ; but it is a sign of the entry of unknown factors. Thus, in the case of ants, the speed will not only be a function of size of leg and body—the relation sought for mathematically—but also of innumerable other factors such as nutrition, fright, health, rest, etc. These cannot be measured by our physical instruments, and it is precisely because of them that the type of analytical investigation Mr. Morley is discussing is so difficult. In physical science it is generally possible to eliminate these factors to a large extent, and, in consequence, well-established and exact laws have been derived, the reliability of which is confirmed by every further experiment made ; but in the less exact sciences, in biology in particular, these factors play a predominant part, and their influence must be taken into account. Mr. Morley has, presumably, done this in drawing his curves : it is implied in his statement that a “ nice ” curve is obtained ; but one would like to see just how “ nice.” Mr. Morley has stressed the need for a knowledge of mathematics among biologists. The greater need, to my mind, is a training in the technique of analysing empirical data, and extracting the significant from the random factors. It is here that the greatest skill is required, and the greatest mistakes have been made in the past.

A somewhat different consideration arises in the analysis made of population increase in the United States. The author quotes an empirical expression which he shows gives remarkable agreement with the actual variation of population over a period of 140 years, in spite of various disturbing factors which he mentions. Now this expression is undoubtedly of value in throwing light on population trends; but is it correct to call it a method of prediction of population? The expression was derived to fit the existing data, which, indeed, it does very well, and there is reason to believe that it will give a reasonable approximation to future conditions; but it must be remembered that *any* set of experimental observations can be fitted by a mathematical function if this is made sufficiently elaborate, and that the *only* criterion by which the correctness of such a function for predicting future events can be judged is its *simplicity of form*. The expression given is not elaborate, but it is sufficiently complex to imply that its agreement with past data is partly the result of chance, and to this extent it must be unreliable as a means of forecasting future trends. It is accurate as far as the past is concerned, but we must not forget the underlying principle by which it must inevitably be less reliable when carried into the future.

The analysis of heredity given in the paper is interesting. To one who has not studied the subject in detail it is somewhat difficult to follow—perhaps unnecessarily so through a lack of any definition of the terms used. A very brief explanation of the meaning of the expressions and steps would have been a great help. This does not, however, detract from its value to those more familiar with the subject, and Mr. Morley has shown that mathematics is of great use in questions of selecting desired characteristics in any natural species. We hope he will continue to develop this important field of work.

Mr. W. E. LESLIE said: We now take the use of mathematics in physics for granted. The extension of the method to biology and psychology raises the question as to how far it can be carried. This is very important for the Christian view of God and the World.

It is possible to draw a straight line through any two points, or a triangle about any three points. We feel that this is necessary—it cannot but be. But when we contemplate the universe containing

unnumbered thousands of millions of points, we have difficulty in believing that its order is something that cannot but be. It gives the impression of design.

Similarly in biology. The skeletons of certain lowly organisms seem to be determined by molecular forces. It seems natural that the length of leg of an ant should bear a relation to its speed. We are not surprised that the distribution of genes should conform to the laws of permutation and combination. But D'Arcy Thompson has called attention to a mathematical relation between the forms of certain organisms which it is difficult to regard as mechanical, or as functional adaptations. Imagine drawings of living forms on a sheet of rubber. The sheet can be stretched up and down or from side to side, or it can be moulded to a curved surface, and so on. This causes a change of shape of the drawings. In many, perhaps most, cases the resultant picture is a mere distortion of reality. But in a large number of cases Thompson has shown that it corresponds to an actual creature related to the first drawing. Is this not due to design, a beauty of mathematical relations that is not necessary ?

#### WRITTEN COMMUNICATION.

Dr. W. T. MARSHALL wrote : As one who has applied mathematics to researches on inanimate things such as steel and concrete, I congratulate Mr. Morley on giving us this interesting paper on its application to much more lively things, such as ants.

Dr. Farmer gave in his remarks various criticisms and suggestions with which I am in complete agreement, and on my part I should like to make the following comments :—

(1) I feel the author should have given a little more thought to his audience. He assumed a knowledge of biology and higher mathematics much greater than most of us possessed, and I feel the paper would have been more enjoyable if certain parts had been omitted and others explained more fully : the paper gave one the impression of an attempt to cover a wide field in a very short time.

(2) With regard to the closing remarks on mathematics for biology students, it has to be remembered that the course covered for the degree at our universities is a very full one, and the addition of a further subject to the syllabus would in most cases be impossible

without making the course longer. Most biology students have a good grounding in elementary mathematics, and many have a working knowledge of the elements of the calculus: all that is really needed is a course of lectures on elementary probability, etc. Mr. Morley may be interested to know that such a course is included in the degree and diploma course for biology students at the Royal College of Science.

#### AUTHOR'S REPLY.

In answer to the Chairman's query as to whether it is possible to forecast accurately the population of the United Provinces of Agra and Oudh, I am afraid that much fuller information would be required than the mere census figures, and the expression, when obtained, would be of necessity more elaborate than that required in the case of the United States of America; and even that, as Dr. Farmer pointed out, is fairly elaborate.

The Chairman is right in thinking that the curve relating to the speed of ants applies to ants of all species, and that if the ratio of length of leg to length of body be 33 : 33, the speed will be within at least a 3 f. error of 196 cm. per minute, provided that the temperature be the normal average summer temperature. Any rise or fall above this temperature would have to be taken into consideration, since for the purpose of correlation the temperature has been brought to a common proportional mean.

The spread of the points in this curve is very little up to the region of 200 cm. per minute, but does become greater after that, although never very great. Full details concerning the method of calculating the figures from which the curve was plotted will be found in my paper on "The Kinetics of the *Formicidae*, and the practical uses of such a study," read at the Seventh International Congress of Entomology, the publication of the Transactions of which has been temporarily delayed by the war.

I agree with Dr. Farmer that the major need is for training in the technique of analysing empirical data, and in concluding my paper I stressed especially the need for training in the *application* of mathematics to biology.

While interested to learn from Dr. Marshall that a course of lectures on elementary probability is included in the degree and diploma course for biology students at the Royal College of Science, I cannot help feeling that rather more is needed than a grounding in elementary mathematics, a working knowledge of the calculus, and such a course of lectures. Certainly, however, the Royal College of Science must be congratulated in going so far when most universities have entirely disregarded the matter.

Finally, in answer to the Chairman's remarks on biological mathematics and the theory of evolution, I feel that I must point out the existence of Haldane's mathematical "proof" of the theory of evolution, although I am not prepared to discuss the rights or wrongs of its mathematics here.

## 841ST ORDINARY GENERAL MEETING.

HELD IN COMMITTEE ROOM 19, LIVINGSTONE HOUSE,  
BROADWAY, S.W.1, ON MONDAY, APRIL 7TH, 1941,

AT 6 P.M.

WILSON E. LESLIE, ESQ., IN THE CHAIR.

The Minutes of the previous meeting were read, confirmed and signed.

The CHAIRMAN then called on Mr. Douglas Dewar, B.A., F.Z.S., to read Professor A. Pierson Kelley's Paper entitled "Some Hiatuses in the Plant Kingdom and their Significance."

The Meeting was then thrown open to discussion in which Mr. W. E. Leslie and Mr. Douglas Dewar took part.

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### SOME HIATUSES IN THE PLANT KINGDOM AND THEIR SIGNIFICANCE

By Prof. ARTHUR PIERSON KELLEY, M.A., Ph.D.

(Being the Dr. A. T. Schofield Memorial Paper).

#### INTRODUCTION.

**I**N the year 1859, made memorable by two epochal events in Britain; namely, the coming of a great evangelical revival to the British Isles as recorded by John Shearer, and the publication of the *chef-d'œuvre* of evolutionism, the *Origin of Species*, by Charles Darwin, there appeared another volume which has had a more modest circulation. This book, entitled "*Botany and Religion*, or Illustrations of the Works of God in the Structure, Functions, Arrangement, and general Distribution of Plants," was written by Dr. John Hatton Balfour, F.R.S. (1808-1884), then Regius Professor of Botany in the University of Edinburgh. In reality a textbook of botany, its scholarship and insight into botanical science places the modern crop of botanics in a very unfavourable light; but of greater interest to us is Balfour's incisive analysis of the "transformation theory." He pointed out that there is no evidence of the evolution of one species into another—a fact admitted by a number of modern biologists; he saw that variations always fluctuate about a mean and that

there are boundaries beyond which there is no variation; he asserted that the "evolutionary series" is "very arbitrary"—a fact that is patent to every one who has given serious attention to the subject. He stated that fossil floras do not give any evidence of evolution; and we in our generation are in an even better position to make the same assertion. As a climax to his analysis, Dr. Balfour wisely saw that the real aim of evolution is to rule God out of the Universe.

Much water has ebbed and flowed in the Firth of Forth since Adam and Charles Black published Balfour's book in 1859, but the passing years have only served to emphasize the points made in that volume. It is the object of the present paper to consider the boasted evolutionary line of organisms and to set forth the facts upon which a judgment of that hypothetical line must be based. As a background for the discussion, let us review briefly the natural system of classification as used in systematic botany.

#### NATURAL VERSUS ARTIFICIAL CLASSIFICATION.

The first great system of botanical classification that could be called modern was devised by an Englishman, John Ray; but Ray's system was overshadowed by the System of Linnæus which was based principally on the numerical parts of the flower. The Linnean system was called *artificial* because it was based on arbitrarily chosen characters, while the later systems of the de Jussieus, and the present Engler-Gilg system are called *natural* because based, it is said, upon actual relationships. To-day the natural classification is tacitly assumed to be the tangible expression of evolution and a vital proof of the evolutionary history. It is deemed a fruit of evolutionism while the artificial system is considered the best that Creationism could produce.

Thus Schaffner called classification "the systematizing of evolutionary progressions." (Ohio Journ. Sci. 24: 146-160, 1924.) But the artificiality of all classification is perceived by Dobzhansky, who admirably expresses the true situation thus: "Since the post-Darwin period a 'natural classification' has meant in biology a classification based on the hypothetical common descent of the organisms. This restriction of the meaning of the term is unjustified. The actual mode of descent has been ascertained, and can be ascertained, only for very few



groups. But even granting the possibility of establishing the complete phylogenetic history of every organism, it has never been adequately proven that the degree of similarity between the organisms is always proportional to the closeness of their blood relationships. Some palaeontological data cast a grave doubt upon this point." (Phil. of Science, 2: 345, 1935.) But the truth is, the natural system was produced under Creationism; and, again to cite Balfour: "By a careful and extended examination, botanists have arrived at certain facts regarding the symmetry of plants. They have found that, in the arrangement of the organs or parts of plants, the Creator has adopted marked laws as regards number and position . . . (and) . . . their existence has been turned to most important uses by man in his attempts to follow the great plan of Creation—the *natural system*, as it is called" (*l.c.*, p. 288).

Linnaeus himself regarded his "artificial system" as a mere convenience, to serve until a "natural system" could be established; for he called the natural system the "*primum et ultimum in botanicis desideratum*." And it is significant that at a joint meeting of the Linnean Society and the Association for the Study of Systematics in Relation to General Biology, held on 11th April, 1940, Dr. E. I. White said: "primarily, taxonomy and the study of phylogeny are distinct and not necessarily interrelated," while Dr. Hamshaw Thomas stated: "We are at the parting of the ways; the rejection of the classical concepts of floral morphology has reduced current phylogeny to a mass of ruins, and a century may elapse before it can be rebuilt. Meanwhile, supposed phyletic trees based on typological morphology have no place in taxonomy, which should follow the principles of a natural classification laid down by Lindley more than a hundred years ago" (*Nature*, 145: 636-637, 1940).

In spite of a century of effort to put forth and clarify the "natural system," there is far from any unanimity regarding it. Differences of opinion will be found in regard to many groups within the system, and a number of attempts have been made in recent years to readjust the system and to redistribute the groups, particularly the Amentiferæ and other portions of the subclass Apetalæ.\* An unprejudiced observer can hardly escape the conviction that the "natural system" differs from the

\* Cf. John Parkin (*Nature*, 115: 340-342, 385-387, 1925). Also Gundersen (*Brooklyn Bot. Gard. Record*, 29: 63-64, 1939).

“artificial system” in degree more than in kind; that is, that both systems are based on human conceptions, but that the “natural system” is more logically arranged and perhaps, as Dr. Balfour remarked, approaches the Plan of Creation. Dobzhansky (q.v., p. 345) says: “It is customary to make a distinction between natural and artificial classifications. A critical evaluation shows that the ‘naturalness’ of a classification may vary quantitatively: more and less natural classifications are possible.”

#### SYSTEMATIC BOTANY AND EVOLUTION.

Does the Natural System show evolution? Did plant life evolve from a primordial slime; or did God say: Let the earth bring forth grass, and the herb yielding seed after its kind, and the tree whose fruit is in its self? Consider the evidence.

#### THE ORGANIC KINGDOMS.

The manifest distinction between plant and animal could not be admitted as real by evolutionary biology. Since all life has evolved from less evolved antecedents, according to the disciples of Transformism, it cannot be conceded that plants and animals are actually distinct; there must be intermediate organisms, genetically linking the two. Ernest Haeckel, with characteristic percipency, invented a new kingdom of *Protista*, or, if we choose,\* two new kingdoms of *Monera* and *Protista*, to subsist between the plant and animal kingdoms. Unfortunately for these puppet states, their guarantors have been unable to establish their authority, and their shadowy existence has depended more upon ignorance of the microscopic organisms composing them than upon any actual linkage value they may possess as intermediary between plants and animals. For as Bergson justly remarked (“Creative Evolution,” trans. A. Mitchell, 1911, p. 106): “The group (Protista) must not be defined by the possession of certain characters but by its tendency to emphasize them. From this point of view, taking tendencies rather than states into account, we find that vegetables and animals may be precisely defined and distinguished, and that they correspond to

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\* See also H. F. Copeland (*Quart. Rev. of Biol.*, 13 (4) : 383-420, 1938).

two divergent developments of life." And the distinctness of each group within the pretended kingdom of "Protista" becomes more apparent as we study the members of each group. Thus, the establishment of a kingdom or subkingdom of *Monera* to include Bacteria and Blue-green algæ is little justified, because, as has often been pointed out, the Bacteria and the Cyanophytes have more differences than resemblances. Moreover, the formation of a kingdom proper of Protista out of such radically diverse groups as Flagellates, Diatoms, Red Algæ, Brown Algæ and Fungi, borders on the absurd.

For convenience we will consider the Plant Kingdom as comprised in four major divisions of Thallophytes, Bryophytes, Pteridophytes, and Spermatophytes; but we will first briefly touch on the hiatuses amongst the so-called "Protista."

#### HIATUSES AMONGST THE "PROTISTA."

These organisms were said to be neither plant nor animal, but an evolutionary complex of unevolved creatures similar to those which æons ago were ancestors of the present algæ and protozoa. But it must be observed that the Flagellates which are thus made to stand sponsor for the alleged common ancestry are less studied organisms, and all the "Protista," as they become known, are seen to be remarkably distinct and unrelated. Not that such distinction is essential to Creationism: we are merely interested in fact.

Bacteria and their neighbours, the Viruses, have been studied intensively in recent years and are seen as discrete and unrelated groups. Each has its own special characters, as ably set forth by Sir Patrick Laidlaw in his *Virus Diseases and Viruses* (1939). Bacteria form a natural group and perhaps we might call them a phylum; but as to their "relationships," only wild guesses have been put forward, as that they are derived spermatia of fungi (Hallier) or that they have come from plastid cells of fungi. In reality, the bacteria form a world of their own, being complex in structure, vastly numerous in kinds and functions\*; and entirely without known relationships. The viruses are considered bodies degenerated through a parasitic life; and speculation is rife concerning their origin and being.

\* See O. Rahn (*Zentbl. Bakt.*, 2 Abt., 100 (18/23): 369-372, 1939).

The Bacteria and the Blue-green algæ (Cyanophyceæ) have been grouped together as Monera, but that grouping took place in the days of crude microscopes and biological ignorance. One could as well group the Walrus and the Royal Palm together because both are alive! The Cyanophytes form a remarkable and highly individual assemblage of plants and have no known relationships.

An instructive volume could be written about those microscopic organisms called the Flagellates. They comprise several natural groups, and as they become known they appear as remarkably distinct and unrelated. The *Chrysophytes* are plants possessing vegetable structure and mode of nutrition, but are unusual in some of their habits. West says ("British Fresh-water Algæ," p. 320): "the Chrysophyceæ exhibit an astounding diversity of development for which there is perhaps no parallel in other classes." Yet the group is little studied, its classification is highly artificial, and we cannot be sure but that it includes, as it now stands, organisms which are not Chrysophytes. The *Chloromonads* are a small group of fresh-water flagellates, their relationships, if any, unknown. The *Cryptophytes* are mostly marine and are not very well known. The *Euglenoids* are common in water that is rich in organic matter. By inclusion of the holozoic *Peranemaceæ* in the group, the Euglenoids are made to do duty as a bridge between the Protozoa and Plants; but by separating the true Euglenoids from organisms that superficially resemble them, it may be that the bridge disappears. Similarly, the *Dinoflagellates* are usually made to include the holozoic *Gymnodiniaceæ*, which probably should be separated off. Thus in all cases the Flagellates have a questionable linkage value; and as they become better known their uniqueness becomes more apparent.\*

#### HIATUSES AMONGST THALLOPHYTA.

We cannot detail in this paper all the natural groups of the algæ and the fungi, those tissue-less plants that together form

\* The recent report made by Dr. S. O. Mast at the 8th Pan-American Scientific Congress of autotrophism in the flagellate, *Chilomonas*, only emphasizes the uniqueness of the flagellated organisms. According to Dr. Mast, *Chilomonas* is able to build starch in the absence of sunlight and chlorophyll. While unconfirmed, the report is quite in line with what has long been known of other autotrophic organisms. It is evident that much work must yet be done on the Flagellates before we can draw rigid general conclusions about them.

the one-time division of the Thallophytes. The Algæ include the Cyanophytes, Diatoms, Conjugates, Green algæ, Charophytes, Brown algæ, and Red algæ; while the true fungi comprise Algal fungi, Sac fungi, and Basidial fungi. The Slime molds (Myxomycetes) are another markedly individual and isolated group, while Lichens (composed of alga and fungus living in symbiosis) are simply a conundrum to the developmentalist. Consider these groups in more detail and realize that according to modern biology they *must* be in some way interrelated. The Creationist does not have to interrelate organisms, but the evolutionist is *compelled* by his hypothesis to suppose that *all organisms* are *blood-kin*. Hence evolutionary biology solemnly sets itself to the task of finding clues to the suppositious interrelationships, and much of biological work is directed—openly or furtively—to the finding of the connecting links which are so hopefully desired. Unfortunately for evolutionism, after nearly a century of search, *not a single undoubted connecting link has been found*.

The Green algæ (Chlorophyceæ) have long been the object of evolutionist attention and several imaginary genealogies have been proposed for the members of the group, based on a suppositious transformation of a flagellate into a polyblepharid which in turn became coleochætoid and from thence the distinctly thalloid algæ are supposed to have arisen. Such a genealogy is purely suppositious, based on a mental progression and having no factual evidence or experimental proof.

In fact, the Green algæ do not show evolution, as Dr. F. O. Bower frankly admits: he speaks of the "conservatism of the Green Algæ" which prevented their "evolutionary advance. . . . Here lies the gap between green aquatic and green amphibian life. There is no use in ignoring it, nor yet in filling it by hypothetical transmigrants that no one has seen, and that we are expressly told we shall never see" ("The Origin of a Land Flora" (1929)).

The Brown and the Red algæ are still more difficult for the evolutionist, the latter group being rather avoided or dismissed as a "specialised offshoot." The Red algæ are decidedly involved in their life history; and in production of non-motile, passive egg and sperm, and elaborate reproductive organs, they are quite suggestive of "higher" plants. As to their "origin," the best that modern science can say is that it is "uncertain."

The Fungi are even more puzzling. The task of assigning an origin for any fungal group presents tremendous difficulties and when we consider that many fungi are symbionts of the most intimate sort, and that the symbiont and the host must have evolved together in the most intimate relation, according to evolutionism, the task of assigning an evolutionary origin to the fungi becomes almost insuperably difficult. The few guesses as to the origin are not even plausible: thus, the suggestion that Rusts were derived from Red algæ is palpably absurd because it would involve the evolution of an extremely complex "finished" group from a complex, "finished" group. Evolution is supposed to proceed from young nascent stocks, not from old, highly-evolved end branches of the process. There is no suggestion regarding the origin of any group of fungi that has met with any general credence, and we can still agree with Strasburger's old assertion that the origin of the fungi is "uncertain."\*

Surveying all that numerous assemblage of organisms which older botanists rejoiced to call Thallophyta, we find not one single case of linkage amongst the discrete groups. From viruses of 10 micromu up through bacteria to the highest alga or fungus we find only discontinuity and unbridged hiatuses. The wood is indeed full of trees but the branches always adhere to their own trunk! If the "lower" plants evolved, they have kept their secret well, for not even the modern microscope has compelled them to interrelate; but on the contrary, research has simply emphasized the isolation and discreteness of the lower plant groups.

#### BRYOPHYTES AND THEIR ORIGIN.

Coming next to Liverworts and Mosses, we meet the division which botanists of a former generation called Bryophyta. Here again we find only doubt and uncertainty amongst evolutionists as to the origin of the liverworts, while as to mosses, the phylogenetist metaphorically throws up his hands in despair. Thus O. E. Jennings writes: "The origin of mosses is one of the most

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\* Dr. J. Ramsbottom states "that in the fungi the fossil evidence is quite unreliable and that the so-called phylogenetic trees from time to time published for this group are based on such superficial evidence as to be sheer nonsense" (*Nature*, 145: 637, 1940).

interesting mysteries of paleobotany" (*Bryologist*, 31: 10-15, 1928). A generation ago Strasburger write: "There are difficulties in the way of the phylogenetic derivation of the Bryophytes from any definite group of Algæ," and the difficulties have not decreased with passage of time. Naturally the evolutionist must derive Bryophytes from Algæ, and Strasburger would have derived them from Brown algæ. But D. H. Campbell—no mean authority—said: Not so; it is from *green* algæ that the Archegoniates (Liverworts and other plants provided with an archegonium) arose. Yet Campbell was uncertain, he wrote: "The direct origin of the simple gametophyte of such a liverwort as *Aneura* or *Anthoceros* from some Confervoid type is readily conceivable, but the very great difference in the complexity of the reproductive organs between even the simplest Liverwort and any known Alga forbids the assumption of any but a very remote connection between them" ("Mosses and Ferns" (1918), p. 564). Not a very positive knowledge of the origin of Liverworts, we should say. And no one has come much closer. As to Mosses, Campbell deems them "one of the most sharply defined and specialized groups of plants known to us. . . Their relationship with other forms is at best a somewhat remote one." That judgment is correct and is generally agreed to by botanists.

Two of the four older divisions of the plant kingdom have been reviewed from the pinnacle of Twentieth Century knowledge; and nowhere in the Thallophyta or the Bryophyta have we found the boasted evolutionary line. On the contrary we have met anxious botanists with furrowed brows and faces lined by arduous study, still searching for the illusive connecting links and phylogenetic progressions that *must* exist since evolution is true. How much those self-sufficient younglings are to be envied who make up a chart of the phylogeny of some vegetable group and proceed to believe it, not just thinking it might be true but actually *believing* that their cerebation is a *fact*!

#### ISOLATION OF THE VASCULAR PLANTS.

Since two divisions of the plant kingdom fail to show evolution, we must find the *sine qua non* of vegetable existence in the remaining two—Pteridophyta and Spermatophyta. But the

Ferns (Pteridophyta) at once bring us to a pause; they say: Evolution is not with us. As Sinnott (Stirling Professor at Yale) justly points out: "Between Mosses and Ferns there are such fundamental divergences, if one is willing to consider all the facts, as to warrant the statement made by the writer, . . . that in passing from Bryophytes to the Pteridophytes . . . we cross the *widest gap which exists in the continuity of the plant kingdom.*" (Italics by Ed.) If Ferns and "Fern Allies" are not to be derived from the "lower" plants, from whence did they come? There is no answer in evolutionism to the question.

So, too, with the Seed Plants (Spermatophyta), which include the Gymnosperms (pine trees and many others) and Angiosperms (the higher flowering plants). Now, Seed Plants are particularly hard on evolution because, first, the Gymnosperms refuse to be derived from cone-bearing "Fern Allies": they not only decline to be derived on present-day morphological evidence but they settle the question by turning up in the geological record before their reputed ancestors. Then, secondly, the Angiosperms are the most isolated of all plant groups, for, like Melchizedek of old, they are positively without known antecedents. The evolutionist, indeed, obviates the difficulty by citing the alleged incompleteness of the record, as in the following graceful subterfuge\* of Pulle ("Remarks on the System of the Spermatophytes" (1937), s. 3). "Strange to say, the phylogenetic tree of the Angiospermæ is a tree of which we know the foliage only; a tree on the crown of which we look from above, but whose dense foliage does not allow us to see the structure of its branches." But it is the inflorescence and not the foliage that is used in the phylogeny of Angiosperms and the attempted derivations are merely comparisons, resting on mental conceptions and not on experimental or other proof. Neither the inflorescence\* type, nor the gynœcium,\* nor any other organ of the Angiosperm has yielded evidence of relationship. Similarities exist, it is true, and markedly so within "families." For example, R. P. Wodehouse found (Ann. Bot., 42, 891-934, 1928) groups of species within the family Compositæ having similar pollen grain characters; but whether these similarities actually prove genetic affinity or not is a highly debatable question.

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\* W. Zimmerman (*Beih. z. bot. Centralbl.*, Abt. A, 53: 95-121, 1935; Hagerup, O (*D. kgl. Dansk. Vidensk. Selskab. Biol. Med.*, 13 (6): 1-60, 1936.



## DISCONTINUITY IN GERMINAL PHENOMENA.

Thus the Plant Kingdom from beginning to end shows only unbridged gaps, and the earnest student who cares to delve still deeper into the evidence will find confirmation of the analysis so briefly made here. Not only in the larger groups, but likewise in the smaller, there is seen distinctness and not a gradual progression from one sort to another. The discontinuity of the Plant Kingdom is its chief character. And now that discontinuity is so patent that it cannot be denied, transformist biologists, who sought for decades to establish *continuity* as a fact and searched unceasingly for connecting links, suddenly deploy with Jesuitical duplicity and say: Ah yes; we knew all along that the larger groups of organisms are discrete and discontinuous, but the discontinuity is only apparent and organisms are actually interrelated through a previous mechanism of mutation and isolation.

Realizing the undeniable discontinuity of organic groups, evolutionists have been compelled to fall back on possible transformism occurring in the germ plasm. Evolutionism has been marked by masterly retreats; and it is the newest flair in biological research that is always about to reveal the long expected solution of the evolutionary problem, just as the hopeful prospector is always just about "to strike it rich" in some newly discovered vein. To-day it is the germ plasm that is to be the El Dorado, and there has been a marked revival of interest in the "species problem" in recent years. It is not possible here to discuss the species question; but we may say tersely that the consensus of biological opinion agrees with what any layman can see with his eyes, that there are species of organisms.\* These species depend for their existence upon the genetic constitution of the germ plasm.

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\* "It has been contended by many authors that the grouping of individuals into species is merely a matter of convenience, since species have no existence apart from the mind of the investigator. As a proof of this contention, it has been pointed out that such criteria of species distinction as the production of sterile hybrids sometimes break down because some forms which are classed as species can be crossed experimentally and can produce semi-fertile or fertile hybrids. This point of view is fallacious, and is based on a failure to understand that the fact that some species can be crossed and can produce fertile hybrids does not prove that these species cross regularly in nature. *Species is a dynamic rather than a static entity* (italics by Ed.), and the essential feature of the process of species differentiation is the formation of discrete groups of individuals which are prevented from interbreeding with other similar groups by one or more isolating mechanisms" (Th. Dobzhansky in *Amer. Nat.*, 71: 404-420, 1937).

The tremendously important question for biology is this: Are species discrete, or are there "cases of continuous variability"? The evolutionist points to series of species arranged in neat progression, as those of the famous horse genealogy amongst fossils, or the distinct and incomparable cases offered by such genera as *Rosa*, *Rubus* and *Hieracium*. It would take us far afield to consider the fossil record of the horse, but even admitting the record as factual it is obviously of a different category to that of living "species complexes" which are separable into a number of allied forms. Since these complexes have offered a fascinating field for cyto-genetics, they are being much studied and the hopeful cry has been raised that in polyploidy and related phenomena the origin of new species has been discovered. These hopes seem doomed to disappointment,\* for with continued research the adamant stability of species remains evident.

Stability of species depends in the last analysis on those metaphysical entities known as "genes." Since the characteristics of an organism seem manifestly determined by the genes, evolution must perforce commence with the gene. Thus Gulick remarks (*Quart. Rev. of Biol.*, 13: 164, 1938): "As part of the evolutionary process, a gene *must be* (italics by Ed.) credited with a liability for undergoing chemical alteration to produce a new gene substance with a slightly different molecular constitution, capable of autocatalysing itself, including the new item in its constitution." In other words, because evolution is true, the genes (ultimate determiners of organic kind) *must* transform! But how such an hypothetical transformation could take place is still a puzzle: "All genetic evidence accumulated so far indicates that the gene offers an efficient mechanism

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\* Compare the following: "The evidence from the plant kingdom as a whole, therefore, suggests that polyploidy has been most important in developing large, complex and wide-spread genera; but that in respect to the major lines of evolution, it has been more important in preserving relics of old genera and families than in producing new ones" (G. L. Stebbins, *Amer. Nat.*, 74: 54-66, 1940). So, too, with supposed evolution by chromosomal change, Brink, *e.g.*, stating in regard to supposed origin of new species in *Crepis* and *Datura* by loss of chromosomes: "We cannot positively assert that the process in question is significant for evolution until one case at least is shown to be of this (positive selective) nature" (*Amer. Nat.*, 69: 97-124, 1935). And even ecological variants seem governed by a strict definity, as pointed out by Bergström (*Nature*, 145: 316-317, 1940).

for the evolutionary progress of living organisms. *Just how this progress is accomplished is not known* (italics by Ed.), but Genetics may soon be in a position to offer a more definite evidence on this subject than is available at present" (M. Demerec, *Amer. Nat.*, 69 : 125-138, 1935).

Assertions of continuity in the organic world are still premature. The "syngameon" may have larger boundaries than have yet been indicated, but within the true species apparently the genetic constitution remains fixed and hiatuses still persist unbridged even in minute groups of the classifier. The possibility of genetic continuity is not ruled out but it is unproved. The actual state of the plant kingdom is this: the larger taxonomic groups are unlinked, and so, too, are the smaller; the species are dynamically discontinuous, and the "genes" form unique systems which determine a discrete specific form.

We have examined the living plant kingdom and found hiatuses between the taxonomic groups, between the species, between the gene-systems. Let us now turn to fossil plants and learn what they teach us.

#### THE VALUE OF THE GEOLOGICAL RECORD.

The importance of Historical Geology to the Hypothesis of Organic Evolution has long been recognized, and T. H. Huxley's famous dictum is widely quoted: "The primary and direct evidence in favour of evolution can be furnished only by palæontology. The geological record, so soon as it approaches completeness, must when properly questioned, yield either an affirmative or a negative answer: if evolution has not taken place there will lie its refutation."

A very important question which is basic to the whole subject of Historical Geology has yet to be adequately treated by modern science, namely, the worth of Lyellian chronology. Devised in an early day by partial methods, it has universal acceptance by custom rather than by an intelligent appraisal of its worth, and the whole of Historical Geology must be viewed with reserve by one who demands a critical evaluation of the truth. It is unfortunate that the only modern critics of Lyellian geology should be content with setting up a rival hypothesis which has

far less basis in observational data; and that a thorough-going critique of Lyellism\* is still lacking.

For the present, all that the botanist can do is to utilize the terminology of current geological science, and to make the best use he can of the fossils, for *they* at least have tangible existence.

Accepting Lyellian chronology, however, at face value, we find its records most contradictory to current evolutionary teaching. Evolutionism teaches† of a slow gradual progression from "primitive" marine algæ to beach or marsh plants, and thence to the vascular land flora. Lyellian geology tells us that land plants appear with the "primitive" aquatic plants, that "highly evolved" vascular plants preceded in appearance their reputed ancestors. The fact that Gymnosperms with structure as "highly evolved" as any living today existed "as early" as Lower Devonian is too well known to require discussion. Further, that land plants were "highly evolved" and widely distributed in the Silurian is also too well established to be questioned; thus, we may cite the Psilophyton-like plants of Gothland and England, and the leafy stemmed plants of Australia, all found in the Silurian; and still more impressive is the discovery of an Annularia-like plant from the Ordovician of England. And thus, if we accept Lyellian geology, we must (if we are truthful) accept what that geology teaches, namely, that the vascular plants appear about as early as the non-vascular plants, and that there is not even a hint of evolution to be discerned in the record.

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\* G. R. Wieland says (*Nature*, Feb. 10, 1940): "there came Huxley's famous fling: 'Geologists had imagined that they could tell us what was going on at all parts of the earth's surface during a given epoch; they have talked of this deposit as being contemporaneous with that deposit, until from our little local histories of the changes at limited spots of the earth's surfaces they have constructed a universal history of the globe as full of wonders and portents as any other story of antiquity.'" And note that Wieland also says: "As justly though, Huxley admitted that, 'It was Lyell who had smoothed the road for Darwin'"

† A recent book on palæobotany presents the following summary of its content: "it has been amply demonstrated in this survey that in the near past there lived many species and genera which have now become extinct, and that, as one searches the record of the remoter past, families, orders, classes, and phyla gradually 'disappear' until in the mid-paleozoic only marine thallophytes are known to us. Yet this record is not merely the elimination of types; it is the directed course of evolution—specialization, modification, and diversification" (quoted from W. C. Darrah's "Principles of Paleobotany," 1939, a book which reflects far more credit on the printer than on the author). The quoted paragraph is egregious falsehood, inexcusable in a profession palæobotanist.

The doubts and tergiversations of the Lyellian palæobotanist are pathetic. For example, there can be little doubt that Sir William Dawson's *Prototaxites* (*Nematophyton*) was a well-developed land plant of the Silurian; but, since according to evolutionism land plants could not exist in the Silurian, Lyellists stand before *Nematophyton* with perplexed bewilderment. Witness Seward, who states ("Plant Life Through the Ages" (1931), pp. 119-120) that the plant was found in an obvious peat bog and hence could scarcely have been a marine alga; it can be argued that it was a land plant; "It probably grew on swampy ground and must have reached the dimensions of a tree"; and the structure of the stem "reminds one of the stem of a conifer that has been partially destroyed by the ravages of a fungus." But, since conifers could not have existed in the Silurian (else evolution would be untrue), *Nematophyton* is considered a queer anomalous fossil which cannot be explained.

#### FOSSIL RECORD OF THALLOPHYTES.

There is little need to pause over the fossil algæ. Being either minute or rarely possessed of hardened structures, their preservation has been difficult or wanting except in certain cases. Yet in an indirect way they have shown their presence by the formation\* of ironstone, graphite, and in some cases, limestone; and thereby have precipitated a discussion as to the earliest appearance of life on the earth. It is not in our province to enter a discussion of possible pre-Cambrian fossils, nor to enquire into their comparative age.

With preservation of algæ so difficult, we cannot draw very positive conclusions from a consideration of their fossils. It would be unfair to point out that the fossils from Cambrian to Silurian that are considered algal belong to the "more evolved" groups of the algæ, and that Green, Brown, and Red Algæ appear to be contemporaneous, because we cannot be certain of anything about these fossils, and especially as reproductive organs are wanting, it is therefore best to leave the fossil algæ out of the discussion.

As to fungi, traces of them are found from the Devonian onwards. While the records of fossil fungi are in cases called

\* See Julius Pia, "Pflanzen als Gesteinbildner," 1926.

into question, there are certain examples which are too well known to be doubted, *e.g.*, the fossil mycorrhizæ of the sort first described by Weiss (Ann. Bot., 18, 255-265, 1904). A mycorrhiza is a fungus-root; *i.e.*, the root of a vascular plant harbouring a symbiotic fungus in intimate union; and it is well known that many forest trees and other plants owe their vegetable existence to the lowly partners of their subterranean life. These mycorrhizæ are highly organized in a definite morphological structure. It is significant that exactly the same structure, in all its complexity has been found, not alone in Weiss's Lower Coal Measure plants, but in other fossils, that indicate the existence of an extremely high degree of "evolutionary progress" in the earliest fungi. The first fungi (if we accept current geology) had a structure as "highly evolved" as the fungi of today, and lived in as complex a symbiosis as their modern "descendants." Theorize as we please, we cannot escape these hard facts. Accepting Lyellian geology at face value, we find it showing us that the fungi when they "first appear" were as "highly evolved" as those of the present day.

#### FOSSIL RECORD OF BRYOPHYTES.

Liverworts are described from the Coal Measures or Carboniferous of Scotland and England. The fossil liverworts greatly resemble modern liverworts in apparent structure and appear in the rock strata fully formed as liverworts, and without known antecedents.\* Indeed, Dr. F. O. Bower himself emphasizes the gap which separates the Liverworts from Algæ and says: "There is no use in ignoring it, nor yet in filling it by hypothetical transmigrants that no one has seen and that we are expressly told we shall never see" ("Origin of a Land Flora" (1909-1929), p. 13).

Nor do Liverworts lead gradually to Mosses, for, as we have noticed, the Mosses exist as one of the most isolated of plant groups. There are not many fossil mosses known except that more recent peat-bog studies are bringing to light some of the older bog mosses; and the earliest authentic moss, according

\* Prof. John Walton describes liverworts from coal balls that closely resemble modern examples of *Fossombronia* and *Treubia* (cf. Seward, *l.c.*, 1931, p. 211-212). In other words, when liverworts first appear, they are like present-day liverworts: they do not show evolution.

to current geology, is described from the Tertiary. Seward, however, thinks that *Muscites* was a true Carboniferous moss. (*l.c.*, p. 212).

#### FERNS AND FERN ALLIES IN FOSSIL RECORD.

Linkage of fossil Thallophytes with fossil Bryophytes could depend only upon the happy find of rare fossils which are yet unknown, because of the rarity of preservation and difficulty of study of fossil algæ. But linkage of Bryophytes and Pteridophytes rests on a more hopeful basis because there is a sufficiently abundant supply of fossils in these groups to make a reasonable study possible; and meticulous studies have in truth been made. In the Rhynie Chert of the Old Red Sandstone (Devonian) in Scotland, fossils occur which are apparently not vascular plants as we know them nor yet exactly liverworts; and these Rhynie fossils were hailed as the long hoped for links between liverworts and vascular plants. "In my view," exclaimed Seward ("Plant Life through the Ages," p. 4, 1931), "nothing of such importance to plant morphology has appeared since Hofmeister's 'Vergleichende Untersuchungen' was published in 1851." Yet *Rhynia* and *Hornea* (*Rhyniaceae*), these would-be linkage plants, appear more as an isolated and unrelated group than as evolutionary connecting links. D. H. Scott has been careful to state ("Extinct Plants and Evolution," 1924, p. 192): "It is possible to interpret the family (*Rhyniaceae*) as a synthetic group, related to both the Vascular Cryptogams and the Bryophytes, while still retaining some of the characters of an original Algal stock. Such a conclusion is justified on the facts actually known; but, on the other hand, we can scarcely feel quite certain that the remarkable simplicity of the Rhyniaceæ was wholly primitive. The peat habitat, as already pointed out, was not a very favourable one, and it is possible that plants growing under such conditions may have already undergone a certain amount of reduction. However that may be, the fact remains that the Rhyniaceæ are the simplest and among the most ancient of land plants known to us."

If the *Psilophytales* (to which the *Rhyniaceæ* belong) are, as they appear to be, an isolated group of plants and not a "primitive" linkage group, the liverworts and ferns are still unlinked. And even were the *Psilophytales* shown to be genetically inter-

mediate between Liverworts and Ferns (and how could the genetic affinity of fossils be shown ?), there would still be significant gaps between these three groups.

In fact, Ferns appear established and without known antecedents in the middle Devonian, before Mosses and Liverworts appear, unless the Psilophytales were truly Liverworts. If the Ferns developed from the Psilophytales, the evolution must have taken place in a hurry! Even in the Devonian, the Ferns (like *Archæopteris*) had large and pinnately compound leaves with sporangia dotted singly or in groups over the frond. They were very definitely Ferns when they "first appear" in the geological record, and as far as fossils enable us to determine, they have always remained ferns.\*

It is interesting to note that evolutionary botany has argued stoutly for the "primitive" character of the Adder's Tongue and Grape Fern Order (*Ophioglossales*) because of the comparatively simple structure of these plants. It was long taught that the Ophioglossaceæ are more or less intermediary between Liverworts and Ferns, and similar to the (hypothetical) ancestors of the Ferns. But the Ophioglossales are almost unknown as fossils, and the few, like *Botryopteris*, that are known, occur long after ferns had appeared in full maturity (accepting current geology). We must now argue as stoutly, therefore, that the Ophioglossales are highly evolved and that they have been severely reduced in structure!

Isolated and extinct groups such as the Lepidophyta need not detain us since no one considers them as anything but isolated and outside any possible "progression." But it is instructive to contemplate others among those groups often called the Fern Allies; thus, the plants called Horsetails (Arthrophyta) appear "abruptly" in the Carboniferous as Arthrophytes, and the Arthrophytes have remained in existence ever since, unchanged in their principal characters. Indeed, the *Equisetites*, which appear in the Palæozoic seem much like the *Equisetums* of today; of their origin, nothing is known.

Similarly, our present Lycopods are antedated by the *Lycopodites* which closely resemble† the living *Lycopodiums*, although

\* Seward says (*l.c.*, p. 147) that only one fern, in a strict sense, is recorded from Devonian rocks; namely, *Asteropteris*, from New York.

† According to Seward (*l.c.*, p. 187) in the Lower Carboniferous *Lycopodites Stockii* we have an example of what is apparently an herbaceous lycopod agreeing closely with modern forms.



found in the Lower Carboniferous. It is strange that in a world of continuous progression we find group after group of plants appearing "suddenly" in the geological record and continuing virtually unchanged through the various rock strata! Selaginella is also represented in the Carboniferous. As to the origin of the Lycopodales, it is unknown.

Summarizing our knowledge of the fossil spore-plants, then, it is evident that isolation and discontinuity prevail amongst them. Nowhere is there evidence of genetic continuity or "continuous variation": on the contrary the student of palæobotany finds only laboured disquisitions that attempt to explain how the isolated groups of fossils *might* be related. Learned writers bewail the paucity of students of fossils; but judging from the entire lack of agreement amongst the afore-said learned authorities as to how the evolution has taken place, they should be glad that so few labourers enter into their field lest confusion be worse confounded.

#### FOSSIL SEED PLANTS VERSUS CONTINUITY.

It is very generally taught in the schools that fossils, when arranged in the order of their age, show a steady progression from the simplest to the most complex; that, starting with traces of simple algæ, the fossil record indicates the evolution of liverworts, ferns, simple seed plants (half fern and half seed plant), gymnosperms like the cycads, and finally a grand culmination in the beautiful Lily and the Rose. The idea, which is believed by both teacher and pupil, is a bald-faced lie—or a disingenuous prevarication, if the reader is sensitive to rhetoric.

No gradual progression is shown amongst fossil plants; at least, *None is shown by evolutionary geology*. On the contrary, this geology shows the Seed Plants to be as old as, if not older than, the Spore Plants that are supposed to have produced them. As a matter of fact, according to evolutionary geology, the Gymnosperms (not Cycads but "highly evolved" Coniferous-type wood) appear among the earliest known plant fossils.\* The "highly evolved" symbiosis of fungi with gymnospermous

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\* It is a curious point that we have such inadequate evidence for the existence of Ferns in Early Devonian time, while, as Hugh Miller's discovery showed, plants of a much higher grade, very probably of Gymnospermous affinities, were already represented" (Scott, 1924, p. 198).

roots also appears for the first time, unexplained, among the early plants; while Ferns appear along with them, also for the first time and "highly evolved"; and Liverworts make their first appearance afterwards and in the same state of "evolution" in which they exist today. Thus the Liverworts, ancestors in type of the Ferns, and through the Ferns of the Seed Plants, appear in the geological record millions of years after their descendants are fully matured, the latter having awaited serenely and unvarying for millions of years for their forefathers to be born and to assume an earthly existence. Truly, the world is fearfully and wonderfully made, and evolutionism abounds in delightful mysteries and fascinating uncertainties!

Considering first among the Seed Plants those fossil forms known as Seed Ferns or Pteridosperms, we may quote H. N. Andrews: "Probably no group of plants, fossil or living, has ever created as much combined interest for the botanist, geologist and layman as the rather heterogeneous assemblage of vegetative and reproductive "species" included within the Palæozoic Pteridospermæ (*Ann. Missouri Bot. Gard.*, 27, 51-118, 1940). Andrews quickly dispels the hopeful evolutionist view that Seed Ferns linked the Ferns with Seed Plants by saying: "The view that the Pteridosperms represent an intermediate group between the ferns and the cycads is no longer tenable. Rather we must look to an (hypothetical, Ed.) common psilophytalean-like ancestor with terminally borne sporangia, a solid protostele and primitive secondary wood for the origin of ferns and pteridosperms (the secondary wood being usually lacking in the former. . . ."

The origin of the Seed Ferns is lost in obscurity. Nevertheless Andrews states (*l.c.*, p. 53): "The evidence supplied by fructifications is overwhelmingly in support of the common origin of the ferns and pteridosperms from plants with terminally borne sporangia. . . ." Scott, however, says: "There is not the most distant likeness between the seed of any known Pteridosperm and the sporangium of a Fern."

Incidentally, while considering the Seed Ferns, it may be pointed out that evolutionary botany has long sought to link flowering plants with ferns through possession of scalariform-pitted tracheids. The Magnolia group is the "primitive" group of the Dicotyls; it has scalariform pitting of the xylem. But now it is recently shown that the Seed Ferns, the "transi-

tional linkage group," have "no indications of scalariform pitting in their (tracheid) side or end walls." How unkind to discover such an untoward fact after the evolutionary progression was so nicely established !

Coming to Seed Plants proper, only the most violent discontinuity is to be found throughout. These groups illustrate a general principle which obtains throughout biology, that the better known the organisms are the more distinctively unique they appear. There may be lengthy arguments about the microscopic Flagellates, of which the structure is not too well known and the habits are obscure ; but with large and evident organisms it is obvious that they are discontinuous. It is scarcely necessary to detail the various groups of Seed Plants, since their uniqueness is too well known to need much repetition. Yet phylogenetists continue their persevering attempts to prove community of descent (which must exist because evolution is true) with as much pertinacity as Philip the Second pursued his letter writing in the Escorial through long dreary years.

The Gymnosperms are an odd group (from a phylogenetic standpoint) : Phylogeny struggles to make the Cycads "primitive," although evolutionary geology teaches us that Conifers are more ancient. And within the Cycadophyta there are two leading groups, the ancient Cycadeoids and the modern Cycads, both of which are tantalizingly obscure as to their origin and relationships. The strange Ginkgo dates from the Permian and has been stubbornly opposed to evolution all its days, besides appearing in history without either ancestors or relatives. *Sequoia* and other genera of conifers also appear "suddenly" in the geological record and have failed to show evolution, remaining with little change through their history as recorded by evolutionary geology.

Distinct and unrelated as the Gymnosperms are, they are as nothing to the Angiosperms which appear with the most extreme abruptness in the Cretaceous without known antecedents. This fact does not dismay the disciples of Transformism because there are two obvious explanations of the curious isolation of the Angiosperms, viz. (1) There was a long, long time when fossils were not preserved, and all the ancestors of the Angiosperms (which developed in this remote age) were thus accidentally lost ; or, (2) the Angiosperms jumped suddenly into existence by a strange mutation. . . . But the serious student of plants is under no obligation to accept either explanation.

Not only do the various genera of Angiosperms appear in the geological record most abruptly, but they continue through the record with little change to the present.\*

#### CONCLUSION.

Fossil plants, like living plants, show only hiatuses and discontinuity: there is no organic progression. True, one may *arrange* fossils in any desired order and produce a fancied progression; but no careful botanist, with a regard for the truth, would assert a "continuous variability" amongst fossil plants when the direct evidence for the assertion must necessarily lie totally outside any possible human knowledge. The quest for organic continuity must be made amongst *living* plants (in spite of the late Mr. Huxley); and to date such continuity has not been found. Discontinuity rules amongst plants, and plants still breed true, the grass and herb "yielding seed, and the fruit tree yielding fruit after his kind."

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\* In a study of the London Clay fossils, Reid and Chandler conclude that the Angiosperms of the London Clays belong to living families but not to living genera; although they admit that the question is one of individual judgment\* (Reid, E. M., and M. E. J. Chandler, "The London Clay Flora." 1933).

#### DISCUSSION.

The CHAIRMAN (Mr. W. E. LESLIE) said: There is Scriptural admonition to be ready to give a reason for the hope that is in us, but when Dr. Kelley brings such charges as Jesuitical duplicity against those from whom he differs, he forgets that we should give it with meekness.

In the early part of the paper the "artificial" and "natural" systems of classification are discussed. It seems that the "natural" system commends itself to evolutionists, but Dr. Kelley quotes with approval a suggestion that it "approaches the Plan of Creation." Is there, then, any congruity between the evolutionary scheme and the Divine Plan?

Our author insists that there is a sharp line between plants and animals. How, then, is it that we find botanists and zoologists disputing as to whether various organisms belong to their respective

departments? Whether bacteria belong to a "world" of their own or not, they appear to be intermediate between the two Kingdoms.

It is evident that living things are found in groups in space—in water and on land, in hot climates and in cold, etc. Are they also grouped in time? Dr. Kelley tilts at "Lyellian chronology," but he does not venture to suggest that all sedimentary deposits were laid down simultaneously. Making every allowance for defective dating, is it not a fact that forms can be grouped in order of time? Our author says (p. 13) that the Angiosperms "appear with the most extreme abruptness in the Cretaceous without known antecedents." He does not accept explanations put forward by evolutionists, but how does *he* explain it? Further, making every allowance for the numerous discontinuities to which the paper calls attention, we must ask whether there is any tendency, however limited, for simpler forms to appear before complex ones? If there is, then a constructive attempt to explain the fact would be more useful than an exclusive insistence upon the exceptions.

Mr. DOUGLAS DEWAR said: Prof. Kelley will doubtless be able to deal with the Chairman's criticisms, but, in his absence, I may say that the doubts as to the status of some microscopic organisms indicate that our technique at present is not developed sufficiently to reveal many of the characters of these. As regards Lyellian chronology, Prof. Kelley is a botanist and not a geologist, and wishes to indicate that he must not, by using it as the basis of his paper, be deemed to accept without question some of the extravagant claims made by geologists, such as fifty million years as the duration of the Tertiary Period. In the present backward state of knowledge it is unwise to put forward anything more than a tentative alternate theory. Vavilov wrote last year: "The ocean of knowledge is practically untouched by biologists." Even so, the succession of the fossils in the rocks known to us is better explained by migration than by transformation. We are told that the sun is losing by radiation 360,000,000,000 tons a day. This means that its gravitational pull on the earth is weakening and the earth is slowly spiralling away from the sun, with the result that the climate of the earth is growing cooler. Long ago the tropics must have been far too hot for the vast

majority of organisms now living. All that were then suited to the present climatic conditions must have been confined to the open oceans or to the highlands, except near the poles. As the temperature fell the original denizens of the coastal seas and lowlands must gradually have become extinct and replaced by immigrants from the open seas and highlands, and this process must have been frequently repeated, so that each locality has been populated by successive immigrant populations, much as England has been receiving immigrants from Europe—Romans, Saxons, Danes, Normans. Now, if the oceans and continents have all along retained their present relations, the only primary and secondary fossiliferous rocks known to us are those laid down on low-lying land and in the sea near the shore, because we have no access to rocks deposited in the open ocean, and all land rocks laid down at high altitudes have been weathered out of existence. Thus it happens that all the fossils laid down in the primary and secondary periods discovered by us are those of organisms living in coastal seas or lands at the time of their death.

This theory accounts for (1) the successions of floras and faunas in the fossiliferous rocks ; (2) the sudden appearance in the rocks of entirely new floras and faunas not derived from those which immediately preceded them in that locality, particularly the sudden appearance of a great land flora in the Devonian and the flowering plants in the Cretaceous ; (3) the fact that, apart from Man, no new class of plants or animals has appeared in the rocks since the Eocene period ; (4) the sudden appearance at the beginning of the Cambrian of the earliest known animals and plants in great numbers and in many parts of the world ; (5) almost all the fossils known from the Primary epoch being those of marine animals. The last four of these facts are not satisfactorily accounted for by any theory of evolution.

Dr. Kelley had so much ground to cover that it was not possible for him to dilate upon "the extreme abruptness" with which the flowering plants appear in the Cretaceous "without antecedents." Prof. Kelley is not exaggerating when he uses these phrases. Let me quote from a paper by the Swedish botanist, Heribert Nilsson, contributed to "Hereditas" in 1938 : "When then did our recent vegetation arise ? and what are the ancestors of the Angiosperms ?

The first question we can answer almost exactly. The Angiosperms appear in the upper layers of the lower chalk. We can also answer the other question, although no one will willingly give a direct and open reply, *we know of no ancestors of the Angiosperms*. In the older chalk an astounding change in the whole vegetation occurs. The Mesozoic flora still occurs in the lowest strata. In the uppermost appears a wholly different, extraordinarily well-developed plant world, a dominant angiospermous one. Such of our genera as *Quercus*, *Platanus*, *Autocarpus* and *Cinnamomum* have been identified here. In the middle and upper chalk, revealed by more numerous and richer finds, there come to light genera from nearly the whole of the existing system: Dicotyledons and Monocotyledons, Choripetales and Sympetales. We find representatives of our families and genera, in certain cases also undoubtedly our species, although the identification of these last is naturally more difficult. This flora presents no primitive forerunners of our Angiosperms. One certainly finds in it species and genera different from those now living, but hardly any different families. The flora of the chalk is *richer*, but *not more primitive* than that now living. It is spread over the whole world. For example, its remains have been found in N. America, Greenland, Siberia, Sakhalin, Bohemia, Portugal, Madagascar, Patagonia. This flora is still living. Our flora, however, exhibits less manifoldness, less variety than the early Tertiary one. Far from a wider development, a *selective reduction* of this has occurred."

Nilsson's assertion that the flowering plant flora of the chalk was richer—more manifold—than it is to-day surprised me, therefore I determined to try to verify it. I have been able to study the fossil records only of Greenland and Sakhalin, and some of those of N. America and Europe, nevertheless I have come upon records of two of the three sub-classes into which Vines divides the Monocotyledons and of all three of the sub-classes of the Dicotyledons, and of all the six series of these classes. These fossils include members of three of the 11 orders into which Engler divides the Monocotyledons and of 21 of the 40 orders of Dicotyledons. In addition to these, there have been found a number of fossils of extinct genera; on this account and in view of the fact that I have not examined any of the fossil records of Africa, Asia or South America, I think I can safely subscribe to Nilsson's dictum that the Angiosperm flora of the Cretaceous

was richer than it is to-day. This, of course, is not in accord with the doctrine of evolution. That fossils have been found in the records examined by me of all three sub-classes of the Dicotyledons and of only two of the three classes of Monocotyledons, and the fossils of the latter in the Cretaceous are not nearly so numerous does not seem to mean that the Monocotyledons were later in making their appearance, because, in fact, the fossils indicate that the two groups made their first appearance *contemporaneously*. The first known Monocotyledons come from the Lower Cretaceous, viz., the Gault of Portugal (Valanginien) and North America (Upper Potamac Beds). The fact that the Monocotyledons make their first appearance simultaneously in areas very far apart is not unusual. I think I may say that in the majority of the great animal and plant groups this is the case. The Monocotyledons seem to be less often fossilized than are the Dicotyledons. In an enquiry I am making (as yet far from complete) into the extent to which living genera of flowering plants have been fossilized, I have so far found records of fossils of 152 of the 411 living genera of British Dicotyledons or 37·2 per cent., and of 12 of the Monocotyledons, or 10·1 per cent. The difference is in part accounted for by the fact that the grasses, which are not readily fossilized, constitute a considerable percentage of the Monocotyledons.

#### AUTHOR'S REPLY.

(1) In regard to my use of the term "Jesuitical duplicity," I am amazed that any exception is taken to so candid a statement of fact. One would wonder whether my critic is familiar with the history of Science. I recall, for example, the case of Professor Ernst Haeckel and the judicial findings of the University of Jena. In my own experience, the policy mentioned was (and probably still is) taught in American universities. At one of our principal graduate schools, which I attended, our professor (a leader in biological science) told us that we should abide by the dicta of Science; but, said he, if any of our postulates be proved untrue, then you must say: "Ah, yes, we knew all along that it was so!" If that is not "Jesuitical duplicity," I know not the meaning of the term.



Moreover, it is not an evidence of an unchristian harshness to be properly descriptive. Our Lord spoke of the Scribes and Pharisees as "hypocrites" (Matt. xxiii, 13 *et seq.*), and termed Herod "that fox" (Luke xiii, 32). History has called a world-conqueror of old, Alexander the Great; but God called Alexander "a rough goat" (Dan. viii, 21). Is God harsh? Is Christ lacking in meekness? Recall that the Lord Christ was like unto Moses (Deut. xviii, 15), and Moses was "very meek, above all the men which were upon the face of the earth" (Num. xii, 3). On the contrary, to fail to speak in true terms makes us as guilty of telling a lie as though we had deliberately spoken a falsehood.

(2) My mention of the "Plan of Creation" was the only reference I could make to the views prevailing in the first half of the 19th century. It was to be assumed that the suggestion would recall to the reader all those arguments dear to Professor Agassiz, and set forth in his books. It scarcely requires pointing out that my paper is marked by extreme compression, and to elucidate the subject in an adequate manner would require several volumes. It should also be emphasized that the concept of "progression" is no evolutionist property but was made clear long before the advent of Charles Darwin. No one can doubt that plants and animals show gradation of development, as we examine their respective kingdoms; and this "stair-like progression," as Sir Thomas Browne (1605-1682) described it, must be explained if we are to concern ourselves with Biology. I know of only two explanations that have ever been advanced (at least by those who admit causation): (a) that the progression is the result of Evolution; or (b) that the progression evidences the plan used by the Divine Creative Mind.

(3) My critic raises the question of linkage of the plant and animal kingdoms, and status of micro-organisms. The distinction between plant and animal activities is admitted as real, I think, quite universally. The point I try to make is that there are always discrete sorts of organisms that function as either plant or animal. No question is raised in regard to this point except in the case of micro-organisms, which are either little studied (in the case of some groups), or are extremely difficult of study in the case of others. Mr. Dewar has already covered this point.

(4) I do not see why any question should be raised as to the necessity for revision of Lyellian Geology. When we recall that Sir Charles Lyell did his work a century ago with limited materials and obsolete methods, it is not surprising that geologists have found difficulty in applying his chronology to rock strata other than those he studied. In point of fact, I understand that in instances it cannot be done. It is almost an axiom in science that scientific "truth" needs constant reworking and restating, and Geology is no exception. But it requires equally emphatic statement that no tyro or pottering amateur can accomplish what only a man of genius, well trained in geological science, could accomplish in a life-time. As a botanist, I decline to be drawn into this work of revision; but I do not see why I should not point out the need of revision, and refuse to accept "Historical Geology" until it is brought into line with modern Science.

(5) Mr. Dewar has replied neatly to the question regarding Angiosperms. The extreme isolation of the Angiosperms is so well known and is so frankly admitted by evolutionists that an answer was hardly required.

(6) Mr. Leslie's last question evidences what I suspect will be a general reaction to my paper; namely, that it involves too technical a subject for most readers to follow. I should explain that the evolutionist hypothesis teaches that all plants and all animals came from preceding organisms by a natural process of transformation of one sort (usually termed a "species") into another sort of organism. Transformation of plants and animals is so basically inherent in the concept of evolution that evolutionism is often called "transformism." Do we comprehend all that is involved in this statement? It means that every man, woman and child in the world is descended from a transformed animal. It means that every kind of animal in the world has been transformed from some other kind of animal, which originally was transformed from a plant or from some ancestor of plants. And naturally, by the same concept, all plants are transformed other-sort plants. Moreover, as transformation can never stop acting (according to evolutionism), we should see transformation occurring under our eyes everywhere, all the time. Rabbits should be littering new

kinds of rabbits (or who knows what ?), Hydras should be budding new kinds of Hydras, Magnolias should be growing into buttercups. And amongst fossils, we should find "connecting links" everywhere in abundance; because, remember, evolution is a universal, world-wide phenomenon, always going on and responsible for the being of every man, animal and plant in existence. It is totally impossible of every man, animal and plant in existence. It is totally impossible that there could ever be so much as even one DIScontinuity in the whole world, if evolution be true.

Hence the importance of my subject. It is not a question of whether simpler forms appeared first, or more complex ones; or whether or not we may emphasize discontinuities. The great, overwhelming, stupendously important fact is that *there are NO TRANSFORMATIONS, there are NO CONTINUITIES* to be found anywhere in the biological kingdoms. I examine the plant record and show from plain, everyday botanical class-room knowledge that there are no continuities to be found amongst living plants, nor among fossil plants, nor even among the entities dear to the Geneticist. Discontinuities are ENTIRELY the rule amongst plants.

Where then does Evolution come in? Evolution cannot exist for a moment without demonstrable transformations. But botanical phenomena provide us with no transformations—not even one. What shall we do? Shall we destroy all living plants and smash every plant fossil that can be found, in order to live comfortably with Evolution? Or shall we submit to fact and give up the antiquated philosophy of Evolution which some 19th century atheists dug out of barefoot Greek antiquity?

## 842ND ORDINARY GENERAL MEETING.

HELD IN COMMITTEE ROOM 19, LIVINGSTONE HOUSE,  
BROADWAY, S.W.1, ON MONDAY, APRIL 28TH, 1941,  
AT 4.30 P.M.

MAJOR H. B. CLARKE (LATE R.E.) IN THE CHAIR.

The Minutes of the previous meeting were read, confirmed and signed.

The CHAIRMAN then called on the Rev. F. N. Davey, M.A., to read his Paper entitled "The Probable Dates of the Gospels," with particular reference to their Importance as Historical Documents."

The Meeting was then thrown open to discussion in which Mr. P. O. Ruoff, Mr. W. E. Leslie, Mr. Philip Dive and the Rev. A. W. Payne took part.

Written communications were received from the Rev. Principal H. S. Curr and Mr. Everard Jose.

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### *THE PROBABLE DATES OF THE GOSPELS, WITH PARTICULAR REFERENCE TO THEIR IMPORTANCE AS HISTORICAL DOCUMENTS.*

By the Rev. F. N. DAVEY, M.A.

**T**HE potential evidence for dating the Gospels may be divided into three classes.

1. **EXTERNAL EVIDENCE** : that is to say, any statements, references or citations, in other extant literature, which may have any bearing at all upon the dating of the Gospels. Of this class of evidence it may be said at once that much of it is uncertain and conflicting, and that none of it can confidently be dated earlier than at the beginning of the second century A.D.

2. **INTERNAL EVIDENCE REFLECTING A HISTORICAL SITUATION ABOUT WHICH THERE EXISTS EXTERNAL EVIDENCE.** For instance : the third evangelist parallels the vague predictions of the "*abomination of desolation standing where he ought not*" and of

the coming affliction, of which we read in Mark xiii, 14-20 and Matt. xxiv, 15-22, with the explicit prophecy "*But when ye see Jerusalem compassed with armies, then know that her desolation is at hand . . . and Jerusalem shall be trodden down of the Gentiles, until the times of the Gentiles be fulfilled*" (Luke xxi, 20-24). This precise situation came about in the year 70 A.D., and the irresistible conclusion is that Luke's rewording of an obscure prophecy must be dated, if not definitely *after* that event, at least sufficiently shortly before it for the situation to have seemed inevitable.

3. INTERNAL EVIDENCE BEARING UPON THE HISTORY OF THE FORMULATION OF THE EXTANT GOSPEL MATERIAL. For example: Mark iii, 22, like Matt. ix, 34, xii, 24 and Luke xi, 15, records the accusation brought against Jesus in terms that reflect the Semitic conception by which a miracle is wrought through the power of a name—*By the prince of the devils casteth he out devils*; but Mark adds, *He hath Beelzeboul*, which aptly expresses the Hellenistic conception of a magician possessed by a devil, and therefore suggests that the Markan version of the story has been reformulated for non-Jewish readers, either by Mark himself, or at some previous stage of its history. It is this third class of evidence which will be further exemplified in some detail, on the grounds that the second, and even the first, classes cannot be adequately handled until the complicated and intricate character of the material as a whole has been recognized.

There are two passages of the Fourth Gospel in the course of each of which Jesus uses the same words with some circumstance. In John xiii, 12-20, Jesus is explaining the meaning of His washing the disciples' feet, which has just taken place. No doubt it is a significant action, showing that His coming death, far from being an irrelevant misfortune, is the necessary and culminating act of service through which He makes men clean; that is to say, sanctifies them; and without which they have no part with Him. But this characteristic act inevitably defines the nature of the Church: there can be no obedience to Jesus without similar service. "*If I then, the Lord and the Master, have washed your feet, ye ought also to wash one another's feet. For I have given you an example, that ye should do as I have done to you.*" Then, "*Verily, verily, I say unto you, A slave is not greater than his lord; neither one that is sent (Gr. an apostle) greater than he that sent him.*" Now turn to John xv, 18-25.

Here Jesus, in the second part of His final discourse to His disciples in the Upper Room, is speaking of the persecution which is the expected lot of the Church, which must necessarily issue from the complete antagonism between Himself and the world, and which is the clear sign that the persecuting world is under the judgement and condemnation of God. In the course of this passage Jesus says : “ *Remember the word that I said unto you, a slave is not greater than his lord* ” ; and from this “ word ” draws the conclusion : “ *If they have persecuted me they will also persecute you ; if they have kept my word, they will keep yours also.* ”

At the centre of each of these passages stands the saying “ *A slave is not greater than his lord,* ” but in chapter xiii this is so introduced as to force upon the apostles the necessity of service as completely self-sacrificing as that of His own death, while in chapter xv it reminds the apostles that the persecution which was His lot will be theirs also. In fact, the two applications of the saying are entirely different. But, further. In either case the saying meets a situation that is known to have arisen in the history of the early Church. 1 Peter, Hebrews, and other parts of the New Testament, show the Church in the throes of persecution : 2 Cor. i-iv, and Gal. ii are not the only evidences that there was a danger lest the apostles should be exalted into great figures whose personal magnitude obscured their office. The saying is therefore used in the Fourth Gospel to meet two quite different situations, both of which, it would seem, had already arisen in the Church. Does this mean that the Fourth Evangelist perverted an ancient saying of Jesus from its original context in order to serve purposes that seemed to him pressing ? That would be a very bold conclusion, for the Synoptic Gospels amply affirm that not only His suffering at the hands of persecutors and the service of the many through His death, but also the declaration that His disciples must be involved in the same suffering and service, were conscious themes of Jesus Himself (e.g., Mark x, 39, 43, 44). In fact, whatever the origin of the saying “ *A slave is not greater than his lord,* ” the Synoptic definition of the fundamental relation between Jesus and His disciples demanded that it should be so interpreted as to comfort the later Church in persecution and to guard the later Church against adulating its apostolic heroes to the detriment of their ministry. If, then, the applications of the saying in these two

passages have been formulated as a result of crises in the Church, they have none the less been fundamentally created by the tradition of the words and works and life and death of Jesus.

The saying in question appears, however, in the Synoptic Gospels as well as in the Fourth Gospel. In Luke it is introduced into the Sermon on the Plain, among a number of heterogeneous sayings of which the general purport seems to be the danger of judging, but which have little logical sequence. "*And he spake also a parable unto them, Can the blind guide the blind? shall they not both fall into a pit? The disciple is not above his master: but every one when he is perfected shall be as his master. And why beholdest thou the mote that is in thy brother's eye, but considerest not the beam that is in thine own eye?*" (Luke vi, 39-42). In this context and form the saying itself has to do neither with persecution nor with serving, but with the assurance that the disciples will be made like their master. Whether, so formulated, this originally referred to martyrdom conforming them to the death of Jesus (? cf. His "perfecting," Luke xiii, 32, 33), or whether it spoke rather of the hope of future glory in the coming Kingdom (cf. Luke xxii, 29), is not clear. These, too, are well-established themes in the Synoptic Gospels. What is clear is that Luke has set the saying here without regard for either of these interpretations, and only because the first part of it more or less suited his immediate purpose of instilling humility in his readers:—I say "Luke," because the arrangement of these same ill-assorted bed-fellows in Matthew makes it extremely unlikely that they were so arranged in any source Luke may have had, particularly as a pastoral interest in the Christian virtues is a characteristic of his. Nevertheless, the precise bearing of Luke's use of the saying is a little obscure. He may have meant, with reference to verse 39, either that Jesus is the only authority—no one else may judge; or even, with no reference to Jesus at all, that no pupil can possibly see, whose teacher himself is blind; or he may have wished to remind Christians, with particular reference to verse 36 (*Be ye merciful, even as your Father is merciful*), that even Jesus did not judge others.

In Matthew the saying appears in the discourse which follows the calling of the twelve (Matt. x, 24, 25), and is applied as in John xiii, to persecution, although more particularly, perhaps, to its moral than to its physical form. It might be

thought that with Matthew firm ground has been reached at last, and that here the saying is in its original context and meaning. So it may be, but here too there are difficulties. Matthew says: "*A disciple is not above his master, nor a slave above his lord. It is enough for the disciple to be as his master, and the slave as his lord.*" It is this addition that is perplexing. For although it is indirectly paralleled in the Lukan version, as we have seen, and therefore very probably appears here more or less as it was received by the First Evangelist, this addition is a proverbial expression found several times in ancient Rabbinical writings. What then of our saying? Is the contrast between a slave and his lord simply a version of a common proverb? And, if so, ought we to regard it as an authentic utterance of Jesus? There is, as it happens, considerable evidence that Jesus used proverbial expressions more than once in His teaching (e.g., Luke iv, 23), and there is little reason to doubt that He used this one (always supposing that the relation between a slave and his lord was for *Him* a natural analogy to the relation between His disciples and Himself—but this question, weighty as it is, is altogether beside the present purpose). The point is that a proverbial expression, which may have been used by Jesus but was probably not coined by Him, is carrying the weight, in our Gospels, of four distinct applications of four Gospel themes to various situations in Christian experience. When men began to set themselves up as judges of their fellows, or began to forget the essential character of their ministry, or began to wax impatient of persecution, or began to lose their grip upon the hope that their end, in this world as well as the next, is to be made like their Master; then the traditional theme of the implications of the actual circumstances and character of the life and death of Jesus for those who called Him Lord again and again enlisted this analogy into its service, and so confronted men, in very different historical circumstances, with the unalterable, but always living and vital Word of Jesus; with the old commandment that is ever new. It was the tradition itself *behind them* that created the traditional applications of our saying.

So far we have seen how a fundamental evangelical conception has controlled the solution of different problems arising in the history of the Church, and has left traces of its creative activity in the various applications of one proverbial saying. I now propose to show how, stimulated by similar pressing problems,



sayings and parables of whose authenticity there is little ground for reasonable doubt, seem to have re-fashioned and re-orientated other equally well-authenticated parables and sayings. In Mark xiii, 34 we read: "*It is as when a man, sojourning in another country, having left his house, and given authority to his servants, gave to each one his work, and commanded also the porter to watch.*" This parable is introduced to enforce the solemn charge, found more than once in each of the Synoptic Gospels, to watch against the unexpected coming of the Lord, or of "the hour." Mark—who is later going to tell how the three most intimate disciples could not watch one hour in Gethsemane, but fell asleep—applies the parable thus: "*Watch therefore: for ye know not when the lord of the house cometh, whether at even, or at midnight, or at cockcrowing, or in the morning; lest coming suddenly he find you sleeping.*" But it is not the first disciples only that must watch: the charge is acutely pertinent to a church which soon, as we know (*e.g.*, 1 Cor. vii, 29–31) needed to be reminded that the things of this world should be of but temporary moment for Christians. Accordingly, Mark adds (xiii, 36): "*And what I say unto you I say unto all, Watch.*" But does the parable really make this point? Fairly well, perhaps, so long as we concentrate upon the absent householder and the doorkeeper, and ignore the apparently gratuitous information about the authority given to each of the servants, and the transitional observation that each was given his work, which prepares us somewhat awkwardly for the doorkeeper's particular task. But look at Matt. xxv, 14. Here the Parable of the Talents begins in words which are even more strikingly similar to the Markan parable in the Greek than they are in the English: "*For it is as when a man going into another country, called his own servants, and delivered unto them his goods. And unto one he gave five talents, to another two, to another one; to each according to his several ability.*" Yet here the similarity ends, and the parable is developed at great length, not so that it turns upon the particular office of doorkeeper, but in such a way that it explains Mark's gratuitous information that each servant had authority and a task. In fact, the completed parable, like its more complicated Lukan parallel, the Parable of the Pounds, leads up to and illustrates a saying of Jesus which is found elsewhere in Matthew, in Luke, and in Mark (Mark iv, 25 = Matt. xiii, 12 = Luke viii, 18). It has nothing to do with "watching": it does not direct men's minds

away from the engrossing cares of this world, but warns them rather against failure to use present gifts in a Christian way : “ *For unto every one that hath shall be given, and he shall have abundance ; but from him that hath not, even that which he hath shall be taken away* ” (Matt. xxv, 29).

Another parable common to Matthew and Luke, the Parable of the Marriage Feast, illustrates a similar phenomenon. The Lukan form is the shorter, but has a distinctive interest, entirely in keeping with one of the evangelist's favourite purposes. Instead of saying, as Matthew does, that the servants are simply to go out and invite any they find so that the places of the neglectful guests may be filled, Luke represents them as sent to fetch “ *the poor, and maimed, and blind and lame.* ” So his parable reinforces the teaching which he has already attributed to Jesus : “ *But when thou makest a feast, bid the poor, the maimed, the lame, the blind* ” (Luke xiv, 13). Yet Luke's particular humane interest—or a lack of humanity on the part of Christians of his day—cannot have created this application of the parable, even if it occasioned it. As it stands in Luke, the parable does not go one whit outside the implications of the saying preserved in Matt. xxi, 31 : “ *The publicans and the harlots go into the kingdom of God before you* ” (the chief priests and the elders of the people). But it illustrates these implications in the context of later Christian experience (*cf.* 1 Cor. xi, 17–34). In Matthew, however, the parable does not apply, as in Luke, simply to the contrast between rich and poor, but first to the rejection of the apostate Jews in favour of the Christians (*cf.* for example, Rom. ix–xi), and then to the problem of sin and apostasy in the Church itself (*cf.* 1 Cor., 1 John, and the movement of John vi, 60–71 and xiii, 21–38). It speaks of the Fall of Jerusalem quite explicitly—“ *But the king was wroth ; and he sent his armies, and destroyed those murderers, and burned their city* ” (Matt. xxii, 7)—and resembles two other parables given only by Matthew, the Tares and the Drag-net, in its evident concern about the presence of evil as well as good in the Church. Yet, as Matthew presents it, the whole leads up to, and culminates in, a saying which some manuscript authorities read also in Matt. xx, 16, and which is not altogether unlike Matt. vii, 13, 14, *cf.* Luke xii, 23, 24 : “ *Many are called but few chosen.* ” As little in its Matthaean as in its Lukan presentation is the parable untrue to the essential implications of sayings fundamental in the Synoptic tradition.

The varying applications in the Gospels of the two or three parables which have been considered suggest certain further conclusions about the formulation of the Gospel material. While, once again, we have found signs that the needs of the Church were being consciously met, the dominant factor in the re-interpretation of these parables already handed down most probably from Jesus Himself, seems to have been the tradition of sayings also most probably His. The material has been fashioned and re-fashioned more than once, but not arbitrarily, or simply under external pressure, but under the pressure of its own implications and in its own interest. If the history through which the primitive Church passed gave men a deeper insight into the meaning of the words and works of Jesus, it was none the less the already existing tradition of these words and works that illuminated their experience and *showed them the true meaning of current events* (such is in all probability the meaning of John xvi, 13; cf. John xiv, 26, xv, 27, remembering that the true understanding of Jesus is always presented in the New Testament as the work of the Father or of the Holy Spirit (cf. Mark ix, 7; Matt. xvi, 17; Mark iii, 9; 2 Cor. v, 16; Gal. iii, 1-5; 1 John iv, 2, etc.), and that the Fourth Evangelist constantly used the future to express circumstances characteristic of Christian experience after the Resurrection had been made known). What Jesus said and did was no static truth, such as might remain tranquilly set forth in the implications in which it had first been apprehended by the apostolic witnesses of the Resurrection. It was—so the New Testament theologians vigorously affirm—the absolute revelation in history of the truth of the living God. Consequently this history had to be re-formulated and re-fashioned immediately Christian perception of its meaning was deepened under the pressure—I will not say of Christian experience, but—of that history ever more deeply experienced by Christians who believed that it contained once and for all the meaning of their own history and of all history. So there lies behind our four Gospels an immensely busy, creative and yet disciplined process—their formulation by Christian apostles, prophets, teachers, and evangelists who, like scribes made disciples unto the Kingdom of Heaven, brought forth out of their treasures things old and new (Matt. xiii, 52).

By now you will, I hope, have perceived why it seems to me that my third class of evidence for the dating of the Gospels—

Internal Evidence bearing upon the history of the formulation of the extant Gospel material—must first be considered if the problem of dating the Gospels is to be seen in its true perspective. The limits imposed upon me by the conditions of this paper have made it impossible for me to take more than a few random examples, and to consider even these far more briefly than they deserve: none the less, these examples suggest two considerations very forcibly. On the one hand they have shown that a long process lies behind our extant Gospels. In this process the commonly assumed use of documents by the Four Evangelists, and in particular the supposed use of Mark and another common source by the authors of Matthew and Luke, which I have deliberately ignored for the purposes of this paper, is only the latest, though perhaps the most instructive, stage. However quickly this process may have been accomplished, the very nature of the Gospel material itself protests vehemently against the second century traditions that Matthew and John are based simply upon the undeveloped reminiscences of eye-witnesses, and Mark and Luke upon the exclusive record of the preaching of two great Apostles. On the other hand, our study of the Gospel material protests equally vehemently against the assumption that this was a process of deterioration, and that because a considerable period must have elapsed between the Crucifixion and the writing of the earliest of our Gospels, the witness of the Gospels has thereby been invalidated. Only the nineteenth-century dogma that the literal form of words, and the observable actuality of events *is*, or could possibly be, identical with historical truth, can support this assumption. But, if it were so, why did the Jews, who must have known far more about the literal form and observable actuality of what Jesus said and did than the majority of early Christians, put Jesus to death instead of worshipping Him? Precisely because they shared this dogma, and so were blind to the glory which the apostles beheld in the flesh of Jesus. This, of course, is an explicit thesis of the Fourth Evangelist (*cf.* John viii, 43), who is, moreover, well aware that even the apostolic understanding of what Jesus said and did, and of His death, did not come about simply because their eyes saw, and their ears heard, certain occurrences and words (*cf.* John 11, 22; xvi, 31; xx, 9, etc.), although—and this I would emphasize most strongly—he is equally insistent that the flesh of Jesus, His words and works

and death, are the point and the moment where the truth of God is concretely set forth in history (e.g., John 1, 51 ; iii, 14, 15 ; xiv, 9, etc.). The Fourth Evangelist writes consciously under the pressure of that paradox to which the eruptive character of the Synoptic material bears witness: *The Word became flesh, and dwelt among us, and we beheld his glory, glory as of the only-begotten from the Father* (i, 14) . . . *the flesh profiteth nothing ; the words that I have spoken unto you are spirit, and are life* (vi, 63).

Far from depending upon the personal authority of four—or seven—or twelve—individuals, the Gospel material commends itself to us as a complex process of apprehending more and more deeply the meaning of the words and works of Jesus, a process forged out in the living, corporate experience of men and women by the living power of those words and works themselves, when accepted as the revelation of God. In this process we ever and again find traces of the particular situation of some one or other of these men caught up and perpetuated. Some of these traces, moreover, appear to correspond with other non-Biblical evidence that can be dated with precision. These form our scanty second class of evidence—Internal Evidence reflecting a historical situation about which there exists external evidence. In the case of Mark, most of these traces are to be found in the thirteenth chapter, the famous Markan Apocalypse. The late Dr. B. W. Bacon thought that this their evidence suggested that Mark was written in Rome, about the year 75 A.D. Streeter, however, found the same evidence suggesting a date just before rather than just after the Fall of Jerusalem, though he also placed the Gospel's origin in Rome. More recently Bishop Hart of Wangaratta, reversing the general view that Mark xiii, 5–8 depends partly upon 2 Thess. ii, 3–12, and arguing that Paul's eschatology depends instead upon Mark, has tried to find in the Markan references to persecution, and in particular to the martyrdom of the Sons of Zebedee (Mark x, 35–40), a reference to the persecution of the Church by Herod in A.D. 43. Bishop Hart owned that his work was set in motion partly by the conclusion to which he was driven by his study of the Synoptic Problem, that the interval between Mark and Matthew must be much greater than that which is supposed by Streeter's or Bacon's dating. Another fairly recent thesis, precisely contrary to this, since it roundly asserts the priority of Matthew, has been set

forth by the late Dom Chapman, regardless of the subtle and much more scholarly attempt of Lagrange to comply with the dogmatic declaration of the Vatican Biblical Commission. More dogmatic still, perhaps, is the tendency of a recent school of German Biblical scholarship to accept the First Gospel as the work of an eye-witness, St. Matthew, simply because it is an authoritative apostolic work and it is therefore quite inconceivable that it should have depended for its material upon other sources than those supplied by the Apostle's memory.

If the character of the Gospel material is indeed such as the passages we have studied suggest, you will understand why there may be traces of persecution in the 'forties side by side with traces of the catastrophe of the Fall of Jerusalem. And if you remember that, in spite of these traces, the pre-occupation of the evangelists, or of their predecessors, was with the history of Jesus, you will be content to find theories of dating "non-proven"—above all when dogmatic interests are weighing down the balances and loading the evidence. We must, of course, take full account of all the traces which suggest dates. They do, perhaps, to the satisfaction of most of us, point towards the final composition of Matthew and Luke just after the Fall of Jerusalem and the composition of Mark just before; and this working hypothesis fits in very well both with much of the second-century External Evidence, and with the far more compelling evidence of the complex nature of the material. But whether we shall ever be able to say, on the basis of these pointers, that the Gospels *certainly* belong to this or to that or to a third date, is not only a matter for scepticism: it is an almost entirely secondary and irrelevant cul-de-sac in the study of Gospel origins.

#### DISCUSSION.

The CHAIRMAN, Major H. B. CLARKE, R.E. (ret'd.), in proposing a vote of thanks to the Author for his interesting paper, said: It is always good for us to be made to think, even when we do not agree with the conclusions. I regret very much that he passed over the first division of the evidence for the dates so lightly, as after all, tradition is a fact and, unless it can be upset, should carry weight. May I suggest, too, another fact arising out of the second paragraph on

page 157, and that is that it is perfectly certain that the Gospel of St. Luke was written before the Acts. The latter brings down the history to about A.D. 61, and therefore as the Gospel precedes the Acts, it presumably was written at an even earlier date.

As regards the third division of the evidence, in class 3, page 148, line 5, may I suggest that the Semitic conception is perfectly correct, that it is the name through the power of the name that works the miracles, *vide* Acts iii, 16. I cannot follow, either, how as Beelzeboul was the God of Ekron, then a very small place, the Markan version of the story would be likely to commend itself to the outsiders for whom it was written.

On page 150, in the first paragraph, may I suggest the solution of the apparent incongruity. The blind Pharisee could not rise above his teacher, nor we above ours, and the connection is that until you can see yourself clearly as God sees you, you cannot be a help to others.

As regards page 153, paragraph 1, line 1, I would suggest that the two parables alluded to are quite distinct, and that in Luke's version it is to be noted that the poor, the maimed, the halt, the blind and the lame belong to the city, which undoubtedly refers to Jerusalem. It was after those who were conscious of their own helpless state had been gathered in that the servants were sent outside the city into the highways and hedges to make the call to the Gentiles.

Page 154, lines 8 and 9. I should really like the lecturer to give some proof for the statement that the material has been fashioned and re-fashioned more than once.

Page 155, line 17. I regret that I cannot agree with this statement. Matthew was a business man accustomed to taking notes, and probably to writing up his diary every day. There was nothing, therefore, to prevent his Gospel being contemporaneous with the events he records, and in line 32 I would suggest that the Jews were looking for the Messianic kingdom and nothing less, and that our Lord's doom from the human point of view was sealed in that He bade them render unto Cæsar the things that were Cæsar's. May I correct a slip in the last lines of this page—only one of the sons of Zebedee suffered martyrdom. There is, I think, another on page 148, line 6, as regards the date, which should, I suggest, be A.D. 66, as it was then that the prediction began to be fulfilled

which allowed the disciples to escape from the city after the repulse of Cestius Gallus.

Mr. PERCY O. RUOFF: This able paper is mainly irrelevant to the subject, and gives meagre and questionable evidence of the probable dates of the Gospels. The last two paragraphs, indeed, cite opposed and contradictory theories. After considering the chief points raised in the paper, it is a relief to turn from the interpreters of Luke to Luke himself, and see what he says. This is Luke's own account: "Forasmuch as many have taken in hand to draw up a narrative concerning those matters which have been fulfilled among us, even as they delivered them unto us which from the beginning were eyewitnesses and ministers of the word, it seemed good to me also having traced the course of all things accurately from the first, to write unto thee, in order, most excellent Theophilus, that thou mightest know the certainty concerning the things which thou wast taught by word of mouth." [Luke 1, v, 1-4.]

The lecturer takes unwarranted liberties with the exact historian Luke, and speaks of "Luke's *rewording* of an obscure prophecy." If Mr. Davey only means that Luke's account of Christ's words reports some additional words to those recorded by Matthew and Mark, no objection can be raised. If, on the other hand, he meant that Luke altered the words for any purpose, it becomes a grave matter, and, moreover, is sheer guesswork.

Mr. Davey says: "It was (what Jesus said and did) so the New Testament theologians vigorously affirm—the absolute revelation in history of the truth of the living God. Consequently this history had to be re-formulated and re-fashioned immediately Christian perception of its meaning was deepened under the pressure—I will not say of Christian experience, but—of that history evermore deeply experienced by Christians who believed that it contained once and for all the meaning of their own history and of all history." If the "absolute revelation" was given, surely this would be a substantial reason why it should in no circumstances be "re-formulated." Christ had promised that the Holy Spirit would "bring all things to your remembrance, whatsoever I have said unto you." [John xiv, 26.]



Mr. E. H. BETTS, B.Sc., wrote :—To the general Christian reader the main features of this paper will appear to be—

- (a) Rejection of the supernatural in the form of divine prophecy.
- (b) Ascription to the evangelists of words and sayings ascribed by them to the Lord Jesus Christ.
- (c) Deprecation of literality of form and actuality of fact in the study of historical truth.

Consider one or two examples :—

(1) Mr. Davey cites Matt. xxiv, 15–22 and Mark xiii, 14–20, as “vague predictions” and Luke xxi, 20–24, as a parallel but “explicit prophecy.” (The parallelism is a demonstrable error, for the two prophecies are separable, in subject-matter, as to time, locality and purpose.) He admits that the last-mentioned was precisely fulfilled in A.D. 70, and thence reaches the “irresistible conclusion” that Luke’s *rewording* of the obscure prophecy of Matthew and Mark must be dated, “if not definitely *after that event*, at least sufficiently shortly before it for the situation to have seemed inevitable.” This “irresistible conclusion” carries the following implications :—

- (a) Prophecy is impossible.
- (b) “Luke” set forth, as a prophecy, an account of events that had already happened—or, alternatively, were already taking shape.
- (c) He represented Christ to have uttered the words on a definite occasion, in answer to a stated question and in the course of a conversation which he gives with some detail.
- (d) He *thus* gave the passage the form of an “explicit prophecy,” obtaining his materials from a parallel but vaguer prediction.

And by such a technique as this we are to believe that men are “confronted with the unalterable but always living and vital Word of Jesus”! (citation from Mr. Davey’s paper).

(2) Mr. Davey asserts that the terms of Mark iii, 22, Matt. ix, 34, xii, 24, and Luke xi, 15, “reflect the Semitic conception by which a miracle is wrought through the power of a name—

*By the prince of the devils casteth he out devils*”; and that the addition by Mark of the words *He hath Beelzebul* “aptly expresses the Hellenistic conception of a magician possessed by a devil,” and that this addition suggests that the Markan version has been reformulated for non-Jewish readers. But seeing that Matthew, Mark and Luke *all* cite his opponents as attributing his power to Beelzebul, the Hellenistic peculiarity of Mark’s statement can lie only in the “*He hath,*” *i.e.*, in the attribution to him of “having” or “possessing” a devil. But if so, too much is proved and the suggestion destroys itself, for Matthew also uses the formula (xi, 18, “*He hath a devil*”); so does Luke (iv, 33, vii, 33, viii, 27) and so does John (viii, 20, x, 20). *Did the writers all “reformulate” for non-Jewish readers?*

(3) If the “literal form of words and the observable actuality of events” is not identical with historical truth, why did the evangelists simulate these features? Why were these writers so false—so *constructively false*? Consider the details of occasion, subject, time, place, interlocution, etc., so carefully given in Matt. xxiv, 3, 4, Luke xxi, 5, 7, 8, Mark xiii, 5 alone. Either these are truthful details of actual circumstance simply recorded as such or, supposing the stories to be re-formulations, they are pure invention. “*And as some spake of the temple . . . he said . . . and they asked him . . . and he said* (Luke xxi, 5, 7, 8),” and then follows the “explicit prophecy” of which Mr. Davey says, it must be dated far subsequently! So too, we presume, must be the words “*And now I have told you before it come to pass that when it is come to pass ye might believe.*”

Mr. W. E. LESLIE said:—The characteristics of the Gospels have long fascinated students. Of later years we have witnessed the rise of “source criticism” (more particularly of the Synoptics) and now “form criticism,” of which the present paper is an example. Evangelical writers have done little along these lines, partly through lack of diligence and partly because of an *a priori* mechanical theory of the mode of inspiration.

But our paper considers specially the dates of the Gospels. It has become usual to bring them down to the destruction of Jerusalem, because it is assumed that the Lord Jesus would not or could not have uttered the predictions which they contain. Surely this is quite illegitimate. Similarly, the later meaning of *ekklesia* has been read back into Matthew, making the usage there anachronistic. But if it is remembered that it is an O.T. word, and the passages be read in the light of the Zadokite communities which then existed in Palestine, the anachronism vanishes.

Mr. Davey contemplates a considerable period during which *this* saying became associated with *that* parable by the pressure of events. But suppose the selective process was simplified by the fact that the Ministry was largely iterative; proverbial and semi-proverbial expressions being repeated in various contents? Might we not then have the sayings in the contexts in which they were originally uttered? This would shorten the period of selection. Further, we must remember that the process was probably well under way before the resurrection.

There is an unfortunate tendency for "form critics" to start with the tacit assumption that the various sayings and parables were not uttered in the connections in which we now find them. Great ingenuity is then exercised in explaining how they reached their present position. From this tendency our author is not free—see page , line , page , lines and page , line . If it was proper for the history to be "re-formulated and re-fashioned" in those days, why should not we continue the process in our day? The fact that it has been committed to writing does not affect the principle.

The Rev. Principal CURR wrote:—In his suggestive and scholarly paper Mr. Davey adopts the modern theory, which enjoys such a vogue at the present hour, to the effect that the Four Gospels incorporate a mass of oral traditions regarding the words and works of Our Lord. These have a history extending over two or three decades at the lowest estimate. In the process of transmission they have been modified to suit various problems in the story of the primitive church. The result is that the Gospels contain not only

a record of what Jesus began to do and to teach, but also the reactions of the earliest Christians to that information. It is as if James Boswell had not merely reported the unique conversation of Dr. Samuel Johnson, but combined with it his own reflections in such a way that the two strands were practically indistinguishable.

The basis of this view is largely the striking differences and similarities between the Four Gospels, and the repetitions which seem to be so hard to understand. These same facts were equally patent to the fathers and brethren in the second century whose theory of the origin of the Four Gospels is thus summarized in the paper. Referring to this process of modification, so to speak, Mr. Davey writes in these terms: "However quickly this process may have been accomplished, the very nature of the Gospel material itself protests vehemently against the second-century traditions that Matthew and John are based simply upon the undeveloped reminiscences of eyewitnesses, and Mark and Luke upon the exclusive record of the preaching of two great Apostles."

Without taking account of the fact of Divine inspiration, attention may be drawn to the fact of supreme genius. The four Evangelists were something more than careful collectors and industrious recorders of early traditions regarding the sayings and doings of Our Lord. They were men of marvellous ability and skill. As a writer in "The Times Literary Supplement" once remarked, "The authors of the four Gospels knew what they were about." May not these perplexing features of their biographies of their Divine Master be explained as the lights and shadows of incomparable genius?

#### AUTHOR'S REPLY.

I am content to let this discussion be printed without particular comment: those who wish to go more deeply into the problems raised will easily find guidance for their study.

I am amused to find myself treated as a "form-critic," for my whole argument might be termed a refutation of the common form-critical conclusions. I sought to show, by means of a few random examples, which I never claimed to be more than straws showing the drift of a current, that the four Gospels reached their present state as the result of a complicated process in which the

dominant factor was always the tradition itself. To this end I took sayings and parables which Form-critics generally explain as *formulated by factors extraneous to the tradition and distorting it*, and attempted to demonstrate that in every case it is more simple to suppose that the formative factor lay *within the tradition*. In other words, I started where the critics *are*, and tried to show that criticism itself leads back to the Jesus of History. For this disservice to Christianity I am reproached !

My hearers and readers were shocked by the suggestion that there was "development" in the tradition. I should be more shocked had the tradition not developed. For if anything is historically certain about the disciples of Jesus, it is that they all forsook Him and fled. This means that those that were afterwards to transmit the record of His words and works to later generations were, until the moment when they became assured of His Resurrection, so ignorant of the meaning of what He had said and done that they could not watch with Him or die with Him. It was the Resurrection that drove them back to His words and works, because then, and then only, when they knew that Christ is risen, did they begin to understand their import. Then it was that these men had to draw upon their memories for the action of Jesus or the word of Jesus most adequate to the proclamation of the meaning of the Gospel of their crucified and risen Lord *for their actual hearers*. So, as they lived their lives and wrought their ministry by the light of the Word of the historical Jesus, they found the hard, short sayings, the dark, enigmatic parables, and the momentous, cryptic actions, which had at the time stuck in their almost entirely uncomprehending minds, more and more luminous with the Truth of God revealed in Jesus crucified and risen. And as their understanding grew, so, quite rightly, did their exposition of these memories develop. This is why I speak of the unalterable but always vital word of Jesus.

I wonder whether my critics have understood the close connexion between the words and works of Jesus and His death and Resurrection? St. Paul says that "if there had been a law given which could make alive, verily righteousness would have been of the law" (Gal. iii, 21). No such law was given, and life came only through the death and resurrection of Jesus. Similarly, in the Fourth Gospel, the Jews are convicted of thinking to find eternal life in the Scriptures,

which in fact point to Jesus who bestows life to those that come to Him ; but the Jesus of the Fourth Gospel is always the Lamb of God who takes away the sins of the world *in His death*. To take the words and deeds of Jesus as a static, final Revelation of God, comprehensible apart from His death and Resurrection, having literal meaning only—that is to say, meaning confined to the same three dimensions in which they were spoken or done, and exhausted in the one moment and situation of their event—is to make of Jesus a second Moses, and to render His death and Resurrection irrelevant. It is impossible for me to read much that is written in supposed loyalty to the Bible without being gravely disturbed by the phenomenon of a Jewish attitude to Scripture among professing Christians, and this impression is aggravated by the complacent and intolerant temper in which this “loyalty” is often expressed, and which also has its New Testament antecedents.

## 843RD ORDINARY GENERAL MEETING.

HELD IN COMMITTEE ROOM 19, LIVINGSTONE HOUSE,  
BROADWAY, S.W.1, ON MONDAY, MAY 12TH, 1941,

AT 6 P.M.

DR. JOHN AITKEN IN THE CHAIR.

The Minutes of the previous meeting were read, confirmed and signed.

The CHAIRMAN then called on Dr. F. T. Farmer, B.Sc., Ph.D., to read Dr. Sutherland's Paper entitled "Inanimate Nature: Its Evidence of Beneficent Design."

The Meeting was thrown open to discussion in which the Rev. A. W. Payne took part.

Written communications were received from Dr. W. T. Marshall, Rev. Principal H. S. Curr, Dr. R. E. D. Clark, and Brig. N. M. McLeod.

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### *INANIMATE NATURE.*

*Its Evidence of Beneficent Design.*

BY BRIAN PORTER SUTHERLAND, M.SC., PH.D.

*(Gunning Prize Essay, 1940)*

THE subject of design in nature and the evidence it affords of the working of an intelligent Designer and Creator have been dealt with in several papers already presented before this Society. Some early papers have considered the metaphysical aspects of the subject and others have brought forward evidences of design, order, and beauty in various realms of nature. Again, the argument from design has been not infrequently a basic consideration in other papers dealing with a variety of natural studies. However, our present subject covers a field to which recent discoveries in science have made important contributions, and with the more specifically defined approach it should be possible to present a useful study.

Although the general philosophy of the "Argument from Design" is beyond the scope of our present paper it may not be amiss to mention briefly the chief points in it. Basically we must assume the existence of mind, particularly our own mind, independently of matter. If with this basic assumption we examine a particular object, phenomenon or a group of such and find therein that which unmistakably points to order, design, beauty, or arrangement, we argue that behind these there must be an intelligent mind.

The arguments urged against this conclusion are mainly along two lines. The materialist refuses to admit our basic assumption. Thought, for him, is but a secretion of the brain. Everything is due to mere chance. A major difficulty of this position is that the very argument disposing of mind is entirely without meaning except to an intelligent mind. Others such as Kant, while admitting the assumption of the separate existence of mind, have refused to allow the analogy of reasoning from the known existence of a controlling mental force in ourselves to that of such a force in nature. The refusal has been made on the ground that such an analogy cannot be proved to hold when comparing the finite and the infinite. Kant's objection is disposed of when the meaning of the word "infinite" is made clear. For the purpose of the argument from design at least, "infinite" is definitely not to be taken as implying that the mind behind nature is essentially different in kind from our own. Broadly considered, in spite of the great advances in knowledge in all spheres, in spite of the reasonings of later philosophies, the main lines of logic of Paley's "Natural Theology" still stand, the argument from design is still valid.

Our present subject is limited to inanimate nature and the term will be taken with the narrower meaning, not extending it to vegetation as is sometimes done. This limitation has some important effects on the main lines of argument.

When dealing with living beings we may find that study leads to the belief that a certain structure is definitely fitted to serve for the good of the being itself. If so, we will say that we have in this an example of beneficent design. However when dealing with inanimate nature the good of the object itself cannot enter into the consideration, but evidence of beneficent design must be sought in facts which show that inanimate nature has been planned for the good of living nature. Generally for this purpose



living nature will be considered in its wholeness, for it is indeed more than a collection of individual organisms. In some cases, however, there is a conflict between what might seem best for one kind of organism as against another. In these we shall expect that beneficent design will be shown in that which favours the higher type. Ultimately many phenomena are to be viewed as in relation to the good of man, although it is obviously ridiculous to attempt to argue every case in this way, except in so far as we may say that anything which shows the power, wisdom, or goodness of the Creator is good for man as it serves to reveal God to him.

This last point may well be briefly considered a little further here, invoking the aid of Holy Scripture as our guide. For though an appeal to the Bible may not convince the sceptic in such a study as this, yet it will be a help to us as believers in giving us a true perspective.

As revealed to us, God's main interest and purpose for this world were in its being inhabited.<sup>1</sup> From the beginning He appointed vegetation as food for every beast of the earth and every fowl of the air and every thing that creepeth, and He saw that the arrangement was good.<sup>2</sup> In His answer to Job's complaint God declares that He provides the ravens with food<sup>3</sup> and He gives the peacock its beauty.<sup>4</sup> It is declared elsewhere that not a sparrow falls to the ground unnoticed.<sup>5</sup> However, of man not only is it declared that his food is provided in the vegetation, but that to him was given dominion over all other living things together with the work of subduing the earth.<sup>6</sup> It is further stated that he is of more value than many sparrows.<sup>7</sup> This exalted position of man was not primarily for his own comfort or convenience but rather that he might use it to gain the likeness of God in whose image he had been made and that in harmony with a subject and contented creation he might bring about the fuller glorification of God. Nearly, if not all, of the present vanity and apparent futility in nature is to be traced to man's failure, and the Christian hope includes the assurance that this is to be entirely remedied when man reaches his destined place of manifest sonship to God.<sup>8</sup>

This leads us to a difficulty that has been raised against the argument from design, namely, that not infrequently the happenings in inanimate nature seem anything but beneficent to man. The crushing hailstorms that ruin miles of harvest

fields, the tornadoes that devastate the islands of the sea, the earthquakes that spread destruction and death, how may these be brought into harmony with the idea of a beneficent Creator and Providence? And besides these outstanding phenomena, what of the lesser occurrences that bring so much trouble, discomfort, and suffering? Admittedly there are these difficulties. Admittedly there is also very much about nature that, though not harmful, is apparently purposeless. But let us also admit that even in the realm of the physical and material, in the realm that rightly belongs to science, we know but a small part. Undoubtedly further study will show the value and purpose of much that is as yet inexplicable. And after all, we know that there is more to be gained than material plenty and physical comfort; there are those values for which life itself is worth sacrificing. We can learn much through the seeming opposition of nature, and we can believe that the "acts of God" which bring present loss are with a view to greater gain. Should there be those who are not ready to admit even this, we can certainly affirm, without fear of contradiction, that in the main, Providence is benevolent and that the charge for by far the greater part of the suffering in the world is only too evidently to be laid to man's inhumanity. It is to be hoped that this essay will support the first of these contentions at least.

But to return to closer consideration of our immediate subject, we need to mention one other general point in connection with design in inanimate nature before proceeding to the detailed study. This is the question of adaptation. Obviously, if a particular condition in the world is suited to the requirements of living creatures the adaptation, if any, cannot have been done by the inanimate. It is, of course, admitted that for all we know now there are many conditions in the inanimate world that could be changed, and with comparatively little major difficulty or adaptation, living beings could adjust themselves to the changes. For example, a healthy person can easily become acclimatized to the rarefied air of moderately high altitudes so that we cannot say that from the point of view of human respiration our particular normal pressure and oxygen content of the air are an evidence of design. We can readily imagine animals proportioned to live with comfort and convenience in an atmosphere with quite a different pressure of oxygen. However, it is different when we try to imagine life on a planet with an atmosphere say of nitrogen or neon.

We submit at the outset that when inanimate nature exhibits a comparatively complicated, abnormal, or unexpected behaviour or condition, and when this dovetails precisely into the requirements of living beings as we find them here, then such is an evidence of beneficent design. It is not necessary to prove the absolute impossibility of another kind of life being able to exist under quite another set of conditions. In fact we know so little of the possibilities even in this universe, so little of life in the ultimate, that proof of such impossibility is beyond our reach. Therefore, although some aspects of this question will be dealt with later, we will in general restrict our consideration to life as manifested through material organisms of the same general order as that we are familiar with. Living beings might exist in the sun, but life could not be manifested under conditions there in any way resembling the physical manifestations of our present experience. We look to find then, in our consideration of inanimate nature, not self-adaptation, but the evidence of beneficent foresight and planning for the good of living creatures, making possible a life of usefulness and happiness for man and leading ultimately to his spiritual welfare as he is brought increasingly to the knowledge of God.

The field of inanimate nature is so vast that in a study of this kind it is difficult to know the best means of approach, how much can be taken for granted with special mention and to what extent the most fundamental phenomena are evidences of design. Perhaps the first essential to be mentioned is that, for any reasonable kind of development, the universe, and particularly that part with which we are mainly concerned, must be designed on a basis of law and order, constructed of materials whose properties do not change, which will always behave the same way under the same conditions. Further, it is evident that there must be a unity about the different kinds of materials; they must all obey certain fundamental laws, or it is difficult to conceive how a stable cosmos could exist except in a condition approaching dead uniformity.

On the other hand, while a unity is necessary, the materials must be such as to allow of a diversity of structures being formed therefrom, which will have their own peculiar properties and yet show a good measure of coherence and stability in the general system. It is hardly necessary to say that this is the case. There are almost numberless kinds of materials possible under

conditions such as on this earth, yet all obey certain basic laws in precisely the same way. That this is so is patent from the fact that physics, at least in its fundamentals, takes no account of the chemical or biological nature of material. The laws of motion, the laws of thermodynamics, the law of gravitation are true for all matter whether grains of sand or mountain ranges. Even the fact, if it be a fact, that under conditions such as exist in certain stars, the laws of conservation of energy and of matter no longer hold, does not alter the argument. Under such special conditions different behaviour is not unexpected and does not affect the fact that the universe, and above all that part that vitally concerns man, has been designed and constructed on fixed and uniform laws by virtue of which alone its ordered stable state is possible.

It is further evident that for anything like the amazing diversity of development that has occurred, particularly in animate nature, there must be provision for the formation of a vast number of structures within the one main framework and with a comparatively limited number of basic materials. An artist may have in one picture a hundred different shades of colours, but he may only have used half a dozen separate pigments. It would be quite impracticable for him to have a ready supply of every shade he would ever need. So it seems that only in some such way would be practical the existence of the remarkable variety and fulness of development that is found in life on this sphere. It seems necessary that there should be a supply of a comparatively small number of basic materials, but these must have the properties of being capable of combination in a great many ways. Also, in order to provide for a succession of growth, progress and development, there must be means whereby the limited supply of basic materials can be used over and over again in new and different ways. This seems precisely the scheme upon which our world has been designed. The globe itself constitutes the supply of basic materials, the chemical elements. (Their nature and extent will be considered later.) The constant flow of energy from the sun fundamentally supplies the means needed to bring about the combination and re-combination of these elements to form the great number of compounds used to support and manifest life. Obviously the energy so supplied must be capable of bringing about these changes. It must have a suitable potential and intensity, using the words in a general sense. On the other

hand, conditions must not be such as will make the existence of these compounds impossible. For example, the sun has its own source of energy. What it is need not now concern us. But the energy conditions in the sun, or as we usually speak, the temperature, is so high that the chemical elements cannot remain in combination to any extent at all sufficient for the purposes of living beings. It, therefore, seems best, if not entirely necessary, that our earth should be provided with an external source of energy at a temperature much higher than its own. The solar system in its essential features is thus evidently particularly fitted for the home of life.

Perhaps equally fundamental and equally giving evidence of design are the basic physical properties of matter. For general stability, and particularly for that of a planetary system, matter must possess inertia. Furthermore, matter must be capable of storing energy. Energy may be simply described if not precisely defined as accumulated mechanical work. Matter shows in a great variety of forms and way, the property of receiving this accumulated work and holding it either statically as potential energy or in movement as kinetic energy. It is possible for the store of work to be kept indefinitely in many forms without appreciable loss and yet for the store to be made available for work again. This may seem very obvious and not at first sight an evidence of design, but surely it is. To use the mechanical illustration of the storage of water at high levels in suitable reservoirs with valves to allow its flow as needed, we might say that nature has been designed with an enormous number of possible and actual energy reservoirs. The sun pours out his stream of energy, but it does not by any means all run down at once to one uniform level. By various agencies, and particularly by living ones, energy is stored at high levels so as to be available for work if the right valve can be opened. To give an example in the chemical realm, there is a very strong tendency for carbon, as in coal, to combine with the oxygen of the air. The two elements have a chemical affinity, but under ordinary conditions the coal may lie out in the air for years and practically nothing happens unless a fire is started by applying intense energy. This phenomenon is described by saying that to allow the reaction between carbon and oxygen to proceed, a certain energy of activation is needed. Once well started, the burning supplies this energy so that the action is continuous. There is no need

to labour the point, but it is evident that if matter did not have properties to allow it to store energy, life could never be manifested in a material world, and it is by no means obvious that matter must be so except as designed and ordered by an intelligent Creator.

At one time the idea was prevalent that many, if not most, of the stars were centres of systems similar to the solar system, each with its series of planets. However, it has been difficult for astronomers to account for the formation of planetary systems under what are considered ordinary conditions. According to the theory perhaps most favoured at present, that the solar system originated by the close approach of two stars, very few indeed of the stars, possibly one in a million, have planets at all. The possible abodes of life are therefore very restricted, the more so as by no means all planets can support life, as we shall see.

A planetary system capable of supporting life must in the first place be stable over long periods of time both as to the matter available on the planet and the supply of energy from the star. In the solar system these conditions depend to an important degree upon the properties of what is commonly called the ether. This is the medium filling all space and serving for the transfer of energy across open space. The force of gravity whereby the relative positions of the sun and earth are maintained is conveyed by the ether, so also is the radiation which constitutes our steady supply of energy from the sun to the earth. This medium, ether, must exert no frictional drag on matter, else the motion of the earth would be retarded and eventually the earth would fall into the sun. It must also be transparent to radiation. Actually radiation is transmitted entirely unquenched, undispersed and undiminished by the ether. No friction nor viscosity can be detected in it. It dissipates no energy and generates no heat. Yet it conveys the enormous forces of gravitation and indeed ultimately is the vehicle for all mechanical and electrical force and chemical affinity. This combination of properties is so remarkable that it is almost unimaginable were it not actually the case, and the argument is not affected if we prefer to speak of space rather than ether. The properties are such as to give the required effect, the nature of the means used is unimportant for the present purpose.

The stability of the planetary system is also dependent on the motion of the planet. It is beyond question that the earth moves in its orbit round the sun and that this motion is continuous and unabating. How it first received the impulse necessary to start this motion is not so clear, but it looks like a matter of design. The earth has another motion, that of rotation on its own axis which, as later consideration will show, is equally an essential for life. All this motion is of course controlled by the sun through gravitational forces.

But this is not the only function of the sun. The mass of the sun is the important factor in the control of the earth's motion. Actually, the mass of the sun is 300,000 times that of the earth. For the other major function a very high temperature is needed. It is actually something like  $6,000^{\circ}$  C. By virtue of this the sun pours forth an unceasing stream of radiation in all directions, that portion of it received by the earth, though only one 2,000-millionth part, being so essential for our life here. The intensity of this radiation at the mean solar distance of the earth, after correcting for that which is absorbed by the atmosphere, is known as the solar constant and has a value of about 1.95 calories per square centimetre per minute. This solar constant is actually subject to some variation from time to time, the changes apparently showing an eleven-year cycle following the same trends as the sun-spot frequency. The amount of the variation is reported to be some 1 per cent. either way from the mean, in all a range of 2 per cent. Other things being equal this variation would cause a change in effective earth temperature of  $1\frac{1}{4}^{\circ}$  C. but actually other effects are largely compensative of this.<sup>9</sup> However, the important point for our immediate concern is not the variability but the constancy of the sun. What minor changes in intensity of radiation may have occurred in the past is not known ; but this much is known, that since life first appeared on the earth the sun has kept the earth's main temperature between  $0^{\circ}$  and  $100^{\circ}$  C. and since animal life appeared the maximum cannot have been over  $70^{\circ}$  C. as at this temperature, albumen, the chief constituent of protoplasm, coagulates and can no longer function. So far as we know astronomers do not expect a major change in this radiation for a long time to come. When we consider that this radiation is produced, according to modern theory, by the conversion of 3 to 4 million tons of matter per second, the constancy is amazing. This is considered

so remarkable by Prof. Ewe that he writes "if it had not happened (it) would be deemed impossible."<sup>10</sup> Surely this is an outstanding example of design.

In connection with this subject of the sun's radiation we should also briefly consider something of the manner of the earth's reception of it, particularly having in view two main purposes served thereby. First, we may continue the question of the maintenance of the earth's temperature. The thermal radiation from the sun, that is, the invisible radiation of longer wave-lengths, is largely lost to space by reflection and scattering at the outer atmosphere. It is different with the radiation of shorter wave-lengths. This includes both visible and ultra violet light, and is variously absorbed by the atmosphere and the surface of the earth itself. The importance of the atmosphere in this connection will be considered later, but it may suffice to mention here that in all about 63 per cent. of the radiation falling on the earth's atmosphere from the sun is absorbed and eventually serves to warm the earth. The effect of radiation on the temperature of the earth may be judged in approximate quantitative terms by supposing the earth's distance from the sun halved. This would increase the intensity of radiation fourfold and, other things being equal, would increase the absolute temperature at the earth's surface in the proportion of the fourth root of four. In other words, it would be raised something of the order of 100° C., that is, to a temperature impossible to life. Correspondingly, were the distance from the sun to the earth increased by one half, the temperature would be too low for anything like present conditions of life. It is true that different conditions in the atmosphere might entirely change these figures, but they serve to show how delicately balanced is the general system of emission and absorption of radiation as between the sun and the earth.

The second function of the sun's radiation is in connection with the growth of living plants. Though only about one-hundredth part of the solar energy reaching the earth is absorbed by plants and a further one-hundredth part only of this is used directly in this growth process, it is of supreme importance. The organic matter of living things is founded on the basic use of carbon dioxide by plants. This gas absorbed from the atmosphere reacts with water within the leaves to form carbohydrates such as sugar, at the same time liberating oxygen, which is returned to the air. The process only takes place in the pre-



sence of the green substance of plants (chlorophyll) and under the influence of light. The light is necessary to supply the energy required, and it must be of such wave-lengths that it is absorbed by the chlorophyll. Blue and red light such as predominate in light from the sky and sun respectively are readily absorbed. There is particularly strong absorption in the position of maximum energy of the spectrum. The energy of light stored by the plant during its growth is liberated again as heat when the plant substance is made to combine with oxygen, as, for example, during the burning of wood in a fire or the less spectacular, but equally true, burning of sugar within the human body. As vegetable life is necessary for the sustenance of animal life, light is in a very real sense at the basis of all physical life. No wonder then that the first recorded word of God was, "Let there be light."

Design in this matter of the relation between the earth and the sun becomes still more evident when we consider the conditions existing on the other planets of our system. Mercury, the nearest to the sun with an average distance of nearly 36 million miles, cannot be the abode of life because it always shows practically the same face to the sun. This face will therefore have a temperature far above the boiling point of water while the temperature of the other side probably approaches the absolute zero ( $-273^{\circ}$  C.). With a mass only one twenty-fifth that of the earth its atmosphere must be very scanty.

Venus, of much the same size as the earth and having a mean distance about 67,200,000 miles from the sun, is different. Apparently its period of rotation is about 68 hours, but its axis is nearly parallel to the plane of its orbit. This would be expected to result in extreme temperatures, the poles having in effect only one day and one night in the year. The heavy atmosphere is apparently mainly carbon dioxide and would have a blanketing effect. It has been estimated that the surface temperature is above the boiling point of water. Also there is little evidence of oxygen or water vapour so the possibilities of life are not very good.<sup>11</sup>

Mars is of course further from the sun than the earth and consequently tends to be decidedly colder. The cold at night is intensified by the long year (687 days) and by the rarity of the atmosphere, which in turn is consequent on the size of the planet. These and other considerations would tend to the belief that life

on Mars, if any, must be localized and limited to peculiar primitive forms capable of withstanding the severe cold.<sup>12</sup>

The other planets are much further away from the sun and consequently have very low temperatures. On account of their large size they have dense atmospheres. Jupiter and Saturn both probably have ice coatings thousands of miles thick and atmospheres further thousands in depth. The atmospheres are probably largely hydrogen and helium together with ammonia and methane. Uranus and Neptune have been estimated to be at temperatures about  $-200^{\circ}$  C. They also have methane in their atmospheres. Obviously none of these is suited for life for two reasons at least. They are too far from the sun and hence too cold. They are too large and thus have retained too heavy atmospheres so that all oxygen has been combined with hydrogen or other elements, leaving none free in the atmosphere, which rather contains hydrogen compounds.

Briefly recapitulating in so far as this part of our subject is concerned, we can say that beneficent design is seen not only in the universe generally in that its properties allow of the formation and existence of a stable planetary system, but also in the particular properties of the solar system. It is seen in the quality, quantity, and constancy of the sun's radiation. It is seen in the mass of the earth and its distance from the sun. It is seen in the movement of the earth round the sun and in its own rotation both as to time and axial direction.

From our consideration of the solar system rather generally we turn to look at the earth itself in more detail. It will be desirable first to review the elements of which it is made, and with modern chemistry to aid us we are able to do this with remarkable completeness in a qualitative sense at least. Not only so, but lest any should suggest that in other worlds there may be other elements with vastly different properties than those that we find used in building our earth, we can definitely state that as far as any heavenly body that comes within the range of our telescopes is concerned no evidence can be found of the existence of such elements, nor are the properties of the elements found in any way different from those found on the earth under similar conditions. One element, helium, was discovered in the sun by means of the spectroscope before it was known on the earth. It is now of course well known on the earth and fits in exactly with the plan under which the rest of our elements have been

designed. Designed is not inappropriate for the elements, because although for ordinary chemical purposes the elementary atoms are still the ultimate indivisible particles of matter, yet through a knowledge of radioactivity and modern physics it is known that these atoms are themselves complete structures which to some extent at least can be divided into their component parts. The number of different units used in the structure of the atoms is not yet known. For a time only two were generally recognised, the proton and the electron, but later other seemingly distinct fundamental entities as the neutron and positron have been discovered. The exact relations between all these and also between these and other very stable larger units cannot be defined, but this need not in any way affect our present general study of the chemical elements.

Without going into detail it may be said that atoms may be considered to be constructed with a central nucleus having a positive electrical charge, surrounded by a number of negatively charged particles (electrons) exactly balancing the central charge. It has been shown that, starting with hydrogen, the lightest known element, which has a central charge of one unit and one electron, all the known elements can be arranged in order of increasing nuclear charges, or atomic number as it is called, up to uranium, the heaviest known element. This has a central positive charge of 92 units and 92 surrounding electrons. With the exception of one or two gaps for which elements have not yet been discovered the whole series with atomic numbers from 1 to 92 is known, and no work has yet indicated the possibility of fractional charges so that the presumption is very strong for believing that all chemical elements in the universe are included in this scheme. When arranged in order the elements show remarkable gradations in properties, all falling in ordered series. It is quite possible that elements of higher atomic number than 92 exist, but these will still fit in with the general scheme and their properties are practically certain to be in accordance therewith. In any case they are of no practical importance for our present study, on account of their extreme rarity, if existent at all.

The relative amounts on the earth of the most abundant of the elements can be seen in the following table, which includes the atmosphere, the ocean, and the earth's surface to a depth of ten miles below sea level.<sup>13</sup> This is approximately representative of the materials ordinarily available for the support of life, and

has been estimated from analyses made in many parts of the world.

|            |       | Per cent.<br>By Weight. | Atoms<br>per 10,000. |
|------------|-------|-------------------------|----------------------|
| Oxygen..   | .. .. | 50·0                    | 5,380                |
| Silicon .. | .. .. | 25·7                    | 1,570                |
| Aluminium  | .. .. | 7·3                     | 470                  |
| Iron ..    | .. .. | 4·2                     | 130                  |
| Calcium    | .. .. | 3·2                     | 140                  |
| Sodium     | .. .. | 2·4                     | 170                  |
| Potassium  | .. .. | 2·3                     | 100                  |
| Magnesium  | .. .. | 2·2                     | 160                  |
| Hydrogen   | .. .. | 0·95                    | 1,630                |
| Titanium   | .. .. | 0·43                    | 16                   |
| Chlorine   | .. .. | 0·21                    | 11                   |
| Carbon     | .. .. | 0·19                    | 29                   |
| Phosphorus | .. .. | 0·11                    | 7                    |
| Sulphur    | .. .. | 0·11                    | 7                    |
| Others     | .. .. | 0·70                    | 180                  |
|            |       | <hr/> 100·00            | <hr/> 10,000         |

The second column is probably the most informative showing the relative numbers of atoms of each kind. Obviously oxygen is by far the most abundant. Oxygen is also very dominant in its chemical properties, being the most strongly electro-negative element except fluorine, which is not an abundant element and has numerous peculiar properties which unfit it to take a place such as that taken by oxygen. The next two most abundant elements are hydrogen and silicon, with each of which oxygen forms stable and very important compounds, respectively water and silica. Fundamentally we may say that the chemistry of the plutonic rocks is based on silica and its compounds, while that on the surface of the earth which more immediately concerns life is a chemistry of water.

In living organisms two other elements are always present besides oxygen and hydrogen, namely carbon and nitrogen. The need for these becomes clear if we bear in mind that the economy of a living organism requires that an enormous variety of chemical compounds must be possible from a comparatively small number of elements. This is in order that in a single organism with

limited resources, the life may be able to adapt itself to very varying circumstances and manifest itself in an almost endless variety of ways. Of all the elements that we know, the most essential one beside oxygen and hydrogen is carbon. Out of the 90 or so known elements, and their general properties are well known, carbon has in an entirely outstanding way the property of forming stable compounds based on a framework of a large number of carbon atoms directly linked together in a great variety of chain and cyclical groupings. This unique property of carbon makes possible the fact that hundreds of thousands of distinct chemical compounds are known based on carbon, particularly combined with hydrogen and oxygen, and the number of such compounds that could be made is recognized to be practically without limit. The fourth element of this group, nitrogen, also possesses properties which enable it to enter in a variety of ways into these carbon compounds and to exert most important effects in modifying the properties of such compounds. Undoubtedly if a chemist were asked to select four elements which would allow of the formation of the greatest number of chemical compounds he would select just these four without any hesitation. To emphasize the point, we may mention that in the International Critical Tables, published in 1926, there are listed in the tables of important well-known chemicals well over 2,000 composed of carbon, hydrogen, and oxygen; these three elements and no more, combined in various proportions. Whereas with sulphur, hydrogen, and oxygen, there are not fifteen known compounds and most of them quite unstable. Much the same is true if we consider phosphorus in the place of carbon and generally with the other elements. The possible number of combinations with hydrogen and oxygen is still less.

Two other elements do form a number of compounds with hydrogen of the same general type as the carbon compounds. These are silicon and boron. However, the number is incomparably less than with carbon, and in any case the nature of their oxides and oxygen compounds is such as would preclude them from filling the role of carbon in the general scheme of biochemistry.

Not only does carbon, with hydrogen and oxygen, form a great number of compounds, but they have the most amazing variety of properties. From these three elements, and no more, are formed such diverse materials as ether, glycerine, sugar,

alcohol, acetic acid, digitalin, cellulose as in paper and cotton, Bakelite resin, linseed oil, acetone, carbolic acid, cellophane, formaldehyde, camphor, oil of wintergreen, and countless others ranging from fragrant perfumes to burning acids, volatile liquids to hard solids, regular articles of food to violent poisons. Carbon compounds are known with as many as sixty carbon atoms united together in one molecule, that is, the smallest unit of compound of a particular substance. Others occur with every degree of complexity down to the simplest such as formaldehyde, whose molecule has one carbon atom, two hydrogens and one oxygen. As to number, variety, and complexity, the carbon compounds are unique, so that organic chemistry, the chemistry of carbon, is practically a distinct science. In nature all these are ultimately built up from carbon dioxide and water.

A little further mention may be made of oxygen. Its strongly electro-negative character has been mentioned, and this has the important results that oxygen readily forms stable compounds with practically all elements, and in doing so large quantities of energy are liberated. On the first of these results depends the method of bringing many other elements into combination with the carbon compounds used in the structure of living matter ; and on the second the convenient storage of energy to be liberated by oxidation. In connection with this last point it may also be mentioned here that hydrogen liberates by far the greatest proportional amount of energy of all the elements when it combines with oxygen. The heat of combustion of hydrogen is about 34,000 calories per gramme. Next in descending order of magnitude are boron at 13,000 and carbon at 8,000. These high values peculiarly fit carbon and hydrogen compounds to be reservoirs of energy, and seem to indicate definite design in the arrangement whereby energy is liberated by oxidation. Linked up with the same general topic are the stability of the oxides, water, and carbon dioxide, and their suitability to serve as the reservoirs of hydrogen and carbon respectively.

Further, not only can carbon form with these other elements an enormous variety of compounds, but it alone of all the known elements can produce materials having the physical properties needed for a living organism. The flexibility, toughness, and other characteristics needed in the body tissues to allow of movement and growth can only be obtained in structures built up of carbon compounds. It is thus evident that carbon, oxygen,

hydrogen, and nitrogen as elements have been designed so that they might be capable of forming the material bodies of living beings. Other elements are also used, but these are dominant. Without these four, other elements form numerous useful compounds, but with negligible exceptions they are either rigid solids or structureless liquids or vapours. These are the only chemical elements that can fill this all-important place.

One more important point in the chemical view of things may be mentioned. There must be a means for bringing within the structure of the living organisms the materials needed from the outside world, and also a means of discarding used or otherwise unwanted materials. A fluid vehicle is obviously the only possible type of means. When addition of material is needed to the inside of an automobile engine, for example, the thing is taken apart and the material added. It is apparent that no such method would do for a living body. The vehicle that is used in nature is, of course, water. We shall consider later some of the unique properties of water, but for the present just mention, in passing, its solvent action. Water is more nearly a universal solvent than any other known material. By virtue of this it is pre-eminently suited to make available the chemical resources of the world for the internal use of living organisms and to form the medium in which occur most of the chemical reactions connected with life. No other known liquid could serve instead.

Much more could be said along these lines, but enough has been said to show that physical life is only possible in an organism largely built up of carbon, hydrogen, oxygen, and nitrogen, and in a world where we have liquid water in sufficient quantity. In other words we see that organic life cannot be built up in anyway essentially different from that in which it is built up in this world. This confirms what has already been stated as to necessary temperature conditions. We can thus feel safe in agreeing with such a statement as that of Sir J. Arthur Thomson when he says, "There is no use in speculating over the presence of life on any planet where water is not present in liquid form. Man's imagination does not rise to picturing any kind of embodied life radically different from the protoplasmic plants and animals that we know."<sup>14</sup>

Very little attention has been given to the elements other than carbon, hydrogen, oxygen, and nitrogen, but in spite of their

relatively secondary place in life they do have considerable importance in the world. It is only necessary to recall the wonderful varieties of materials that can be made to realize that the 90 odd different basic building units are indeed marvellously designed. As it seems now, the various atoms have all been made of identically the same fundamental entities in order to allow of their ready combination in different and yet strictly ordered ways. The proportions in which the various elements combine are regulated by a property called valence which is dependent on the relations of their basic structure. Because of this not only are all atoms of carbon and of oxygen, for example, identical, but when carbon and oxygen combine they do so in definite proportions. In this particular case there are three known possible proportions and they result in three specific compounds with their own distinct properties. So with all the elements in all their combinations. Through the combinations the endless variety of useful and beautiful materials result. Particular properties of a few of the chemical elements will be considered later, but enough has been said to show beneficent design in their general scheme and above all in the place taken by the four basic elements of living matter.

Having thus briefly reviewed the elements of which the earth is made up we look at something of the structure of the earth and the forms in which these elements occur. As is well known, matter exists in three states: solid, liquid, and gaseous; the transformations between them being dependent on temperature and pressure. This is in itself an evidence of design in that by change into the liquid or gaseous state the movement of matter is made possible in ways which could never be accomplished by solid matter, while solid matter is necessary for stability. For example, the moon is in a condition such that all the material thereof is permanently solid. It has neither liquid nor vapour. It is utterly dead. At the other extreme the sun is so hot that all or nearly all its matter is in the gaseous state. The existence of a living body is equally impossible. By contrast, the earth has all three states of matter represented; the gaseous in the atmosphere, the liquid in the ocean, and other waters or the hydrosphere, and the solid in the crust of the earth or the lithosphere. The centre of the earth may be liquid, but that is not our present concern. It will probably be convenient to follow this threefold division for this study and in keeping with



the order as in Genesis, Chapter I, the atmosphere will be considered first, being also, perhaps, the simplest.

From the point of view of its mass as compared with the total mass of the earth, the atmosphere is really negligible, being somewhat less than one millionth part of the whole; however, this is not by any means a measure of its importance. The total gas in the atmosphere is equivalent to a layer about five miles thick at uniform normal pressure, or a mass of  $5 \times 10^{15}$  tons. Its major constituents are nitrogen and oxygen, which are present in amounts of about 78 per cent. and 21 per cent. respectively by volume of dry air. Argon and other inert gases together amount to about 1 per cent. by volume, while carbon dioxide is only 0.03 per cent. These all are present in substantially constant amounts throughout the lower atmosphere. Moisture is also present in varying amounts as well as some minor other substances.

The total quantity of matter in the atmosphere is, as previously mentioned, dependent on the mass of the earth, a small mass being only able to hold a relatively small atmosphere by gravity. According to currently accepted views the atmosphere is now almost completely immune from loss to space, but how to explain its present constituents is still a problem. The proportions of oxygen and nitrogen are anomalous, a far smaller amount of oxygen being more usual. Theories have varied from those by which the primitive atmosphere was oxygen free but very rich in carbon dioxide to those postulating an originally much greater oxygen content. Without deciding in favour of any theory we notice the difficulty of explaining the atmosphere on the basis of chance as it emphasizes the element of design, as will be the more apparent from a consideration of the part played by the different gases in the economy of nature.

Nitrogen, the major constituent of the air, is an indispensable element in the formation of protein without which no living creature exists. For the original supply of this we must look to the atmosphere except for possible minor amounts from volcanic materials and certain mineral springs. In accordance with the general principle previously stated we find in nature a vast circulation known as the nitrogen cycle.<sup>15</sup> The distribution of nitrogen in the world has been estimated as in the following table, the figures being in millions of tons:

|                                   | Millions of Tons<br>of Nitrogen. |
|-----------------------------------|----------------------------------|
| Coal and peat .. .. .             | 100,000                          |
| Soil .. .. .                      | 40,000                           |
| Vegetation (mainly forests) .. .. | 592                              |
| Animals (including man) .. ..     | 11                               |

The amount in the atmosphere is much greater than in any of the preceding forms, being  $4 \times 10^{15}$  tons. How this is brought into use in these other forms will next be discussed.

To ordinary chemical reaction elemental nitrogen is comparatively inert and cannot be used by higher plants or animals, but a comparatively small quantity is combined with oxygen by electrical discharges in the atmosphere and brought down to the earth as nitric acid with rain. Incidentally this combination of oxygen and nitrogen absorbs a large proportion of energy. If it liberated energy, that is, if it were exothermic as almost all combinations with oxygen are, the first thunderstorm would deluge the world in nitric acid and bring an end to organic life. However, actually the amount of combined nitrogen so brought down is but small, estimated at one pound per acre per year. Other nitrogen in the air combined as ammonia probably arises from decomposing organic matter in the earth and is similarly brought back by the rain. It is perhaps four pounds per acre per year. This would be insufficient for anything like the present plant growth, but the needed amount is made up by living organisms which have the power of fixing the nitrogen of the air and transforming it in the soil into compounds useful for higher plants. These organisms are chiefly bacteria, but also include some fungi and algæ. The bacteria are of two main types, non-symbiotic, particularly the *Azotobacter* group, and the symbiotic, particularly those that co-operate with legumes, fixing nitrogen in their roots. These last will fix on an average about 50 to 60 pounds of nitrogen per acre of legumes per year, while the other types of living organism account for some 10 to 20 pounds per acre. Of the combined nitrogen thus brought into the soil part is lost to the ocean in drainage, part is decomposed by other bacteria to free nitrogen again and part is used in plant growth. This last may be used by animals before returning to the soil or directly returned. In either case it enters the cycle again. The eventual loss from the soil is either as free nitrogen or in drainage.

This net loss is made up by the processes just described. Artificial means now at man's disposal allow of transforming the atmospheric nitrogen into chemical fertilizers for addition to the soil so entering into the great cycle whereby the essential nitrogen is drawn from the inexhaustible reservoir of the air, used by all living things, and ultimately returned to the atmosphere. Nitrogen in the air was evidently in the design for the world.

Equally interesting and vital is the cycle of oxygen linked with carbon dioxide. Part of this has already been mentioned in connection with radiation, but may be referred to again. However, before doing so further attention should be given to the existence of free oxygen in the air.

Oxygen is a very different element from nitrogen in its chemical properties. It readily combines with nearly all other elements to form stable compounds. This is evidenced by the fact that the known part of the earth's crust contains about 50 per cent. by weight of combined oxygen. The contrast with nitrogen is worth further emphasis. The total amount of this latter element in the known material of the earth is smaller than that of any included in the table given earlier, being actually about 0.03 per cent. How important it is then that this relatively small amount should be preserved in a state at once available all over the surface of the earth! That this is so is dependent on the fact that nitrogen does not readily form stable compounds which would have bound it in the earth's crust. Oxygen, on the other hand, is present to a very large extent, but still provision has been made that a sufficient portion of the whole should be uncombined and present all over the globe. This is remarkable when we consider that of the vast amount of oxygen present in the earth's crust about 99.98 per cent. is combined in the various minerals and water, and so is not available for respiration. Upon the stable existence of the remaining five-hundredth part in the free gaseous state all animal life depends. If, for example, the hydrogen content of the crust had been a fraction of 1 per cent. of its amount larger than it is, it would have sufficed to combine with all this oxygen in the form of water. At least one modern authority recognizes this fact, that the oxygen of our atmosphere is "The excess of that element that remained unused after all the possible oxidations had been effected".<sup>16</sup> In the case of the planets Jupiter, Saturn, Uranus,

and Neptune, there actually is a large excess of hydrogen and its compounds in the atmosphere, and of course no free oxygen, as we noticed before.

The oxygen cycle on the earth is maintained by the liberation of free oxygen from carbon dioxide by vegetation and the consumption of free oxygen by animals, various combustion processes and the oxidation of weathering rocks. The quantities involved in these processes are of general interest. Thus it has been estimated that an average man exhales about three pounds of carbon dioxide per day and that three trees each 200 feet high and weighing 24 tons are needed to use up this and restore the oxygen consumed. In a recent paper before the Meteorological Society it was estimated that some 4,300 million tons of carbon dioxide are added to the atmosphere annually by combustion of fuels, and that between 1900 and 1936 the carbon dioxide content of the atmosphere has increased by 6 per cent. of its amount.<sup>17</sup> This change is not detectable from data available at present. Similarly although there is considerable opinion that the oxygen content of the atmosphere is decreasing, analytical means have not been sufficient to prove the case. There are various minor changes in both the oxygen and carbon dioxide contents of air from time to time and place to place but definite trends are difficult to establish. Possibly the carbon dioxide was much higher in early geological times and was reduced to its present levels by the heavy vegetation and by combination in mineral carbonates. At least it is certain that since modern animals appeared, the oxygen content of the air has not seriously changed and there is a well-planned mechanism to maintain a suitable supply.

Carbon dioxide deserves further consideration in view of its importance in a number of ways. Its solubility in water is one outstanding property. We have already noticed how it pervades the surface of the earth by its universal presence in the atmosphere. This pervasiveness is greatly extended by its solubility in water so that not only is carbon dioxide present in all the atmosphere but it is also in practically all waters. Its solubility coefficient in water is intermediate in magnitude. It is about 35 times as great as that of oxygen but only one-fortieth of that for sulphur dioxide and still less than that for ammonia. This is not unimportant because with gases the amount dissolved in a liquid varies with the concentration of the particular gas in

equilibrium. The relatively high coefficient allows appreciable carbon dioxide to dissolve in waters even though the concentration in the atmosphere is only 0.03 per cent. On the other hand, its coefficient is not too high, as for ammonia, or the atmosphere would be stripped of practically all the carbon dioxide. But with an intermediate solubility it can under different conditions be absorbed or evolved from aqueous media without undue concentrations or too severe conditions being necessary. This is highly important for physiological processes. The three pounds, or so, that an average man produces per day must be got rid of. This can be done because carbon dioxide is readily dissolved in the blood and then readily given off again in the lungs. For this process alone it is evident that it is at least very advantageous that carbon dioxide is a gas and that it has a moderate solubility in water.

The nature of the solution formed when carbon dioxide dissolves in water is also of great interest. As is well known, this solution is slightly acidic, carbonic acid. This acidic character greatly aids the dissolving power of water for many types of rock minerals. This is well illustrated by the so-called temporary hardness of many natural waters. In these, calcium carbonate is dissolved as the acid- or bi-carbonate by means of dissolved carbon dioxide. When such water is boiled the carbon dioxide is driven off to the atmosphere and the calcium carbonate can no longer be held in solution, but precipitates. Clearly such action is of major importance in the weathering of rocks. Though it has a comparatively powerful dissolving action in geological terms, yet carbonic acid is chemically speaking a weak acid. This is also of significance in its physiological action, particularly in what is called its buffer action.

This buffer action is the power possessed by solutions of carbonic acid and its salts to reduce changes in the acidity or alkalinity of such solutions when subject to changes in concentration or additions of other chemicals. An example as given by Professor L. J. Henderson will illustrate this.<sup>18</sup> We start with a solution of 1 kilogram of carbon dioxide in 100 kilograms of water. This has a mild acidity which we can represent by the factor 1000, this being the number of times the hydrogen ion concentration is greater than that of pure water. Equivalent acidity would be produced by dissolving about one-third of a gram of hydrochloric acid in the same quantity of water. If now

caustic soda is added to the carbonic acid solution, even as much as 700 grams will only just bring the acidity to a little less than that of pure water. Adding the soda to the hydrochloric acid half a gram would have more effect, and correspondingly in pure water even a two-hundredth part of a gram would have a greater effect. If the carbonic acid solution is in equilibrium with the gas its buffer action is still stronger. Now many chemical reactions in solution, particularly those of the general type that occur in the processes of metabolism, are markedly affected or even regulated by the acidity or alkalinity of the solution in which they take place. This controlling action of carbon dioxide and its salts allows the body fluids to take up considerable quantities of different compounds, particularly such as acidic end-products of food stuffs, without any great change in their acidity. About the only other volatile acid that has a similar strength to carbonic acid is hydrogen sulphide. This, however, is altogether too unstable to function in this way. Carbon dioxide shares this important power with no other substance.

One other chemical feature about the atmosphere worth mentioning is the absence in it of any poisonous substance. As we are at present constituted, if the carbon dioxide content were increased to 10 per cent., animal life would be seriously upset, while at 25 per cent. death would ensue. But it is not so. In fact it has been said that air is the only substance entirely non-poisonous in that it is the only one of which unlimited amounts cause no harm.

The atmosphere serves other purposes also that evidence its design. One of these is its blanketing effect. In a general way it is clear that the atmosphere moderates the heat of the day and the cold of the night. As is well known, the temperature of the atmosphere decreases with increasing altitude fairly regularly, for about 6 miles in temperate latitudes, after which a constant temperature layer extending a further 12 or more miles is reached. The temperature of this is about  $-50^{\circ}$  C. All vertical convection takes place within the lower atmosphere and this portion is largely responsible for the temperature regulating effects.

Actually the absorption of radiation by the air is mainly due to its moisture content and in lesser degrees to ozone, dust, and carbon dioxide. However, although these substances absorb effectively in a region of the sun's radiation where the energy

transmitted is appreciable, they are transparent over a very considerable region, corresponding to roughly one half of the total energy. Were they absorbent to all, the temperature at the earth's surface would be much lower and darkness would reign. Further, when the transmitted radiation reaches the earth's surface it is absorbed and the balancing energy leaving the earth as radiation is of much greater average wavelength. This is to a far greater degree absorbed by the water vapour, etc., so producing a very marked greenhouse effect. These absorption phenomena are at the basis of the vertical temperature gradient previously mentioned, and this in turn is the main ultimate cause of wind, whose effects on rainfall distribution and temperature are patent to all, and clearly necessary for any widespread distribution of life. The limit to this temperature gradient at the boundary of the stratosphere is fixed where the air reaches a temperature such that its absorption and emission of radiation are equal. This again links up with climate and weather.

Another interesting feature in connection with the sun's radiation is the effect of ozone. In the upper air some 15 miles high there is a significant amount of this element. It is formed from the ordinary oxygen by absorption of certain parts of the sun's radiation and it is sufficient to remove from the radiation received on the earth practically all the ultra violet with wavelength below 2,885 Ångström units. The stability of this ozone depends on the dry low temperature conditions in the stratosphere, and it has been estimated on the average to amount in all to the equivalent of something like one-eighth of an inch at normal pressure. It is said that were this amount considerably greater there would be such a reduction in ultra violet light on the earth that bacteria would multiply to a most dangerous degree for higher life. On the other hand, were it much less, then this radiation would be positively harmful to human beings. We saw before that the total oxygen of the air is an almost infinitesimal proportion of the whole, and now we find that our present organised life is dependent on a further tiny fraction of this existing in a particular modification. It scarcely looks like chance.

Before leaving this part of our subject it may be worth mentioning the ability of the atmosphere to transmit sound. This depends mainly upon its elasticity. Though perhaps not so essential to life as some other properties it is not beyond the range of beneficent design for man's fuller life.

We now turn to a brief review of the hydrosphere, the part of the earth's surface existing in the liquid state. By far the greater part of this is the ocean, which covers some five-eighths of the whole surface of the earth and has been estimated to contain well over 300 million cubic miles of water, each cubic mile containing some 4,000,000,000 tons. Dissolved in the ocean there are many different salts which need not occupy us at present except to notice that if separated they would occupy a solid mass over 4,800,000 cubic miles. In comparison with the ocean, the quantity of water in rivers and lakes is almost negligible, but its importance is not in this proportion by any means.

That water is necessary to life is well known and is emphasized by the large proportion of combined water in animals and plants, for example, fish contain about 80 per cent. ; the human body, 70 per cent. ; ordinary land plants, 50 to 75 per cent. ; and aquatic plants, 95 to 99 per cent. Many rocks also contain very considerable amounts of combined water ; in fact, it has been estimated that three quarters of the surface material on the earth's crust is water. Of course, not all this is properly part of the hydrosphere, but a mention of it may not be out of place at this point. It will also be necessary for us to consider in this general connection the behaviour of water in the atmosphere. These introductory remarks about water will serve to remind us of its unique place, as has been recognised from antiquity, and by way of showing in more detail some of its chief properties we will outline the vast movement of nature known as the water cycle.

The general recognition of this goes back at least as far as the writing of the book of Ecclesiastes where we read that " all the rivers run into the sea ; yet the sea is not full ; unto the place from whence the rivers come, thither they return again."<sup>19</sup> Perhaps the writer did not at the time know much of the many and varied factors that come into play in the circulation so briefly described, but we can to-day set out sufficient of these at least to show the hand of the Great Designer at work.

For the immediate requirements of life on land the water of the ocean must undergo a twofold change. It must be purified, that is, separated from its dissolved salts, and it must be distributed over the land surface. The first step to accomplish these ends is evaporation, which has been estimated to be about 7.5 feet per year at the equator. Heat from the sun, either



directly or indirectly, supplies the energy needed to bring about this evaporation. The amount of the evaporation is dependent on a variety of factors. One of the most obvious is the area of water exposed. Suppose, for example, that the relative areas of ocean and land on the earth's surface had been reversed, then the average rainfall would only have been about one-third of what it is. There may be more than poetry in the words of the ancient prophet, "Who hath measured the waters . . . and comprehended the dust of the earth in a measure."<sup>20</sup> Another important factor in connection with this evaporation is the removal of the water vapour from the air immediately above the ocean. This is brought about partly by diffusion, but the process is greatly accelerated by the wind (basically dependent on radiation and absorption as we have just seen) and by the lightness of water vapour causing it to rise in air. The lightness or low specific gravity of water vapour (about 62 per cent. of air) is quite remarkable. Liquid water is relatively heavy, yet water vapour is lighter than any other gas or vapour with the exception of a very few such as hydrogen, helium, ammonia and methane, and some quite uncommon vapours at high temperatures.

This evaporation of course is the method whereby the water is purified, and depends on the simple fact that water is volatile while the salts of the ocean are not. This is a simple fact, but why it should be so other than by design is not so simple. Mercury, for instance, one of the few other naturally occurring liquids beside water, although at ordinary temperatures it is considerably further from its freezing point than water, has an entirely negligible volatility as compared with water. In fact water is almost the only naturally occurring substance which is found on the earth in the three forms, solid, liquid, and vapour. At the moment the important feature is that the liquid has under ordinary conditions on the earth a relatively high vapour pressure or volatility. Even from the solid appreciable evaporation also takes place.

The water vapour rising by virtue of its low density and carried by winds and convection currents reaches upper levels where the lower temperature causes condensation. This has been previously explained, but it may be worth mentioning that it is by no means obvious that upper levels should be colder. In any of our buildings the air is warmer at the ceiling and in the upper stratosphere there is a wide zone where the temperature rises

with increasing altitude. The fact that we may have what we call a scientific explanation as to why the temperature of the troposphere decreases with altitude does not detract from the reasonableness of the belief that this is a designed feature in view of bringing about among other benefits the condensation of water vapour. The quantity of water condensed by any given drop in temperature is dependent on the change in vapour pressure or vaporization. At the temperatures prevailing, the change in vapour pressure of water is remarkably high, thus aiding the processes resulting in dew and rain.

Condensation of water vapour also depends on the presence in the air of a multitude of dust particles to serve as nuclei for the formation of drops of water or crystals of ice, otherwise precipitation would occur in the form of catastrophic cloudbursts.

Distributed by wind as we have seen, the water is brought to the different parts of the earth's surface as rain and snow. Lower temperatures in the upper air tend to bring heavier precipitation on mountains from whence the water drains to lower levels with obvious benefit. The cold of high altitudes whereby the water is stored as snow to be gradually melted and flow down is also connected with the same general group of phenomena. A small fraction of the total precipitation is fixed in the earth, but for the most part it either runs off, percolates through the earth and by springs and rivers reaches the sea again, or is evaporated either directly or after use in living organisms.

A few data, estimates of Sir John Murray and others, may be of interest to show the magnitude of the circulation involved. The total average annual rainfall on all land is 29,347 cubic miles of water, of which 6,524 cubic miles drain off to the sea. The area of land so drained is 40 million square miles and the dissolved matter taken to the sea by this drainage is some 2,500 million tons per year, equivalent to the lowering of the land surface by one foot in 30,000 years. That this quantity of material is dissolved is confirmation of the remarkable solvent powers of water particularly aided, in the case of mineral matter, by carbon dioxide. Of this, rain has been reported to contain 0.0013 per cent., and more is added to streams from decaying organic matter and other sources. Of the total solids in the water of the chief rivers of Europe about 60 per cent. is said to be calcium bicarbonate. The total quantity of sodium chloride carried to the ocean annually is about 160 million tons at the present time.<sup>13</sup>

In connection with this dissolving action of water it should be noted that it is done without chemical action. Other chemicals we know of would, in equal quantities, dissolve more minerals, but they would be used up in the process so that the action could not be continuous. With water, however, the action is one of ordinary solution and the water is completely recoverable by evaporation to be used over again. The same is true, to a large extent at least, in the case of carbon dioxide. Here, although there is definite chemical action, yet by virtue of its volatility much of the carbon dioxide is liberated to the atmosphere again to be re-absorbed in rain.

The ocean has other valuable functions besides serving as a source of water. One of these of considerable importance is temperature regulation. This is of particular interest because it depends for its effectiveness on a number of remarkable properties of water.

The ocean shows constancy of temperature to a great degree. Its surface in open waters never goes above  $15^{\circ}$  C. and in the great depths the range is from  $-2^{\circ}$  near the poles to  $2^{\circ}$  C. at the tropics. Needless to say, this constancy is of great importance in reducing temperature changes on land surfaces. It is maintained in the first place by the high heat capacity of water. With the single exception of ammonia, which at normal temperatures has a heat capacity about 10 per cent. greater, water has the highest specific heat of any known substance. This means that a comparatively large quantity of heat is required to change the temperature of water, perhaps four times the average required for other substances.

As heat is added, however, the temperature does rise to some extent, but this rise is much reduced, in conditions prevailing in nature, by evaporation. This of course absorbs heat as in the case of all substances. In passing it may be noted that this universal phenomenon of absorption of heat when passing from the solid to the liquid or the liquid to the vapour state may in itself be taken as an evidence of design in the stability it confers on the different states of matter as well as in other ways. With water, however, the general phenomenon becomes something unique, because water has an unusually high vapour pressure at temperatures proportionately near its freezing point, because it has an usually high rate of increase of vapour pressure so that the heat absorption rapidly increases as temperature rises, and

particularly, because it has, by a very considerable margin, the highest heat of evaporation of any known substance. It is easy to see how these properties, most certainly unique in their combination, reduce the rise in temperature that would otherwise occur when water is subject to heat from the sun or other sources. Of lesser importance but still an aid is water's degree of transparency to the sun's radiation whereby all the heat is not concentrated in the surface.

When water is subjected to loss of heat similar phenomena come into play. Clearly the high specific heat and the falling vapour pressure will tend to retard the cooling, but eventually the freezing point may be reached. Now water has a remarkably high freezing point, perhaps  $100^{\circ}$  C. higher than the average of other chemical substances of comparable structure. This fact is particularly important for living organisms because, as the temperature falls, the chemical processes on which life depends become more and more sluggish. If water froze at the same temperature as hydrogen sulphide, for example ( $-83^{\circ}$  C.), it is almost certain that processes of life would be entirely suspended even if death did not ensue before any actual freezing took place. At least the effects on aquatic life would be most serious. When the freezing point is reached, further loss of heat does not lower the temperature, but the change of state to the solid, ice, occurs. Again water is remarkable. It has the highest latent heat of fusion of any substance except ammonia and a few alkali salts.

The high heat capacity of the ocean is also important in the formation and maintenance of the ocean currents and in the origination of winds. The relatively high heat conductivity of water as compared with other non-metallic liquids also aids in equalizing temperatures. Altogether a most remarkable group of phenomena combine to make the vast body of water of the ocean an effective temperature regulator.

The ocean also has a regulatory action in connection with the carbon dioxide in the air. The quantity of carbon dioxide dissolved in the ocean is over twenty times as much as in the atmosphere. There is a circulation between the two, the colder parts of the sea removing some from the atmosphere and the warmer parts restoring some. Perhaps there is a net withdrawal from the air in this process, linked with the dissolution of calcium carbonate, but this is not at all marked and certainly

the ocean does help to maintain a suitable carbon dioxide concentration in the air.

The ocean and other waters also dissolve oxygen and nitrogen from the air. The former is of importance for the oxidation of dead organic matter and the maintenance of life of marine organisms. In this connection it is interesting to notice that although the air contains only one-fourth as much oxygen as nitrogen, a given quantity of water will dissolve from the air about one-half as much oxygen as nitrogen. In other words, the relative solubilities of these gases in waters is such as is to the advantage of living organisms. The solubility of carbon dioxide was previously discussed and it may further be pointed out that if oxygen had a solubility in water as great as that of carbon dioxide depletion of the oxygen content of the air would take place to a serious extent. Actually, the amount of oxygen dissolved in the ocean is about one and one-half per cent. of the oxygen in the atmosphere.

Other qualities of the ocean of importance to marine life are its salinity and alkalinity. There are slight variations in salinity from place to place, but the relative concentrations of the different salts are remarkably constant. Chlorine, for example, is always very close to 55 per cent. of all the dissolved substances, even though the total concentration of salts varies from about 3 per cent. to about 4 per cent. It appears that physiologically the relative quantities of the various salts in sea water is quite important. It has been shown that single salts, and various other combinations of salts are definitely toxic to fish, but that sea water has such amounts of chlorides, sulphates, and carbonates of sodium, potassium, calcium, and magnesium and other constituents as form a balanced solution most suited for marine life. Of equal importance is the faint alkalinity of the ocean, which is variable only to a very small degree. This is important, because changes would have great effects on processes of metabolism. While it may be argued with some reason that the living organisms could have been adapted to other types of solution, this much is apparent, that the solution we find in the sea is very suitable and that its relative invariance is certainly essential.

Another unique property of water that is of great importance in natural waters other than the ocean is its anomalous behaviour on cooling. As water is cooled it first contracts in volume and so becomes denser as do all other substances. The result of this

is that normally the coldest part of a body of water is at the bottom. However,  $4^{\circ}$  C. before reaching the freezing point, water ceases to contract and starts to expand again on further cooling. No other known substance behaves in this way. Below  $4^{\circ}$  therefore the coldest water is at the surface, and when freezing takes place it starts on the surface. As the ice formed is less dense than water it remains on the surface, forming a protective covering that reduces the rate of further cooling. If these changes in density did not occur freezing would start at the bottom of lakes and streams and would proceed until in the winter in many parts of the world the whole body of fresh water would be frozen solid. In many parts the heat of the summer would be insufficient to completely thaw the ice so that serious restrictions to life would result.

Still another property in which water is unusual is its high surface tension. It has a considerably higher surface tension than any other common liquid except mercury. This is of value in that water will rise by surface tension about 4 or 5 feet in ordinary soils as compared with 2 or 3 feet that other liquids would rise. Mercury, even though it has a higher surface tension, would not rise in this medium but would be depressed. It is highly probable that the surface tension of water is also of benefit in this way in the movement of water in living organisms. It certainly is of importance in adsorption. According to Gibbs' rule, if the solution of a substance in a liquid has a lower surface tension than the pure liquid then the dissolved substance tends to accumulate at the surface of the liquid. The reverse is true if the substance dissolved increases the surface tension. By virtue of its high surface tension water is peculiarly fitted to show this effect, and the resulting adsorptions on the greatly extended surfaces in living matter are of no small importance.

Once again, water is outstanding in its dielectric constant ; it is amongst the highest known for liquids. It would be beyond the scope of this paper to go into this matter in detail, but it may suffice to say that the dielectric constant is a measure of a property of a medium on which depends the force of electrostatic attraction through the medium. A high dielectric constant reduces the force of attraction, and in the case of a solvent it thereby increases the ionisation of an electrolyte dissolved therein. An electrolyte is a substance which has the power of conducting an electric current when dissolved, and this is done by its ionisation. This latter phenomenon is a more or less complete dissociation of the

dissolved substance into two or more types of particle called ions, in the solution. These ions are of two kinds, having respectively positive and negative electrical charges. Upon them depend all electrical phenomenon in solutions and many processes, particularly connected with colloids in living organisms, as has been demonstrated by J. Loeb and many other physiologists. Water is again seen to have properties peculiarly fitted for the all-important part it has to play.

Perhaps one or two other properties of water more in the chemical line will be all that space will allow of mentioning at present. It has been shown that a great many chemical reactions will not take place at all except in the presence of a trace of water. For example, when dried with the powerful chemical agents now available, hydrogen and oxygen gases will not combine even when heated to  $1000^{\circ}$  C. Similarly sulphur, carbon, or phosphorus will not burn in perfectly dry oxygen. A great many other instances of this are known so that water is necessary not only when it is obviously used as in biochemical processes but also when it is present in such minute amounts as to be ordinarily unnoticed.

Water enters more directly into a class of chemical reactions known as hydrolysis. These are of major importance in biology and can be so used because they take place with very slight energy changes and because they are reversible.

Before leaving the subject of water it should also be pointed out that the same properties of water that aid in keeping the ocean temperature comparatively uniform are also operative to the same end in animals, except that the properties connected with freezing do not function. Thus water is fitted to be a major constituent of animal bodies in order that temperature changes may be kept at a minimum and particularly that exertion may not cause too high a rise. Temperature needs to be relatively constant in animals because the rates of the chemical processes of metabolism are dependent upon it.

Evidently water, the fundamental constituent of the hydrosphere, has been designed to fill a place that no other known substance could occupy.

We now turn to the last of the three divisions under which we are considering the earth, the lithosphere. In the first place, we may ask why there should be this solid matter at all. It is fairly evident that active life is impossible in an entirely gaseous region, and that severe limitations would be imposed in an

entirely liquid region. This is confirmed in that very few creatures could live in a shoreless ocean. It is also more obvious that civilized human life is dependent in many ways on the existence of the solid crust of the earth. The mention of the appearing of dry land even before fishes in the account of Genesis I is of interest in this connection.

The solid state of the earth's crust is dependent upon its relatively low temperature, and it may be presumed that cooling has taken place allowing this solidification. The rate of cooling and the time elapsed since the solid crust formed have been the subjects of considerable study and speculation. It appears at present that radioactive matter provides a continuous supply of heat that is of no little importance in this connection. Thus if the total quantity of radioactive matter had been much greater, cooling would have stopped altogether, at least until all this matter had been spent. Also if the radioactive matter actually present had not been largely concentrated in the upper layers of the earth's surface as it is, then the depth of solid crust would have been much less with perhaps very serious consequences to living beings.<sup>21</sup>

We have previously mentioned the importance of the relative land and water surfaces of the earth, which is of course dependent to a large extent on the irregularities in the solid crust. These irregularities are important in other ways also. Of the dry land about 90 per cent. has an elevation less than 6,000 feet above sea level. This is all quite habitable as far as elevation is concerned. Further, of this same dry land about two-thirds is comparatively level, either plains or plateaus, obviously to the advantage of man. When it is considered that from the highest mountain peak to the lowest sea depth is only a vertical distance of twelve miles compared with the earth's diameter of nearly 8,000 miles design can be seen in what might otherwise look like the merest chance. On a globe reduced to the size of an orange a mountain range would be no more than a hair's breadth, only a surface roughness; but if the surface had been a little smoother or a little rougher what a difference it would have made to the earth as habitable! Other effects of land masses on climate and weather we pass over.

However, the dry land is more than so much solid matter of a given shape. It is not only a place on which man and animals can move about. It is the essential support of vegetation. Although it has been said that plant growth is, except for about



2 to 5 per cent. of its substance, the product of air, moisture and sunshine, it must be admitted that the 95 to 98 per cent. cannot exist without the 2 to 5 per cent. In other words, plants must have soil.

Soil must have in the first place a physical structure allowing the penetration of moisture and air to a sufficient depth for root development. This structure is due to weathering of rocks, particularly by the changes of temperature and the action of water. Climatic conditions, the expansion of water on freezing, the dissolving power of water, the effects of carbon dioxide and oxygen and other factors previously discussed all play their part in this work of soil formation.

From the chemical point of view it is also necessary that soils have neither too great an acidity nor too great an alkalinity. The buffer action of carbon dioxide plays a part in this. Besides all these there must be an available supply of the necessary nutrient elements. We have already spoken of the main four elements used in organic compounds, but many others are recognised as necessary to life. The more common ones are phosphorus, sulphur, chlorine, calcium, magnesium, sodium, potassium, and iron. Minor constituents also believed necessary in very small amounts include copper, boron, silicon, manganese, zinc, iodine, and fluorine; while many other elements seem necessary for certain species at least. For example, "bush sickness," a disease of sheep prevalent in New Zealand, was found to be due in part at least to the absence of cobalt in the feed, which in turn was due to a lack of this element in the soil. Only a very small quantity is needed, in fact too much would be poisonous. To what extent life would be possible without these minor elements is beyond present capabilities. Certainly many of them play a very important part and soil generally throughout the world is so constituted that as regards the soluble matter that directly affects plants a multitude of necessary elements is present in suitable, generally very small, amounts. Even soil shows beneficent design.

Space fails for other than brief mention of the main useful properties of the various minerals of the earth and the products that man has been able to contrive from them for his convenience and comfort. Nearly all the known elements have their uses to-day even though not essential, and doubtless new properties leading to new uses will be found in the future. But this is surely enough.

We have viewed the universe in its basic structure, the solar system with its component parts, the particular relations of the sun and the earth. We have counted the elements of which the earth is made and seen their different proportions. We have thought of radiation, of the atmosphere, of the ocean and streams flowing into it, of the solid crust of the earth. We have studied the chemical properties of oxygen, nitrogen, carbon, and hydrogen. We have found carbon dioxide and water, particularly the latter, to be well-nigh miraculous substances. We have dealt with traces of ozone in the stratosphere and with minute proportions of radioactive elements in the lithosphere. Looking back, we are not surprised that L. J. Henderson says "There is, in truth, not one chance in countless millions of millions that the many unique properties of carbon, hydrogen, and oxygen, and especially of their stable compounds water and carbonic acid, . . . should simultaneously occur in the three elements otherwise than through the operation of a natural law".<sup>18</sup> We have gone further in our range. We go further in our conclusion. We do not stop at natural law. We recognize beneficent design.

"Lo, these are parts of His ways : but how little a portion is heard of Him !"

Numbers in the text refer to the list below. Where direct references are not given, as in cases 9, 13, 14, 16, 18 and 21, the sources of information are named. In other cases support can be found in any modern text-books on Astronomy, Chemistry, and Physics for the statements made.

- <sup>1</sup> Proverbs viii, 31 ; Isaiah xlv, 18.
- <sup>2</sup> Genesis i, 30-31.
- <sup>3</sup> Job xxxviii, 41.
- <sup>4</sup> Job xxxix, 13.
- <sup>5</sup> Matthew x, 29.
- <sup>6</sup> Genesis i, 28.
- <sup>7</sup> Matthew x, 31.
- <sup>8</sup> Genesis iii, 17 ; Romans viii, 19-23.
- <sup>9</sup> "Physics of the Air," p. 29, Humphreys (1929).
- <sup>10</sup> "Nature," 16th May, 1936.
- <sup>11</sup> "Nature," 10th December, 1938, H. Spencer Jones.
- <sup>12</sup> "Transactions," Vol. 44, E. W. Maunder (1912).
- <sup>13</sup> "Data of Geochemistry," F. W. Clark (1920).
- <sup>14</sup> "Biology for Everyman," p. 915.
- <sup>15</sup> "Fixed Nitrogen," chap. II, H. Curtis (1932).
- <sup>16</sup> "Americana," article on Atmosphere (1937).
- <sup>17</sup> "Nature," 26th March, 1938.
- <sup>18</sup> "Fitness of the Environment," L. J. Henderson (1924).
- <sup>19</sup> Ecclesiastes i, 7.
- <sup>20</sup> Isaiah xl, 12.
- <sup>21</sup> "Encyclopædia Britannica," article on Earth (1937).

## DISCUSSION.

Rev. ARTHUR W. PAYNE, expressing his gratitude for the Gunning Prize Paper, said its devout and scriptural spirit would have been one that would have delighted the recently Home-called Mr. Sidney Collett. The reading of it and the summary of much of its contents was most admirable, and he thanked Dr. Palmer sincerely.

The general tone reminded him of probably the oldest book in the Bible, that of Job. It was well that the British Empire was represented in the Victoria Institute through this fine message of Dr. Sutherland, of British Columbia. It was indeed a day when knowledge was increasing in the earth.

The references to Beauty in inanimate Nature reminded one of the expression in the Greek for a "good" heart, which is "Kalos." "I am the Good Shepherd" is also the "Beautiful Shepherd." One thought of the colours of the High Priest's garments and of the Tabernacle structure, and the Stones of the Heavenly Jerusalem, and the multi-coloured stars in the night sky—indicative of Jehovah's love of beauty.

## WRITTEN COMMUNICATIONS.

Rev. Principal CURR wrote: Dr. Sutherland makes an excellent point when he observes that the overwhelming balance of the evidence furnished by the marvellous correspondence which exists between the maintenance and welfare of the human race and the general structure and behaviour of inanimate nature, is of such a kind that we must postulate a beneficent and intelligent origin to explain it. He does not argue that there are no difficulties associated with that phase of the argument from design, which he has discussed with such thoughtfulness and thoroughness. He frankly recognises that hailstorms, and tornadoes, and earthquakes can work awful havoc amongst the children of men, and yet he emphasises the great truth that these are exceptional. They only attract so much attention because these things happen so infrequently. Over against them it is necessary to set the one consideration that the world's population is steadily increasing. If conditions were intolerable, that would be most unlikely to happen. There is

ample evidence of the kind which the paper adduces in such abundance to undergird the unfailing optimism of the Bible, which finds such adequate expression in the famous words, "And God saw everything that He had made, and behold, it was very good" (Genesis i, 31). To use the language of commerce, the credit balance is still large enough to overshadow all that points in the opposite direction. The records of crimes and disasters to which the newspapers give such prominence are, after all has been said, so exceptional as to be quite abnormal. The ordinary march of man's affairs is so widespread that it is taken for granted. In the same way the occasional deviations of inanimate nature from its path seem matters of great magnitude, which they often are, but that is only because they are so unusual.

On the other hand, it is always well to bear in mind, as the paper implies, that, to the understanding which has been enlightened by celestial wisdom, inanimate nature wears a very different appearance from what it does to the savage who is the prey of superstitions of the most debasing type. To him the inanimate world is the abode of a multitude of malignant spirits whose one aim and object is to work him harm. Life is thus resolved into a long-drawn struggle with these supernatural forces and factors lurking in every bush and stone and stream. It is not co-operation with an immeasurably large and powerful as well as immeasurably beneficent system, as for the Christian, but endless wrestling with principalities and powers. Yet the evidence is the same. The wind which bloweth where it listeth may delight the disciple of the Lord Jesus Christ and terrify the animist. In that connection I recall a striking illustration used by Dr. John Kelman, a distinguished Edinburgh divine of a past generation. He was travelling on a liner off the coast of West Africa, when he saw a tropical thunderstorm bursting over the interior. In describing the scene, he remarks on the contrasted emotions which it would awaken in the minds of the aborigines and in those of his fellow-passengers—to the one, a savour of life unto life, and to the other a savour of death unto death. The explanation, of course, lay in the knowledge which Christian civilisation gives. Such instances could be multiplied indefinitely, and they illustrate the saying which has a close bearing on the

argument from design in inanimate nature, that the eye only sees what it brings with it to see.

Brigadier N. M. McLEOD wrote : I would like to raise one or two points in connection with certain statements made by the author.

1. *On page* he says : " All this motion is, of course, controlled by the sun through *gravitational forces*."

Should this not read " gravitational and electro-magnetic forces " ?

Gravity can only account for action in one direction, *i.e.*, towards the centre of gravity in direct opposition to centrifugal force.

The force which drives the Solar System and causes the rotation of the planetary bodies is surely an electro-magnetic force, whose mode of action is well described in modern books on electro-magnetism (*vide* " Cosmic Machinery," H. A. Staples).

2. *On page (concerning Venus)* : " It has been estimated that the surface temperature is above the boiling point of water."

This I understand is the orthodox opinion on the question ; but I venture to suggest that it should not be accepted without a further examination of the climatic effects to be looked for as the result of the very high angle of axial tilt and other known conditions :—

- (1) Axial tilt—about  $82^{\circ}$ .
- (2) Albedo— $\cdot 76$ , equal to that of " freshly-fallen snow."
- (3) No water, but heavy enveloping cloud of  $\text{CO}_2$ . Rapidly shifting markings, pointing to cloud movements.
- (4) Infra-red photo shows an almost completely white surface, but a greyish band at the equator.
- (5) No satellites.
- (6) Distance from the sun about three-quarters that of the earth's.

In estimating the surface temperature it would appear that the last condition has been given undue weight, whereas the really important factors are (1), (2), (4) and (5).

Let us consider these in turn :—

No. (1).—The tilt of the axis being the most important factor governing seasonal climatic changes, it is obvious that the tilt of  $82^{\circ}$  must cause the most extreme conditions of summer heat, provided the sun's rays are able to penetrate the thick cloud blanket, and of

winter cold. Condition No. (2) tells us that only about one-quarter of the sun's rays reaching the planet can penetrate even the surface of the cloud.

Now if only one-quarter of the rays can penetrate the surface, how much heat can penetrate through the cloud blanket (No. (3)) to the surface of the planet ?

No. (5).—There are no satellites to generate heat by friction.

Is it not much more likely that the surface is coated with solid  $\text{CO}_2$  over the arctic and antarctic regions, which extend to about  $8^\circ$  from the planet's equator ?

This would appear to be strongly confirmed by infra-red photos (No. (4)).

As regards the surface temperatures of the other planets, the same undue weight seems to be attached to their distance from the sun, and little consideration given to their axial tilts.

Taking, for example, Jupiter, of whose conditions the following is known :—

- (1) Axial tilt about  $2^\circ$ .
- (2) Albedo—not high.
- (3) Water or liquid surface as indicated by an Eastward Equatorial current too slow to be atmospheric. The known presence of a large excess of free hydrogen supports this indication.
- (4) Photo shows no ice caps.
- (5) Several satellites.
- (6) Relatively very distant from the sun.

The effects of these would be :—

Of (1).—Sun's rays reach every point on the surface every day. There is no winter ; in fact, no seasonal changes.

Of (2).—A high proportion of the sun's rays reaching the extensive surface of the planet are absorbed.

Of (5).—Planet receives heat from friction due to rotation of its numerous satellites, and it also becomes highly magnetised.

All these conditions, except (6), would tend to produce a warm or temperate climate.

There seems to be no evidence to support the assumption of extreme cold on Jupiter.

W. T. MARSHALL, Esq., B.Sc., Ph.D., wrote: The words "I believe in God, maker of all things, visible and invisible," are familiar to all, but the "Argument from Design" is generally only applied to "things visible." The beauty of a flower tells of a master hand behind its creation, but Dr. Sutherland, in his very excellent paper, has shown that the same master hand is behind "things invisible." The following interesting points occurred to me on reading it through:

1. The devastating forces of Nature, such as earthquakes, while presenting a problem difficult to explain in the light of beneficent design, give, to my mind, her equivalent of the judgment of God: "Behold the goodness and severity of God."

2. Dr. Sutherland points out that the universe must be designed on a basis of law and order, and that materials must obey certain fundamental laws. He also mentions briefly the structure of the atom, which, as far as we know at present, is a fine example of law and order. The simple atomic weights, the constant valencies, etc., show a beauty and a simplicity which, to my mind, is a strong argument in favour of beneficent design. If animate nature shows such design, then it follows that the atom, of which all substances are made, must be similarly designed, for one cannot conceive of the whole being perfect unless the component parts are perfect also.

3. Generally Dr. Sutherland has pointed out how perfectly balanced inanimate nature is, and how a small percentage difference would make life as we know it impossible. It is to be regretted, therefore, that in his remarks on the effect of the distance from the sun on life he finds it necessary to allow for a 50 per cent. alteration.

In conclusion, I should like to congratulate Dr. Sutherland on his very useful and interesting paper.

Dr. R. E. D. CLARK wrote: Evidences of design in the inorganic world are exceedingly remarkable, of that there can be no shadow of doubt. Yet in attempting to explain them to the layman, scientists are sometimes apt to give a rather wrong impression. If it could be shown that some remarkable purpose was served if a certain algebraic quantity  $x$  was equal to 7, it might certainly be

urged as an evidence of design. Nevertheless, anyone putting forward this argument would in no way strengthen his case if he urged that  $2x = 14$ ;  $3x = 21$ , etc., were also remarkable features.

In algebra such a mistake would deceive no one, but in science the mistake may be only too easily overlooked, because it is not always immediately apparent. Yet there surely can be little doubt that some of the instances of design quoted by Dr. Sutherland in his otherwise excellent paper are of this character.

If carbon dioxide is moderately soluble in water to give carbonic acid, and if both calcium carbonate and bicarbonate can be made from the solution, it follows at once that carbonic acid will exert a buffering action—nothing else could be expected. This is certainly no new instance of design, as Dr. Sutherland seems to suggest. Similarly, the mere fact that the atmosphere is made of matter ensures that it will transmit sound; so do all gases, liquids and solids. Again, granted that water possesses some wonderful properties, we may trace many of them to the fact that near the freezing point water molecules are associated, while the resulting large molecules break up before the liquid boils. The fact that the vapour pressure of water rises rapidly with temperature, that the vapour is lighter than air, that water melts at a remarkably high temperature, etc., follow at once from this simple fact, while several other properties are also obviously connected with association. No doubt God, in planning the world, worked out the numerous consequences which would follow if the  $H_2O$  molecule were to combine with itself, and designed Nature so that, on the whole, this association would result in enormous advantages. The association is certainly most remarkable and, in view of analogies with other elements, completely unexpected. But to quote the properties of water as if they were *separately* designed is surely misleading. It can only be justified if we urge that the laws governing the inter-relation of the properties of all substances were specially designed in order that they might apply to water. The inter-relations are so remarkable that, unlikely as it seems, this is a *possible* theory; but it is not what Dr. Sutherland has urged.

The danger of making lists of supposedly designed properties of water, etc., is all the more apparent when we consider its effect



upon the general public. A good deal of thoughtless "rationalist" propaganda really amounts to this: if God designed all these properties separately, why did He not do so more carefully? Why did He not design the earth so that it should not quake, and why did he not make deuterium common and hydrogen rare (for in *some* respects "heavy water" seems even better designed for life than ordinary water)? Again, if it is really true that water was designed to have a maximum density at 4° C., how is it that this property disappears in the case of salt water, seeing that salt water is so much more abundant than fresh water on the earth's surface? Such questions are bound to raise serious problems so long as Christians forget that inanimate nature is connected by physical laws, and that as a consequence a major advantage may necessarily involve a minor disadvantage, just as the fact that a wheel possessing a circular form precludes it from being square.

As Dr. Sutherland has pointed out, much evidence of inanimate design is to be found in astronomy, geo-physics, and the fundamental properties of the chemical elements. Perhaps there can be no more startling way of presenting this fact than by considering the first nine simplest elements of the periodic system. Of these, four (*hydrogen, helium, carbon, oxygen*) are common in the universe as a whole, and the rest are rare. On the earth's surface, however, *hydrogen, carbon, nitrogen* and *oxygen* are common, while helium and the other elements are rare. Of the nine elements, those possessing properties which seem to be designed for the needs of living organisms are *hydrogen, carbon, nitrogen* and *oxygen* alone, the very same elements which are plentiful on the earth's surface. This, surely, is a most remarkable fact.

#### AUTHOR'S REPLY.

Before dealing with the discussion on this paper, I should like to take this opportunity of expressing my gratitude to the Council for their award of the Gunning prize. At the same time, my regret is that circumstances prevented me from being present in person to deliver the paper. The pleasure of attending some meetings of the Institute will have to remain one that I anticipate until better

conditions prevail in the political world. I also wish to thank Dr. Palmer for his kindness in summarising and reading the paper for me.

On the comments of Rev. Arthur W. Payne and Rev. Principal Curr I need say nothing, except to thank the authors for their interesting and appreciative remarks.

In connection with Brigadier McLeod's discussion, I am happy to accept his correction, inserting "electro-magnetic" in the description of forces controlling planetary motion. As regards surface conditions on the various planets, his points are very interesting, and seem to suggest that the orthodox views need revision. For the purpose of my paper I used what I believed to be the generally accepted opinions, seeking to avoid issues which might divert from the main line of argument. In any event, it seems safe to conclude that neither Venus nor Jupiter is suitable for life. The argument in this connection is unaffected.

Thanks are also due to Dr. Marshall for his helpful notes. In connection with his last comment I may point out further, that, assuming the ordinary laws of radiation to apply, the distance from the sun does not seem to be a very critical factor in regulating conditions on the earth. It should be remembered that the ellipticity of the earth's orbit is such that our distance from the sun varies from about 91 million miles on January 1st to about 94 million miles on July 3rd each year, in itself an appreciable amount. According to the simple radiation formula as explained in the essay, it thus seems necessary to consider rather large proportional changes, but these are not so great when compared to the distances of other planets.

Dr. Clark has raised difficulties which deserve careful consideration, and warrant a rather lengthy discussion. The main feature of his position that leads to his criticism seems to be that he believes that God was limited in the design of the universe by what we call natural laws, so that He could not make an earth that would not quake, nor salt water that would show a maximum density some degrees above the freezing point, nor the universe generally without what appear to us to be disadvantages. Perhaps Dr. Clark would prefer to say that God designed the natural laws from which, in the main,

beneficial results followed, but which also resulted in inevitable disadvantages.

I cannot agree with this, because what we call natural laws are not laws with any inherent necessity, but are merely summary expressions or generalised descriptions of observed phenomena. It is well recognised that these laws have to be revised and modified from time to time as more extended and more accurate observations are made. Pearson, in discussing the omnipotence of God (Exposition of the Creed), observes truly that "whatsoever implieth a contradiction is impossible, and therefore is not within the object of the power of God." Clearly twice seven can be nothing but fourteen, or seven is sometimes not seven. It is beyond the power of God to make it anything else. Similarly, a circular wheel by very definition cannot at the same time be square, though it is quite possible to suppose a wheel to have certain advantages of both forms; but it cannot have both forms. It is, however, quite a different matter to claim any such necessity for natural laws.

A further objection to Dr. Clark's view is that, according to it, the elements of design have to be varied as scientific theory varies. Presumably Dr. Clark would describe evidence of design in water in terms of a remarkable association from which certain advantageous properties inevitably followed. Later scientific theory might be more advanced, and we would have to say that the elements hydrogen and oxygen were designed with a view to certain chemical reactions, and that the properties of the elements were such that liquid water must, by physical law, show association from which in turn its unusual physical properties must follow. Later still, all evidence of design might be found in the electron and other "original" particles. Once given these, the universe, with its advantages and disadvantages, would be inevitable. God Himself could do nothing to change it. The very interesting evidence of design Dr. Clark gives in his last paragraph would, with the rest, cease to have any significance.

In writing the essay I tried to limit myself to statements of observable facts. That water has a maximum density at 4°, that its vapour has a certain low density, etc., are directly observable facts that no one can deny. These properties separately considered are unusual, if not unique, and considered collectively are certainly unique. The usual way of making these unique properties consistent

with more normal liquids is to assume a certain changing association of the molecules. But this association, while very probable, is not an observable fact, and its relations with the physical properties are not necessary, though we are able to fit them into an order which we designate "law."

Incidentally the fact that sea water does not show the anomalous density change is not an evidence of lack or failure of design. The large bodies of salt water are not in danger of freezing from the bottom up because of other factors. Hence there is not the same necessity for the special regulation as in the case of fresh water.

Similarly, in describing the buffering action of carbon dioxide, it was sought to show how the weak acid formed on solution in water has a remarkably effective action in the processes of metabolism, as well as the previously described geo-chemical action. A chemist would no doubt expect that carbonic acid would show buffer action if given a list of its chemical and physical properties, but to the more general reader such a list would not show beneficent design. Even though it is true, as Dr. Clark says, that, knowing certain properties of carbon dioxide, this action would be expected, it still remains true that no other known substance could replace carbon dioxide for this purpose. The properties of carbon dioxide thus show design as remarkably adapted to the needs of animal life and the requirements of geo-chemistry.

Again, although gases, liquids, and solids generally transmit sound, not all do so to the extent that the atmosphere does, which makes the property a useful one. Rarified gases do not transmit sound appreciably.

Dr. Clark further objects to the listing of properties which seem to show design on the ground that these are only significant if God designed them separately. I am not prepared to say whether they were designed separately or not. It is definite, at least, that with all their various effects they were known to God from the beginning, and the fact that we afterwards observe apparent connections between different properties by no means proves that there was such a connection in the original design.

Although seeking to answer his objections, I wish to make it plain that I appreciate Dr. Clark's criticisms and the spirit in which they were made. I am happy to have them appended to the essay.

## 844TH ORDINARY GENERAL MEETING.

HEL IN COMMITTEE ROOM 19, LIVINGSTONE HOUSE,  
BROADWAY, S.W.1, ON MONDAY, MAY 26TH, 1941,  
AT 5 P.M.

MR. L. C. W. BONACINA, F.R.G.S., VICE-PRES. R.MET.S., IN  
THE CHAIR.

The Minutes of the previous meeting were read, confirmed and signed.

The CHAIRMAN then called on Miss C. M. Botley, R.R.A.S., F.R.Met.S., to read her Paper entitled "Climate and Weather in the Bible."

The Meeting was thrown open to discussion in which the following took part: Group Captain P. J. Wiseman, Colonel Molony, Dr. F. J. W. Whipple, Mr. F. E. Carruthers, Mr. Derek Schove and Mrs. Walter Maunder.

Written communications were received from the Rev. J. H. J. Barker, Dr. C. E. P. Brooks and Rev. Principal H. S. Curr.

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### *CLIMATE AND WEATHER IN THE BIBLE.*

By CICELY M. BOTLEY, F.R.A.S., F.R.Met. S.

**F**OUR centuries ago it was said that to many the city of Rome was "dearer, sweeter, and more beneficent than their own fatherland." Hyperbole may be, but expressive of the special regard in which some of us, without prejudice to other loyalties, hold the lands of the Bible, and which makes every detail about them of interest.

There is more than sentiment about this interest. That the Scriptures were inspired by God is not to be doubted. But since the message came through men it became strongly coloured by their environment, therefore any knowledge of such environment is of value.

One of the most outstanding features in any environment are those atmospheric conditions called weather and climate, and full comprehension of many allusions, indeed happenings, in the Bible is not possible without some knowledge, not only of actual

climatic conditions but of the ancient Hebrew ideas concerning them.

To take actual conditions first. Now it happens that the Bible was compiled in what Sir Napier Shaw calls "one of the most curious regions of the world from the point of view of weather and climate."<sup>1</sup> There is much desert—partly the "barren and thirsty land where no water is" of the Psalmist—and partly arid land made fertile by great rivers and careful irrigation. In contrast to this (cf. Deut. xi, 10) are lands which "drink water of the rain of heaven." Everywhere conditions are strongly seasonal; both Nile and Euphrates rise and fall, the rains come "in due season." Winter and summer are the two seasons (Gen. viii, 22) and are strongly contrasted. Amos mentions that the rich had winter and summer houses (iii, 15). The reason is, that unlike that of Britain, where local conditions act as a mask, the climate of Bible Lands shows clearly the rhythm of the atmospheric circulation.

In summer conditions are simple (Fig. 1). Atmospheric pressure is very low over S.W. Asia and N.E. Africa. Over the Sudan the flow of air is ultimately from the ocean (probably the Atlantic), and yields the rains which are the source of the Nile flood. Over Palestine and its neighbourhood, however, the air currents are northerly and dry. From June to September scarcely a drop of rain falls. Except in irrigated land vegetation withers and "the noise of a flame of fire that devoureth the stubble" is a familiar sound (Joel ii, 5). Fire breaks out easily in the dry scrub and spreads with fearful rapidity (cf. metaphors Is. ix, 8. Amos vii, 4, etc.). Over the heated ground whirlwinds develop and carry up sand and dust to great heights (cf. "pillars of smoke," Joel ii, 30). From a cloudless sky the sun blazes down; as Ben Sira says, "at noontide he scorseth (lit. "causethe to boil") the world." (Eccles. xliii, 3, Hebr.). It is not surprising then that popular superstition created a noontide demon, to whom Dr. Theodor H. Gaster<sup>2</sup> finds references in "the spoiler at noonday" of Jer. xv, 8, and in "the destruction that wasteth at noonday" of Ps. xci, 6. Indeed, the LXX version of this actually reads "destruction and the demon of noon" while the Vulgate has "daemonio meridiano."

There is one recorded case of sunstroke in Scripture, that of the Shunammite's son (2 Kings iv, 19).

The heat is dry and therefore more bearable than if the air

were moister and perspiration less free. But the loss of bodily fluid conduces to thirst, hence the frequent allusions to this, both actually (ii Cor. xi, 27) and metaphorically (Ps. xlii, 1, lxiii, 1).

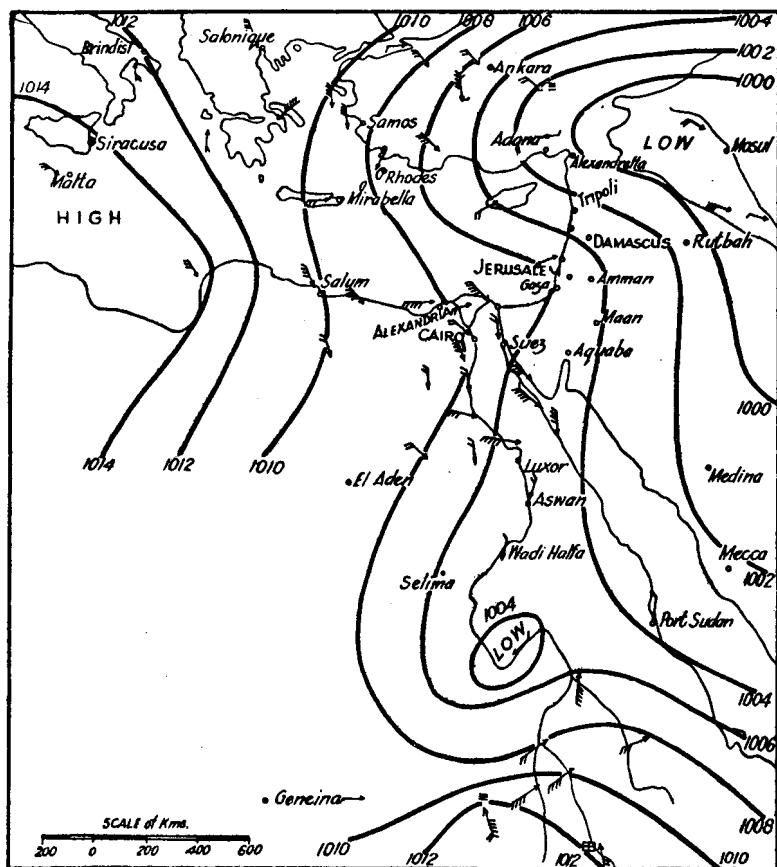


FIG. 1.—Pressure and winds at 8 h., 28.7.1934. *Prevailing summer type.*

In the heat streams and rivers shrink to a trickle or vanish altogether; no wonder Zechariah's vision of an ideal Palestine included perennial streams, "in summer and in winter shall it be" (xiv, 8).

“ But the healing of all things is the dropping from the clouds the dew which speedily refresheth the parched ground ” (Eccles. xliii, 22, Heb.). During the summer from late afternoon till early morning a “ cloud of dew ” (Is. xviii, 10) hangs over the high ground, formed by the forced ascent of moist air brought inland by the daily sea-breeze. The cloud is soon dissipated by the sun (Hos. vi, 4), but not before it has brought refreshment, and the occasional failure of the dew (as happened in July, 1916) means great hardship. It was in the absence of dew as well as of rain and the consequent utter barrenness that lay the terror of Elijah’s drought (1 Kings, xvii, 1) and the force of David’s curse on Gilboa (II Sam. i, 21).

As the year wears on the atmospheric situation changes. The Asiatic low pressure and its associated winds die away, and an Atlantic-Mediterranean circulation takes its place. Depressions from the Atlantic with their rain and wind begin to invade the Mediterranean which becomes stormy (Fig. 2). From Acts xxviii, 9, we learn that sailing was considered dangerous after the fast of the Day of Atonement 10 Tisri (September-October). On that day, too, the high priest prayed for rain; eleven days later, on the 7th day of Tabernacles, “ the great day of the feast ” water was poured beside the Temple altar “ that the rains of the year may be blessed to you ” (The Talmud).

How exquisite was the way then in which the Saviour (John vii, 37-8) used this “ raw material of Tabernacles ” for His own purposes—“ in the ancient festival the earth was to be fertilised, in the new usage of Tabernacles the spirit of man is to be made alive.” (V. Burch.)<sup>3</sup>

About the time of Tabernacles the first showers of the season—the “ former rains ” (*moreh*) fall. They are often accompanied by thunder and lightning (cf. Jer. x, 13) and are eagerly awaited since they moisten the soil which, after the summer is literally “ as iron,” and unworkable with the primitive tools of the ancient (and modern) peasant. “ Thou makest it soft with showers,” says Psalm lxxv, which was proper for Tabernacles.

As the season advances the Mediterranean becomes a trough of low pressure between the high pressures of Africa and Eurasia, and a highway for depressions (Fig. 2). No doubt St. Paul’s ship was caught in a procession of such bad-weather systems and “ driven up and down ” by the veering winds. They approach Palestine from the sea—Elijah told his servant to look seaward (I Kings,



xviii, 43); at last the man saw the first cloud, perhaps detached cirrus, blown ahead of the storm (cf. also Luke xii, 54). These depressions give the *geshem*, or winter rains, which are of great service in replenishing the water-supply both natural and

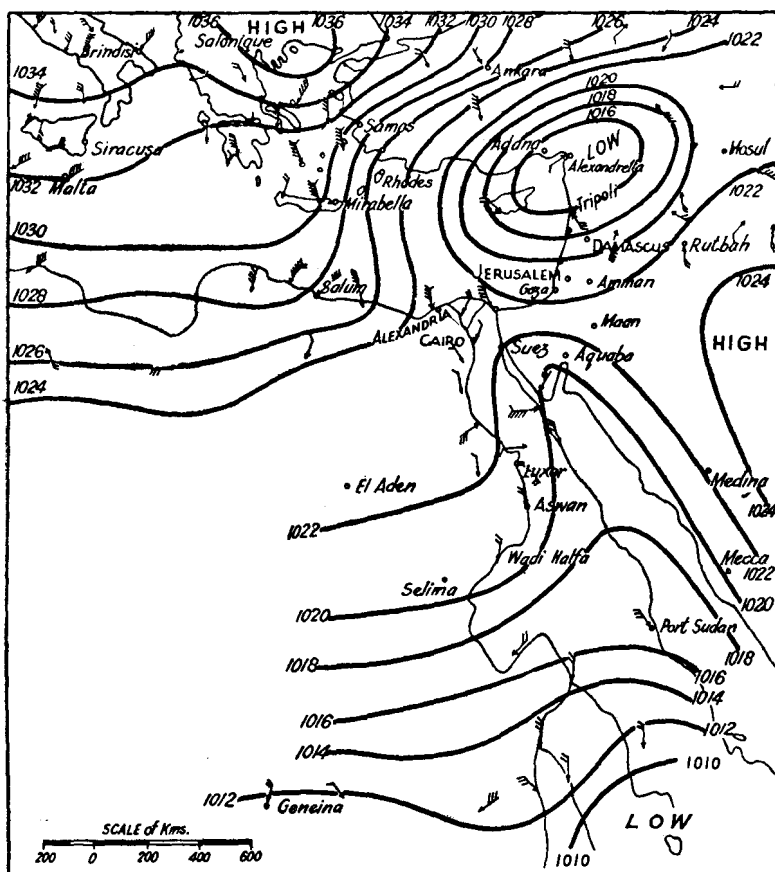


FIG. 2.—Pressure and winds at 8 h., 25.2.1938. Prevailing winter type.

artificial. Some authorities account for the decline in prosperity of many places and districts, e.g., Jerash, since Biblical times by a decline in rainfall, but it seems more likely that the secret lay in extensive and well-organised storage of water in cisterns

like the one in which Jeremiah was imprisoned. In Sinai, for instance, there are derelict cisterns with an estimated storage capacity sufficient for twenty times the present population. Such systems require peace for efficient maintenance, and would soon break down in times of anarchy such as followed the fall of Roman power.

Some of the winter precipitation falls as snow. In southern Palestine this happens on the comparatively rare occasions when a cold wave out of Armenia arrives over the country, simultaneously with the "warm front" of a depression. Perhaps this occurred when "Tryphon made ready all his horsemen to come that night, but there came a very great snow by reason whereof they came not" (I Macc. xiii, 22). It is also recorded how Benaiah slew a lion "in time of snow" (II Sam. xxiii, 20), G. A. Smith<sup>4</sup> thinks the beast must have wandered up from the warmer Jordan Valley. Snow falls throughout the winter on Hermon, whose beautiful snow-cap gave it its Biblical name of Sirion or "shining." Some believe it to be the scene of the Transfiguration, one ground being the comparison in Mark:—"white as snow" (ix, 3).

Upon a common sequel to these winter rains was probably founded one of those vivid Gospel parables which seem to be the words of an eye-witness of the occurrence mentioned. Not only are the ordinary winter rainstorms of Palestine heavier than those of Britain but, on occasion, they become veritable cloudbursts, such as that which swept away 100 villages near Damascus in 1937.

Such downpours are associated with a peculiar meteorological situation (Fig. 3) in which a tongue of low pressure extends northward from the Sudan to Sinai, and high pressure lies over the Sahara and Syrian deserts. In such a case there is much mixing of air currents over Palestine, warm moist air from the south being undercut by cold heavy northern air, and forced upwards, often violently, into higher and colder atmospheric regions. Rapid condensation takes place, the rains descend and the floods come, and should any poorly built house be in the way, great is the fall thereof (Matt. vii, 27). Any rivers affected by such storms rapidly become raging torrents, sweeping all before them as the Kishon swept the host of Sisera. Perhaps such floods may be what St. Paul calls "perils of waters" (II Cor. xi, 25) or more correctly "rivers" (*potamon*). It has been

pointed out he must have often used the Jerusalem-Antioch road which was crossed by many torrents from Lebanon. The rise of streams is incredibly rapid—following a cloudburst on the

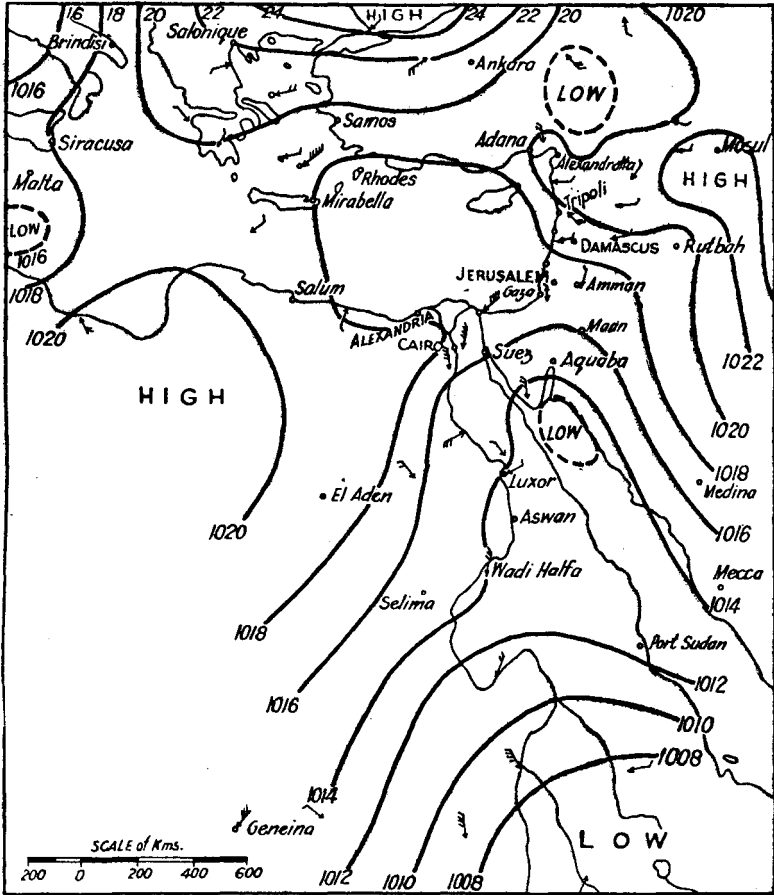


FIG. 3.—Pressure and winds at 8 h., 17-11-1937.

wolds the Lud at Louth (May 29, 1920) is reported to have risen 16 feet in 15 minutes !

Now the rapid uplift of moist air not only produces heavy rain but promotes the formation of hail of the large and dangerous

type which smote the Amorites (Josh. x, ii) and devastated Egypt (Exod. ix, 18-34). The account of the damage done is not exaggerated, *e.g.*, near Luxor in November-December, 1923, the growing crops were cut to pieces by hailstones, many of which measured more than  $1\frac{1}{2}$  in. in diameter. As regards the casualties to the Amorites cases of death and injury are common in semi-tropical lands.\*

The Bible account of the Egyptian plague and Josephus' story of the Amorite rout associate hail with thunder and lightning. This is natural, as the strong ascending currents which produce hail also promote electrical phenomena. The connection is also noted in Ps. xviii, 12, "hailstones and coals of fire."

The winter rains end about March and are followed by the showers known as the "latter rains" (*malkosh*). These mature the crops and are prized accordingly; it is because of their agricultural importance that they are linked in Scripture with the "former rains" (*e.g.*, Deut. xi, 14). Should they be deficient (Jer. iii, 3) the harvest is bad.

As their name indicates, it is with the "latter rains" that the rainy season really terminates.

In May precipitation falls off greatly, and by June summer conditions are re-established. "Rain in harvest" (May-June) is proverbial for "unseemly" (Prov. xxvi, 1, *cf.* I Sam. xii, 18).

Late spring is the season for the hot winds called Kadim in Scripture, and scirocco or khamsin nowadays. The warm indraft in front of a south Mediterranean depression is made still warmer by coming off the heated deserts and arrives in Palestine or Egypt as "a dry wind of the high places—not to fan or cleanse" (Jer. iv, 11) from east or south—so "When ye see the south wind blow ye say there will be heat" (Luke xii, 53); or better still "burning heat" (*kauston*). In a scirocco shade temperatures of 113° F. are not uncommon. Near the desert, as in Egypt, the wind is heavily laden with sand which causes "a darkness which may be felt." Should one blow too early in the season much damage is done to crops like the ears Pharaoh dreamed of, "blasted by the east wind." These easterly winds may be very strong (*cf.* Ps. xlvi, 7). They also played their

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\* Discussing this battle (Palestine picture, Hodder & Stoughton, 1936, p. 172), D. V. Duff mentions he has seen "sheep and even cattle brained by the huge hailstones which fall occasionally in Palestinian storms."

part in the drama of the Exodus. An east wind (Exod. x, 13) brought the locusts; another "caused the sea to go back" or "along" as is the better rendering.

From his intimate knowledge of local conditions, Col. C. S. Jarvis,<sup>5</sup> former Governor of Sinai, has suggested Moses led the Israelites along the sandy causeway which separates the great clay pan known as Lake Bardawil from the Mediterranean. The Egyptian commander, seeing his quarry out on the causeway, decided to send his chariots across the pan to cut them off. But he either failed to appreciate or else disregarded the weather. The strong east wind was causing a heavy sea, and on the Bardawil this means the possibility of flooding. Coming from the eastward, too, was the tall thundercloud characteristic of dirty weather in Sinai, and which perhaps the wind carried between the Egyptians and their prey. Exodus xiv, 20, states that the pillar of cloud was white and shining to the Israelites and dark to the Egyptians, and according to Col. Jarvis this describes accurately a typical Sinai cloudburst: "the cloud . . . is always intensely black but outside of its scope, the sun shining on the falling rain makes it appear as a shimmering silver curtain." This heavy rain would soften the ground so that the chariots "drove heavily" while the darkness and storm would upset the morale of the men. "Let us flee from the face of Israel for the Lord fighteth for them" (v. 25). Perhaps, even then, Jehovah's special association with thunder was recognised (cf. I Sam. vii, 10). But worse was to come—the rough sea had breached the causeway; the Mediterranean with the wind behind it came pouring in. Soon the whole Bardawil, which lies some feet below the sea, was flooded, "and the Lord overthrew the Egyptians in the midst of the sea." Col. Jarvis also remarks that this local thundercloud is "at night an intermittent blaze of fire"—a veritable pillar of fire and cloud.

The Exodus is not the only Biblical event associated with local peculiarities of climate. That most romantic of tales—that of Ruth—is connected with a climatic detail recently discussed by Dr. David Ashbel,<sup>6</sup> of the Hebrew University, Jerusalem, whose recent studies of the climate of Palestine have been so fruitful. He points out that the westerly winds, after crossing Judaea, descend into the valley, being warmed and dried in the process. In this state they cross the Dead Sea and absorb moisture which, on rising to the hills of Moab 4,000

feet above, they precipitate as rain. Thus Moab often has good rains when there is drought elsewhere, and that was probably why Naomi and her family went there.

It would be tempting to connect one of the most tremendous of Our Lord's miracles—the stilling of the storm—with another point discussed by Ashbel.<sup>6</sup> On arriving at the edge of the valley the Mediterranean sea-breeze spills over, reaching the Sea of Galilee below as a warm, gusty wind, somewhat dangerous to small boats. Or the historic storm may have been one of the local squalls to which all lakes surrounded by hills are subject.

Again, the general characteristics of the Palestinian climate are reflected in Scripture. The Old Testament is full of references to famine and drought which are ever-present dangers in a semi-arid country with a fluctuating rainfall. The sort of variations that occur are shown by the following figures for Jerusalem :—

|                   |    |    |    |          |
|-------------------|----|----|----|----------|
| Average rainfall  | .. | .. | .. | 27 in.   |
| Least recorded    | .. | .. | .. | 12·5 in. |
| Greatest recorded | .. | .. | .. | 40 in.   |

Variations also occur in the length of the rainy season and in the distribution of rain throughout the season, *e.g.*, either the beginning or end may be dry, the rains stopping “when there was yet three months to the harvest” (Amos iv, 7). These variations are probably connected with changes in the general circulation of the atmosphere, which though rhythmical never repeats itself exactly, and about the realities of which we are still very ignorant.

One cannot reasonably doubt that it was because of this particular climate—semi-arid, with variable rains—that Palestine was chosen to be the home of a race with a definite mission to the world. “It is,” says Dr. Alfred Berthelet, “its very greatest educational peculiarity, that, being a country whose fertility is so completely dependent on the rain, it casts its people absolutely and decisively on the goodness of Heaven, and those who are familiar with the conditions that prevail in rural life testify that the more dependent man is for the prosperity of his labours on nature and natural phenomena against which he is helpless the greater is the devotion to God in his heart.”<sup>7</sup>

Even the pagan cults of Canaan reflect this tendency of associating control of the seasons with higher powers :—The

Ras Shamra tablets tell of the rivalry of Mot, god of aridity, and Baal, god of rain—and in this perhaps lay the fatal fascination of the Canaanite cults to the Hebrews. They were inclined to associate Jehovah exclusively with war, thus in national emergencies they turned to Him; but in peace, especially after a drought or two, they were apt to go after Canaanite gods, for they “did not know that I gave her corn and wine and oil” (Hos. ii, 5–7).

It is, of course, significant that Elijah’s campaign against the Tyrian Baal was connected with a drought. He was the first in the great line of prophets raised up to do battle for the true God.

But, though at last the faith of Israel was purified, certain primitive Semitic ideas about rain, etc., were retained. To the Semite the earth was a cupola rising out of the cosmic ocean, with (to the Hebrew) Jerusalem at its summit. The sky was another such solid dome or firmament resting on the circle of earth. Above this were reservoirs (called variously “chambers,” Ps. civ, 13, or “treasuries,” Job. xxxviii, 22) in which rain, snow or hail were stored by Jehovah. The Psalmist pictured Him storing the waters of the cosmic ocean or “deep” (Ps. xxxiii, 7). Rain was due to the opening of the sluices or “windows” in the firmament (Gen. vii, 11). During drought the heavens were said to be “shut up” (Luke iv, 25). Dew was supposed to fall (Num. ix, 11). It was only in 1814 A.D. that Wells proved it to be caused by condensation.

There were probably many popular weather sayings in Bible times, of which two appear in the Gospels (Matt. xvi, 2, 3).

“When it is evening ye say, It will be fair weather for the sky is red.”

“And in the morning, It will be foul weather to-day; for the sky is red and lowring.”

The last two words are important, and show accurate observation. There are *two* kinds of morning red, one a light clear hue implying little moisture in the air and therefore the probability of fine weather. But a sombre, cloudy red means much moisture and the chance of storm.

Any remarks about weather in Scripture would be quite incomplete with reference to its poetic aspect. The Psalms contain mention of the blessing of the rain (*e.g.*, lxxv, 9–10,

civ, 13, etc.). Only in a semi-arid country could the ideal king be compared to showers (Ps. lxxii, 6). Snow is wondered at:—

“The eye marvelleth at the beauty of its whiteness, and the heart is astonished at the raining of it” (Ecclus. xliii, 18).

While, as regards the sparkling frost,

“He causeth flowers to bloom like sapphires,” says the Hebrew version of Ecclus. xliii, 19.

As for the rainbow it inspired these stately lines:—

“Look upon the rainbow and praise Him that made it, very beautiful is it in the brightness thereof. It compasseth the heavens about with a glorious circle, and the hands of the Most High have bended it” (Ecclus. xliii, 11–12).

The rainbow plays a part in Scripture worthy of its beauty. It appears as the sign of the covenant with Noah (Gen. ix, 13); like unto it was the glory round the Being Ezekiel saw (Ezek. 1, 28); John the Divine saw it surrounding the Throne (Rev. iv, 8). But the Biblical poets not only rejoiced in the beautiful and useful aspects of the weather, their faith in God was such that, in what caused terror and discomfort to weaker spirits, they could see glory. They revelled in depicting Jehovah riding on the wings of the wind, enveloped in the black storm-clouds and shooting out the fiery darts of lightning (Ps. xviii, 9–14), or thundering “marvellously with His voice” (Job. xxxvii, 5). There are some moderns who share this spirit—it is told of the famous Pastor Theodore Monod that, when his young sons were frightened by a storm, he came amongst them Bible in hand and read Psalm xxix—“the Song of the Thunderstorm”—with its sevenfold refrain “the Voice of the Lord.”

It was to men who had been brought up in this robust tradition that the Holy Ghost manifested with “a sound from heaven as of a rushing mighty wind” (Acts ii, 2), perhaps something like the roar with which the Southerly Burster of Australia announces its coming.

To the Bible poets even the discomforts of weather could redound to the glory of God. The terrible heat of the summer sun inspired the Psalmist (Ps. xix, 6) and Ben Sira (Ecclus. xliii, 1–6). The latter also gave honourable mention to the bitter cold of winter (vv, 20, 21) and so does the author of “the Song of the Three Children,” known to many Christians as the Benedicite. This poem has been called “the true prayer of all



meteorologists" and with reason, for therein all the elements of weather and climate—showers, dew, winds, frosts, snow, ice, lightnings and clouds, cold and heat, summer and winter, join with the rest of creation animate and inanimate, with stars and hills and animals, with angels and with the children of men in one great song in which the common Creator and Lord is praised and blessed and magnified for ever.

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The Bible. Except where stated the text used is that of the Authorised Version with Apocrypha.

<sup>1</sup> Shaw, "Manual of Meteorology," vol. 1, p. 11, 1926.

<sup>2</sup> Th. H. Gaster, "Some Ancient Oriental Folklore," *Folklore*, vol. 49, pp. 333-375, 1938.

<sup>3</sup> V. Burch, "Anthropology and the Apocalypse," p. 170, 1939.

<sup>4</sup> G. A. Smith, "Hist. Geog. of Holy Land," p. 65.

<sup>5</sup> C. S. Jarvis, "The Forty Years Wanderings," *Blackwood's Magazine*, vol. 184, 1931.

<sup>6</sup> D. Ashbel, *Q.J.R. Met. Soc.*, vol. 65, pp. 185, 1939; *Met. Mag.*, June, 1936.

<sup>7</sup> A. Berthelet, "History of Hebrew Civilization" (English trans.) (Harrap & Co., London), p. 30, 1926.

The three charts are reproduced from *Q.J.R. Met. Soc.*, Vol. 64, 635-7, 1938 ("Great Floods in Sinai Peninsula, Palestine, etc.," by D. Ashbel) by kind permission of the Council, who loaned the blocks. Owing to war conditions Dr. Ashbel, in Jerusalem, was not accessible.

#### DISCUSSION.

The Chairman (Mr. L. C. W. BONACINA), in opening the proceedings, said: The Bible, especially perhaps the Old Testament, abounds in references to weather and climate, which could roughly be arranged in three classes: (1) references to particular events, like the crossing of the Red Sea or the shipwreck of St. Paul; (2) references to climatic peculiarities, such as the former and latter rains about which the prophets had so much to say; (3) references forming part of the magnificent nature imagery so conspicuous in the Psalms and elsewhere, culminating in certain chapters of the Book of Job, e.g., "Dost thou know the balancings of the clouds, the wondrous works of Him Which is perfect in knowledge?" Miss Botley, our

lecturer, has not neglected any of these aspects, and in calling upon her to deliver the lecture, I would remind you that she is a scholarly meteorologist who has made a special study of the bearings of her subject in the cognate fields of history, religion, folklore and mythology.

In opening the discussion the Chairman said : The audience will, I feel sure, agree that Miss Botley has given us a most stimulating and interesting address. She had well portrayed the rigor of summer heat and draught, and the vividness of the landscape in the Holy Land. There were two curious omissions to important weather events, probably due to intrinsic difficulty in giving a naturalistic interpretation thereof, namely, the Noachian Deluge and the promulgation of the Decalogue on Mount Sinai. The hail plague of Egypt, which I confess always to having read about with a certain thrill, fits in very well with what we know of the protracted and violent character of hailstorms in the Mediterranean region, though less frequent in Egypt than in other parts.

In proposing a vote of thanks and winding up the proceedings, the Chairman said that the liveliness of the discussion showed that there was plenty of scope for fuller treatment of the subject, and certainly no more congenial environment could be imagined for another paper by Miss Botley than this Society, where religion, philosophy and science have a common meeting ground.

Group-Captain WISEMAN said : I have served in Palestine and Iraq for seven years, and know of no climate so remarkable as that of Palestine. In this small country, the size of Wales, so great is the variety in the weather, which may exist at the same time, that I have left Jerusalem (2,270 feet above sea level) in a snow-storm, and travelled by road to the Dead Sea (1,292 feet below sea level), where the temperature was almost tropical. At Gaza the rainfall is scanty, while 100 miles north, at Haifa, the rainfall is higher than in any part of the country.

Miss Botley relies—without sufficient reason—on Major Jarvis' explanation of the pillar of cloud and fire. He writes of the " huge column of cumulus, black in the centre with hard white edges. This column, which begins at the skyline and is most impressive, extends

to the zenith, constantly emitting lightning at night in an intermittent blaze of fire." But, as Major Jarvis points out, this is the herald of "a typical Sinai cloudburst." While this explanation may help us to understand the medium used by God, it utterly fails to account for the Biblical statements. It is unreasonable to imagine that the Israelites experienced stormy weather throughout the whole of their march. Over a year elapsed between Exodus xiii, 22, and Numbers xiv, 14. The Bible statements seem clearly to indicate something beyond the natural course of weather events.

The lecturer seems to have accepted the current evolutionary idea that "at last the faith of Israel was purified." I suggest that there is no evidence that Israel's faith was more pure at the end than at the beginning of their career. The citations from Genesis, the Psalms, or Job, could be paralleled from modern writers acquainted with scientific knowledge, and no one would suggest that this was due to ignorance. I would take particular exception to the implication of ignorance on our Lord's part when He spoke of the heavens being "shut up." One might more reasonably accuse any modern writer of speaking of the "setting sun." Those acquainted with the Babylonian writers will realise that the Bible narratives seem to have been amazingly preserved from making the grotesque mistakes made in the current literature of the time.

Lieut.-Colonel MOLONY said: This has been a very interesting paper throughout, and our sincere thanks are due to Miss Botley, and to Colonel Skinner, who persuaded her to write it. I shall confine my remarks to the great crossing of the Red Sea. Miss Botley does not precisely state her own opinion as to where this was, but she quotes Colonel Jarvis, who believes that it was along the narrow bank which separates Lake Bardawil from the Mediterranean. That is, some fifty miles E.N.E. of Port Said. But surely this takes us much too far from Marah, Elim, and other well-identified sites. I concur with Miss Botley in regarding the crossing as a miracle of coincidence, rather than as a physical marvel (and, indeed, the same may be said of most of the wonders of Moses' day). For this reason I think that we ought to reject the theory brought before us by Lieut.-Colonel Robertson in March, 1936, that the crossing was far to the south, where the Red Sea is deep.

General Sir C. Warren (who knew all the country well) read us a paper in 1917, in which he gives his belief that the crossing was north of the Bitter Lakes. This agrees with Professor Flinders Petrie's view, that it was at Serapeum, nine miles south of Ismailia. Now between Ismailia and the Bitter Lakes the Suez Canal runs through a cutting, some 12 feet deep. If the whole of the neighbourhood was some 15 feet lower in Moses' day, which seems likely, then at this place the extension of the Red Sea northwards would only have been 3 feet deep, a depth which might easily be dried out by a strong wind. All dwellers on the lower River Tay have been astonished by the effect which a strong S.W. wind has on that long lake. The only difficulty which arises is in connection with the *direction* of the wind, which the Bible says was east. One would have thought that a north-west wind would have been more effective. For if the north end of the Red Sea was near Ismailia, then there would have been nowhere from which the water blown away could be replaced.

Now the only known form of defence in Moses' day was a wall, hence when I read in Exodus xiv, 22, that the waters were a wall unto the Israelites on their right hand and on their left, I take this to mean that the waters connected with the Bitter Lakes to the south, and those connected with Lake Timsah to the north, which were not dried out, were a defence to the flanks of the Israelites.

I know that the song of Miriam says, Exodus xv, 8, "The floods stood upright as an heap." But this is poetry.

Petrie and Warren are great authorities, and when they agree, as they do here, and topography supports them, their opinions should be given weight when rival theories are brought forward.

Mr. D. JUSTIN SCHOVE, B.Sc., F.R.Met.S., said that as he was engaged in investigating climatic variations in relation to history, Miss Botley's remarks in this connection were of special interest to him. With regard to the Flood, if the distribution of the clay deposit were mapped, it would be at once apparent whether the cause was local or due to climatic change.

In the latter case, the change would be world-wide (*cf.* the Glaciation Crisis, the theory given by Peake and Fleure, "The Corridors of Time"); a chronology of more recent climatic calamities in the

Near East would provide a clue to the interpretation of the Great Flood, the earliest calamity of which there is any recorded attempt at human description.

With regard to the influence of climate on man's beliefs, the Mohammedan religion extended mainly over the region where the annual rainfall was less than 10 inches ; to what extent was this reflected in the references to climate given, *e.g.*, in the Koran ?

#### WRITTEN COMMUNICATIONS.

Mrs. MAUNDER, F.R.A.S., wrote : I have been greatly interested in Miss Botley's paper, and I write now, not to criticise any point, but rather to induce her to criticise some suggestions of mine on the weather and climate of the Bible, because I am not a practising meteorologist, and all the knowledge I have of that science is taken from Dr. C. P. Brooks' two books, "The Evolution of Climate" and "Climate Through the Ages."

In my paper on "Early Hindu Astronomy," read before the Institute in April, 1934, I found two significant dates—700 B.C. and 1600 B.C. About 700 B.C. there was a reformation of the Calendar in the Punjab, somewhat similar to ours in 1752, the only difference being that we dropped 11 days and the Hindu astronomers dropped 12, thus bring back the Calendar into adjustment with the seasons, particularly with the summer solstice—that is, with the Monsoon rains which occur there at that solstice. This meant that the origin of their calendar was about 900 years prior to 700 B.C. We can infer from this that the Hindu Aryans were invading the Punjab (with its well-watered plains) shortly before 1600 B.C. Elsewhere in meteorological history I found that these two dates were significant as regards sudden change of climate. For instance, to quote from Dr. Brooks ("Climate Through the Ages," p. 163) : "The change of Climate for the worse was very rapid, and, according to H. Gams and R. Nordhagen, in the Alps it 'had the appearance of a catastrophe.' There was, in fact, a sudden change from drought to deluge." So, too, it was in the Punjab. There are many hymns at this epoch testifying to disastrous floods at the fount of the Seven Rivers ; especially there was continual reference to the Great Vritra at this time : he was the Demon, slain by Indra, the Weather God,

and it was the slaying of him that gave Indra supremacy among the gods. From the many descriptions of Vritra, I judged it to be an enormous glacier which obstructed the rivers of the Punjab, at their sources high up in the Himalayas. It seemed to me that it was an obstruction on a great scale, like that of the Shyok dam, in 1926, on a small scale. I am not knowledgeable in the origin of words, but Sanskrit is closely allied to the European Aryan languages, and *vritra* is as like vitreous as glass is like glacier.

How long did the Great Vritra take to grow to his full length? I judge that he came suddenly into existence about 1600 B.C. For in his "Our Mobile Earth" (published 1926), Dr. Daly told of his (then) recent discovery of sea caves, found on the ocean coasts all over the world, and all indicating a sea-level shift of about 20 feet. He writes: "Field studies in *all* the ocean basins—Atlantic, Pacific and Indian—show that there has been a world-wide sinking of sea-level, the land at most places remaining quiet. One naturally inquires for the cause of the lowering of sea-level. The best explanation seems to be an increase of the existing glaciers, particularly the ice-cap of Antarctica. For ice-caps, like all other glaciers, are formed by evaporation of sea-water and its subsequent precipitation as snow on the lands. The withdrawal of enough water from the ocean to supply only a fraction of the Antarctic ice-cap would lower general sea-level 20 feet."

"The increase of the ice-cap or caps has been tentatively referred to late Neolithic times, about 3,500 years ago. At that approximate date there was some chilling of the northern hemisphere at least, following a prolonged period of drought when the world climate was distinctly warmer than now. Late-Neolithic man lived in Europe 3,500 years ago." This date, "about 3,500 years ago," is near enough to my 1600 B.C. for the invasion of the Persians, by Persian Aryans, and this intensity of glaciation is *not* confined to the polar caps, for the high mountains, such as the highlands of Afghanistan, where these Persians had been living for some two or three hundred years previously, must have experienced a very great deterioration of climate, great enough to induce them to invade in great numbers the warm and well-watered plains of the Punjab.

In the Bible we know nothing concerning the date 1600 B.C., for at that time the children of Israel were in the Land of Egypt, and

this temporary increase in the ice-caps did not affect adversely the Nile, any more than it did Seven Rivers.

Now as to the date of the Deluge. If we take it according to the Septuagint Version as about 4000 B.C., then the account given in Genesis reads something like the catastrophic deluge in the Alps or in the Punjab Hills. The highlands of Armenia are of the same order as the highlands of Afghanistan. The description of them in the *Encyclopædia Britannica* is as follows: "On the north and west the slopes of Great Ararat are covered with glittering fields of unbroken *névé*. The only true glacier is on the north-east side, at the bottom of a large chasm which runs into the heart of the mountain. . . . The middle zone of Ararat, 5,000 to 11,000 feet, is covered with good pasture; the upper and lower zones are for the most part sterile."

This raises a question:—Which is the normal level of the ocean for our present geologic age? Is it the present level, or one 20 feet higher? This involves, however, a discussion too lengthy for a note to Miss Botley's paper.

Rev. J. H. J. BARKER, M.Sc., wrote: The subject under discussion is one which has interested me for many years, and I am very grateful for the erudite paper read by Miss Botley. Distance precludes my attendance and share in the discussion.

The terms "former" and "latter" rain give the impression that there are two periods of rainfall in Palestine separated by a non-rainy season. This is not the case. A glance at the monthly average rainfall of Jerusalem during the winter half of the year indicates that the rainy season is one, viz., October, 0·4 inches; November, 2·3 inches; December, 5·4 inches; January, 6·2 inches; February, 5·4 inches; March, 3·9 inches; April, 1·7 inches. The reason for the former and latter portions of the rainy season being so important is that any delay in the onset of the rains, or any early diminution towards the end of the season, would have disastrous effects. The early rain is required to soften the hard ground, while the latter rain fills the ears of grain preparatory to the summer drought. The grain harvest takes place in the early days of the dry period.

While allowing due weight to the ancient organisation of water storage, I do think that there is evidence of a decline in rainfall in

parts of Palestine and the Near East. G. A. Smith records the sites of many villages south of Beersheba indicating the presence of vegetation (and rainfall?) in times long past. Two further factors must be considered to account for this. One, that lands bordering the desert not only have a seasonal variation in rainfall, but also a serious variation from year to year. Such variations seem to occur in cycles. At Jerusalem, as Miss Botley records, this variation is from 12·5 inches to 40 inches, with an average of 27 inches; but in the Negeb the average rainfall is probably 15 inches or less. If the difference between average and lowest annual rainfall is half of what occurs at Jerusalem, *i.e.*, 7 inches, then drought conditions throughout the whole year become extremely severe. Such cycles of drought and rain account, I believe, for the prosperity of these border areas in times gone by; then a dry cycle will be experienced and population will fade away, and with the incidence of the second factor, re-population in a more favourable period will become difficult.

The second factor is that of forestation. Trees assist precipitation. Careless cultivation and war means that trees are destroyed and not replaced, and in an area where the margin of rainfall is so scanty the reduction in precipitation as a result of deforestation means desert conditions. It is a well-known fact that parts of Spain suffered in this way as a result of the huge inroads made upon timber to build the Armada. Without the binding effect of vegetation the soil becomes friable, and even a solitary spate can sweep away and sweep bare many a stretch of land, which then becomes incapable of producing trees. We all know, too, that attempts to remedy this state of affairs were impossible while the Turk was in power in Palestine, for he taxed all trees. However, in more favourable parts, afforestation is now taking place, and possibly the precipitation will be so materially increased that one day the land even south of Beersheba will "blossom as the rose," and upon the ruins of ancient villages in the Negeb new centres of population will arise. An interesting commentary on the weather conditions of the south part of Palestine (though not further south than Beersheba) is found in Gen. xxvi. It would appear that there was drought at Gerar, for we have the term "famine" in verse 1; but in verse 12



Isaac reaps an hundredfold. Perhaps we have here some evidence of this type of rainfall variation from cycle to cycle of years.

Dr. C. E. P. BROOKS wrote : I found Miss Botley's paper most interesting, and there is really very little that I could add to it. There are a good many references to Palestine in Professor J. W. Gregory's paper, "Is the Earth Drying Up?" (*Geograph. Journal*, Vol. 43, 1914). Unfortunately our Meteorological Library copy is still at South Kensington, so that I cannot consult it; but I remember having some correspondence with Gregory about it. He maintained that there is nothing in the Bible to suggest that the climate of Palestine differed appreciably from the present climate at any time; but from a close study of the dates of the various references, I concluded that the country had passed through several cycles of favourable and unfavourable conditions of rainfall. If these cycles really existed, they must have had a great influence on the various migrations into and out of Palestine, but my notes are not at present accessible.

I notice that Miss Botley has not referred to the first recorded successful long-range weather forecast, namely, the seven years of good Nile floods, followed by the seven years of poor floods. . . . There are several cycles of about 14 years (11 years,  $12\frac{1}{2}$  years, 15 years,  $16\frac{2}{3}$  years), and when these all fall in step they give a period of about seven years of good floods, followed by seven years of bad floods.

Rev. Principal H. S. CURR wrote : I regret that I have been unable to read the paper before the meeting, with the result that the remarks which follow may do no more than emphasise some aspects of the subject already discussed. That, however, is of such interest and importance to Bible students for an adequate appreciation of many passages that some observations may be made even at the expense of repetition.

The Bible contains narratives which deal with a considerable stretch of land and sea in the Near East, and in several of these there are allusions to climatic conditions. The overwhelming majority are concerned with Palestine, as one would expect, since it

was the tiny theatre in which the redemption of the world was consummated.

Palestine has been described as a museum country on account of the remarkable variety exhibited by its geography, its flora and fauna, as well as by its climate. Our present concern is with the last. In illustration of what has just been said about it, two brief statements by eminent authorities may be cited. Dr. R. A. S. Macallister writes: "The climate of Palestine is, on the whole, that of the sub-tropical zone, although, owing to the extraordinary variation of altitudes, there is probably a greater range of average local temperature than in any other region of its size on the world's surface. On the one hand, the summits of Hermon and of certain peaks of the Lebanon are covered with snow for the greater part of the year; on the other hand, the tremendous depression, in the bottom of which lies the Dead Sea, is practically tropical, both in climate and vegetation."\* In these circumstances, it need be no matter for surprise to find Colonel C. R. Conder writing: "In the Bible we read of snow, hail, and ice, as well as of the desert whirlwinds and the sunstroke."† When we remember that Palestine is no larger than Wales, we shall be disposed to agree with the remark that there is no hundred miles on the globe to compare with it in sheer diversity of climatic conditions, with all that is thereby implied and involved.

The significance of these sentences can only be grasped to the full when we realise that Palestine was the cradle of the chosen people, the unique home of a unique race. It would be interesting and instructive to trace the effects on Jewish mentality and character of such a remarkable environment. The influence of climate on character has long been recognised. Thus the differences between the Scotsman and the Spaniard are partly explicable by such considerations. It is certain that, in the loving wisdom of God, the land of promise was the ideal training ground for the nation in whom all the families of the earth were destined to be blessed.

The climatic miracles recorded in the Bible must be of special interest to the meteorologist. There are stories of storms and droughts which are directly ascribed to the finger of God. The

\* Hastings' Bible Dictionary (one vol.), p. 673.

† Hastings' Bible Dictionary, Vol. III, p. 643.

problems which these narratives raise will be more deeply understood by the scientific investigator of weather conditions. Although I disclaim all specialised knowledge on the subject, I venture to think that the conclusions of the meteorologist with regard to these miraculous interventions in the ordinary course and process of the Palestinian climate will support the contention of Calvin that God does not deviate in His mighty works further from the laws and workings of Nature than is absolutely essential for His gracious purposes.

#### AUTHOR'S REPLY.

I am much interested in, and obliged for, all the comments that have been made.

As regards Mrs. Maunder's date of 4000 B.C., it is interesting to note that Dr. Julian Huxley ("The Uniqueness of Man," London, 1941, p. 89) states that round about 4500 B.C. there was an elevation of land. This would mean increased snowfall round about the Mesopotamian basin and violent spring floods year after year. There is, too, the interesting theory that the Flood had nothing to do with Mesopotamia, but represents the flooding of the Mediterranean basin by the Atlantic at the end of the Ice Age.

I mentioned Colonel Jarvis' theory of the Exodus because of its meteorological interest. I am not archæologist enough to decide about routes.

I am sorry Group-Captain Wiseman misunderstood some of my remarks. Surely he will agree that, *as practised*, the Israelite faith had become contaminated with heathenism and needed purifying. Likewise, Luke iv, 25, was quoted solely with the object of illustrating the popular idea of the reason for drought, and with no thought of irreverence.

I agree with the Rev. J. H. J. Barker and Dr. Brooks about the part played by cycles of rainfall. These would have a marked effect on the prosperity of semi-arid districts.

The omissions mentioned by Mr. Bonacina were due to lack of space. As he says, the difficulty of a naturalistic explanation is great; indeed, "explaining away" is often not very profitable. Incidentally, however, there are some interesting remarks (too long

to quote) in "Once in Sinai," J. M. C. Plowden (Methuen, 1940), pp. 107-108.

With regard to Mr. Schove's query, my knowledge of the Koran is limited, but it seems that its meteorological references are not very striking. The most interesting local touch is the comparison of "the works of the unbelievers" with the desert mirage (*serab*): "the thirsty man takes it for water till he comes and finds that it is not." There is also mention of the fertilising power of rain, conspicuous in an arid climate.

### Teaching of Biology in Schools.

To the President of the Board of Education,  
Whitehall, London, S.W.1.

THE VICTORIA INSTITUTE, OR  
PHILOSOPHICAL SOCIETY OF GREAT BRITAIN,  
1, CENTRAL BUILDINGS, LONDON, S.W.1.

SIR,

October 6th, 1941.

I have the honour, by request of the Council of the Victoria Institute, or Philosophical Society of Great Britain, to bring to your notice a complaint that is being made in respect of the manner of teaching biology in schools.

Representations have been made to the Council that correct teaching of biology is prejudiced by the use, *with official sanction*, of text-books in which the theory of organic evolution is assumed to be a fact of science and, while facts which appear to favour the theory are stressed, others which tell heavily against it are left unmentioned; are, in effect, suppressed; a method of teaching which, if employed, is unscientific and unphilosophical.

In consequence of these representations the Council have felt it desirable to appoint, from among the Fellows of the Society, a small committee of gentlemen possessing necessary scientific qualification, to examine into the matter and report to them on the allegation of unfair teaching.

A copy of this Committee's report, substantiating the original representations, is submitted herewith, for favour of perusal by the Board of Education. It embodies a few quotations only, by way of samples, but many more can be furnished, if desired.

The Council venture to hope that the Report may be given the serious consideration it merits, since, in their opinion, ill consequences are bound to result; not only from suppression of truth, but worse, from the harnessing of immature minds in advance to a theory, adoption of which in certain quarters as the basis of a philosophy of life has already, they have good reason to know, served to undermine belief in God and in man's accountability to Him, with disastrous results in the moral realm.

They desire me to lay special emphasis on the point at issue in this submission, which is solely that of *unfair presentation*. They raise no objection whatever to employment of the theory, or any modification thereof, as a *mode* of teaching, a working hypothesis, *provided the facts standing against it are given equal prominence with those in its favour*, and that discussion of the subject be reserved entirely for older scholars; who should also be warned that, though at present popular with many biologists, the theory is not accredited by all, has certainly not been proved true, and to which, in point of fact, the fossils at present known are very unfavourable.

I have the honour to be, Sir,

Your obedient servant,

T. C. Skinner, Lt.-Col.,  
Honorary Secretary.

## TEACHING OF BIOLOGY IN SCHOOLS.

*Report of a Committee of Fellows of the Victoria Institute, or Philosophical Society of Great Britain, convened by the Council to examine into and report to them on allegations of unfair teaching.*

Our investigations show that the allegations regarding the unsatisfactory nature of biological text-books are justified.

2. It will be generally agreed that, among others, the following canons should be observed by every teacher of science :—

- (a) Adoption of careful and accurate phraseology.
- (b) Making sharp distinction between ascertained fact and unverified theory.
- (c) When enunciating a theory, taking great care to give equal prominence to facts against and to those in favour of the theory.
- (d) Refraining from making assertions demonstrably untrue.
- (e) Making clear that Science tells us nothing of origins, that it can only observe what now exists and draw inferences as to the past ; speculation as to origins coming within the domain of the philosopher.

3. Our enquiry shows that all these canons are to-day being violated by authors of biological textbooks. From scores of violations of the above canons the following will serve as illustrations :—

(a) CARELESS AND INACCURATE PHRASEOLOGY.

“ The birds and mammals solved the problem (of maintaining the blood at a constant temperature) by acquiring a non-conductive covering ” (*School Certificate Biology*, by Shann and Gillespie, p. 312). The correct way of making this statement would be : “ The hairy covering of mammals and the body feathers of birds assist greatly the maintenance of the bodily heat of these animals at a constant temperature, generally above that of the surrounding medium.”

(b) FAILURE TO DISTINGUISH BETWEEN ASCERTAINED FACT AND UNVERIFIED THEORY.

“ In whales all external trace of hind legs has disappeared ” (*Zoology*, by Shipley and MacBride, p. 697). The correct statement

is, "Whales have no external hind limbs," or "have no hind limbs." This is an established fact. That their ancestors had these and lost them is a theory unsupported by the evidence of the fossils.

(c) ONE-SIDED PRESENTATION OF A THEORY.

As an example of omission it may be noted how, in support of the theory that man is derived from a tailed ancestor, most text-books say that the human embryo has a tail which is of no use, but is formed because the embryo during its development has to recapitulate the ancestral stage of a tailed ancestor; thus Prof. R. Munro Fox writes (*Biology*, p. 303): "In the embryos and larvæ of animals there are structures which can only be explained by evolution. . . . The human embryo at one stage has a tail (Fig. 150)"; but neither this book nor any other school book making this statement mentions the fact that at one stage the human and all mammalian embryos have a length of gut in front of the mouth and behind the vent, for the reason that no adult animal can ever have existed having such an alimentary canal; so to have mentioned this would have destroyed the evidence supposed to be furnished by the embryonic tail. In this connection, Prof. L. Vialleton wrote in 1924 (*Membres et Ceintures des Vertébrés tétrapodes*, p. vii): "Depuis cinquante ans les manuels sont une simple illustration du transformisme, ne mettent en lumière que ce qui lui est favorable. Passant sous silence tout ce qui est en dehors de lui ou contre lui"—a true but severe indictment of the methods of biologists to-day.

(d) MAKING ASSERTIONS DEMONSTRABLY FALSE.

"The rocks of that (the Pre-Cambrian) period have been so altered by heating, crushing and in other ways that we cannot hope for palæontological evidence from them" (*A General Zoology of the Invertebrates*, by G. S. Carter, p. 470). R. Munro Fox writes (*op. cit.*, p. 297): "The lowest layers of rocks which once contained fossils have been literally cooked . . . in this process all fossils are destroyed." These statements are untrue. Most Pre-Cambrian rocks have been altered, but there are in several parts of the earth great thicknesses of these rocks, *e.g.*, the Cuddapah formation in India, which have undergone no alteration and are eminently fitted to have preserved fossil relics. The entire absence of fossils in these formations is a most serious objection to the theory of organic evolution, because in regions not far removed rocks of the succeeding Cambrian system exhibit abundant fossil remains of highly developed animals of the most diversified types.

On page 227 of *Biology: An Introductory Textbook to Matriculation Standard*, by A. P. Graham and B. T. Marples, the following statement occurs: "Another important characteristic of vertebrates is the presence of paired openings through the body wall passing from the alimentary canal to the outside world. These paired openings are called gill slits because in fishes they contain the gills and are concerned with breathing. Gill slits are present in all vertebrates at least during the early stages of their development." Shipley and MacBride write (*op. cit.*, p. 385): "All vertebrata possess at some period of their lives slits in the wall of the front part of the alimentary canal." Munro Fox says (*op. cit.*, p. 303): "The embryos of both birds and mammals, including man himself, have gill slits."

The above incorrect statements are made as evidence of the descent of reptiles, birds and mammals, including man, from fish-like ancestors. The truth, as can be ascertained by consulting any reliable modern book on human anatomy or physiology, such as Cunningham's *Anatomy* and Keith's *Embryology*, is that at no stage in the human embryo is the wall of the alimentary canal perforated.

(e) DOGMATIC ASSERTIONS REGARDING ORIGINS.

"Bats came from mammal ancestors not unlike shrew mice" (R. Munro Fox, *op. cit.*, p. 301). As the earliest known fossils of bats, those of the Eocene, have all the features that distinguish bats from all other animals, some of these being practically indistinguishable from genera now living, there is no scientific justification for the above dogmatic assertion. All the biologist can say *qua* biologist, is that nothing is known about the origin of bats. Those who adopt the theory of evolution as a philosophy have to derive bats from some other type of animal, and, as the teeth of bats are more like those of Insectivora than of other groups of animals, a shrew-like ancestor is postulated. But this is mere speculation and should not find place in any book written for educational purposes.

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BOARD OF EDUCATION,  
ALEXANDRA HOUSE,  
KINGSWAY, LONDON, W.C.2.

DEAR SIR,

8th October, 1941.

I am writing on behalf of the President of the Board of Education to acknowledge the receipt of your letter of the 6th October on the subject of the teaching of biology in schools. I will lay your letter before Mr. Butler.

Lt.-Col. T. C. Skinner,

Yours faithfully,

The Victoria Institute,  
1, Central Buildings, S.W.1.

Sylvia Goodfellow,  
Private Secretary.