EIGHTEENTH ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

ABSTRACT OF PROCEEDINGS,
AND LIST OF MEMBERS.
JANUARY, 1887.

LIVERPOOL:
TURNER, ROUTLEDGE AND CO. PRINTERS.
(Late J. A. D. Watts and Co.)
MDCCCLXXXVII.

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Liverpool Microscopical Society.

SESSION XIX. 1887.

Past Presidents:

JOHN BIRKBECK NEVINS, M.D.
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REV. DR. DALLINGER, F.R.S.
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FRANK T. PAUL, F.R.C.S.
CHARLES BOTTERILL, F.R.M.S.

OFFICERS AND COUNCIL ELECTED 21st JANUARY, 1887.

President:

REV. FRANK BALLARD, M.A. F.G.S.

Vice-Presidents:

REV. HENRY H. HIGGINS, M.A.
A. NORMAN TATE, F.I.C.

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ISAAC C. THOMPSON, F.R.M.S.

Hon. Curator:

ALFRED LEICESTER.

Council:

HENRY M. BENNETT.
CHARLES BOTTERILL, F.R.M.S.
G. MANSFIELD BROWNE.
THOMAS W. BRUCE.
WILLIAM CARTER, M.D. F.R.C.P.
JOHN J. HOWELL.
ROBERT NICHOLSON.
W. OELRICHS, F.R.MET.SOC.
FRANK T. PAUL, F.R.C.S.
THOMAS C. RYLEY.
J. T. NORMAN THOMAS.
JOHN VICARS.

EIGHTEENTH ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

In reviewing the events of the Eighteenth Session, your Council do not see that there is much to call for special comment in the working of the Society.

The interest in the Meetings has been well maintained, and some of the Papers read have been well illustrated by various Members at the subsequent Conversaziones.

The Council feel that this is an important feature in the welfare of the Society, and would solicit the co-operation of all the Members in making the exhibits at the Conversaziones as large and instructive as possible.

It is intended for the future to embody with the Annual Report a list of objects shown at each Conversazione.

Eight new Members have been enrolled during the year, and thirteen have resigned. The number of Members now stands as follows:—148 Ordinary Members, 8 Honorary Members, and 1 Associate Member.

The following Papers have been read during the year:—

"The Copepoda of Liverpool Bay," illustrated by the oxy-hydrogen lantern, by Isaac C. Thompson, F.R.M.S.

"The Development, Structure and Functions of the Eye," illustrated by diagrams, by Dr. Barron.

"On the Practical Use of Micro-Photography," by Thomas Higgin, F.L.S. assisted by F. T. Paul, F.R.C.S.

"Remarks on Melobesia and its Allies," by Rev. H. H. Higgins, M.A. President.

"Some New Apparatus and Methods for the Microscopical Examination of Water," by A. Norman Tate, F.I.C.

"Notes on a Few Forms of Fresh Water Algæ," illustrated by the oxy-hydrogen lantern, by W. Narramore

The Council welcome the birth of a sister Society, the Liverpool Biological Society, which has resulted from the work of the Marine Biology Committee.

It is hoped that by its help Microscopical research in Liverpool may receive a further stimulus, the Microscope being an essential feature in all modern Biological investigation.

Among the chief additions to the Library during the year is Hudson and Gosse's valuable work on the Rotifera.

In conclusion, the Council tender the thanks of the Society to the donors of slides, books, &c. and to Mr. Thomas Higgin, F.L.S. for his valuable gift of Micro-Photographic Apparatus.

Abstract of Papers read and Communications made during the year 1886 :—

February 5.—Mr. Thomas Higgin, F.L.S. presented to the Society his camera for photographing microscopic objects, with heliostat and other apparatus, and explained his method of using them. The hearty thanks of the Society was accorded to Mr. Higgin for this most valuable gift.

The paper of the evening was read by Mr. Isaac C. Thompson, F.R.M.S. entitled "The Copepoda of Liverpool Bay, obtained during the summer dredging expeditions." Mr. Thompson commenced by expressing the debt of gratitude owed by all local biologists to Professor Herdman by his systematic and successful attempt to work out and classify the marine life of our neighbouring shores, the first report of which was in the press and very shortly to be published. The task of collecting and examining the materials obtained was divided amongst a considerable number of workers, and it had fallen to his (Mr. Thompson's) lot to work out a class large in point of numbers but very microscopical in size—the Copepoda, one of the branches of the Crustacea.

The specimens were obtained mostly by tow-net during the several summer excursions, chiefly on the "Hyæna," and during several excursions to Hilbre Island, and from material collected by Professor Herdman at the Isle of Man. To show the profusion of these minute crustaceans throughout the seas, Mr. Thompson stated that the ocean near the Arctic reigons is sometimes found to be of an almost red colour, from the abundance of one large species of copepoda—the Calanus finmarchicus, which is known to constitute an important part of the food of the whale, and must therefore exist in prodigious quantities. Indeed the presence of copepoda throughout the sea seems almost universal, and they are one of the many forms of life that give rise to the phenomena of phosphoresence. They vary in size from 1-30th to ½ inch in length in different species, 1-10th inch being about the average size, and appear to be equally plentiful on a fine or stormy day. Mr. THOMPSON proceeded to describe the means adopted for permanently preserving and mounting the specimens of the various species obtained, many of which were shown upon the screen from carefully prepared drawings by the aid of the oxy-hydrogen lantern. Amongst the latter the nauplius or larval condition was shown and its metamorphosis traced out, the embryological development throughout the crustacea being very remarkable. The paper concluded by commending the study of these and allied forms to the members as having a wonderfully varied arrangement of structure and affording a continual feast of surpassing interest and instruction to the microscopist and lover of nature.

Professor HERDMAN and others took part in the subsequent discussion, and the thanks of the Society were awarded to Mr. THOMPSON.

At the Conversazione the following subjects were illustrated:—

	Algæ, Marine, various	ALFRED LEICESTER.
	Annular cells from Cactus, Opuntia cylindrica	THOMAS C. RYLEY.
Illustrating the Paper.	Copepoda, Anomalocera patersonii, &c.	ISAAC C. THOMPSON.
	,, Calanus finmarchicus	CHARLES BOTTERILL.
	,, Candace truncata	A. T. SMITH, Jun.
	,, Centropages hamatus	WILLIAM OELRICHS.
	,, Dias longiremis	JOHN VICARS.
	,, Pseudocalanus elongatus	JOHN H. CLAYTON.
	,, Temora longicornis	HENRY M. BENNETT.
	Cuticle of Canary Seed	T. BICKESTETH BERRY.
	Cyclops	EDWARD NEWALL.
	Dodder, Cuscuta trifolii, exhibiting suckers	Rev. FRANK BALLARD, M.A.
	Head of Wasp, showing organs in situ	J. M. WILLIAMS.
	Section of nerve fibre, human	THOMAS J. DAVIES, M.R.C.V.S.
	Seeds of Pyrola rotundifolia	ROBERT NICHOLSON.

March 5.—The President exhibited a beautiful model of the "Portuguese Man-of-War" *(vhysalia utriculus)*, and made some remarks on this curious animal. The paper of the evening was read by Mr. ALEXANDER BARRON, M.B. M.R.C.S. on the "Development, Structure, and Functions of the Eye." The lecturer first described the structure of the human eye, fully explaining all its parts, and dwelling minutely on the marvellous composition of the retina, &c. He then gave an account of the development of the eye in the embryo, as exemplified in the chick, &c. and concluded by explaining the optical functions of the eye, its power of accommodation to light, distance of objects, &c. The lecture was illustrated by diagrams and models. After some discussion, in which the President and several other members joined, a hearty vote of thanks was given to the lecturer.

At the Conversazione the following subjects were illustrated:—

Illustrating the Paper.	Section of Rabbit's Eye	Dr. BARRON.
	Optic Disc, Human, normal	Dr. BARRON.
	Do. do. inflamed	Dr. BARRON.
	Corneal Corpuscles	Dr. BARRON.
	Choroidal Vessels, injected	Dr. BARRON.
	Section of Chick's Head, showing development of Lens and Retina	W. OELRICHS.
	Do. Sheep's Eye, showing Optic Nerve	ISAAC C. THOMPSON.
	Do. Eye of Drone Fly	J. J. HOWELL.
	Do. Sclerotic coat, human	C. G. LEE, M.R.C.S.
	Do. Cornea, with nerve and nuclei	T. W. BRUCE.
	Cornea of Eye of Beetle	CHARLES BOTTERILL.
	Choroid, with pigmentum nigrum	JOHN VICARS.
	Fusiform Cells from wood of Scotch Fir	THOMAS C. RYLEY.
	Petiole of Limnanthemum, transverse section	T. OLIVER.

April 2.—THOMAS HIGGIN, F.L.S. assisted by F. T. PAUL, F.R.C.S. aided by the oxy-hydrogen lantern, practically demonstrated the use of the Micro-Photographic Apparatus recently presented by him to the Society, taking and developing on the spot photographs of some of the objects exhibited.

At the Conversazione the following subjects were illustrated:—

Crisia denticulata, and other Polyzoa	WILLIAM OELRICHS.
Diatoms, various	T. W. BRUCE.
Lantern fitted with Watson's microscope stage and prism, for use with ordinary microscope objectives	A. NORMAN TATE.
Larva of Sea Anemone, from Hilbre	ISAAC C. THOMPSON.

Micro-photograph of St. Sulspice, Paris ....Robert Nicholson.
Micro-photograph, page of the *Times* ....J. M. Williams.
Micro-photographs, various..F. T. Paul, F.R.C.S.
Do. ....J. H. Clayton.
Slides recently added to the Cabinet ....Alfred Leicester.

May 7.—The President delivered an address entitled "Remarks on Melobesia and its Allies," which was illustrated with diagrams and a beautiful series of calcareous seaweeds, from the small forms on our own coast to the tinted corallines of California, including also a large mass of white stony carbonate of lime, which was once a plant growing on the sea bottom. These plants form a division of the algæ, having a rigid stem; nearly all found in salt water, and in almost every latitude. These hard shelled seaweeds differ physiologically from their softer kinsmen, and thus there ensues a morphological difference. The relationship existing between the giant *Sequoida Wellingtonia* of America, which towers to a height of 300 or 400 feet, and the tiny crisp seaweed, is not superficially apparent, but it exists nevertheless. The calcareous seaweeds are near relatives of the deep-water weeds, but as they came near the shore, where the waters dashed and roared, then came a necessity for a harder coat than when in the quiet waters of the deep, and so they learned to secrete an armour of carbonate of lime. This stiff, brittle, stony matter would not have helped them at all, unless it had been modified to elasticity, and this is admirably shown in the "shepherds' purse coralline," where the armour is in short, solid joints, forming little triangles, with the apex downwards, so that each joint moves freely on the part below it, thus forming a strong-jointed armour for the delicate plant body. The massive lime-like form of the *Melobesia* is simply a modification of this same process, by which the tender seaweed has found protection from the dashings of the sea. This development has doubtless occurred in past times, but the modified stability of species keeps them all true to their form. The number and variety of the seaweeds are enormous, but as they have not hitherto been of great economic importance, they have not received the study they deserved; but they are an exceedingly interesting group. During Professor Hooker's researches into Antarctic flora and fauna he discovered the famous seaweed which, from the one stem, has floating fronds over 1000 feet long, in which countless forms of life find food and shelter. The lowly seaweed thus becomes to the plant family what the whale is to the mammals—the overshadowing form of all.

At the Conversazione the following subjects were illustrated:—

Amphipoda, various, from Hilbre ....Isaac C. Thompson.
Bugula turbinata..J. M. Williams.
Campanalaria crystallinus ....W. Oelrichs.
Elytron of Diamond Beetle ....E. F. Stead.
Hydra fusca ....T. Oliver.
Piper geniculatus..J. J. Howell.
Puccinia graminis ....Rev. F. Ballard, M.A.

October 1.—Mr. Isaac C. Thompson, F.R.M.S. gave a short resumé of the dredging expeditions undertaken during the summer by the Liverpool Marine Biology Committee under Professor Herdman. The results already recorded include large additions to the previously-known marine fauna of Liverpool Bay, several of the species obtained being also altogether new to Britain. It was gratifying to know that the voluminous first report of the Committee would be soon followed by a second.

At the Conversazione the following subjects were illustrated:—

Amœba ....William Narramore.
Diatomaceæ, various ....Rev. Frank Ballard, M.A.
Entomostraca, marine ....Henry M. Bennett.
Garnets—Philadelphian and Virginian; and Coralloid Silver; Slides recently presented to the Society...Isaac C. Thompson.
Human Scalp, vertical section.........................Charles Botterill.
Insects, various ....Henry Kendall, B.A.
Oolitic Grains of Sand ....Alfred Leicester.
Section of Echinus Spine ....William Oelrichs.
Spine of Acrocladia trigonaria..........................J. M. Williams.
Sponge, transverse section of Halichondria ....Thomas C. Ryley.

November 5.—Mr. Oelrichs exhibited some seeds of the Indian Plantain, which he had found to possess interesting microscopical characters, and which, though new to this country, were largely used in India for medicinal and other purposes.

Mr. I. C. Thompson, F.R.M.S. exhibited two recent adaptations of microscopes. One of them was a new binocular stereoscopic prism by Messrs. Ross and Co. and fitted to their large microscope, and equally applicable for high and low powers. The other was the improved Stephenson binocular microscope, designed for dissecting purposes, and which, besides erecting the image of the object, enables the operator to work without any of the injurious fatigue so frequently experienced by continual bending of the head over the instrument.

Mr. A. NORMAN TATE, F.I.C. read a Paper on "Some New Apparatus and Methods for the Microscopical Examination of Water." After giving a brief outline of Professor Koch's method for the biological examination of water, he referred to the importance of the operation of sterilising the apparatus and substance used in the process, and exhibited and described several forms of hot-air ovens and steam and water chambers in which the operation can be conducted. He mentioned the special features of each, and the precautions necessary in using them, especially the arrangements for securing proper temperature. He also showed other warm chambers, such as are used for solidifying blood-serum, &c. and then described the moist chambers employed in developing bacterial colonies on glass plates covered with nutrient gelatine, &c. and in conclusion spoke of the interesting character of the study of the micro-organisms in water, the wide field of investigation it offered, and its great importance in connection with health and disease, remarking that the study of the one process of sterilisation alone was of the greatest value in preventing the spread of infectious diseases by assisting in the arrangement of methods for the disinfection of infected clothing, bedding, &c.

Dr. BARRON followed with some practical observations upon the subject; and, upon the motion of the President, the thanks of the Meeting were accorded to Mr. TATE for his valuable Paper.

At the Conversazione the following subjects were illustrated:—

Apparatus for sterilizing solutions, &c. ....A. NORMAN TATE.
Diatoms, various, from neighbourhood ....W. H. READ.
Foot of Dytiscus, exhibiting suckers, &c. ....J. MICHAEL WILLIAMS.
Foraminifera from the Adriatic ....ALFRED LEICESTER.
Juncus effusus, section of stem showing stellar cells ......ROBERT NICHOLSON.
Larva of Ascidian, exhibiting embryonic notochord, dredged off Puffin Island ....ISAAC C. THOMPSON.
Nitella translucens, in fruit.......................... ....A. T. SMITH, Jun.
Pond Water from brick-field ....Rev. F. BALLARD, M.A.
Section of Human Skin, perspiration ducts and glands ...CHARLES BOTTERILL.
Sedimentary Matter from foul water ....WILLIAM OELRICHS.
Sediment from surface drainage water ....WILLIAM NARRAMORE.
Seed of the Wild Clematis ....E. F. STEAD.
Volvox globator, living, and mounted ....T. MUSKETT.

December 3.—A Paper was read by Mr. WILLIAM NARRAMORE on "Notes on some few forms of Fresh Water Algæ." He said to the microscopist the study of the fresh water algæ is most interesting, and supremely instructive; they are within reach at all times, found as they are almost everywhere, easily cultivated in the aquaria, and can readily be examined in the living condition. Their relative simplicity of structure, their delicate arrangement of parts, exquisite beauty of colour, and the interesting life histories which belong to so many of them, all combine to make this group of plants a truly fascinating field of study. The writer then proceeded to describe several forms of algæ, beginning with the simple unicellular chlamydococcus, and pointing to this as the starting point in the evolution of the spherical colonial form, as found in pandorina morum, eudorina and volvox globator. Next showing how a similar miscellular organism like chlamydococcus would likely become the attached cell and develop the filamentous algæ like ulothrix zonata, oedogonium and bulbochoete. Passing from these, some of the more interesting branching forms were next considered, such as chœtophora pisiforms and elegans, batrachospermum and drapernaldia, and finally nostoc sphœricum and hydrodictyon utriculatum. The paper was illustrated with lantern transparencies shown by the oxy-hydrogen light.

At the Conversazione the following subjects were illustrated:—

Illustrative of the Paper.

Bulbochœta	W. H. Read.
Cylindrospermum macrospermum	Joseph Gould.
Cladophora crispata	G. Watson Gray.
Chœtophora elegans	Alfred Leicester.
Do.	A. T. Smith, Jun.
Do. pisiformis	Rev. Frank Ballard, M.A.
Draparnaldia glomerata	J. Harbord Lewis.
Do	A. Norman Tate.
Euglena and Protococcus	Henry Kendall, B.A.
Fresh Water Algæ in congugation	T. Muskett.
Nostoc sphœricum	J. Montgomery, Jun.
Do. and Hydrodictyon utriculatum	William Narramore.
Oscillaria tenuis	F. C. Larkin, M.R.C.S.
Polypothrix coactilis	Alfred Johnson.
Spirogyra nitida (congugation)	Edward Newall.
Ulothrix zonata (zoospores)	Frank B. Allen.
Ceramium ciliatum	J. M. Williams.
Fucus vesiculosus, transverse section of Thallus	R. Nicholson.
Larva of Dytiscus marginalis	T. Oliver.

FINANCIAL STATEMENT OF THE LIVERPOOL MICROSCOPICAL SOCIETY.

Dr.

1886.				£	s.	d.
To Rent of Rooms				10	10	0
,, E. Doling, Tea at Meetings, and Attendance				11	0	0
,, ,, Sub-Librarian				1	0	0
,, S. Burke, Attendance				2	7	6
,, J. Lind and Son, Oil for Lamps				0	4	0
,, I. Knott, Lantern Exhibitions				2	2	0
,, Subscription to Ray Society	£1	1	0			
,, ,, Microscopical Journal	3	0	0			
,, Henry Young, "Hudson's Rotifera"	2	16	0			
,, ,, Back Nos. Science Gossip	0	1	8			
				5	18	8
,, E. Manning, Bookbinding				0	7	6
,, Turner, Routledge and Co. Printing, &c.				12	4	3
,, D. Marples, 50 Vols. "Fauna of Liverpool"				10	0	0
,, Fire Insurance Premium				0	5	0
,, Postages per Secretary				4	0	0
,, ,, per Treasurer and Collector's Commission				2	1	6
,, Balance				66	6	9
				£128	7	2

Cr.

1886.	£	s.	d.
By Balance from 1885	39	10	0
,, 140 Subscriptions for 1886	73	10	0
,, 6 Half ,, ,, 1886	1	11	6
,, 7 Entrance Fees	3	13	6
,, Library Fines	0	2	2
,, Sale of 50 Vols. "Fauna of Liverpool"	10	0	0
	£128	7	2
By Balance in hands of Treasurer	£66	6	9
,, ,, ,, ,, to credit of Suspense Account	5	5	0

J. MICHAEL WILLIAMS,
Hon. Treasurer.

Audited and found correct,
HENRY M. BENNETT.
J. T. N. THOMAS.

LIVERPOOL, *21st January, 1887.*

LIVERPOOL MICROSCOPICAL SOCIETY.

LIST OF MEMBERS,

JANUARY, 1887.

HONORARY MEMBERS.

WITHAM M. BYWATER, 5, Hanover-square, London.

ARTHUR C. COLE, 171, Ladbroke Grove-road, Notting Hill, London W.

W. G. CORTHELL, Tremont Temple, Boston, U.S.A.

Rev. Dr. DALLINGER, F.R.S. Pres. R.M.S. Wesley College, Sheffield.

W. H. GRATTANN, 1, Weston Cottage, Torquay.

Professor THOMAS TAYLOR, Chief of the Microscopical Staff, Agricultural Department, Washington, U.S.A.

WASHINGTON TEASDALE, Headingley, Leeds.

TUFFEN WEST, F.L.S. F.R.M.S. Furnell House, Frensham, Farnham, Surrey.

ORDINARY MEMBERS.

* *Members of Council.*

Elected.	
1881	Abraham, Alfred Clay, 3, Lancaster-avenue, Sefton Park.
1881	Abraham, Miss Emma C. Grassendale Park.
1880	Allen, Francis Birkbeck, 33, Newsham-drive.
1869	Archer, Francis, B.A. Boundary Cottage, Great Crosby.
1878	Bacon, Tapley, Cuckoo-lane, Gateacre.
1879	Baird, James, 3, Windsor-road, Tue Brook.
1883	Baker, Arthur, 7, Mill-lane, Liscard.
1882	*Ballard, Rev. Frank, M.A. F.G.S. Newby-street, Walton-lane.
1868	Banister, Rev. W. B.A. St. James's-mount.
1883	Barron, Alexander, M.B. M.R.C.S. 31, Rodney-street.
1883	Barss, Howard, 11, Redcross street.
1874	Beasley, Henry C. Chestnut-grove, Wavertree.
1880	*Bennett, Henry M. 173, Lodge-lane, Prince's Park.
1883	Berey, T. Bickesteth, 21, Edge-lane.
1878	*Botterill, Charles, F.R.M.S. 52, Fern-grove, Sefton Park.

Elected.
1870 Bower, Anthony, Bowersdale, Seaforth.
1874 Brown, J. Campbell, D. Sc. F.C.S. 27, Abercromby-square.
1872 *Browne, George Mansfield, 15, South Hill-road.
1875 *Bruce, Thomas W. 26, Wapping.
1883 Cameron, John, M.D. 4, Rodney-street.
1881 Capon, Robert M. L.D.S. 1, Mount-street.
1879 Carter, Edward, 4, The Quadrant, Wellington-road, New Brighton.
1868 *Carter, William, M.D. F.R.C.P. 74, Rodney-street.
1869 Chadburn, William, 71, Lord-street.
1882 Clayton, John H. Oak Hill Park, Old Swan.
1885 Clinch, John William, Douglas, Isle of Man.
1884 Cooper, Mrs. James T. 24, Shrewsbury-road, Oxton.
1886 Councell, Edward A. L.D.S. 49, Rodney-street.
1885 Cradock, Miss Lucy E. L.K.Q.C.P.I. 29, Catharine-street.
1874 Davies, Edward, F.C.S. Royal Institution, 88, Seel-street.
1885 Davies, Thomas J. M.R.C.V.S. 2, St. Alban's-road, Bootle.
1884 Davies, Walter E, Egerton Park, Rock Ferry.
1879 Deacon, H. Wade, Appleton House, Widnes.
1869 Drysdale, John J. M.D. F.R.M.S. 36, Rodney-street.
1871 Edmonds, William, 27, The Albany, Oldhall-street.
1885 Edwards, Henry, 56, Hanover-street.
1885 Eskrigge, Robert Brockbank, New Brighton.
1881 Evans, John H. M.R.C.P. 33, Sandy-road, Seaforth.
1871 Evans, W. H. Wyllisholm, Huyton Hey-road, Huyton.
1879 Faulkner, Frank, Crosswells Brewery, Oldbury.
1881 Fryer, Miss Helen, 17, Elsie-road, Anfield.
1882 Fullerton, James, 67, Demesne-street, Seacombe.
1880 Gardner, Joseph K. Jun. Greenbank, Piercefield-road, Freshfield.
1882 Gardner, Willoughby, C 18, Exchange Buildings.
1879 Gatehouse, Charles, Ashley House, West Kirby.
1870 Gill, E. C. Belmont Villa, 7, Strathmore-road, Newsham Park.
1868 Glynn, T. R. M.D. M.R.C.P. 62, Rodney-street.
1879 Goodwin, Gilbert Smith, Rockville, 23, Anfield-road,
1884 Gould, Joseph, Cunard-road, Litherland.
1885 Gray, George Watson, 12, Argyle-road, Garston.
1880 Greening, Linnæus, Warrington.
1882 Grisewood, William, Westminster-road, Liscard Park, Egremont.
1882 Guest, George Seller, 23, Oxford-street.
1873 Harpin, Edward, 46, Onslow-road, Fairfield.
1868 Hayward, E. K. National Steam Ship Company, Water-street.
1869 Healey, George F. Oakfield, Gateacre.

Elected.

1871 Hicks, John Sibley, F.R.C.S. F.L.S. F.R.M.S. 2, Erskine-street.
1868 Higgin, Thomas, Ethersall, Roby.
1873 *Higgins, Rev. H. H. M.A. 29, Falkner-square.
1880 Higgins, Henry A. 3, Alfred-road, Birkenhead.
1887 Hornel, James, 123, Canning-street.
1880 *Howell, John Job, Branksome, Cearns-road, Birkenhead.
1868 Hughes, Lewis, 10, Conyers-street.
1878 Job, Robert Hugh. c/o Job Brothers, Mersey Chambers.
1882 Johnson, Alfred, Fort-street, New Brighton.
1874 Jones, C. W. Field House, Prince Alfred-road, Wavertree.
1881 Kendall, Henry, B.A. 17, Marmion-road.
1871 Knott, Isaac, 20, Elliott-street.
1882 Lahy, James, 23, Lilly-road, Fairfield.
1868 Lambert, James, M.D. 80, Price-street, Birkenhead.
1886 Larkin, Frederick Charles, M.R.C.S. 2, Fitzclarence-street, Everton.
1883 Lee, Charles George, M.R.C.S. 73, Rodney-street.
1875 *Leicester, Alfred, Holly Mount, 4, Albert-road, Birkdale.
1884 Lewis, J. Harbord, F.L.S. 145, Windsor-street.
1885 Lloyd, John Wesley, 34, Mount Pleasant.
1885 Lloyd, Thomas Isaac, L.D.S. 36, Bold-street.
1884 Maples, Arthur, 51, The Elms, Peel-street.
1868 Masters, F. H. Fairfield-terrace, Tranmere.
1879 McClelland, Joseph, M.D. 7, Sefton-drive, Sefton Park.
1880 Monks, F. W. 115, Lovely-lane, Warrington.
1883 Montgomery, John, Jun. Rowson-street, New Brighton.
1868 Moore, Thomas J. Cor. Mem. Z.S. Museum, William Brown-street.
1883 Mossop, Thomas, 18, Coltart-road, Kingsley-road.
1883 Muskett, Thompson, F.C.S. 75, Newby-street, Stanley Park.
1885 Muskett, Mrs. Thompson, 75, Newby-street, Stanley Park.
1880 Narramore, William, 5, Geneva-road, Elm Park.
1884 Newall, Edward, 14, Elm-grove, Tranmere.
1880 Newton, J. Banner, Sunnyside, Prince's Park.
1882 Newton, Mrs. J. Banner, Sunnyside, Prince's Park.
1878 *Nicholson, Robert, 11, Harrington-street.
1879 *Oelrichs, William, F.R.Met. Soc. 9, Village-road, Oxton.
1883 Oliver, Thomas, Tarbuck-road, Huyton.
1868 Owen, Peter, The Elms, Capenhurst, near Chester.
1883 Padley, Fred. 15, Church-street.
1879 Parkinson, John Charles, Alexandra-road, Waterloo.
1878 Patterson, Charles S. Students' Club, Park-street, Edinburgh.
1879 *Paul, Frank T. F.R.C.S. 44, Rodney-street.

Elected.	
1880	Pendlebury, William Martin, 17, Tithebarn-street.
1881	Pennock, John, 21, Victoria-street.
1876	Quayle, Alfred, 182, Regent-road.
1883	Quinby, Henry C. L.D.S. 3, Prince's Gate West, Prince's Park.
1885	Raleigh, Miss Isabel, 13, Catharine-street.
1886	Read, William H. Fern-grove, Lodge-lane.
1868	Roberts, Edward, Wilbraham Cottage, Melling.
1872	Roberts, Isaac, F.G.S. Kennessee, Maghull.
1885	Robertson, Helenus R. Glendaragh, Livingstone-drive South.
1885	Rosling, Percy, 11, Kenyon-terrace, Birkenhead.
1886	Routledge, Tom, Stanley Park, Litherland.
1879	Rowlandson, William, South lawn, Breeze-hill, Bootle.
1878	Russell, William, Manorlee, Prince's-avenue, Prince's Park.
1884	Rutherford, William Watson, 4, Mannering-road, Sefton Park.
1885	Rutherford, Mrs. W. W. 4, Mannering-road, Sefton Park.
1868	Ryland, William, 5, Eldon-terrace, Rock Ferry.
1875	*Ryley, Thomas Cropper, 31, Alexandra-drive.
1879	Scholefield, Joshua William, J.P. 33, Pembroke-road, Bootle.
1882	Schofield, Philip H. 27, Slatey-road, Claughton.
1878	Scoullar, David Marshall, 69, Berkeley-street.
1882	Servaes, Francis Charles, St. George's Hospital, London, S.W.
1884	Shillinglaw, William, L.D.S. Hamilton-square, Birkenhead.
1879	Smith, Andrew T. Jun. 13, Bentley-road, Prince's Park.
1884	Stead, Edward F. Park-hill, Victoria Park, Aintree.
1886	Stewart, W. H. L.D.S. 37, Rodney-street.
1873	Stone, John, Archway-road, Huyton.
1874	Stuart, Peter, Jun. M.D. Elm House, Seaforth.
1875	Symes, Charles, Ph.D. Ellerslie, Town-row, West Derby.
1882	*Tate, Alex. Norman, F.I.C. 9, Hackins-hey.
1868	Thomas, George, 1, Chatham-road, Bedford-road, Rock Ferry.
1879	*Thomas, J. T. Norman, Crosby-road, Waterloo.
1883	Thomas, Mrs. J. T. Norman, Crosby-road, Waterloo.
1872	Thompson, Edward P. Thingwall Hall, Broad Green.
1873	*Thompson, Isaac Cooke, F.R.M.S. Woodstock, Waverley-road.
1879	Tooker, E. G. Castletown, Isle of Man.
1878	Turner, James, Hafod Wen, Minera, near Wrexham.
1884	Vaughan, Le Baron, Rathmore, Aigburth-road.
1879	*Vicars, John, 8, St. Alban's-square, Bootle.
1886	Walker, George E. F.R.C.S. 43, Rodney-street.
1877	Wall, Joseph, 42A, Everton-brow.
1883	Wallace, Arthur John, 1, Gambier-terrace.

Elected.	
1868	Walmsley, G. G. 50, Lord-street.
1881	Weightman, Alfred Ernest, Naval Medical Service, Haslar, Gosport.
1868	Weightman, W. H. Minster Buildings, Church-street.
1887	Westby, George, M.K.Q.C.P.I. Farmleigh, Lodge-lane.
1884	Williams, David, 156, Chatham-street.
1871	*Williams, J. Michael, F.R.M.S. 156, Chatham-street.
1886	Williams, Thomas, F.C.S. 4, York Buildings, Dale-street.
1879	Wilson, Henry, M.R.C.S. 22, High-street, Wavertree.
1869	Wood, J. J. 20, Lord-street.
1868	Woolloxall, Thomas, 21, Houghton-street.
1872	Wyllie, Andrew, 1, Leicester-street, Southport.
1884	Young, Thos. Fred. M.R.C.S. &c. 12, Merton-road, Bootle.

ASSOCIATE MEMBER.

Mortimer, Captain (care of Mr. T. J. Moore, Free Museum).

NINETEENTH ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

ABSTRACT OF PROCEEDINGS,

AND LIST OF MEMBERS.

JANUARY, 1888.

LIVERPOOL:

TURNER, ROUTLEDGE AND CO. PRINTERS.

MDCCCLXXXVIII.

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Liverpool Microscopical Society.

SESSION XX. 1888.

Past Presidents:

JOHN BIRKBECK NEVINS, M.D.	GEORGE F. CHANTRELL.
REV. WM. BANISTER, B.A.	J. S. HICKS, F.R.C.S., F.L.S.
REV. DR. DALLINGER, F.R.S.	WILLIAM CARTER, M.D., F.R.C.P.
JOHN ABRAHAM.	W. H. WEIGHTMAN, F.R.M.S.
J. J. DRYSDALE, M.D., F.R.M.S.	FRANK T. PAUL, F.R.C.S.
JOHN NEWTON, M.R.C.S.	CHARLES BOTTERILL, F.R.M.S.
REV. HENRY H. HIGGINS, M.A.	REV. F. BALLARD, M.A., F.G.S.

OFFICERS AND COUNCIL ELECTED 20th JANUARY, 1888.

President:

A. NORMAN TATE, F.I.C., F.C.S.

Vice-Presidents:

REV. FRANK BALLARD, M.A., F.G.S. ISAAC C. THOMPSON, F.L.S., F.R.M.S.

Hon. Treasurer:

J. MICHAEL WILLIAMS, F.R.M.S.

Hon. Secretary:

THOMAS W. BRUCE.

Hon. Curator:

ALFRED LEICESTER.

Council:

HENRY M. BENNETT.	F. CHARLES LARKIN, M.R.C.S.
CHARLES BOTTERILL, F.R.M.S.	WILLIAM NARRAMORE.
GEO. MANSFIELD BROWNE.	WM. OELRICHS, F.R.MET.SOC.
WILLIAM CARTER, M.D., F.R.C.P.	FRANK T. PAUL, F.R.C.S.
JOHN H. DAY.	THOMAS C. RYLEY.
REV. H. H. HIGGINS, M.A.	J. T. NORMAN THOMAS.

NINETEENTH ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

In reviewing the events of the Nineteenth Session, your Council do not see that there is much to call for special comment in the working of the Society.

The Meetings during the session have been largely attended, and some of the papers read have been well illustrated by various Members at the subsequent Conversaziones.

It is with much pleasure that the Council are able to report a decided increase in the number of the exhibits at the monthly Conversaziones, and it is to be hoped that the active interest thus shown in the Society will make further progress during the coming session.

The Council mourn the loss by death of one of the earliest and most esteemed Members of the Society, W. H. WEIGHTMAN, who was President in 1882.

Seven new Members have been enrolled during the past year. 24 Members have left or resigned. The Members on the list now stand—133 Ordinary Members, 8 Honorary Members and 1 Associate Member.

As heretofore, the Society, assisted by several Members of the Chester Society of Natural Science, took an active part in the Associated Soirée, annually held in St. George's Hall.

The following Papers were read during the year :—

"Vegetable Reproduction, with Especial Reference to Embryology in Phanerogams." By the PRESIDENT.

"The Microscopical Characteristics of Birds' Eggs." By the Rev. H. H. HIGGINS, M.A.

"Recent Improvements in the Microscope: A Visit to Jena." By JOHN MAYALL, Jun., F.Z.S., V.P.R.M.S.

"The Development, Structure and Functions of the Ear." By C. G LEE, M.R.C.S.

"The Comparative Anatomy of the Reproductive Organs of Plants viewed as a Basis for a Phylogenetic Classification." By R J. HARVEY GIBSON, M.A.

"Microscopical Examination of Commercial Fibres." By A. NORMAN TATE, F.I.C., F.C.S.

"Radiolarian Protozoa, collected in the 'Challenger' Explorations." By the Rev. H. H. HIGGINS, M A.

The Council express their obligation to the Members of the Society, and others, who have read papers during the year, and trust that Members will come forward with a large number for the ensuing session.

In conclusion, the Council cordially thank the Donors of Books, Slides, &c. for their various presentations.

Abstract of Papers read and Communications made during the year 1887 :—

January 21st.—The Rev. FRANK BALLARD M.A., F.G.S., President elect, delivered an address on "Vegetable Reproduction, with Special Reference to Embryology in Phanerogams." He commenced by pointing out the similarity, functionally for reproductive purposes, of the zoospores of the lowest forms of Algæ. There may be a physiological differentiation, but it is imperceptible to us. Here is the perfectly asexual form of vegetable reproduction. With ascent, however, to higher forms, comes the gradual evolution of sex. First, the planogametes are similar. Then the gametangia give rise to slightly differing bodies, distinguished as microzoospores (large) and microzoospores (small). Reproduction takes place by fusion of one of each. The characteristics are such as to warrant our regarding the smaller as male, the larger as female. In addition to this sexual process, some forms—as Ulothrix, Ectocarpus, Scytosiphon, &c.—have zoospores capable of independent germination. This incomplete sexuality disappears in the Fucaceæ, where the reproductive organs are distinct, and all trace of primitive Planogamete is lost in the oosphere of Colœochete, Vaucheria, Œdogonium, Volvox, Chara. This perfect manifestation of sex was then carried on through the Muscineæ, Pteridophyta, and Florideæ to the Phanerogams. The importance of alternation of generations and its continued traces in the higher plants were then pointed out. A detailed account was then given of the Gymnosperms and Angiosperms separately, in regard to the structure and development of the ovule, the development and growth of embryosac, the structure of the oospore, the process of fertilisation, the result of fertilisation in the embryosac, and the development of the embryo into the seed. In a *resumé*, it was pointed out that we have no choice but to start with the simple yet enormous assumption that the reproductive capacity is a fundamental property of protoplasm. Whence it follows that all our knowledge is phenomenal. The analysis of reproduction brings us no nearer to the synthesis of life. Hence evolution as a thorough going theory has to be received with distinct caveats. Dr. Vines was quoted—"that evolution of plants is the expression of more than fortuitous variation." And Professor Huxley's description of the development of the tadpole from the spawn was taken as applying *mutatis mutandis* to vegetable life also. Finally, the inference was drawn that the marks of adaptation were so manifest and all-pervading as to substantiate a higher teleology, which constitutes an enhanced and intensified design argument.

The usual vote of thanks closed the proceedings.

February 4th.—The paper of the evening was read by the Rev. H. H. HIGGINS, M.A., upon "The Microscopical Characteristics of Birds' Eggs." The lecturer alluded to the little attention which had been given to the subject of microscopical characteristics of the shells of birds' eggs; the valuable article upon "Birds" in the new Encyclopaedia Britannica giving perhaps the best information. Mr. Sorby, F.R.S., had also written on the subject of the colours of birds' eggs. By the help of sketches upon the black board Mr. HIGGINS pointed out the cellular structure revealed by the microscope in a thin shell section of eggs, the shells being found to contain a remarkable form of crystalisation, or more properly concretion, as well as a number of calcareous triangular masses distributed throughout, known as calcified blastema. These were very plainly seen in a number of sections exhibited under the microscope by various members of the society at the subsequent conversazione, including the eggs of the common fowl, guinea fowl, emeu, ostrich, goose, turkey, guillemot, and swan. It was shown that a well-defined type of shell structure belongs to certain families of birds, and is easily recognised under the microscope; as witnessed in the colourless and transparent shell of the woodpecker's egg and the highly coloured shell of the emeu's. It is a well-known fact that the size of eggs is dependent upon the time spent in the nest by the birds after being hatched, thus, although the guillemot and the raven are birds of equal size, their respective eggs vary in size as ten to one. Mr. HIGGINS warmly commended the further study of the subject to the attention of the members, there being in it much room for original research of a most interesting kind.

Mr. T. J. MOORE and others made some further remarks on the subject.

At the Conversazione the following subjects were illustrated:—

Illustrative of the Paper.	Crystals of Carbonate of Lime in Egg of Fowl	J. M. WILLIAMS.
	Section of Egg Shell of Common Fowl	WM. OELRICHS.
	Do. do. Guinea Fowl	ALFRED LEICESTER.
	Do. do. Emeu	ISAAC C. THOMPSON.
	Do. do. Ostrich	THOMAS C. RYLEY.
	Do. do. Goose	HENRY M. BENNETT.
	Do. do. Turkey	CHARLES BOTTERILL.
	Do. do. Guillemot	A. T. SMITH, Jun.
	Do. do. Swan	JOHN VICARS.
	Carapace of Crab, horizontal section	ROBERT NICHOLSON.
	Crystals in abdomen of Formica rufa	HENRY KENDALL, B.A.
	Diatoms, new forms, from Oamaru	T. W. BRUCE.
	Eggs of House Fly	T. MUSKETT.
	Moist Chambers for culture of Micro-organisms	A. NORMAN TATE.
	Section of Pitchstone, from Saxony	The PRESIDENT.
	Shell of Shrimp, polarized	T. OLIVER.

March 4th.—Mr. JOHN MAYALL, Jun., F.Z.S., Vice-President of the Royal Microscopical Society, read a paper on "Recent Improvements of the Microscope: A Visit to Jena."

Mr. J. MAYALL said that upon the last occasion he had the honour to address the society—six years ago—he had to bring to their special notice certain improvements in the microscope—the introduction of the homogeneous-immersion system—the practical development of which had had the good fortune to attract the attention of Dr. E. Abbe, of Jena University.

The path of progress in microscopy indicated by the homogeneous-immersion system was clearly in the direction of higher and still higher apertures, till the limit should be reached—the limit imposed by the refractive index of the front lens, the immersion medium, or the cover glass. It was gratifying to reflect that our leading microscope opticians, Messrs. Powell and Lealand, had fully realised the importance of this progress, and had steadily extended the apertures of their high powers until about three years ago they arrived very approximately at the limit imposed by the plane surface of the cover glass. When that point was reached, which might fairly be said to obtain when the apertures of microscopic objectives were extended to within 2½ per cent. of the transmitting power of the plane surface of the cover glass, it seemed that the only further progress to be made would consist of slight changes in the formulæ whence minute reductions in the residuals of aberration might be effected, and these improvements, combined with higher quality of technical execution of the lenses, centering, &c., would lead to somewhat greater perfection of images seen in the microscope. But, happily, the ultimate progress of microscopy, so far as the perfection of the microscope itself was concerned, was not really so restricted by the nature of things; and this conception got possession of Dr. Abbe's thoughts to such purpose that he was induced to make large sacrifices of time and means to fairly test the matter, for he had reasoned himself into the conviction that by an exhaustive series of experiments it might be possible to discover new compounds of glass by which a higher degree of achromatism might be obtained, thus furnishing a new basis or starting-point for improvements in all optical instruments. With the assistance of Dr. Otto Schott, an able chemist who had had much experience in the manufacture of glass, Dr. Abbe carried out a long and carefully-classified series of experiments, resulting in the discovery of new kinds of glass, by which higher achromatisation than any previously reached was plainly demonstrated in practical constructions. These new kinds of glass formed the basis of the new microscope-objectives termed "Apochromatic," and for the "compensating" eyepieces recently issued by Messrs. Zeiss, the well-known opticians of Jena, and since taken up with important modifications by Messrs. Powell and Lealand, of London, Mr. MAYALL explained in detail the aim of the new apochromatic objectives and the points of difference when compared with the older objectives, in the course of which he described the circumstances that led him to visit Dr. Abbe at Jena, with whom he had examined a large number of microscope objectives that might be regarded as representative of the highest points of technical excellence reached in England and Germany. He mentioned with special pleasure the fact that when he informed Dr. Dallinger, the President of the Royal Microscopical Society, of his intended visit to Jena, he (Dr. Dallinger) at once expressed his earnest desire that every objective in his collection that might enable Dr. Abbe to correctly estimate the quality of English optical workmanship should be placed at his disposal. Mr. Frank Crisp, Secretary of the Royal Microscopical Society, also desired that his collection of objectives should be examined by Dr. Abbe, and similarly with Mr. E. M. Nelson, who had spared no efforts to collect examples of the best known objectives. Referring to his visit to Messrs. Zeiss's Optical Works at Jena, Mr. MAYALL said upwards of 300 persons were there employed, and the organisation appeared to him excellent throughout. He had witnessed the various technical processes of manufacturing microscopes. In the mechanical departments he had examined everything from the brass-casting in the foundry to the final adjustment through which every microscope stand went before being sent away from the workshops. In the optical departments he had watched the process of glass-slitting, cutting into squares, &c., grinding, polishing, gauging of thicknesses, testing the accuracy of the sphericity of the surfaces, centering, cementing into combinations, mounting in cells—in fact, the building up of objectives on a very large scale, where the system of manufacture passed them successively through the hands of more and more highly-trained workmen until they reached the final stage of testing to standard before being regarded as finished. For testing the sphericity of the surface, Fraunhofer's contact method was employed, which consisted in utilising for each curvature a corresponding gauge or test surface, finely and accurately worked in rock-crystal, the contact of the two surfaces in various positions displaying Newton's rings more or less symmetrically, according to the accuracy of the surface under trial. The accuracy of the rock-crystal gauge itself was in every case assured by its own corresponding gauge, also of rock-crystal, the contact of which showed perfect symmetry in the formation of Newton's rings. In practice the surfaces of the lenses were polished and tested with the rock-crystal gauges until the requisite degree of accuracy was attained. He had observed with particular attention the manufacture and mounting of the front lens of an apochromatic one-eighth homogeneous immersion where the spherical curve was somewhat greater than a hemisphere. The skill with which that delicate piece of work had been executed had given him a high opinion of the system of training in vogue in Messrs. Zeiss's establishment, for it should be noted that even such high-class work was not limited to one pair of hands, several experts being wholly engaged upon similar work. With regard to the Jena Optical Glass Works, Mr. MAYALL said they were under the direction of Dr. Schott, and appeared to him planned with admirable practical aims. He understood the installation was now on a commercial basis. Prior to the establishment of the present glass works, the German Government had made special grants of money to Dr. Schott and Dr. Abbe, in furtherance of a large series of experiments in the manufacture of optical glass, with the distinct purpose of promoting scientific improvements in optical instruments. One of the principal aims of the experiments had been to determine precisely within what range it was possible to control the ratios of refraction and dispersion, utilising the whole known series of substances capable of vitrification. Upwards of 1000 different samples of glass had been made, of which the chemical composition and other technical data, as also the optical analysis, had been systematically tabulated, and the experience thus gained was now available to meet the demands for optical glass of any required refractive and dispersive powers within the limits under control. The importance of the aims in view could hardly be overrated, for telescopes, field glasses, &c., microscopes and photographic lenses, all stood in need of a greater range of media to not only lessen the difficulties of construction, but to further their advancement to higher standards of excellence. The first important practical outcome of Dr. Schott's experiments had been the production of the apochromatic objectives, by Messrs. Zeiss, on computations made by Dr. Abbe. It was also known that telescope object-glasses were in progress in which the higher achromatism due to the new glass, was the essential aim. The progress shown in the new microscope objectives clearly pointed to the possibility of analogous improvement in photographic lenses, where an increased facility of obtaining achromatism would certainly lead to larger and flatter field with a given linear aperture and focal length—qualities of the highest importance, which would not fail to be appreciated by every one interested in photography.

A cordial vote of thanks was conveyed to Mr. Mayall for his paper, this being moved by the President, and seconded by Mr. A. Norman Tate.

April 1st.—The Rev. H. H. Higgins alluded to the discovery of a new Marine Medusa, by a member of the Chester Society of Natural Science, as an illustration of the value of early dredging work, the probability being that the Marine Fauna of winter and early spring may materially differ from that of the summer.

The paper of the evening was read by Mr. C. George Lee, M.R.C.S., on the "Development, Structure, and Functions of the Ear." The lecturer described the structure of the human ear, fully explaining all its parts, and illustrated the same on the screen by means of the oxy-hydrogen lantern, prepared specimens and models. After some discussion, in which the Rev. H. H. Higgins and several others joined, a hearty vote of thanks was given to the lecturer.

At the Conversazione the following subjects were illustrated :—

Illustrative of the Paper.

Section of Ear of Mouse	John Vicars.
Do. Lobe of Human Ear	J. M. Williams.
Do. Human Ear through the Auditory Meatus	A. Norman Tate.
Do. Internal Ear of Pig	A. Norman Tate.
Model of Ear	A. Norman Tate.
Otoliths from Ear of Fish	The President.
Do. do.	W. H. Read.
Drum of Frog's Ear	Isaac C. Thompson.
Eye-lash of Whale, transverse section	Wm. Oelrichs.
Mouth of Tadpole	Alfred Leicester.

May 6th.—Mr. J. Harvey Gibson, M.A., F.R.S.E., read the paper of the evening, entitled "The Comparative Anatomy of the Reproductive organs of the Plants viewed as a basis for a Phylogenetic Classification."

After some remarks from the President, a vote of thanks to the lecturer was moved by Mr. A. Norman Tate, seconded by Mr. C. Botterill, and carried.

At the Conversazione the following subjects were illustrated :—

Anther of Lily, transverse section	A. Johnson.
Anther and Pollen of Lavetera	Chas. Botterill.
Apothecium of Lichen, vertical section	The President.
Clubiona brevipes	T. Muskett.
Englenæ	J. Gould.
Grain of Wheat, embryo	Geo. F. Healy.
Indian Corn, transverse section through embryo	A. Norman Tate.
Ovules of Poppy, transverse section, fertilised and unfertilised	Do.
Do. Tulip, fertilised	Do.
New Slides from Cabinet	A. Leicester.
Lophopus crystallinus	H. M. Bennett.
Ovary of Cucumber	W. H. Read.
Do. Purple Foxglove	P. H. Schofield.
Do. Tulip, four-celled	H. Kendall, B.A.
Pandorina morum	J. T. Norman Thomas.
Pollen Grains, sections	J. M. Williams.
Pollen of Polyanthus narcissus	E. F. Stead.
Prothallus of Fern	T. Oliver.

Section of Fucus ves	W. H. READ.
Seeds, various	T. C. RYLEY.
Spores and Sori	JOHN J. HOWELL.
Sporocarp of Pilularia globulifera	ROBERT NICHOLSON.
Vaucheria sessilis and v. terrestris	WM. NARRAMORE.
Fertilised Ovules of Malva moschata	WM. OELRICHS.

October 7th.—The paper of the evening was read by Mr. A. NORMAN TATE, F.I.C., F.C.S., on the "Microscopical Examination of Commercial Fibres." After referring to the large number of fibres now imported for textile purposes, rope and twine making, and the manufacture of paper, brushes, mats, &c., he spoke of the great value of microscopical examination in noting the minute structure and many other characters of these fibres, and urged the desirability of more extended investigation by means of the microscope. Subsequently, with the aid of drawings and diagrams shown by the lime-light lantern, he described in detail the character of several varieties of sheep's wool, mohair, alpaca, the hair and fur of other animals, silk, cotton, hemp, flax, jute and numerous other fibres, some of which have only lately been introduced into commerce.

After some discussion, in which Mr. J. M. WILLIAMS and others took part, a vote of thanks was accorded to the lecturer for his interesting paper.

At the Conversazione the following subjects were illustrated :—

Illustrative of the Paper:

Fibres, various	H. M. BENNETT.
Hemp fibre	W. H. READ.
Mexican fibre, Jute, Flax	TAPLEY BACON.
Mixed fibres prepared for analysis	A. NORMAN TATE.
Vegetable fibres used for ropes, &c.	Do.
Collection of many commercial fibres	
Sea Island Cotton fibres (various)	J. M. WILLIAMS.
Spun Silk	ALFRED LEICESTER.
Varieties of Wool, showing effects of chemical treatment	W. NARRAMORE.

Drosera rotundifolia (Sundew)	WM. OELRICHS.
Larva in situ in bud of Black Currant Tree	T. OLIVER.
Larval stage of Star Fish, from Puffin Island	ISAAC C. THOMPSON.
Protella phasma	HENRY KENDALL, B.A.
Section of Cocoon of Silk Worm	G. W. GRAY.
Do. Elder twig in balsam	PERCY ROSLING.
Stained vegetable sections	E. DAVIES.
Sting of Wasp	A. JOHNSON.
Triceratium morlandii, new diatom	THOMAS W. BRUCE.

November 4th.—The REV. H. H. HIGGINS, M.A. read a very interesting paper on "The Radiolarian Protozoa, collected in the 'Challenger' Explorations," beautifully illustrated on the screen by means of photographs.

The lecturer explained that these curious animals, made up almost entirely of protoplasms, are found floating on all seas, swimming near the surface of the water. In some species skeletral structures are developed in the form of radiating silicious spines. The individuals cohere in compound masses or colonies, which assume various shapes, cylindrical, spheroidal, or like a chain or circlet of beads. They delight in a smooth sea and pure transparent water at a moderately warm temperature. The voyage of the "Challenger" resulted in finding these organisms at all depths in the ocean, though specimens taken from near the surface appeared to be generally of greater size and development. Very wonderful and beautiful are the forms of these lowly creatures, as seen in the reproductions of Murray's fine plates.

Some further remarks on the subject were made by Messrs. E. DAVIES and A. NORMAN TATE, and a vote of thanks was accorded to the lecturer for his paper.

At the Conversazione the following subjects were illustrated :—

Astromma aristotelis	J. M. WILLIAMS.
Aulacodiscus janischii	THOMAS W. BRUCE.
Foraminifera from Post Pliocene Silt	W. OELRICHS.
Hind Leg of Honey Bee, showing Pollen Basket	J. J. HOWELL.
Lagena squamosa	T. MUSKETT.
Verneuilina polystropha	T. MUSKETT.
Polycystina	TAPLEY BACON.
Do.	A. JOHNSON.
Do. from Barbadoes	ALFRED LEICESTER.
Salicornaria farciminoides (Bugle Coralline)	W. H. READ.
Section of Cat's Tongue	CHARLES BOTTERILL.
Sori of Scaly Spleenwort	E. F. STEAD.
Stigonema mammilosa	J. HARBORD LEWIS.
Tail of young Newt, stained with Chloride of Gold	HENRY KENDALL, B.A.

December 2nd.—Mr. A. NORMAN TATE, F.I.C., F.C.S., brought under the notice of the members the very beautiful designs which can be obtained from micro-crystals, and exhibited some designs taken from them.

There being no paper, the Conversazione was largely attended, and the following subjects were illustrated :—

Aneura pinguis (Hepaticæ jungermanniæ)	The PRESIDENT.
Coscinodiscus excavatus .... Podosira	THOMAS W. BRUCE.
Chemical Crystals (polarized)	G. WATSON GRAY.
Crystals of Pyrogallic and Citric acids	H. M. BENNETT.
Daphnia	WILLIAM OELRICHS.
Eggs of Tetranychus lapidum	J. GOULD.
Head of Saw Fly, showing mouth organs...... Head of Thistle Bee, do.	T. MUSKETT.
Fairy Fly..	A. JOHNSON.
Formica rufa, showing muscular structure	J. M. WILLIAMS.
Gonium pectorale, showing method of reproduction	W. NARRAMORE.
Lichen, Physica stellaris	E. DAVIES.
Micro-Fungi .... Paper-making Fibre	A. NORMAN TATE.
Miscellaneous Slides	CHARLES BOTTERILL.
Motion of Zoospores in Gasteromycetous Fungi...	Rev. H. H. HIGGINS, M.A.
Polycistina from Barbadoes .... Red Sea Soundings by H.M.S. "Unicorn." ...	J. J. HOWELL.
Recent Cabinet Slides	ALFRED LEICESTER.
Ribes nigrum, transverse section of Stem	THOMAS C. RYLEY.
Salivary Glands of Blatta orientalis	W. H. READ.
Several specimens of stained Blood Corpuscles ...	F. C. LARKIN, M.R.C.S.
Skin of Negro, transverse section	P. H. SCHOFIELD.
Spongilla fluviatilis	J. T. NORMAN THOMAS.
Stellate Hairs from Fern (polarized)	JOSEPH WALL.
Thrips	H. KENDALL, B.A.
Wing Scales of Small White Butterfly (Pieris rapæ)	WILLOUGHBY GARDNER.

Dr. FINANCIAL STATEMENT OF THE LIVERPOOL MICROSCOPICAL SOCIETY. Cr.

1887.	£	s.	d.
To Rent of Rooms	10	10	0
,, E. Doling, Tea at Meetings, and Attendance	10	17	6
,, ,, Sub-Librarian	1	0	0
,, S. Burke and Benj. John, Attendance	2	0	0
,, J. Lind and Son, Oil for Lamps	0	8	6
,, I. Knott, Lantern Exhibitions	4	4	0
,, J. Conlan Do.	1	0	0
,, Subscription to Ray Society	1	1	0
,, J. J. Atkinson, Carrier for Photographic Apparatus	0	5	0
,, W. Watson and Sons, Cabinet Slides	0	13	9
,, J. Mayall, for Lecture	3	3	0
,, Turner, Routledge and Co. Printing, &c.	13	9	0
,, B. Haram, Receipt Books	0	10	6
,, Postages per Secretary	4	14	0
,, ,, per Treasurer and Collector's Commission	2	13	6
,, Fire Insurance Premium	0	5	0
,, Balance	90	19	6
	£147	14	3

1887.	£	s.	d.
By Balance from 1886	66	6	9
,, 10 Entrance Fees	5	5	0
,, 4 Subscriptions for 1886	2	2	0
,, 6 Half ,, ,, 1887	1	11	6
,, 138 Subscriptions for 1887	72	9	0
	£147	14	3
By Balance in hands of Treasurer	£90	19	6
,, ,, ,, ,, to credit of Suspense Account	5	5	0

J. MICHAEL WILLIAMS,
Hon. Treasurer.

Audited and found correct,

HENRY M. BENNETT.
J. T. N. THOMAS.

LIVERPOOL, *20th January, 1888.*

LIVERPOOL MICROSCOPICAL SOCIETY.

LIST OF MEMBERS,

JANUARY, 1888.

HONORARY MEMBERS.

WITHAM M. BYWATER, 5, Hanover-square, London.
ARTHUR C. COLE, 171, Ladbroke Grove-road, Notting Hill, London W.
W. G. CORTHELL, Tremont Temple, Boston, U.S.A.
Rev. Dr. DALLINGER, F.R.S. V.P.R.M.S. Wesley College, Sheffield.
W. H. GRATTANN, 1, Weston Cottage, Torquay.
Professor THOMAS TAYLOR, Chief of the Microscopical Staff, Agricultural Department, Washington, U.S.A.
WASHINGTON TEASDALE, Headingley, Leeds.
TUFFEN WEST, F.L.S. F.R.M.S. Furnell House, Frensham, Farnham, Surrey.

ORDINARY MEMBERS.

* *Members of Council.*

Elected.	
1881	Abraham, Alfred Clay, 3, Lancaster-avenue, Sefton Park.
1881	Abraham, Miss Emma C. Grassendale Park.
1880	Allen, Francis Birkbeck, 33, Newsham-drive.
1869	Archer, Francis, B.A. Boundary Cottage, Great Crosby.
1878	Bacon, Tapley, Cuckoo-lane, Gateacre.
1879	Baird, James, 3, Windsor-road, Tue Brook.
1883	Baker, Arthur, 7, Mill-lane, Liscard.
1882	*Ballard, Rev. Frank, M.A. F.G.S. Newby-street, Walton-lane.
1868	Banister, Rev. W. B.A. St. James's-mount.
1883	Barron, Alexander, M.B. M.R.C.S. 31, Rodney-street.
1880	*Bennett, Henry M. 173, Lodge-lane, Prince's Park.
1883	Berey, T. Bickesteth, 21, Edge-lane.
1878	*Botterill, Charles, F.R.M.S. 52, Fern-grove, Sefton Park.
1874	Brown, J. Campbell, D. Sc. F.C.S. 27, Abercromby-square.
1872	*Browne, George Mansfield, 15, South Hill-road.

Elected.	
1875	*Bruce, Thomas W. 27, Wapping.
1883	Cameron, John, M.D. 4, Rodney-street.
1881	Capon, Robert M. L.D.S. 1, Mount-street.
1868	*Carter, William, M.D. F.R.C.P. 78, Rodney-street.
1869	Chadburn, William, 71, Lord-street.
1882	Clayton, John H. Oak Hill Park, Old Swan.
1885	Clinch, John William, Douglas, Isle of Man.
1884	Cooper, Mrs. James T. 24, Shrewsbury-road, Oxton.
1886	Councell, Edward A. L.D.S. 49, Rodney-street.
1885	Cradock, Miss Lucy E. L.K.Q.C.P.I. 29, Catharine-street.
1887	Dalby, Miss, Talbot House, Mather-road, Birkenhead.
1874	Davies, Edward, F.C.S. Royal Institution, 88, Seel-street.
1885	Davies, Thomas J. M.R.C.V.S. 2, St. Alban's-road, Bootle.
1884	Davies, Walter E, Egerton Park, Rock Ferry.
1887	*Day, John H.. 2, Carlton Mount, Allerton-road, Tranmere.
1879	Deacon, H. Wade, Appleton House, Widnes.
1869	Drysdale, John J. M.D. F.R.M.S. 36, Rodney-street.
1871	Edmonds, William, 69, The Albany, Oldhall-street.
1885	Eskrigge, Robert Brockbank, New Brighton.
1881	Evans, John H. M.R.C.P. Broomfield, Crosby-road, N. Waterloo.
1871	Evans, W. H. Wyllisholm, Huyton Hey-road, Huyton.
1879	Faulkner, Frank, Crosswells Brewery, Oldbury.
1881	Fryer, Miss Helen, 11, Rockfield-road, Anfield.
1882	Fullerton, James, 67, Demesne-street, Seacombe.
1880	Gardner, Joseph K. Jun. Greenbank, Piercefield-road, Freshfield.
1882	Gardner, Willoughby, C 18, Exchange Buildings.
1879	Gatehouse, Charles, c/o Messrs. Gatehouse & Yates, Birkenhead.
1870	Gill, E. C. Belmont Villa, 7, Strathmore-road, Newsham Park.
1868	Glynn, T. R. M.D. M.R.C.P. 62, Rodney-street.
1879	Goodwin, Gilbert Smith, Rockville, 23, Anfield-road,
1884	Gould, Joseph, Cunard-road, Litherland.
1885	Gray, George Watson, 12, Argyle-road, Garston.
1882	Grisewood, William, Westminster-road, Liscard Park, Egremont.
1882	Guest, George Seller, 54, Canning-street.
1873	Harpin, Edward, c/o Messrs. Bates, Stokes & Co. 14, Water-street.
1868	Hayward, E. K. National Steam Ship Company, Water-street.
1869	Healey, George F. Oakfield, Gateacre.
1868	Higgin, Thomas, Ethersall, Roby.
1873	*Higgins, Rev. H. H. M.A. 29, Falkner-square.
1880	Higgins, Henry A. 3, Alfred-road, Birkenhead.
1887	Hornel, James, 105A, Grove-street.

Elected.

1887 Houlgrave, Henry, Crosby-road, South, Seaforth.
1880 Howell, John Job, Branksome, Cearns-road, Birkenhead.
1882 Johnson, Alfred, Stainborne Villa, Westminster-road, Liscard.
1874 Jones, C. W. Field House, Prince Alfred-road, Wavertree.
1881 Kendall, Henry, B.A. 17, Marmion-road.
1882 Lahy, James, 23, Lilly-road, Fairfield.
1868 Lambert, James, M.D. 80, Price-street, Birkenhead.
1886 *Larkin, Frederick Charles, M.R.C.S. 2, Fitzclarence-street, Everton.
1883 Lee, Charles George, M.R.C.S. 73, Rodney-street.
1875 *Leicester, Alfred, Enfield-place, 24, Aughton-road, Birkdale.
1884 Lewis, J. Harbord, F.L.S. 145, Windsor-street.
1887 Lewis, Edward, 2A, Tiber-street, Prince's Park.
1885 Lloyd, Thomas Isaac, L.D.S. 36, Bold-street.
1887 Mahon, George, 86, Anfield-road, Anfield.
1884 Maples, Arthur, 51, The Elms, Peel-street.
1868 Masters, F. H. Fairfield-terrace, Tranmere.
1879 McClelland, Joseph, M.D. 7, Sefton-drive, Sefton Park.
1868 Moore, Thomas J. Cor. Mem. Z.S. Museum, William Brown-street.
1883 Mossop, Thomas, 18, Coltart-road, Kingsley-road.
1883 Muskett, Thompson, F.C.S. 75, Newby-street, Stanley Park.
1885 Muskett, Mrs. Thompson, 75, Newby-street, Stanley Park.
1880 *Narramore, William, 5, Geneva-road, Elm Park.
1884 Newall, Edward, 14, Elm-grove, Tranmere.
1880 Newton, J. Banner, Sunnyside, Prince's Park.
1878 Nicholson, Robert, 11, Harrington-street.
1879 *Oelrichs, William, F.R.Met. Soc. Sunnyside, Wexford-road, Oxton.
1883 Oliver, Thomas, Tarbuck-road, Huyton.
1868 Owen, Peter, The Elms, Capenhurst, near Chester.
1883 Padley, Fred. 15, Church-street.
1879 Parkinson, John Charles, Alexandra-road, Waterloo.
1879 *Paul, Frank T. F.R.C.S. 44, Rodney-street.
1880 Pendlebury, William Martin, 17, Tithebarn-street.
1881 Pennock, John, 21, Victoria-street.
1876 Quayle, Alfred, 182, Regent-road.
1883 Quinby, Henry C. L.D.S. 3, Prince's Gate West, Prince's Park.
1885 Raleigh, Miss Isabel, 13, Catharine-street.
1886 Read, William H. Fern-grove, Lodge-lane.
1868 Roberts, Edward, Wilbraham Cottage, Melling.
1872 Roberts, Isaac, F.G.S. Kennessee, Maghull.
1885 Robertson, Helenus R. Glendaragh, Livingstone-drive South.
1886 Routledge, Tom, Stanley Park, Litherland.

Elected.	
1879	Rowlandson, William, South-lawn, Breeze-Lill, Bootle.
1868	Ryland, William, 5, Eldon-terrace, Rock Ferry.
1875	*Ryley, Thomas Cropper, 31, Alexandra-drive.
1879	Scholefield, Joshua William, J.P. 33, Pembroke-road, Bootle.
1882	Schofield, Philip H. 27, Slatey-road, Claughton.
1884	Shillinglaw, William, L.D.S. Hamilton-square, Birkenhead.
1879	Smith, Andrew T. Jun. 13, Bentley-road, Prince's Park.
1884	Stead, Edward F. Park-hill, Victoria Park, Aintree.
1886	Stewart, W. H. L.D.S. 37, Rodney-street.
1873	Stone, John, Archway-road, Huyton.
1874	Stuart, Peter, Jun. M.D. Elm House, Seaforth.
1875	Symes, Charles, Ph.D. Ellerslie, Town-row, West Derby.
1882	*Tate, Alex. Norman, F.I.C. 9, Hackins-hey.
1868	Thomas, George, 1, Chatham-road, Bedford-road, Rock Ferry.
1879	*Thomas, J. T. Norman, Crosby-road, Waterloo.
1883	Thomas, Mrs. J. T. Norman, Crosby-road, Waterloo.
1872	Thompson, Edward P. Thingwall Hall, Broad Green.
1873	*Thompson, Isaac Cooke, F.L.S. F.R.M.S. Woodstock, Waverley-road.
1879	Tooker, E. G. Castletown, Isle of Man.
1878	Turner, James, Hafod Wen, Minera, near Wrexham.
1879	Vicars, John, 8, St. Alban's-square, Bootle
1886	Walker, George E. F.R.C.S. 43, Rodney-street.
1877	Wall, Joseph, 42A, Everton-brow.
1883	Wallace, Arthur John, 1, Gambier-terrace.
1868	Walmsley, G. G. 50, Lord-street.
1887	Westby, George, M.K.Q.C.P.I. Farmleigh, Lodge-lane.
1884	Williams, David, 156, Chatham-street.
1871	*Williams, J. Michael, F.R.M.S. 156, Chatham-street.
1887	Williams, P. P., 69, Chatham-street.
1886	Williams, Thomas, F.C.S. 4, York Buildings, Dale-street.
1887	Willmer, Miss Laura, Fernlea, 94, Westbourne-road, Birkenhead.
1879	Wilson, Henry, M.R.C.S. 22, High-street, Wavertree.
1869	Wood, J. J. 20, Lord-street.
1868	Woolloxall, Thomas, 21, Houghton-street.
1872	Wyllie, Andrew, 1, Leicester-street, Southport.
1884	Young, Thos. Fred. M.R.C.S. &c. 12, Merton-road, Bootle.

ASSOCIATE MEMBER.

Mortimer, Captain (care of Mr. T. J. Moore, Free Museum).

TWENTIETH ANNUAL REPORT

OF THE

LIVERPOOL

MICROSCOPICAL SOCIETY.

ABSTRACT OF PROCEEDINGS,

AND LIST OF MEMBERS.

JANUARY, 1889.

21st Rept. in Vol. 1, No 3

LIVERPOOL:
TURNER, ROUTLEDGE AND CO. PRINTERS.

MDCCCLXXXIX.

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LIVERPOOL:

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MDCCCLXXXIX.

Liverpool Microscopical Society.

SESSION XXI. 1889.

Past Presidents:

JOHN BIRKBECK NEVINS, M.D.
Rev. WM. BANISTER, B.A.
Rev. Dr. DALLINGER, F.R.S., V.P.R.M.S.
JOHN ABRAHAM.
J. J. DRYSDALE, M.D., F.R.M.S.
JOHN NEWTON, M.R.C.S.
Rev. HENRY H. HIGGINS, M.A.
GEORGE F. CHANTRELL.
J. S. HICKS, F.R.C.S., F.L.S.
WILLIAM CARTER, M.D., F.R.C.P.
W. H. WEIGHTMAN, F.R.M.S.
FRANK T. PAUL, F.R.C.S.
CHARLES BOTTERILL, F.R.M.S.
Rev. F. BALLARD, M.A., B Sc., F.G.S., F.R.M.S.
A. NORMAN TATE, F.I.C., F.C.S., F.R.M.S.

OFFICERS AND COUNCIL ELECTED 20th JANUARY, 1889.

President:

ISAAC C. THOMPSON, F.L.S., F.R.M.S.

Vice-Presidents:

A. NORMAN TATE, F.I.C., F.C.S., F.R.M.S.
ALEXANDER BARRON, M.B., M.R.C.S.

Hon. Treasurer:

J. MICHAEL WILLIAMS, F.R.M.S.

Hon. Secretary:

THOMAS W. BRUCE.

Hon. Curator:

ALFRED LEICESTER.

Council:

EV. F. BALLARD, M.A., B.Sc., F.G.S., F.R.M.S.
HARLES BOTTERILL, F.R.M.S.
ILLIAM CARTER, M.D., F.R.C.P.
OHN H. DAY.
EV. H. H. HIGGINS, M.A.
AMES HORNELL.
FREDERICK C. LARKIN, M.R.C.S.
WILLIAM NARRAMORE.
J. BANNER NEWTON.
WILLIAM OELRICHS, F.R.Met.Soc.
WILLIAM H. READ.
THOMAS C. RYLEY.

TWENTIETH ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

In presenting the Twentieth Annual Report, the Council are able to state that the Meetings during the session have been well attended, and that the papers read have been more than previously illustrated by exhibits during the Conversaziones. This the Council look upon as a gratifying and hopeful feature.

During the year 2 new Members have been enrolled, 11 have left or resigned, and the number on the list now stands—124 Ordinary Members, 8 Honorary Members and 1 Associate Member.

The Council express their obligation to the Members who have read papers and exhibited objects at the Meetings, and also to the donors to the Library and Cabinet.

The Council have recently had under their consideration how best to further the usefulness of the Society, and have issued recommendations which they trust will result in greater activity among the Members generally; and they especially call attention to the appointment of referees in several departments of Microscopical Science.

The following Papers have been read during the session:—

"The Application of the Microscope to Technological Purposes."
By the President.

"On Making Permanent Microscopical Specimens of Blood." By FREDERICK C. LARKIN, M.R.C.S.

"Wing Scales of Butterflies." By WILLOUGHBY GARDNER.

"Some New and Rare Species of Copepoda, recently found in Liverpool Bay." By ISAAC C. THOMPSON, F.L.S., F.R.M.S.

"Types of the Anoplura compared with Menopon Cucullare." By JAMES HORNELL.

"Notes on the Desmids." By J. HARBORD LEWIS, F.L.S.

"Some Remarks on the Diseases associated with the Parasite Bilharzia hæmatobia." By ALEXANDER BARRON, M.B., M.R.C.S.

Abstract of Papers read and Communications made during the year 1888:—

January 20th.—Mr. A. NORMAN TATE, F.I.C., F.C.S., F.R.M.S., President elect, delivered an inaugural address on "The Application of the Microscope to Technological Purposes," in the course of which he said: The microscope is no longer what it was a comparatively short time since, an instrument employed more especially for recreative purposes, for a few researches in natural history, and an occasional test by medical men and chemists. It has of late years proved itself not only valuable in scientific research, but also of great service in very many of the practical applications of science. It has afforded to the physician and surgeon information of the greatest value, and during the last few years it has been especially serviceable in the study of micro-organisms in connection with health and disease, and in the examination of the minute structure of the tissues of the body. The work done by its aid in relation to bacteriology has been immense, and the results are being rapidly systematised and put to useful purposes; but, great as has been the progress of bacteriology, there is still a very wide field for further work, and room for very many new workers.

Its study has already been made useful in examinations of the air for micro-organisms, but the work yet done in this direction is a mere trifle compared to the importance of the investigation in relation to health. Although a subject that can well be worked at with advantage by individual microscopists, it is highly desirable that it should be taken up by Government departments and sanitary authorities.

In the examination of water the microscope has also been of great service of late years; and here, again, whilst there is much to afford individual microscopists interesting and useful work, still it is so absolutely necessary that our water supplies should be systematically examined regularly by the most refined methods known, that the use of these methods by sanitary authorities should be far more general than it is at present. (Examples of work done by Dr. Percy Frankland with London water and by Government sanitary departments in America were given.) The examination of the water of any locality shows at different times much variation in the character of its microscopic inhabitants, and, as has been shown by researches by Sir T. Leone and others, important changes are induced in water by the development of bacteria. Some investigations have been made on the vitality and multiplication of pathogenic organisms present in or purposely introduced into various waters, but the results are not sufficiently concordant to draw conclusions from, and these very important investigations require much further careful study and work. Amongst other results recently reported are some bearing upon the turbidity of some waters owing to the presence of micro-organisms, and a very interesting case is mentioned by Dr. C. O. Harz, who, in examining the waters of the Schliersee, in Bavaria, when it was covered with ice, noted a dense turbidity, at first of a green or blue tinge, but becoming yellowish-red or a peach colour before finally disappearing, and this was chiefly due to enormous quantities of a palmetta, which was attacked and finally completely destroyed by a peach-coloured micrococcus.

Another practical purpose to which the microscope may be put is in the examination of foods, and especially in connection with the preparation, transit and storage of preserved and other foodstuffs now so largely imported from abroad. Also, it is serviceable in detecting sophistications of foods and drinks, and continually is the microscope adding new means of detecting adulteration. (Some new results in detection of mixed fats in butter, &c. were shown).

Microscopy is again useful in noting the characters of fibres used in textile manufactures, and for cordage, paper-making, &c. and so important has this been considered in America that there was formed there in 1885 a National Textile Microscopical Association. Not only can the microscope give useful information respecting the natural characters of fibres and the changes they undergo during treatment, but it can also give much valuable aid in connection with the dyeing and colouring operations they are subjected to.

In agriculture, also, the microscope is of great use. Even as regards the soil it has, by studying micro-organisms, taught much respecting the nitrification of the soil and changes taking place in the carbon constituents; but it is especially valuable in noting some of the diseases of plants, such as those caused by the ravages of fungi and minute insects. (Many examples of diseases occurring amongst corn, grass, fruit, potato and other vegetable crops, were mentioned). With respect to agricultural and gardening operations, further aid may be given by microscopy in the study of fertilisation and germination, and also in the examination of many animal organisms injurious to plant life. To the timber merchant, joiner, carpenter, cabinet maker, and builder the microscope is of use in noting unhealthy conditions due to fungoid growths, &c. (Dry rot attacking the timber of buildings and fungoid growths injurious to growing trees were described).

The microscope may be a still further guide to builders in the examination of the mineralogical constituents of building stones, and in the same way it may be often serviceable in examining materials used for road making, paving, &c. As shown by elaborate experiments on the devitrification of glass made by Messrs. Douglas Herman and Frank Rutley, and communicated to the Royal Society, microscopy can throw much light upon changes taking place in glass owing to different circumstances of treatment, and the same experiments have an important bearing on the study of the formation of some minerals. Microscopy is also serviceable in practical mineralogy, and capable of detecting mineralogical constitution where chemistry fails.

It is also serviceable to the brewer in noting the purity of the air in the fermenting room, the nature of the water, the quality of the ferment, including the presence or absence of organisms that cause unhealthy fermentations; and in the same way it is useful to the distiller, and others who have to work with saccharine liquids, such as the sugar refiner. In the mechanical arts, microscopes have been employed with advantage in making delicate levelling operations; also in noting causes of difference in the efficiency of tools, consequent on the character of the materials of which they are made. (Examples of comparators, levelling instruments and callipers were shown; and also of good and faulty tools, and the work done by them). Dr. Sorby has shown the importance of the microscope in noting the characters of iron and steel; and Dr. H. Wedding has described the microscopical examination of a compound armour-plate, and states that the different varieties of iron and steel used in its construction could be recognised without difficulty. And I have myself found microscopical examination very useful in noting the character of the metal used for shafting, bearings, coatings, &c.

One other use may be mentioned, viz: in connection with the legal profession in the examination in doubtful cases of handwriting, ink, and paper of documents, &c. Microscopical appearances have also been suggested as the basis of ornamental designs, as, for example, the appearances, noted under the microscope, of chemical crystals, mentioned in the "Scientific American" in connection with designs for wall-papers, dados, &c. In the study of microscopy a knowledge of drawing and the practice of photomicrography can be of much service, and excellent progress in the latter art has been made of late years, but further developments should be sought for, especially in connection with observations with high power objectives.

As the microscope is of so much value for practical purposes, it should be studied more than it is in science schools and in connection with trades and industrial occupations. Even in ordinary school teaching it might be made available for exciting greater interest in the lessons than is often given now, and in giving a training in habits of thorough and careful investigation; but in trade and technical schools a training in its use should form an important part of the curriculum. In many such schools on the continent, practice with the microscope is insisted on, and the value of such study has been testified to, not only by the professors under whose auspices the instruction has been given, but by a large number of manufacturers and others in whose service the students have subsequently worked.

In short, the practical applications of the microscope are so many and so varied, that a more extended study of microscopy cannot fail to be productive of great advantages, not only in scientific research, but also to manufactures and commerce, and the health and comfort of the community.

The lecture was illustrated by many diagrams shown by Mr. Knott with the oxy-hydrogen lantern. A vote of thanks to the President for his address concluded the proceedings.

February 3rd.—Dr. Frederick C. Larkin, M.R.C.S. read a paper "On Making Permanent Microscopical Specimens of Blood," in which he described in detail the methods most suitable for mounting specimens of the blood of different animals. In the short discussion which followed, Mr. Edward Davies, F.I.C. and the President spoke of the practical difficulty often experienced in medico-legal inquiries in detecting with certainty the nature of blood found in bloodstains, &c. and Messrs. W. Narramore and Kendal detailed special methods they had employed in preparing blood specimens. Mr. Willoughby Gardner then read an interesting paper on "Wing Scales of Butterflies," in which he described the many beautiful forms and colours of the scales, and the usual modes of arrangement, and illustrated his remarks with many drawings and a collection of butterflies.

At the Conversazione the following subjects were illustrated:—

Illustrative of Papers.	Blood discs of Frog	JOSEPH DAVIES.
	Do. Typical examples	The PRESIDENT.
	Butterfly scales, artistically arranged	The PRESIDENT.
	Scales of White Cabbage Butterfly	The PRESIDENT.
	Scales of Meadow Brown Butterfly (Hipparchia janira)	G. WATSON GRAY.
	Wing scales of Butterflies	WILLOUGHBY GARDNER.
	Do. do.	WILLIAM OELRICHS.
	Cartilaginous ring from the sucker of Squid	WILLIAM NARRAMORE.
	Cat's Tongue, transverse section	CHARLES BOTTERILL.
	Crystals (polarized)	R. NICHOLSON.
	Foraminifera from West Indies	W. H. READ.
	Hair-follicles, cross sections	F. C. LARKIN, M.R.C.S.
	Myrica cerifera, section of	J. M. WILLIAMS.
	Oak-apple Fly (Andricus terminalis)	A. JOHNSON.
	Spirillum volutans	JOSEPH WALL.
	Triceratium septangulatum	T. W. BRUCE.

March 2nd.—A communication from Mr. GEORGE THOMAS, entitled "A few Notes on Microscope Eye-Pieces," was read by the Secretary. The paper of the evening was read by Mr. ISAAC C. THOMPSON, F.L.S., F.R.M.S. upon "Some New and Rare Species of Copepoda recently found in Liverpool Bay." Since the establishment of the Liverpool Marine Biology Committee by Professor Herdman, some three years ago, a vast amount of work has been done towards investigating and tabulating the marine life of our neighbourhood. Mr. THOMPSON has worked chiefly at the Copepoda, a large class of microscopic Crustacea—animals somewhat resembling very minute shrimps; and in this paper described some of the new and rarer species recently found. Until the L.M.B.C. was established, only six species of marine Copepoda had been recorded in this district, the number having since reached over fifty. Of these, four species are new to Britain, and three are altogether new to science. Two of the other species have not been before recorded in Britain for fifty and thirty years respectively. Some of the new and rarer forms Mr. THOMPSON described by the aid of wall illustrations, the animals themselves being all shown under microscopes by Members at the subsequent Conversazione. The Biological Station recently opened on Puffin Island, under the directorship of Professor Herdman, had proved a great success, and was the means of furnishing much new and valuable information respecting the lowly organisms constituting the surface life of our seas. Mr. THOMPSON described the mode of capturing the Copepoda in a fine long tow-net from the stern of a boat or steamer. The

Curator at Puffin Island goes out-collecting whenever weather permits, the results being at once placed in a preservative fluid, and forwarded to Mr. THOMPSON for examination. The recent cold temperature has appeared to favour the presence of species not found in warmer water, and other forms have been found only on dark winter nights. The regular series of observations now being undertaken will probably prove of great interest and of value in many ways. One of these was as to food supply. It is well known that the Copepoda live upon refuse matters from our shores and rivers, thus preventing pollution, and showing that the question of the disposal of sewage is biological rather than chemical. And as Copepoda are allowed to increase and multiply not only are our rivers purified, but furnishing as they do the chief if not entire food of fishes and even whales, they are of the greatest benefit to mankind both as efficient scavengers and as valuable food producers. Mr. THOMPSON concluded by recommending the microscopical study not less of the fresh water forms of Copepoda than the marine. He believed there was still much original work to be done regarding them, and they were to be found in every pond.

At the Conversazione the following subjects were illustrated :—

Illustrative of the Paper.

Cymbasoma herdmani, Thompson, *Cyclops puffini*, Thompson, and other new species of Copepoda, found about Puffin Island .... ISAAC C. THOMPSON.

Eurytemora hirundo, Giesbrecht, a Copepod new to Britain, found in Crosby Channel .... The PRESIDENT.

Euterpe gracilis, Claus (Copepoda), a very rare species, found about Puffin Island.................. T. W. BRUCE.

Isias clavipes, Boeck (Copepoda), occasionally taken in Liverpool Bay .... ALFRED LEICESTER.

Lichomolgus sabellæ, Thompson, a new semi-parasitic Copepod, recently found at Beaumaris. CHARLES BOTTERILL.

Longipedia coronata, Claus (Copepoda), common about Puffin Island .... A. JOHNSON.

Parapontella brevicornis, Lubbock (Copepoda), occasionally taken about Puffin Island............ E. F. STEAD.

Peltidium interruptum, Goodsir (Copepoda), often found in rock pools at Hilbre, &c.................. G. WATSON GRAY.

Pontella wollastoni, Lubbock (Copepoda), hitherto very scarce, recently plentiful about Puffin Island. THOMAS C. RYLEY.

Temora velox, Lilljeborg (Copepoda), a brackish water species, found at Leasowe, &c............... WILLIAM OELRICHS.

Thorellia brunnea, Boeck (Copepoda), occasionally taken off Puffin Island .... A. T. SMITH, Jun.

Trebius caudatus, Kroyer, a parasitic Copepod, recently taken by night tow-net off Puffin Island. HENRY M. BENNETT.

Asterina gibbosa .... T. OLIVER.
Copepoda, various Slides from the Cabinet .... W. H. READ.
Cyclops (various stages) .... JOSEPH WALL.
Hair follicles from Human Scalp, transverse and long. sections .... F. C. LARKIN, M.R.C.S.
Mussel (fresh water), showing Ciliary action .... W. NARRAMORE.
Spiracle of Larva of Dytiscus .... J. M. WILLIAMS.
Sugar Cane, long. section .... R. NICHOLSON.
Tongue of Cricket .... TAPLEY BACON.

April 6th.—The paper of the evening, entitled "Types of the Anoplura compared with Menopon Cucullare," was read by Mr. JAMES HORNELL. The debatable question of their position in the insect scale was first noticed. The view that they are not degenerate Hemiptera, but rather a less modified and distinct branch of a common stock was favoured. The features of the great types were then described and compared with Menopon cucullare—a parasite found upon the common starling, and not described by Mr. Denny in his great monography of these insects. The importance of an accurate knowledge of the physiological conditions favouring undue increase of these too often undesirable guests, as well as the present narrowness of our information, were dwelt upon. Diagrams and numerous microscopical slides illustrative of the subject were exhibited.

At the Conversazione the following subjects were illustrated :—

Illustrative of the Paper.
Docophorus leontodon .... W. NARRAMORE.
Hæmatopinus eurysternus .... G. WATSON GRAY.
Menopon cucullare (Parasitic upon the common Starling) .... J. HORNELL.
Menopon cucullare, showing adhesive disc on the foot. The PRESIDENT.
Nirmus argulus .... W. OELRICHS.
Parasite of Horse .... W. H. READ.
Phthirius inguinalis .... T. W. BRUCE.
Pteropus vespertilionis (Parasitic upon the Bat) .... A. JOHNSON.
Trichodectes scalaris (Parasitic upon the Cow) .... J. M. WILLIAMS.

Dodder on Heath .... T. C. RYLEY.
Retina (section of) .... F. C. LARKIN, M.R.C.S.

May 4th.—Mr. J. T. NORMAN THOMAS called the attention of the Society to a very interesting old microscope he exhibited, and the President made some remarks on a microscope fitted with "Electric Light" apparatus.

At the Conversazione the following subjects were illustrated :—

Adapter for Micro-Photographic work ....
Microscope fitted with Mawson and Swan's arrangement for using Electric Light .... The PRESIDENT.

Crustacean from Mid-Atlantic ....T. W. Bruce.
Deep Sea Soundings, illuminated by Dr. Smith's method..Charles Botterill.
Microscope, old form ....R. Nicholson.
Micro-fungi (various)...J. M. Williams.
Mounting and section cutting apparatus of old and new design ....F. C. Larkin, M.R.C.S.
Mucous membrane of Human Stomach ....W. H. Read.
New Cabinet Slides ....Alfred Leicester.
Ocelli and Stemmata of living insects..................Joseph Wall.
Parasite of the Capercailzie ....J. J. Howell.
Pollen of Œnothera biennis ....Rev. F. Ballard, M.A.
Sponge Spicules ....F. Padley.
Toe of Mouse ....A. Johnson,
Tongue of Syrphus...F. Nelson Pierce.

October 5th.—The Rev. H. H. Higgins mentioned that last Monday was the first time the Free Museum, William Brown Street, was reopened to the public in the evenings, and that it would continue to be open every Monday evening.

Mr. I. C. Thompson exhibited under the microscope, and made some remarks upon, some remarkable and little-known *Cladocera*, a branch of the *Crustacea*, which he had recently found at various depths in the Cumberland and Westmoreland lakes. One of these—the *Leptodora hyalina*—is an exquisitely transparent creature about a quarter to half an inch in length, and has the appearance when alive of a minute fragile glass canoe rapidly beating its way through the water. He had found it in Grasmere, Easedale, and Thirlmere lakes, its presence in the latter possibly possessing some interest in the near future to Manchester water-drinkers. The other forms Mr. Thompson exhibited were *Bythostrephes cederstromii*, *Bosmina longirostris*, an animal not uncommon in London drinking water, and *Hyalodaphnia kahlbergensis*, a most eccentric-looking microscopic crustacean, with an immense eye surmounted by a long-pointed head, comically resembling a dunce's cap. Mr. Thompson strongly recommended to the members the study of the minute animal life of our lakes and ponds as affording a rich field for research, and one in which a large amount of original work is yet to be done.

An interesting discussion followed, in which the President, the Rev. H. H. Higgins, Dr. Carter, and others took part.

The President made some remarks on "Microscopy as a special branch of scientific study," in the course of which he said that Microscopy was now more especially employed either for amusement, recreative study, or as an adjunct to other scientific studies, and there was not usually a sufficient preliminary training in the knowledge of the principles on which the microscope was constructed or in its manipulations, whereas there are so many details to be considered and worked out carefully before the microscope could be used with advantage, that a special training in Microscopy is highly desirable, and he advocated courses of such study in scientific colleges and schools, and for all who took up the microscope for the purpose of research.

The Rev. H. H. Higgins and Mr. E. Davies also spoke on the subject.

At the Conversazione the following subjects were illustrated :—

Diatomaceæ from Cuxhaven	W. H. Read.
Endings of Nerve in Muscle	F. C. Larkin, M.R.C.S
Leptodora hyalina	I. C. Thompson.
Living Diatoms	T. W. Bruce.
Recent Cabinet Slides	A. Leicester.
Sections of Oliva peruviana and Cypræa moneta	J. M. Williams.
Slides illustrating Mycro-Petrology	A. Norman Tate.
Taste bud in a Rabbit's Tongue	Edward Davies.
Tongue of Cricket Section through Gizzard of ditto	Tapley Bacon.

November 2nd.—Mr. J. Harbord Lewis, F.L.S., read the paper of the evening entitled "Notes on the Desmids."

Messrs. I. C. Thompson and W. Narramore made some further remarks on the subject.

At the Conversazione the following subjects were illustrated :—

Illustrative of the Paper.	Anthrodesmus octocornis Do. incus	W. Narramore.
	Closterium lunula, exhibiting cyclosis, also molecular motion of terminal granules	Isaac C. Thompson.
	Cosmarium minutum	G. Watson Gray.
	Euastrum verrucosum	Joseph Wall.
	Micrasterias furcata	Alfred Leicester.
	Do. rotata	W. Oelrichs.
	Do. denticulata	The President.
	Staurastrum arctiscon	J. Harbord Lewis.
	Do. brasiliense	T. W. Bruce.
	Xanthidium armatum	A. Johnson.
	Cycloid and Ctenoid Scales	J. Hornell.
	Human Nail (transverse section of)	F. C. Larkin, M.R.C.S.
	Peziza granulata Spores of Asci Fungus	Rev. F. Ballard, M.A.

Polyzoa, Fresh Water ....J. Gould.
Protococcus pulvialis..................................W. H. Read.
Sheep's Kidney (section of) .... } R. Nicholson.
Human do. do. .... }

December 7th.—The paper of the evening, by A. Barron, M.B., M.R.C.S., entitled "Some Remarks on the Disease associated with the Parasite Bilharzia hæmatobia," was read by Dr. Larkin, M.R.C.S.

The lecturer gave a short account of the parasitic worm Bilharzia hæmatobia, so prevalent in Egypt, Abyssinia and other parts of Africa. He alluded to its discovery in the mature condition in the blood vessels of the portal system by Dr. Bilharz, of Cairo, in 1887, giving subsequently a short account of the life history of the parasite so far as known, and ascribed its presence in man to the drinking of stagnant water containing the embryos of the animal. He subsequently alluded shortly to the commoner diseases in man due to the presence of the parasite, viz: Egyptian dysentery and Egyptian hæmaturia, and stated in conclusion that out of five specimens received by him from Egypt of the bladders of men dying from hæmaturia, four showed cancer as well as Bilharzia ova, adding another cause to those already known, where long continued irritation has been found to eventuate in the development of cancers in the locality where the irritation is present. Dr. Barron considered that during the presence of our troops in Egypt, where the disease appears to be more prevalent than in any other part of Africa, soldiers ought to be supplied with some simple form of pocket filter for use when drinking water from ponds and canals.

At the Conversazione the following subjects were illustrated:—

Foraminifera from Hilbre Island..........................Alfred Leicester.
Insect mimicry ....F. N. Pierce.
Leaf of Sundew (Drosera rotundiflora) with insects in situ .... } J. J. Howell.
Green Weevil .... }
Lung of Serpent, showing capillaries injected ......W. H. Read.
Lung and Tongue of a Rabbit (section of)............E. F. Stead.
Micrasterias americana (Desmid).........................J. Harbord Lewis.
Ova of Bilharzia hæmatobia..............................A. Barron, M.B., M.R.C.S.
Do. do. ....W. Oelrichs.
Salt from the mines of Wielsckra, Poland, containing hollow cubes filled with brine, and a free air cell in each..Isaac C. Thompson.
Shell, spicules, &c. of Echinus (section of) ....J. M. Williams.
Taste organs ....F. C. Larkin, M.R.C.S.
Triceratium favus ....T. W. Bruce.

Dr. FINANCIAL STATEMENT OF THE LIVERPOOL MICROSCOPICAL SOCIETY. Cr.

1888.			£	s.	d.
To Rent of Rooms			10	10	0
,, E. Doling, Tea at Meetings, and Attendance			11	7	6
,, ,, Sub-Librarian			1	0	0
,, B. John, Attendance			1	5	0
,, J. Lind and Son, Oil and Repairs to Lamps			0	8	0
,, Subscription to Ray Society	£1 1 0				
,, ,, Micro. Journal, 1887 and 1888	4 0 0				
,, G. G. Walmsley, Scrap Book for Photos.	0 7 0				
			5	8	0
,, Turner, Routledge and Co. Printing, &c.			18	1	8
,, S. R. Gresson, do.			1	4	0
,, Postages per Secretary			1	10	0
,, ,, per Treasurer and Collector's Commission			2	5	0
,, Fire Insurance Premium			0	5	0
,, Balance			101	7	4
			£154	11	6

1888.	£	s.	d.
By Balance from 1887	90	19	6
,, 1 Subscription for 1887	0	10	6
,, 118 do. for 1888	61	19	0
,, 2 Entrance Fees	1	1	0
,, Library Fines	0	1	6
	£154	11	6
By Balance in hands of Treasurer	£101	7	4
,, ,, ,, ,, to credit of Suspense Account	5	5	0
	£106	12	4

J. MICHAEL WILLIAMS,
Hon. Treasurer.

Audited and found correct,

WM. OELRICHS.
ISAAC C. THOMPSON.

Liverpool, *17th January, 1889.*

LIVERPOOL MICROSCOPICAL SOCIETY.

LIST OF MEMBERS,

JANUARY, 1889.

HONORARY MEMBERS.

WITHAM M. BYWATER, 5, Hanover-square, London.
ARTHUR C. COLE, 171, Ladbroke Grove-road, Notting Hill, London W.
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Professor THOMAS TAYLOR, Chief of the Microscopical Staff, Agricultural Department, Washington, U.S.A.
WASHINGTON TEASDALE, Headingley, Leeds.
TUFFEN WEST, F.L.S. F.R.M.S. Furnell House, Frensham, Farnham, Surrey.

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* *Members of Council.*

Elected.	
1881	Abraham, Alfred Clay, Jersey Cottage, Oxton.
1881	Abraham, Miss Emma C. Grassendale Park.
1880	Allen, Francis Birkbeck, 33, Newsham-drive.
1869	Archer, Francis, B.A. 14, Cook-street.
1878	Bacon, Tapley, Cuckoo-lane, Gateacre.
1879	Baird, James, 3, Windsor-road, Tue Brook.
1883	Baker, Arthur, 7, Mill-lane, Liscard.
1882	*Ballard, Rev. Frank, M.A. B.Sc. F.G.S. F.R.M.S. Crosby.
1868	Banister, Rev. W. B.A. St. James's-mount.
1883	*Barron, Alexander, M.B. M.R.C.S. 31, Rodney-street.
1883	Berey, T. Bickesteth, 21, Edge-lane.
1878	*Botterill, Charles, F.R.M.S. 52, Fern-grove, Sefton Park.
1872	Browne, George Mansfield, 15, South Hill-road.
1875	*Bruce, Thomas W. 27, Wapping.

Elected.

1883 Cameron, John, M.D. 4, Rodney-street.
1881 Capon, Robert M. L.D.S. 1, Mount-street.
1868 *Carter, William, M.D. F.R.C.P. 78, Rodney-street.
1869 Chadburn, William, 71, Lord-street.
1882 Clayton, John H. Oak Hill Park, Old Swan.
1885 Clinch, John William, Douglas, Isle of Man.
1884 Cooper, Mrs. James T. 24, Shrewsbury-road, Oxton.
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1885 Cradock, Miss Lucy E. L.K.Q.C.P.I. 29, Catharine-street.
1887 Dalby, Miss, Talbot House, Mather-road, Birkenhead.
1874 Davies, Edward, F.C.S. Royal Institution, 88, Seel-street.
1888 Davies, J. 69, Adelaide-street.
1885 Davies, Thomas J. M.R.C.V.S. 2, St. Alban's-road, Bootle.
1884 Davies, Walter E, Egerton Park, Rock Ferry.
1887 *Day, John H., 2, Carlton Mount, Allerton-road, Tranmere.
1879 Deacon, H. Wade, Appleton House, Widnes.
1869 Drysdale, John J. M.D. F.R.M.S. 36, Rodney-street.
1871 Edmonds, William, 69, The Albany, Oldhall-street.
1881 Evans, John H. M.R.C.P. Broomfield, Crosby-road, N. Waterloo.
1871 Evans, W. H. Wyllisholm, Huyton Hey-road, Huyton.
1879 Faulkner, Frank, Crosswells Brewery, Oldbury.
1881 Fryer, Miss Helen, 11, Rockfield-road, Anfield.
1882 Fullerton, James, 67, Demesne-street, Seacombe.
1880 Gardner, Joseph K. Jun. Greenbank, Piercefield-road, Freshfield.
1882 Gardner, Willoughby, C 18, Exchange Buildings.
1879 Gatehouse, Charles, Westwood, Noctorum, Birkenhead.
1870 Gill, E. C. Belmont Villa, 7, Strathmore-road, Newsham Park.
1868 Glynn, T. R. M.D. M.R.C.P. 62, Rodney-street.
1879 Goodwin, Gilbert Smith, Rockville, 23, Anfield-road.
1884 Gould, Joseph, Littledale-road, Egremont.
1885 Gray, George Watson, 12, Argyle-road, Garston.
1882 Grisewood, William, 8 Fairholme-road, Crosby.
1873 Harpin, Edward, c/o Messrs. Bates, Stokes & Co. 14, Water-street.
1868 Hayward, E. K. National Steam Ship Company, Water-street.
1869 Healey, George F. Oakfield, Gateacre.
1868 Higgin, Thomas, Ethersall, Roby.
1873 *Higgins, Rev. H. H. M.A. 29, Falkner-square.
1887 *Hornell, James, 105A, Grove-street.
1887 Houlgrave, Henry, Crosby-road, South, Seaforth.
1880 Howell, John Job, Branksome, Cearns-road, Birkenhead.
1882 Johnson, Alfred, Stainborne Villa, Westminster-road, Liscard.

Elected.

1874 Jones, C. W. Field House, Prince Alfred-road, Wavertree.
1881 Kendall, Henry, B.A. 17, Marmion-road.
1882 Lahy, James, 23, Lilly-road, Fairfield.
1868 Lambert, James, M.D. 80, Price-street, Birkenhead.
1886 *Larkin, Frederick Charles, M.R.C.S. 29, Bedford-street North.
1883 Lee, Charles George, M.R.C.S. 73, Rodney-street.
1875 *Leicester, Alfred, Enfield-place, 24, Aughton-road, Birkdale.
1884 Lewis, J. Harbord, F.L.S. 145, Windsor-street.
1887 Lewis, Edward, 2A, Tiber-street, Prince's Park.
1885 Lloyd, Thomas Isaac, L.D.S. 36, Bold-street.
1887 Mahon, George, 86, Anfield-road, Anfield.
1884 Maples, Arthur, 51, The Elms, Peel-street.
1868 Masters, F. H. Fairfield-terrace, Tranmere.
1868 Moore, Thomas J. Cor. Mem. Z.S. Museum, William Brown-street.
1883 Mossop, Thomas, 7, Westmorland-road, Liscard, Cheshire.
1883 Muskett, Thompson, F.C.S. 75, Newby-street, Stanley Park.
1885 Muskett, Mrs. Thompson, 75, Newby-street, Stanley Park.
1880 *Narramore, William, 5, Geneva-road, Elm Park.
1884 Newall, Edward, 14, Elm-grove, Tranmere.
1880 *Newton, J. Banner, Sunnyside, Prince's Park.
1878 Nicholson, Robert, 11, Harrington-street.
1879 *Oelrichs, William, F.R.Met. Soc. Sunnyside, Wexford-road, Oxton.
1883 Oliver, Thomas, Tarbuck-road, Huyton.
1868 Owen, Peter, The Elms, Capenhurst, near Chester.
1883 Padley, Fred. 15, Church-street.
1879 Parkinson, John Charles, Alexandra-road, Waterloo.
1882 Patterson, C. S. M.B.C.M. 16, Devonshire-road.
1879 Paul, Frank T. F.R.C.S. 44, Rodney-street.
1880 Pendlebury, William Martin, 17, Tithebarn-street.
1888 Pierce, F. N. 143, Smithdown-lane.
1876 Quayle, Alfred, 182, Regent-road.
1886 *Read, William H. 6, Dingle-lane.
1868 Roberts, Edward, Wilbraham Cottage, Melling.
1872 Roberts, Isaac, F.G.S. Kennessee, Maghull.
1885 Robertson, Helenus R. Glendaragh, Livingstone-drive South.
1886 Routledge, Tom, Stanley Park, Litherland.
1879 Rowlandson, William, Parkfield, Spital.
1868 Ryland, William, 5, Eldon-terrace, Rock Ferry.
1875 *Ryley, Thomas Cropper, 31, Alexandra-drive.
1879 Scholefield, Joshua William, J.P. 33, Pembroke-road, Bootle.
1882 Schofield, Philip H. 1, Shrewsbury-road, Birkenhead.

Elected.	
1884	Shillinglaw, William, L.D.S. Hamilton-square, Birkenhead.
1879	Smith, Andrew T. Jun. 13, Bentley-road, Prince's Park.
1884	Stead, Edward F. Park-hill, Victoria Park, Aintree.
1886	Stewart, W. H. L.D.S. 37, Rodney-street.
1873	Stone, John, Archway-road, Huyton.
1874	Stuart, Peter, Jun. M.D. Elm House, Seaforth.
1882	*Tate, Alex. Norman, F.I.C. F.L.S. F.R.M.S. 9, Hackins-hey.
1868	Thomas, George, 30, King-street, Rock Ferry.
1873	*Thompson, Isaac Cooke, F.L.S. F.R.M.S. Woodstock, Waverley-road.
1879	Tooker, E. G. Castletown, Isle of Man.
1879	Vicars, John, 8, St. Alban's-square, Bootle.
1886	Walker, George E. F.R.C.S. 43, Rodney-street.
1877	Wall, Joseph, 42A, Everton-brow.
1868	Walmsley, G. G. 50, Lord-street.
1887	Westby, George, M.K.Q.C.P.I. Farmleigh, Lodge-lane.
1884	Williams, David, 156, Chatham-street.
1871	*Williams, J. Michael, F.R.M.S. 156, Chatham-street.
1887	Williams, P. P., 143, Grove-street.
1886	Williams, Thomas, F.C.S. 4, York Buildings, Dale-street.
1887	Willmer, Miss Laura, Fernlea, 94, Westbourne-road, Birkenhead.
1879	Wilson, Henry, M.R.C.S. 22, High-street, Wavertree.
1869	Wood, J. J. 20, Lord-street.
1868	Woolloxall, Thomas, 21, Houghton-street.
1872	Wyllie, Andrew, 1, Leicester-street, Southport.
1884	Young, Thos. Fred. M.R.C.S. &c. 12, Merton-road, Bootle.

ASSOCIATE MEMBER.

Mortimer, Captain (care of Mr. T. J. Moore, Free Museum).

TWENTY-SECOND ANNUAL REPORT

OF THE

LIVERPOOL

MICROSCOPICAL SOCIETY.

ABSTRACT OF PROCEEDINGS,

AND LIST OF MEMBERS.

JANUARY, 1891.

LIVERPOOL:

TURNER, ROUTLEDGE AND CO. PRINTERS.

MDCCCXCI.

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Liverpool Microscopical Society.

SESSION XXIII. 1891.

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JOHN BIRKBECK NEVINS, M.D.
Rev. WM. BANISTER, B.A.
Rev. Dr. DALLINGER, F.R.S., V.P.R.M.S.
JOHN ABRAHAM.
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J. S. HICKS, F.R.C.S., F.L.S.
WILLIAM CARTER, M.D., F.R.C.P.
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CHARLES BOTTERILL, F.R.M.S.
Rev. F. BALLARD, M.A., B Sc., F.G.S., F.R.M.S.
A. NORMAN TATE, F.I.C., F.C.S., F.R.M.S.
ISAAC C. THOMPSON, F.L.S., F.R.M.S.

OFFICERS AND COUNCIL ELECTED 16th JANUARY, 1891.

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WILLIAM CARTER, M.D., F.R.C.P.

Vice-Presidents:

ISAAC C. THOMPSON, F.L.S., F.R.M.S.
A. NORMAN TATE, F.I.C., F.C.S., F.R.M.S.

Hon. Treasurer:

J. MICHAEL WILLIAMS, F.R.M.S.

Hon. Secretary:

WM. OELRICHS, F.R.Met.Soc., F.R.M.S.

Hon. Curator:

ALFRED LEICESTER.

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THOMAS BIRKS.
CHARLES BOTTERILL, F.R.M.S.
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JOSEPH GOULD.
Rev. H. H. HIGGINS, M.A.
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FREDERICK C. LARKIN, F.R.C.S.
WILLIAM NARRAMORE, F.L.S.
JOHN NEWTON, M.R.C.S.
WILLIAM H. READ.
THOMAS C. RYLEY.
ANDREW T. SMITH, Jun.

TWENTY-SECOND ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

In presenting their Twenty-second Annual Report the Council have much pleasure in stating that the Society's work during the past session has been throughout successful and gratifying. The Meetings have been well attended, and lively interest has been shown by the Members in the proceedings, while at the Conversaziones the number of interesting and novel exhibits has been fully up to the average of previous years. The Notes and Papers read during the session have been much appreciated, and bear testimony to the earnest desire of the Society to contribute its share to the furtherance of Microscopical Science.

The Council embrace this opportunity to tender their thanks to the Members who have read Papers and exhibited at the Conversaziones.

The Society's Library and Cabinet have been augmented by a number of valuable donations, for which the Council heartily thank the donors.

During the year sixteen new Members have joined the Society, while five have resigned, thus showing an increase of ten, and the total numbers now stand at one hundred and twenty-five Ordinary, eight Honorary, and one Associate Members.

The third number of the Journal was issued to Members early in the year, and it is contemplated to publish another volume shortly.

In conclusion the Council express the hope that all Members will endeavour to contribute their share towards the prosperity and usefulness of the Society, and that a full measure of success will crown its future work.

The following is a summary of the proceedings of the Society during the year 1890:—

January 17th.—The President elect, Mr. ISAAC C. THOMPSON, F.L.S., F.R.M.S., delivered his inaugural address, the subject being:—"Types of Metamorphosis in the Development of the Crustacea."

February 7th.—The President exhibited and read some notes upon "Halobates Wüllerstorffi," a Pelagic Insect found on the surface of the Southern and Indian Oceans, far from any land; the specimens exhibited having been found amongst surface material taken in the Bay of Bengal.

Mr. J. M. WILLIAMS, F.R.M.S., made some remarks on the subject of "Colour Markings on Shells," illustrated by diagrams and drawings.

Mr. JAMES HORNELL communicated his investigation of the "Tube-dwelling Marine Worm, 'Dasychone lucullana.'"

Mr. W. H. READ exhibited and explained by means of various diagrams a Dividing Engine for ruling Micrometers.

At the Conversazione the following subjects were illustrated:—

Chlamydococcus pluvialis, free swimming Algæ........	ALFRED LEICESTER.
Colour markings on the smaller Mollusca	J. M. WILLIAMS.
Dasypoda Hirtipes	WM. OELRICHS.
Dasychone lucullana (a rare Tube forming Annelid) illustrated by a series of Slides	JAMES HORNELL.
Euglena Sanguinea and Astasia, Flagellate Infusoria...	WM. NARRAMORE.
Entire Sponges: Sycon ciliatum and Grantia compressa	C. H. H. WALKER.
Improved Micrometer Guage, for measuring thickness of sections, &c.	C. H. H. WALKER.
Foraminifera from Barbadoes	J. J. HOWELL.
Deep Soundings from Red Sea............................	J. J. HOWELL.

Fungi: Xenodochus carbonarius, Phragmidium violaceum, Peziza scutellata, &c. .... THOS. BIRKS.
Hair of Polar Hare, showing cells containing air making the hair white .... R. NICHOLSON.
Halobates Wüllerstorffi, a Pelagic Insect found in the Indian Ocean .... The PRESIDENT.
Micro-Chemical Crystals............................. A. NORMAN TATE.
Nais proboscidea .... J. GOULD.
Scales from Moth and other Insects.......... .... JOSEPH WALL.
Urticating Hair from the larva of Cnethocampa processionea .... F. N. PIERCE.

March 7th.—Mr. WM. NARRAMORE, F.L.S. communicated some interesting notes on the Fission of Vorticella, which were illustrated with numerous slides, shown by the lantern.

Rev. F. BALLARD, M.A. read a Paper on "Life in Death, as shown in Falling Leaves," illustrated by lantern slides.

Mr. A. T. SMITH, Jun. exhibited a slide of the Proboscis of the Breeze Fly, and explained the method adopted by him in mounting the object.

Mr. C. H. H. WALKER followed with notes on the Spiracles of Insects, illustrated with drawings on the board.

At the Conversazione the following subjects were illustrated:—

Acarus of Humble Bee, 250 taken from one Bee ....The PRESIDENT.
Amphicora fabricia, an Annelid new to the district ...JAMES HORNELL.
Campanularia volubilis, Hydroid Zoophyte ....ALFRED LEICESTER.
Fungi: Trichia chrysosperma, Stemonitis fusca, Comatrichia, and other Myxomycetes ....THOMAS BIRKS.
Hair of Egyptian Mummy Cat ....ROBERT NICHOLSON.
Hemionitis palmata, Fructification.................. ......T. C. RYLEY.
Human Skin, injected ....W. H. READ.
Nycteribia Hopei, Parasite of Indian Flying Fox ......WM. OELRICHS.
Palates of Mollusca, various............. ....J. M. WILLIAMS.
Plumose Hairs of Liparis auriflua ....F. N. PIERCE.
Proboscis of Breeze Fly (Tabanus), mounted without pressure ....A. T. SMITH, Jun.
Section of Sponge: Tethya Schmidtii .. ..F. PADLEY.
Spiracles of Insects and Corophium longicorne, ova, larvæ and adults (20 slides) ....C. H. H. WALKER.
Tubifex rivulorum...J. GOULD.
Various Slides to illustrate Paper ....Rev. F BALLARD.
Vorticella...WM. NARRAMORE.

March 28th.—Mr. J. J. HOWELL exhibited and explained a New Lamp for burning Wax in lieu of Oil.

Mr. THOS. BIRKS read a Paper on some "Myxomycetes," which was illustrated by Lantern Slides.

Mr. F. C. LARKIN, F.R.C.S., read a Paper on "Epithelium," profusely illustrated by Lantern Slides and numerous Microscopical specimens.

At the Converzazione the following subjects were illustrated :—

Brachyura and Echinii, various specimens, mounted entire	C. H. H. WALKER.
Chaetogaster	J. GOULD.
Crista acoustica	W. H. READ.
Crystalline lense of Frog	ALFRED LEICESTER.
Epithelium of Skin	J. M. WILLIAMS.
Do. Intestine	J. M. WILLIAMS.
Epithelial cells of Salivary Glands	R. S. SANDFORD.
Epithelial cells of Liver, Pancreas, &c.	F. C. LARKIN.
Exuvium of Myriapod	A. JOHNSON.
Fungi—Diderma globosum. &c.	THOMAS BIRKS.
Ileum of Cat (transverse section)	T. C. RYLEY.
Isatin—for Polariscope	J. HARBORD LEWIS.
New Lamp for burning Wax	J. J. HOWELL.
Ova and Embryos of Scoloplos armiger, an Annelid new to the district	JAMES HORNELL.
Pinna of Cow's Ear (transverse section)	ROBERT NICHOLSON.
Retina and Retinal Pigment Epithelium	WM. NARRAMORE.
Sections of Tongue—Man, Sheep and Cat	The PRESIDENT.
Spiracles of Dytiscus marginalis	Rev. F. BALLARD.
Taste Buds	WM. OELRICHS.

May 2nd.—Mr. WILLOUGHBY GARDNER read some notes on "The Hair of Mammoth," which he exhibited, and gave an account of the life history of this extinct animal.

Mr. ALEXANDER BARRON, M.D. followed with a Paper on "Phagocytosis," which was illustrated with a number of diagrams, and in which he principally referred Anthrax, Rabies, Leprosy, &c.

At the Conversazione the following subjects were illustrated:—

Amphipoda, various, found on Algæ attached to ship's bottom after a voyage from Iquique	I. C. THOMPSON.
Fresh Water Algæ, Chaetophora tuberculosa	THOS. BIRKS.

Hair of the Mammoth, Elephas primigenius from Siberia .... WILLOUGHBY GARDNER.
Hormospora transversalis and other fresh water Algæ .... WM. NARRAMORE.
Human Skin.. T. C. RYLEY.
Lumbricus terrestris (transverse sections) .... J. GOULD.
Pond Life, &c. .... R. NICHOLSON.
Do. .... R. S. SANDFORD.
Do. .... JOS. WALL.
Section of fossil Shark's tooth .... W. H. READ.
Section of compound Ascidian and free swimming Larvæ of same .... F. PADLEY.
Starfish .... C. H. H. WALKER.
Various, to illustrate Paper .... ALEXANDER BARRON.
Do. do. .... J. M. WILLIAMS.
Do. do. .... WM. OELRICHS.

October 3rd.—WILLIAM CARTER, M.D. F.R.C.P. was unanimously elected President of the Society for the year 1891.

Mr. T. C. RYLEY referred to the Conversazione of the Chester Society as a very successful gathering.

Mr. C. H. H. WALKER read a Paper on "Differentiation of the Sexes in Insecta," illustrated with diagrams and drawings.

At the Conversazione the following subjects were illustrated:—

Caligus Mülleri, parasite of Cod, pair of lunules or sucking discs on the lower surface of frontal plates .... I. C. THOMPSON.
Eggs of Limnaea stagnalis .... JOS. WALL.
Elytron of Curculio .... W. H. READ.
Male Genital Armature of the genus Hepialus (Lepidoptera) .... F. N. PIERCE.
Ovipositor of Ichneumon .... A. JOHNSON.
Parts of Water Boatman, Notonecta glauca .... ALFD. LEICESTER.
Specimens to illustrate Paper .... WM. OELRICHS.
Do. do. .... C. H. H. WALKER.
Do. do. .... J. M. WILLIAMS.
Spinal Cord of Calf (transverse section)........ J. GOULD.
Wing of Polyommatus Alexis, peculiar to male insect .... J. HORNELL.

November 7th.—Mr. THOMAS COMBER, F.L.S., read a paper on "Photomicrography," in which he gave a full explanation of the working of the Camera and Microscope: he also exhibited a series of photographs of Diatomaceæ and other objects, made by him.

There was no Conversazione on this evening.

December 5th.—Mr. WILLIAM OELRICHS, F.R.M.S., exhibited photographs of various Bacilli taken and published by Dr. Robert Koch of Berlin.

Mr. JAMES HORNELL referred to and described with drawings his exhibit, "Northia conchylega," an Annelid new to the district.

Mr. THOMAS BIRKS read a paper "On Some of the Smaller Fungi," illustrated by drawings and numerous well prepared specimens.

At the Conversazione the following subjects were illustrated:—

Æcidium Ranunculacearum	W. H. READ.
Eurotium Aspergillus glaucus, &c.	WM. NARRAMORE.
Fungus off a Banana	F. N. PIERCE.
Oak Leaf Fungus	J. GOULD.
Peziza scutellata	THOS. BIRKS.
Phragmidium gracile	T. C. RYLEY.
Phragmidium violaceum, &c.	A. N. TATE.
Roestelia lacerata, &c.	WM. OELRICHS.
Stemonitis fusca, Craterium pyriforme	A. LEICESTER.
Xenodochus carbonarius, &c.	J. M. WILLIAMS.
Feather of young Starling in its follicle	A. JOHNSON.
Gloeocapsa sanguinea (Confervoid Alga) Cluster Cups (Æcidium from leaf of Coltsfoot)	I. C. THOMPSON.
New Life Trough Deep Cell Mounts of some British Sponges	C. H. H. WALKER.
Northia conchylega (an Annelid new to the district)	JAS. HORNELL.

Dr. FINANCIAL STATEMENT OF THE LIVERPOOL MICROSCOPICAL SOCIETY. Cr.

1890.				£	s.	d.
To Rent of Rooms				10	10	0
,, E. Doling, Tea at Meetings, and Attendance				11	11	6
,, ,, Sub-Librarian				1	0	0
,, Subscription to Ray Society	£1	1	0			
,, ,, to Microscopical Journal	2	0	0			
,, Books for Library	0	14	6			
				3	15	6
,, Turner, Routledge and Co., Printing, &c.				26	12	0
,, I. Knott and Co., Lantern Exhibitions				3	3	0
,, Fire Insurance Premium				0	5	0
,, Postages, per Secretary				5	1	6
,, ,, per Treasurer and Collector's Commission				1	18	6
,, Balance				73	13	7
				£137	10	7

1890.	£	s.	d.
By Balance from 1889	65	14	1
,, 1 Subscription for 1888	0	10	6
,, 4 Subscriptions for 1889	2	2	0
,, 110 do. for 1890	57	15	0
,, 2 Half do. for 1889	0	10	6
,, 2 Half do. for 1890	0	10	6
,, 16 Entrance Fees	8	8	0
,, Library Fines	0	2	0
,, Interest as per Bank Book	1	18	0
	£137	10	7
By Balance in hands of Treasurer	73	13	7
,, ,, ,, ,, to Cr. of Suspense Acc'nt	5	5	0
	£78	18	7

J. MICHAEL WILLIAMS,
Hon. Treasurer.

Audited and found correct,

WM. NARRAMORE.
JAMES HORNELL.

LIVERPOOL, *16th January, 1891.*

LIVERPOOL MICROSCOPICAL SOCIETY.

LIST OF MEMBERS,

JANUARY, 1891.

HONORARY MEMBERS.

WITHAM M. BYWATER, 5, Hanover-square, London.
ARTHUR C. COLE, 171, Ladbroke Grove-road, Notting Hill, London, W.
W. G. CORTHELL, Tremont Temple, Boston, U.S.A.
Rev. Dr. DALLINGER, F.R.S., V.P.R.M.S., London.
W. H. GRATTANN, 10, Geneva Cottages, Torquay.
Professor THOMAS TAYLOR, Chief of the Microscopical Staff, Agricultural Department, Washington, U.S.A.
WASHINGTON TEASDALE, Headingley, Leeds.
TUFFEN WEST, F.L.S., F.R.M.S., Furnell House, Frensham, Farnham, Surrey.

ORDINARY MEMBERS.

* *Members of Council.*

Elected.
1881 Abraham, Alfred Clay, Stanley Rock, St. George's Mount, New Brighton.
1881 Abraham, Miss Emma C., Grassendale Park.
1880 Allen, Francis Birkbeck, 53, Newsham-drive.
1869 Archer, Francis, B.A., 14, Cook-street.
1878 Bacon, Tapley, The Slopes, Gateacre.
1883 Baker, Arthur, 7, Mill-lane, Liscard.
1882 Ballard, Rev. Frank, M.A., B.Sc., F.G.S., F.R.M.S., Eshe-road, Great Crosby.
1868 Banister, Rev. W., B.A., St. James's-mount.
1883 Barron, Alexander, M.B., M.R.C.S., 31, Rodney-street.
1883 Berey, T. Bickesteth, 21, Edge-lane.
1889 *Birks, Thomas, 25, High Park-street.
1878 *Botterill, Charles, F.R.M.S., 46, Fern-grove, Sefton Park.
1890 Brocklehurst, Henry, Aigburth-drive, Sefton Park.
1890 Brocklehurst, Septimus, 305, Edge-lane.
1872 Browne, George Mansfield, 15, South Hill-road.
1875 Bruce, Thomas W., 27, Wapping.

Elected.

1883 Cameron, John, M.D., 4, Rodney-street.
1868 *Carter, William, M.D., F.R.C.P., 78, Rodney-street.
1869 Chadburn, William, 71, Lord-street.
1882 Clayton, John H., Adlington, Livingstone-drive.
1885 Clinch, John William, Douglas, Isle of Man.
1890 Comber, Thos., F.L.S., Leighton, Parkgate.
1884 Cooper, Mrs. James T., 24, Shrewsbury-road, Oxton.
1885 Cradock, Miss Lucy E., L.K.Q.C.P.I., 29, Catharine-street.
1887 Dalby, Miss, Talbot House, Mather-road, Birkenhead.
1874 Davies, Edward, F.C.S., Royal Institution, 88, Seel-street.
1888 Davies, J., 69, Adelaide-street.
1885 Davies, Thomas J., M.R.C.V.S., 2, St. Alban's-road, Bootle.
1887 Day, John H., 2, Carlton Mount, Allerton-road, Tranmere.
1879 Deacon, H. Wade, Appleton House, Widnes.
1869 Drysdale, John J., M.D., F.R.M.S., 36, Rodney-street.
1890 Dumergue, A. F., 79, Salisbury-road, Wavertree.
1889 Dwerryhouse, Arthur R., Hale, nr. Liverpool.
1871 Edmonds, William, 69, The Albany, Oldhall-street.
1890 Edwards, W. H., 59, Olney-street.
1871 Evans, W. H., Wyllisholm, Huyton Hey-road, Huyton.
1879 Faulkner, Frank, Langley, Oldbury.
1881 Fryer, Miss Helen, 11, Rockfield-road, Anfield.
1882 Fullerton, James, 67, Demesne-street, Seacombe.
1880 Gardner, Joseph K., Jun., Trefoil, Freshfield-road, Freshfield.
1882 *Gardner, Willoughby, C 18, Exchange Buildings.
1870 Gill, E. C., Belmont Villa, 7, Strathmore-road, Newsham Park.
1868 Glynn, T. R., M.D., M.R.C.P., 62, Rodney-street.
1879 Goodwin, Gilbert Smith, Rockville, 23, Anfield-road.
1884 *Gould, Joseph, Littledale-road, Egremont.
1885 Gray, George Watson, 14, Argyle-road, Garston.
1882 Grisewood, William, 8, Fairholme-road, Crosby.
1873 Harpin, Edward, c/o Messrs. Bates, Stokes and Co. 14, Water-street.
1868 Hayward, E. K., National Steam Ship Company, Water-street.
1869 Healey, George F., Oakfield, Gateacre.
1873 *Higgins, Rev. H. H., M.A., 29, Falkner-square.
1887 *Hornell, James, 38, Church-street, Egremont.
1887 Houlgrave, Henry, Crosby-road, South, Seaforth.
1880 Howell, John Job, Branksome, Cearns-road, Birkenhead.
1882 Johnson, Alfred, Stainborne Villa, Westminster-road, Liscard.
1874 Jones, C. W., Field House, Prince Alfred-road, Wavertree.
1882 Lahy, James, 4, Oak-terrace, Beech-street.
1886 *Larkin, Frederick Charles, F.R.C.S., 29, Bedford-street North.

Elected.

1883 Lee, Charles George, M.R.C.S., 73, Rodney-street.

1875 *Leicester, Alfred, Enfield-place, 24, Aughton-road, Birkdale.

1884 Lewis, J. Harbord, F.L.S., 145, Windsor-street.

1885 Lloyd, Thomas Isaac, L.D.S., 36, Bold-street.

1890 Lorimer, George, 31, Bank-road, Bootle.

1887 Mahon, George, 86, Anfield-road, Anfield.

1890 Marsh, Peter W., 1, Courtney-road, Waterloo.

1868 Masters, F. H., Fairfield-terrace, Tranmere.

1889 Monks, F. W., Brooklands, Warrington.

1868 Moore, Thomas J., Cor. Mem. Z.S., Museum, William Brown-street.

1890 Morgan, Joseph B., F.R.M.S., Stand House, Childwall.

1883 Mossop, Thomas, 7, Westmorland-road, Liscard, Cheshire.

1883 Muskett, Thompson, F.C.S., 75, Newby-street, Stanley Park.

1885 Muskett, Mrs. Thompson, 75, Newby-street, Stanley Park.

1880 *Narramore, William, F.L.S., 5, Geneva-road, Elm Park.

1889 *Newton, John, M.R.C.S., 44, Rodney-street.

1878 Nicholson, Robert, 11, Harrington-street.

1890 Nickels, W. L., 16, Forrest-road, Claughton.

1879 *Oelrichs, Wm., F.R.Met.Soc., F.R.M.S., Sunnyside, Wexford-road, Oxton.

1883 Oliver, Thomas, Tarbuck-road, Huyton.

1868 Owen, Peter, The Elms, Capenhurst, near Chester.

1883 Padley, Fred., 15, Church-street.

1879 Parkinson, John Charles, Alexandra-road, Waterloo.

1882 Patterson, C. S., M.B.C.M., 16, Devonshire-road.

1879 Paul, Frank T., F.R.C.S., 38, Rodney-street.

1880 Pendlebury, William Martin, 17, Tithebarn-street.

1888 Pierce, F. N., 143, Smithdown-lane.

1876 Quayle, Alfred, 182, Regent-road.

1886 *Read, William H., Eden Cottage, Holland-road, Liscard.

1868 Roberts, Edward, Clifton Villa, Halewood-road, Gateacre.

1885 Robertson, Helenus R., Glendaragh, Livingstone-drive South.

1886 Routledge, Tom, Stanley Park, Litherland.

1879 Rowlandson, William, Parkfield, Spital.

1868 Ryland, William, 5, Eldon-terrace, Rock Ferry.

1875 *Ryley, Thomas Cropper, 10, Waverley-road, Sefton Park.

1890 Sandford, R. S., 28, Bidston-road, Oxton.

1879 Scholefield, Joshua William, J.P., 33, Pembroke-road, Bootle.

1882 Schofield, Philip H., 1, Shrewsbury-road, Birkenhead.

1889 Shaw, W. G., 48, Bidston-road, Oxton.

1884 Shillinglaw, William, L.D.S., Hamilton-square, Birkenhead.

1890 Shilston, Miss Bessie, 1, Saltoun-terrace, Seacombe.

1879 *Smith, Andrew T., Jun., 13, Bentley-road, Prince's Park.

Elected.

1889 Smith, J. Forrester, Newstead, Wavertree.
1884 Stead, Edward F., 10, Adelaide-terrace, Waterloo.
1886 Stewart, W. H., L.D.S., 37, Rodney-street.
1873 Stone, John, Huyton.
1874 Stuart, Peter, Jun., M.D., Elm House, Seaforth.
1882 *Tate, Alex. Norman, F.I.C., F.L S., F.R.M.S., 9, Hackins-hey.
1868 Thomas, George, 30, King-street, Rock Ferry.
1873 *Thompson, Isaac Cooke, F.L.S., F.R.M.S., Woodstock, Waverley-road.
1879 Vicars, John, 8, St. Alban's-square, Bootle.
1889 Walker, Charles H. H., Mossy Bank, Egremont.
1886 Walker, George E., F.R.C.S., 43, Rodney-street.
1877 Wall, Joseph, 42A, Everton-brow.
1868 Walmsley, G. G., 50, Lord-street.
1890 Wardleworth, Theo. H., 56, Hanover-street.
1890 Warriner, J. Brack, 41A, North John-street.
1890 Watson, C. S., 50, Bidston-road, Oxton.
1871 *Williams, J. Michael, F.R.M.S., 156, Chatham-street.
1887 Williams, P. P., 143, Grove-street.
1886 Williams, Thomas, F.C.S., 4, York Buildings, Dale-street.
1887 Willmer, Miss Laura, Fernlea, 94, Westbourne-road, Birkenhead.
1879 Wilson, Henry, M.R.C.S., 22, High-street, Wavertree.
1869 Wood, J. J., 20, Lord-street.
1872 Wyllie, Andrew, 1, Leicester-street, Southport.
1884 Young, Thos. Fred., M.R.C.S., &c. 12, Merton-road, Bootle.

ASSOCIATE MEMBER.

Mortimer, Captain (care of Mr. T. J. Moore, Free Museum).

TWENTY-FOURTH ANNUAL REPORT

OF THE

LIVERPOOL

MICROSCOPICAL SOCIETY.

ABSTRACT OF PROCEEDINGS,

AND LIST OF MEMBERS.

JANUARY, 1893.

LIVERPOOL:

TURNER, ROUTLEDGE AND CO. PRINTERS.

MDCCCXCIII.

TWENTY-FOURTH ANNUAL REPORT

OF THE

LIVERPOOL

MICROSCOPICAL SOCIETY.

ABSTRACT OF PROCEEDINGS,

AND LIST OF MEMBERS.

JANUARY, 1893.

LIVERPOOL:

TURNER, ROUTLEDGE AND CO. PRINTERS.

MDCCCXCIII.

Liverpool Microscopical Society.

SESSION XXV. 1893.

Past Presidents:

JOHN BIRKBECK NEVINS, M.D.
Rev. WM. BANISTER, B.A.
Rev. Dr. DALLINGER, F.R.S., Hon. Sec. R.M.S.
JOHN ABRAHAM.
J. J. DRYSDALE, M.D., F.R.M.S.
JOHN NEWTON, M.R.C.S.
Rev. HENRY H. HIGGINS, M.A.
GEORGE F. CHANTRELL.
J. S. HICKS, F.R.C.S., F.L.S.
WILLIAM CARTER, M.D., F.R.C.P.
W. H. WEIGHTMAN, F.R.M.S.
FRANK T. PAUL, F.R.C.S.
CHARLES BOTTERILL.
Rev. F. BALLARD, M.A., B.Sc., F.G.S., F.R.M.S.
A. NORMAN TATE, F.I.C., F.C.S., F.R.M.S.
ISAAC C. THOMPSON, F.L.S., F.R.M.S.

OFFICERS AND COUNCIL ELECTED 20th JANUARY, 1893.

President:

F. CHARLES LARKIN, F.R.C.S.

Vice-Presidents:

WILLIAM CARTER, M.D., F.R.C.P.
JOHN NEWTON, M.R.C.S.

Hon. Treasurer:

ROBERT NICHOLSON.

Hon. Secretary:

A. T. SMITH, Jun.

Hon. Curator:

ALFRED LEICESTER.

Council:

THOMAS BIRKS.
HERBERT E. DAVIES, B.A.
JOSEPH GOULD.
G. H. MORTON, F.G.S.
WILLIAM NARRAMORE, F.L.S.
WM. OELRICHS, F.R.M.S.
F. N. PIERCE, F.E.S.
WILLIAM H. READ.
EDWARD ROBERTS.
I. C. THOMPSON, F.L.S., F.R.M.S.
C. H. H. WALKER.
J. M. WILLIAMS, F.R.M.S.

TWENTY-FOURTH ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

The Council have the honour to present the Twenty-fourth Annual Report, and are able to state that the Meetings have been well attended, and that the Session has been productive of good work in furtherance of the objects of the Society.

The Papers read and Demonstration Lecture given during the year have been highly interesting, and much appreciated, and the thanks of the Society are due to the various Lecturers.

The number of exhibits at the Monthly Conversaziones, although of great excellence, does not show the increase which the Council had expected, and it is hoped that Members will bear in mind that the success of the meetings depends in a large measure on ample and interesting exhibitions at the Conversaziones. To those Members who have exhibited at the meetings during the past session, as well as to the donors to the Cabinet and Library, the Council express their warmest thanks.

The Society has to mourn the loss by death of several of its oldest and most valued Members, and the Council desire to record their deep gratitude for and appreciation of the services rendered to the Society by the late FRANCIS ARCHER, T. J. MOORE, Dr. DRYSDALE and A. NORMAN TATE, the two latter having filled the Presidential chair with great distinction.

During the past Session nine new Members have been enrolled, while the loss through resignation and death amounts to twenty. The total numbers at present are—one hundred and four Ordinary, seven Honorary and one Associate Members.

The following is a summary of the proceedings of the Society during the year 1892:—

January 15*th*.—The President elect, Mr. WILLIAM CARTER, M.D., F.R.C.P., delivered his Inaugural Address, subject—"Some Facts and Fallacies of the Microscope."

February 19*th*.—In consequence of the continued illness of Mr. C. H. H. WALKER, the reading of his Paper, originally fixed for the 5th, was again postponed.

Mr. I. C. THOMPSON, F.L.S., F.R.M.S., kindly took his place, and read a Paper on "Diffraction and Aperture as affecting Microscopical Vision," with Illustrations.

March 4*th*.—The following Paper was read by Mr. JOSEPH DAVIES:—"Pedesis, or the Brownian Movement of Particles."

At the Conversazione the following subjects were illustrated:—

Chalk with Nummulites	J. M. WILLIAMS.
Fresh Water Algæ, Characium Sieboldii, &c.	THOS. BIRKS.
Hisperia Linea and Lineola, and their distinction	F. N. PIERCE.
Pterodina Patina and variety	WM. NARRAMORE.
Section of Rhinoceros Horn	W. H. READ.
Pedetic motion of Pumice Stone particles suspended in pure water	A. N. TATE.
Pedetic motion of Gamboge particles suspended in sap from a tree, &c.	JOSEPH DAVIES.
Pedetic motion of Indigo particles suspended in ordinary water, &c.	G. W. GRAY.

April 1st.—The following Paper was read by Mr. Wm. Narramore, F.L.S.:—
"Notes on Fresh Water Algæ."

At the Conversazione the following subjects were illustrated:—

Apiocystis Brauniana, with cilia	F. C. Larkin.
Batrachospermum moniliforme	F. B. Allen.
Chætophora elegans	W. H. Edwards.
Chlamydococcus nivalis	P. W. Marsh.
Closterium Jenneri, showing pedesis	Joseph Davies.
Coleochæta scutata...	T. C. Ryley.
Cosmarium præmorsum, showing pedesis	A. Norman Tate.
Cylindrocystic V. Conferva	A. Leicester.
Draparnaldia plumosa	F. Padley.
Enteromorpha ramulosa	A. T. Smith.
Hildenbrandtiaccæ rivularis	Miss J. H. Willmer.
Hormospora transversalis	J. M. Williams.
Microspora floccosa	W. H. Read.
Microthamnion Kuetzingianum	Miss Laura Willmer.
Mischococcus confervicola	C. H. H. Walker.
Nostoc sphæricum	Joseph Wall.
Prasiola crispa	F. N. Pierce.
Spirogyra bellis, stained	A. Johnson.
Spirogyra orthospira	Herbert Davies.
Stigeoclonium tenue	W. H. Read.
Tetraspora gelatinosa	Thos. Oliver.
Ulothrix and Schizogonium	Thos. Birks.
Vaucheria sessilis, with parasite	Wm. Narramore.
Vaucheria terrestris in reproduction	J. Gould.

May 6th.—The following Paper was read by Mr. Herbert E. Davies, B.A. (Camb) B.Sc. (Lond.):—"The Aldehyde-Theory of Protoplasm."

At the Conversazione the following subjects were illustrated:—

Illustrating Paper.	Spirogyra, showing silver reduction	Herbert E. Davies.
	Spirogyra, natural state	Wm. Narramore.
	Spirogyra poisoned with Strychnine, showing silver reduction	Thos. Birks.
	Acronycta Psi and Tridens	F. N. Pierce.
	Andricus terminalis	A. Johnson.
	Carchesium, Epistylis, &c.	J. Wall.
	Closterium striolatum	Miss J. H. Willmer.
	Eggs of Noctua baja	Louis Liversedge.

Foraminefera (local)	A. LEICESTER.
Fossil Bryozoa, &c. from the Miocene	C. H. H. WALKER.
Manubrium of Nitella opaca	Miss LAURA WILLMER
Pinus Sylvestris, trans. section	W. H. EDWARDS.
Plumules of Pieridæ (male)	W. GARDNER.
Pollen of Tigitalis alba	A. NORMAN TATE.
Pollen of Asparagus officinalis	JOSEPH DAVIES.
Pollen of Lagerströmia Indica	WM. WOOLCOTT.
Pro-embryo of Chara fragilis	T. C. RYLEY.
Section of Ulmus campestis	J. M. WILLIAMS.
Do. the Thyroid body	F. C. LARKIN.
Do. Pollen grains, Marvel of Peru	THOS. OLIVER.
Do. Rubus vulgaris	J. GOULD.

October 7th.—Demonstration Lecture:—"Celloidin Embedding and Section Cutting, with Special Reference to the Preparation of Serial Sections," by Mr. C. H. HESKETH-WALKER.

At the Conversazione the following subjects were illustrated:—

Section of Sponge, Tethyra schmidtii	F. C. LARKIN.
Do. through gills of Tench	I. C. THOMPSON.
Do. of Sagartia parasitica	J. M. WILLIAMS.
Sections of Alcyonium digitatum	WM. OELRICHS.
Do. Sponge, Pachymatisma johnstonii (2 slides).	ALFRED LEICESTER.
Do. Sponge, Halichondria panicea (2 slides)	THOS. BIRKS.
Serial Sections of Sponge (2 slides)	A. J. SMITH.
Do. Sponge, Sycandra compressa (2 slides)	W. H. READ.
Do. Sponge, Leucandra johnstonii	ALFRED JOHNSON.
Do. Caterpillar, Pieris brassicæ (2 slides)	JOS. GOULD.
Do. Musca vomitoria, abdomen (4 slides)	WM. NARRAMORE.
Do. Musca vomitoria, thorax (4 slides)	F. N. PIERCE.
Do. Musca vomitoria, head (2 slides)	C. H. H. WALKER.
Do. Syrphus, abdomen	

November 4th.—The following Paper was read by Mr. F. N. PIERCE, F.E.S.:—"Notes on the Genitalia of Lepidoptera." Illustrations by the Oxy-Hydrogen Lantern, by Mr. C. H. H. WALKER.

At the Conversazione the following subjects were illustrated:—

Genitalia of Anchocelis rufina	I. C. THOMPSON.
Do. Tæniocampa stablis	WM. OELRICHS.
Do. Xanthia citrago	JOS. GOULD.

Genitalia of Miana fasciuncula.................................. C. H. H. WALKER.
Do. Xylina petrificata .... ROBT. NICHOLSON.
Do. Leucania littoralis .... THOS. BIRKS.
Do. Apamea gemina.................................... J. M. WILLIAMS.
Do. Tæniocampa gothica.............................. ALFRED JOHNSON.
Do. Dianthecia cucubali.............................. WM. NARRAMORE.
Do. Neuria saponariæ .... A. T. SMITH.
Do. Mamestra anceps .... W. H. READ.
Do. Tæniocampa gracilis... .... C. H. H. WALKER.
Do. Apamea oculea .... ALFRED LEICESTER.
Do. Luperina cæspitis................................. Dr. LARKIN.
Do. Epunda lutulenta............. .... A. F. DUMERGUE.

December 2nd.—The following Papers were read:—"Notes on the Eyes of Trilobites," by Mr. G. H. MORTON, F.G.S., and "Notes on a Few of the Recent Foraminifera," by Mr. W. H. READ. Illustrated by the Oxy-Hydrogen Lantern.

At the Conversazione the following subjects were illustrated:—

Amoeba difflugia, Nematocysts of Hydra .... WM. NARRAMORE.
Arrangement of scales on the wing of Zygaena minos... F. N. PIERCE.
Raphides and ducts in vegetable tissue .... ROBT. NICHOLSON.
Eyes of Phacops caudatus, Oxygia Buchii. Asaphus tyrannus, and others .... G. H. MORTON.
Lagenæ.. A. JOHNSON.
Recent Foraminifera—
Soundings of Red Sea .... W. H. READ.
Do. Indian Ocean .... J. M. WILLIAMS.
Do. Atlantic Ocean .... A. LEICESTER.

FINANCIAL STATEMENT OF THE LIVERPOOL MICROSCOPICAL SOCIETY.

Dr.

1892.	£	s.	d.
To Rent of Rooms	10	10	0
,, Refreshments and Attendance	10	3	6
,, Sub-Librarian's Fee	1	0	0
,, Oil and Chimneys for Lamps	0	5	6
,, Subscription to Ray Society	1	1	0
,, Do. Microscopical Journal	2	0	0
,, Printing Circulars, &c.	11	16	0
,, Fire Insurance Premium	0	5	0
,, Hydrogen Gas	0	4	3
,, Collector's Commission	1	2	6
,, Postages, &c.	5	1	6
,, Balance	97	18	9
	£141	8	0

Cr.

1892.	£	s.	d.
By Balance from 1891	80	6	10
,, 7 Subscriptions for 1891	3	13	6
,, 97 do. for 1892	50	18	6
,, 3 Half do.	0	15	9
,, 9 Entrance Fees	4	14	6
,, Bank Interest	0	18	11
	£141	8	0
By Balance in hands of Treasurer	97	18	9
,, Amount to Credit of Suspense Account	5	5	0
	£103	3	9

ROBT. NICHOLSON,
Hon. Treasurer.

Audited and found correct,
THOS. BIRKS.
W. H. READ.

LIVERPOOL, 20*th January*, 1893.

LIVERPOOL MICROSCOPICAL SOCIETY.

LIST OF MEMBERS,

JANUARY, 1893.

HONORARY MEMBERS.

WITHAM M. BYWATER, 5, Hanover-square, London.
ARTHUR C. COLE, 171, Ladbroke Grove-road, Notting Hill, London, W.
W. G. CORTHELL, Tremont Temple, Boston, U.S.A.
Rev. Dr. DALLINGER, F.R.S., Hon. Sec. R.M.S., London.
W. H. GRATTANN, 7, Scarborough-terrace, Torquay.
Professor THOMAS TAYLOR, Chief of the Microscopical Staff, Agricultural Department, Washington, U.S.A.
WASHINGTON TEASDALE, Headingley, Leeds.

ORDINARY MEMBERS.

* *Members of Council.*

Elected.
1881 Abraham, Alfred Clay, Stanley Rock, St. George's Mount, New Brighton.
1881 Abraham, Miss Emma C., Grassendale Park.
1880 Allen, Francis Birkbeck, 53, Newsham-drive.
1883 Baker, Arthur, 7, Mill-lane, Liscard.
1883 Barron, Alexander, M.B., M.R.C.S., 31, Rodney-street.
1883 Berey, T. Bickesteth, 145, Edge-lane.
1889 *Birks, Thomas, 25, High Park-street.
1892 Blake, W. H., 15, Park-road.
1878 Botterill, Charles, 55, Upper Parliament-street.
1890 Brocklehurst, Henry, Aigburth-drive, Sefton Park.
1890 Brocklehurst, Septimus, 305, Edge-lane.
1875 Bruce, Thomas W., 27, Wapping.

Elected.

1868 *Carter, William, M.D., F.R.C.P., 78, Rodney-street.

1882 Clayton, John H., Adlington, Livingstone-drive.

1885 Clinch, John William, Douglas, Isle of Man.

1890 Comber, Thos., F.L.S., Leighton, Parkgate.

1892 Cooke, Miss Amy, Gorsey-hey, Liscard.

1884 Cooper, Mrs. James T., 24, Shrewsbury-road, Oxton.

1887 Dalby, Miss, Talbot House, Mather-road, Birkenhead.

1874 Davies, Edward, F.C.S., Royal Institution, 88, Seel-street.

1891 *Davies, Herbert E., B.A., 88, Seel-street.

1888 Davies, J., 28, Robarts-road, Anfield.

1887 Day, John H., Crosfield, Allerton-road, Tranmere.

1879 Deacon, H. Wade, Appleton House, Widnes.

1890 Dumergue, A. F., 7, Montpelier-terrace, Upper Parliament-street.

1889 Dwerryhouse, Arthur R., Hale, nr. Liverpool.

1871 Edmonds, William, 69, The Albany, Oldhall-street.

1871 Evans, W. H., Wyllisholm, Huyton Hey-road, Huyton.

1892 Forshaw, J. H., 89, Merton-road, Bootle.

1882 Fullerton, James, 67, Demesne-street, Seacombe.

1882 Gardner, Willoughby, C 18, Exchange Buildings.

1868 Glynn, T. R., M.D., M.R.C.P., 62, Rodney-street.

1879 Goodwin, Gilbert Smith, Rockville, 23, Anfield-road.

1884 *Gould, Joseph, Littledale-road, Egremont.

1885 Gray, George Watson, 14, Argyle-road, Garston.

1882 Grisewood, William, 40, Falkland-road, Egremont.

1873 Harpin, Edward, c/o Messrs. Bates, Stokes and Co. 14, Water-street.

1892 Haydon, W. T., 15, Great George-square.

1868 Hayward, E. K., National Steam Ship Company, Water-street.

1869 Healey, George F., Oakfield, Gateacre.

1873 Higgins, Rev. H. H., M.A., 29, Falkner-square.

1887 Houlgrave, Henry, Crosby-road South, Seaforth.

1882 Johnson, Alfred, 6, Sea Bank-road, Egremont.

1874 Jones, C. W., Field House, Prince Alfred-road, Wavertree.

1892 Jones, Hugh R , M.D., 58A, Grove-street.

1892 Knight, Charles, 105, Newsham-drive.

1886 *Larkin, Frederick Charles, F.R.C.S., 54, Rodney-street.

1892 Lee, H. P., Queen's-road, Great Crosby.

1875 *Leicester, Alfred, 1, Priory-gardens, Weld-road, Birkdale.

1891 Liversedge, Louis, Crosby.

1885 Lloyd, Thomas Isaac, L.D.S., 36, Bold-street.

1887 Mahon, George, 2, St. Ambrose-road, Anfield.

1890 Marsh, Peter W., 1, Courtney-road, Waterloo.

1868 Masters, F. H., Fairfield-terrace, Tranmere.

Elected.
1890 Morgan, Joseph B., F.R.M.S., Stand House, Childwall.
1891 *Morton, G. H., 209, Edge-lane.
1883 Mossop, Thomas, 7, Westmorland-road, Liscard, Cheshire.
1880 *Narramore, William, F.L.S., 5, Geneva-road, Elm Park.
1889 *Newton, John, M.R.C.S., 44, Rodney-street.
1878 *Nicholson, Robert, 11, Harrington-street.
1890 Nickels, W. L., 16, Forrest-road, Claughton.
1879 *Oelrichs, Wm., F.R.Met.Soc., F.R.M.S., Sunnyside, Wexford-road, Oxton.
1883 Oliver, Thomas, Woodland Cottage, Roby.
1868 Owen, Peter, The Elms, Capenhurst, near Chester.
1883 Padley, Fred., 15, Church-street.
1879 Parkinson, John Charles, Alexandra-road, Waterloo.
1882 Patterson, C. S., M.B.C.M., 16, Devonshire-road.
1879 Paul, Frank T., F.R.C.S., 38, Rodney-street.
1880 Pendlebury, William Martin, 17, Tithebarn-street.
1891 Philpots, H., M.D., 56, Shrewsbury-road, Oxton.
1888 *Pierce, F. N., F.E.S., 143, Smithdown-lane.
1876 Quayle, Alfred, 182, Regent-road.
1886 *Read, William H., Eden Cottage, Holland-road, Liscard.
1868 *Roberts, Edward, Clifton Villa, Halewood-road, Gateacre.
1885 Robertson, Helenus R., Springhill, Wavertree.
1886 Routledge, Tom, Crosby-road South, Seaforth.
1879 Rowlandson, William, Parkfield, Spital.
1868 Ryland, William, 5, Eldon-terrace, Rock Ferry.
1875 Ryley, Thomas Cropper, 10, Waverley-road, Sefton Park.
1879 Scholefield, Joshua William, J.P., 33, Pembroke-road, Bootle.
1882 Schofield, Philip H., 1, Shrewsbury-road, Birkenhead.
1884 Shillinglaw, William, L.D.S., Hamilton-square, Birkenhead.
1879 *Smith, Andrew T., Jun., 13, Bentley-road, Prince's Park.
1889 Smith, J. Forrester, Newstead, Wavertree.
1891 Smith, Rev. Wm. Hodson, 29, Hope-street.
1884 Stead, Edward F., 10, Adelaide-terrace, Waterloo.
1886 Stewart, W. H., L.D.S., 37, Rodney-street.
1873 Stone, John, Huyton.
1868 Thomas, George, 30, King-street, Rock Ferry.
1873 *Thompson, Isaac Cooke, F.L.S., F.R.M.S., Woodstock, Waverley-road.
1879 Vicars, John, 8, St. Alban's-square, Bootle.
1889 *Walker, Charles H. H., Mossy Bank, Egremont.
1886 Walker, George E., F.R.C.S., 43, Rodney-street.
1877 Wall, Joseph, 42A, Everton-brow.
1868 Walmsley, G. G., 50, Lord-street.
1890 Wardleworth, Theo. H., 56, Hanover-street.

Elected.

1871 *Williams, J. Michael, F.R.M.S., 156, Chatham-street.

1886 Williams, Thomas, F.C.S., A, Queen Insurance Buildings.

1891 Willmer, Miss J. H., Fernleigh, Westbourne-road, Birkenhead.

1887 Willmer, Miss Laura, Fernleigh, Westbourne-road, Birkenhead.

1879 Wilson, Henry, M.D., M.R.C.S., 22, High-street, Wavertree.

1869 Wood, J. J., 20, Lord-street.

1892 Woolcott, William, 166, Grove-street.

1872 Wyllie, Andrew, 1, Leicester-street, Southport.

ASSOCIATE MEMBER.

Mortimer, Captain (care of Mr. T. J. Moore, Free Museum).

TWENTY-FIFTH ANNUAL REPORT

OF THE

LIVERPOOL

MICROSCOPICAL SOCIETY.

ABSTRACT OF PROCEEDINGS,

AND LIST OF MEMBERS.

JANUARY, 1894.

LIVERPOOL:
TURNER, ROUTLEDGE AND CO. PRINTERS.

MDCCCXCIV.

TWENTY-FIFTH ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

ABSTRACT OF PROCEEDINGS,

AND LIST OF MEMBERS.

JANUARY, 1894.

LIVERPOOL:

TURNER, ROUTLEDGE AND CO. PRINTERS.

MDCCCXCIV.

Liverpool Microscopical Society.

SESSION XXVI. 1894.

Past Presidents:

JOHN BIRKBECK NEVINS, M.D.
Rev. WM. BANISTER, B.A.
Rev. Dr. DALLINGER, F.R.S., Hon.Sec.R.M.S.
JOHN ABRAHAM.
J. J. DRYSDALE, M.D., F.R.M.S.
JOHN NEWTON, M.R.C.S.
Rev. HENRY H. HIGGINS, M.A.
GEORGE F. CHANTRELL.
J. S. HICKS, F.R.C.S., F.L.S.
WILLIAM CARTER, M.D., F.R.C.P.
W. H. WEIGHTMAN, F.R.M.S.
FRANK T. PAUL, F.R.C.S.
CHARLES BOTTERILL.
Rev. F. BALLARD, M.A., B.Sc., F.G.S., F.R.M.S.
A. NORMAN TATE, F.I.C., F.C.S., F.R.M.S.
ISAAC C. THOMPSON, F.L.S., F.R.M.S.
F. CHARLES LARKIN, F.R.C.S.

OFFICERS AND COUNCIL ELECTED 19th JANUARY, 1894.

President:

JOHN NEWTON, M.R.C.S.

Vice-Presidents:

F. CHARLES LARKIN, F.R.C.S.
J. M. WILLIAMS, F.R.M.S.

Hon. Treasurer:

ROBERT NICHOLSON.

Hon. Secretary:

ANDREW T. SMITH, Jun.

Hon. Curator:

ALFRED LEICESTER.

Council:

WM. CARTER, M.D., F.R.C.P.
THOS. COMBER, F.L.S.
EDWARD DAVIES, F.C.S.
H. E. DAVIES, M.A., B.Sc.
A. R. DWERRYHOUSE.
JOSEPH GOULD.
G. H. MORTON, F.G.S.
WILLIAM NARRAMORE, F.L.S.
W. OELRICHS, F.R.Met.Soc., F.R.M.S.
WILLIAM H. READ.
EDWARD ROBERTS.
C. H. HESKETH WALKER.

TWENTY-FIFTH ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

THE President and Council are pleased to be in a position to report that the work of the Society has been carried on satisfactorily during the year just closed.

The ordinary meetings have been well attended, and the papers presented have maintained the usual high standard of excellence, and have been much appreciated.

The Council would like to see an increase in the number of microscopes exhibited at the ordinary meetings, in view of the fact that the conversazione forms an important feature of the meeting and if well supported tends to considerably advance the interests of the Society by bringing Members together and promoting a free interchange of ideas, to their mutual advantage.

With this in view, the Council will be glad if Members wishing to exhibit will intimate their desire to the Hon. Secretary, who will send them exhibition cards regularly.

To increase the interest of Members in the work of the Society, it was resolved in the early part of the year to hold a series of field meetings during the Summer months, and in accordance with this resolution three field meetings were held, viz.—

1st, on Saturday, 29th April, at Formby.

2nd, on Saturday, 3rd June, at Bromborough.

3rd, on Saturday, 9th September, at Parkgate and Heswall.

It is hoped that in the coming session, Members joining in these excursions will forward to the Secretary lists of the various objects found in their gatherings, so that a reliable *record* may be compiled of the microscopical fauna and flora of the neighbourhood.

The Council allude with deep regret to the death of the Rev. H. H. HIGGINS, a past President of the Society, and one of our oldest and most respected Members, whose kindly disposition, extensive knowledge, and deep interest in everything pertaining to Natural History endeared him to all.

During the Session the Society has lost fifteen Members, and eight new Members have been elected. The membership roll now stands as follows—97 Ordinary, 7 Honorary and 1 Associate Member.

The Council take this opportunity of thanking those gentlemen who have read papers, exhibited at the conversaziones, and otherwise contributed to the success of the meetings, and they also have pleasure in recording their thanks to the donors of books to the library and of slides to the cabinet.

The following is a *precis* of the proceedings at the meetings.

January 20th.—The President, Dr. F. C. LARKIN, delivered his Inaugural Address, subject, "Microscopical Facts and Theories, Past and Present, and the Value of Microscopical Observation." The lecture was copiously illustrated with the aid of magic-lantern slides, and the thanks of the Society were tendered to Dr. LARKIN for his address.

February 3rd.—A Paper, "Notes on the Eyes of Trilobites," was read by Mr. G. H. MORTON, F.G.S. At the Conversazione the following objects were exhibited :—

Eyes of *Aeglina vinodosa, Asaphus tyrannus, Ogygia buchii*	G. H. MORTON.
Eye of *Phacops caudatus*	A. T. SMITH, Jun.
Head of *Blatta orientalis*	W. H. READ.
Head of Gnat	ROBERT NICHOLSON.
Palate of Garden Snail (*Helix pomatia*)	A. F. DUMERGUE.
Starfish (*Amphiura squamata*)	CHAS. H. H. WALKER.
Stylonychia mytilus	WM. NARRAMORE.
Section Tail of Mouse	J. M. WILLIAMS.

March 3rd.—Mr. ROBERT NICHOLSON read an interesting Paper on "Polarised Light," which he illustrated by diagrams and models; at its conclusion a discussion took place, in which Mr. EDWARD DAVIES, F.C.S., Mr. ARTHUR DWERRYHOUSE, and others took part. At the Conversazione the following objects were exhibited :—

Cuticle of *Equisetum*	Polariscope	J. M. WILLIAMS.
Crystals (various)	Polariscope	FRANK TATE.
Do. from Honey	Polariscope	ROBERT NICHOLSON.
Do. Sulphate of Copper	Polariscope	EDWARD DAVIES.
Platinocyanide of Yttrium	Polariscope	F. N. PIERCE.
Section *Solanum tuberosum*	Polariscope	W. H. READ.
Do. Spine of *Echinus*	Polariscope	F. B. ALLEN.
Polarising Apparatus		A. T. SMITH, Jun.
Do. do.		CHAS. H. H. WALKER.
Cornea of Beetle's Eye, showing multiple images		Dr. NEWTON.
Head of Hive Bee		A. F. DUMERGUE.
Spores of *Xenodochus carbonarius*		THOMAS BIRKS.

April 7th.—The Members were informed that the Committee had decided to hold a Field Meeting at Formby, on Saturday, the 29th instant. Dr. JOHN NEWTON read the Paper of the evening, on "The Later Researches of the Rev. Dr. Dallinger, and their Relation to the Germ Theory of Fermentation and Disease." The subject was treated in a very able manner, and was well illustrated by diagrams. The lecturer drew attention to the extreme value which the researches of Drs. DALLINGER and DRYSDALE had assumed in connection with the now famous discoveries of PASTEUR and KOCH, and pointed out that these researches, carried on in Liverpool principally, had paved the way for the discoveries which promise to be of such signal service to humanity in the ceaseless battle against disease. At the close of the paper a discussion took place, in which Messrs. ALFRED LEICESTER, A. T. SMITH, Jun., W. GRISEWOOD, and HERBERT E. DAVIES took part. The meeting terminated with the customary Conversazione, at which the following objects were exhibited :—

Amoeba	WM. NARRAMORE.
Bacillus anthracis in Liver	FRANK TATE.
Disease Germs, Tubercle, &c.	Dr. NEWTON.
Fire Ant of Jamaica	CHAS. H. H. WALKER.
Fungi *Raestclea lacerota*	THOMAS BIRKS.
Lepidopterous Scales	F. N. PIERCE.
Lung Tissues	ROBERT NICHOLSON.
Micrasterias denticulata	T. C. RYLEY.
Odostomia spiralis (Testaceous Mollusca)	A. LEICESTER.
Polycystinæ from Barbadoes	A. F. DUMERGUE.
Trichina spiralis in Cat's tongue	H. E. DAVIES.
Sections of Pancreas	F. C. LARKIN.
Transverse Section Eye of *Pecten islandicus*	A. K. DWERRYHOUSE.

May 5th.—The President, Dr. F. C. LARKIN, made reference to the field meeting which was held at Formby on Saturday, the 29th ultimo, which, he informed the meeting, was well attended, and had resulted in some very satisfactory captures, in the shape of Rotiferæ, Desmidiæ, Algæ, &c. which would be exhibited at the Conversazione, at the end of the meeting. He intimated that the Committee had decided to hold two more Field Meetings during the summer, viz. on Saturday, the 3rd June, and on Saturday, the 2nd September, which he hoped would be well attended. Mr. J. DAVIES, F.C.S., then read the Paper of the evening, entitled, "Some Further Notes on Pedesis." After giving a short resumé of the facts laid before the Society in his last paper on the subject, Mr. DAVIES described some further experiments which he had been making in connection with the retarding action of mineral acids and salts on sulphate of barium, mercuric sulphide, and other solutions in which this extraordinary phenomenon of motion without life is vigorously apparent. He also drew attention to the fact that the detergent properties of soaps and alkaline solutions is in a large measure due to the power which these substances have of accelerating this peculiarly vigorous oscillating motion of exeedingly minute particles suspended in fluids. He concluded a very interesting communication by drawing a parallel between this pedetic motion and the theoretical vibration of molecules of matter; and after some friendly criticism by the PRESIDENT and Mr. EDWARD DAVIES, F C.S., of the views set forth, the meeting concluded with the usual Conversazione, at which the following objects were exhibited :—

Cuscuta europea attached to *Trifolium*	W. J. HAYDON.
Eyes of *Nauplius Cyclops quadricornis*	CHAS. KNIGHT.
Pedesis Illustrating Paper	FRANK TATE.
Do.	J. DAVIES.
Do.	W. WOOLCOT.
Section (stained) *Rosa canina*	J. M. WILLIAMS.
Do. Human Scalp	A. F. DUMERGUE.
Living objects—	
Eggs, Larva and Imago of *Culex pipiens*	JOSEPH WALL.
Granular movement in *Desmidiae*	W. NARRAMORE.
Volvox globator	A. T. SMITH, Jun.

The PRESIDENT, ALFRED LEICESTER, ROBT. NICHOLSON, W. H. READ, F. N. PIERCE, HERBERT DAVIES, and other Members exhibited living objects collected at the Formby meeting.

October 6th.—This being the first meeting of the Society since the Summer recess, the PRESIDENT referred in a few well-chosen words to the great loss the Society had sustained through the death of the Rev. H. H. HIGGINS, a past President of the Society, and one of its oldest and most respected Members, and he intimated that a letter of condolence had been sent by the Secretary, acting under the instructions of the Council, to the members of Mr. HIGGINS's family. Dr. JOHN NEWTON was elected President for the ensuing Session, to take office in January. Mr. ROBERT NICHOLSON made a short communication in reference to an article on a micro-telescope in the *Scientific American*, and Mr. A. T. SMITH, Jun., gave a short report on the field meetings which had been held during the Summer; after which Mr. NARRAMORE, F.L.S., read the Paper of the evening, entitled, "Notes on Starch," at the conclusion of which a discussion took place, and the meeting concluded with the usual Conversazione, at which the following objects were exhibited :—

Starch from Potato	WM. NARRAMORE.
Do. do. treated with Chromic acid	WM. NARRAMORE.
Do. Tous le mois	WM. NARRAMORE.
Do. do. saliva action	WM. NARRAMORE.
Do. *Euphorbia splendens*	THOS. BIRKS.
Do. do stained	THOS. BIRKS.
Do. *Iris Germanica*, with amyloplasts	A T. SMITH, Jun.
Do. Bean	A. LEICESTER.
Do. Pea (polarised)	J. M. WILLIAMS.
Do. Lentil	C. H. H. WALKER.
Do. Wheat (polarised)	W. H. READ.
Do. Rice	F. TATE.
Do. Oats	F. TATE.
Do. Barley	A. F. DUMERGUE.
Do. *Arum maculatum*	EDWD. DAVIES.
Do. Ipecacuanha	F. N. PIERCE.
Do. Pepper	F. C. LARKIN.
Do. Bermuda Arrowroot (polarised)	R. NICHOLSON.
Do. St. Vincent do. (do.)	R. NICHOLSON.
Transverse section Spruce Fir	Miss L. WILLMER.
Plumatella jugalis (living)	A. T. SMITH, Jun.

November 3rd.—Mr. ISAAC C. THOMPSON, F.L.S., F.R.M.S., called attention to an interesting series of studies in Marine Zoology, now being issued from the laboratory of the Jersey Biological Station, prepared by Mr. JAMES HORNELL, a former Member of the Society, and he referred in complimentary terms to the general excellence of these preparations. Mr. THOMAS BIRKS made a short communication on a rare species of micro fungus, *Roestelia cornuta*, from Norway, which he had received from Mr. A. F. DUMERGUE. The Paper of the evening was contributed by Mr. A. R. DWERRYHOUSE, and was entitled, "The Microscope in Petrology." The lecturer dealt skilfully with this very difficult subject, and dwelt upon the value of polarised light as a means of distinguishing between and identifying different classes of minerals, and as an aid in arriving at correct opinions as to the methods of formation of the igneous rocks. A short discussion ensued, in which Messrs. THOMPSON, WALKER and BEASLEY took part, and the meeting then resolved itself into a Conversazione, at which the following objects were exhibited :—

Rock Sections—Mica plates, showing interference figures...	A. R. DWERRYHOUSE.
Obsidian, showing Perlitic structure	A. F. DUMERGUE.
Altered Rhyolite, showing Spherulitic structure............	F. C. LARKIN.
Corriegills Ditchstone	J. DAVIES.
Microclinic Graphic Granite (polarised)	C. H. H. WALKER.
Hornblende Granite (do.)	A. T. SMITH, Jun.
Microcline (do.)	F. N. PIERCE.
Jasper and Amethyst (do.)	WM. OELRICHS.
Agate and Chalcedony (do.)	JOHN NEWTON.
Jasper (do.)	J. M. WILLIAMS.
Coal Sections (Lancashire)	FRANK TATE.
Do.	W. WOOLCOT.
Pegmatite	W. H. READ.
Roestelia cornuta	THOMAS BIRKS.
Tradescantia virginica (Staminal Hairs)	WM. NARRAMORE.
Nais proboscidæ—...	J. GOULD.
Heads of *Taenia saginata* and *Taenia mediocanallata*...	H. E. DAVIES.

December 1*st.*—Mr. HERBERT E. DAVIES, M.A., B.Sc., read a Paper on "The Cholera Bacillus." The subject was thoughtfully discussed from various points of view, the discoveries of PASTEUR, KOCH, and other scientists, being brought into evidence, with, however, the general result of showing that, though much has become known regarding the habits and developing capabilities under varying conditions of the organism which causes the dreaded scourge of Cholera, a good deal has yet to be learned. After the reading of the Paper, for which Mr. DAVIES was cordially thanked, a Conversazione was held, at which the following objects were exhibited :—

Bacillus Anthracis in blood .... } Bacillus from Maize infusion... .... }	W. NARRAMORE.
Finkler's Comma Bacillus	HERBERT E. DAVIES.
Koch's Cholera Bacillus	H. R. JONES.
Koch's Comma Bacillus	WM. OELRICHS.
Cholera Bacillus..	WM. M. READ.
Porphyritic Basalt (polarised)	ROBT. NICHOLSON.
Sting of Hornet	A. F. DUMERGUE.
Section of Eucalyptus	J. M. WILLIAMS.
Seaweed	F. N. PIERCE.
Living objects—	
Volvox globator	JOHN NEWTON.
Actinophrys sol	A. T. SMITH, Jun.

THE LIVERPOOL MICROSCOPICAL SOCIETY,

Dr. IN ACCOUNT WITH ROBERT NICHOLSON, HON. TREASURER. **Cr.**

1893.	£	s.	d.
To Rent of Rooms	10	10	0
,, Refreshments and Attendance	11	0	6
,, Sub-Librarian's Fee	1	0	0
,, Printing Annual Report, 1892	4	1	0
,, Printing Circulars	10	13	0
,, Addressing and Postage	4	1	0
,, J. Knott and Co. (for lantern)	1	1	0
,, Ray Society Subscription	1	1	0
,, Quarterly Journal of Microscopic Science	2	0	0
,, Hewick on the Microscope	0	15	0
,, Fire Insurance Premium	0	5	0
,, Postages per Hon. Treasurer	0	5	6
,, Collector's Commission	0	8	6
,, Cheque Book	0	2	0
,, Balance	109	18	4
	£157	1	10

1893.	£	s.	d.
By Balance from last Account	97	18	9
,, 96 Subscriptions for 1893	50	8	0
,, 5 do. for 1892	2	12	6
,, 2 do. for 1891	1	1	0
,, 2 Half do. for 1893	0	10	6
,, 6 Entrance Fees	3	3	0
,, Interest allowed by Bank	1	8	1
	£157	1	10
1894.			
By Balance	109	18	4
,, Suspense Account	5	5	0
	£115	3	4

Audited and found correct,

WM. NARRAMORE.
J. GOULD.

LIVERPOOL, 19*th January*, 1894.

LIVERPOOL MICROSCOPICAL SOCIETY.

LIST OF MEMBERS,

JANUARY, 1894.

HONORARY MEMBERS.

WITHAM M. BYWATER, 5, Hanover-square, London, W.

ARTHUR C. COLE, 171, Ladbroke Grove-road, Notting Hill, London, W.

W. G. CORTHELL, Tremont Temple, Boston, U.S.A.

Rev. Dr. DALLINGER, F.R.S., Hon.Sec.R.M.S., London.

W. H. GRATTANN, 1, Park-mount, Torquay.

Professor THOMAS TAYLOR, Chief of the Microscopical Staff, Agricultural Department, Washington, U.S.A.

WASHINGTON TEASDALE, Headingley, Leeds.

ORDINARY MEMBERS.

* *Members of Council.*

Elected.

1881 Abraham, Miss Emma C., Grassendale Park.

1880 Allen, Francis Birkbeck, 53, Newsham-drive.

1883 Barron, Alexander, M.B., M.R.C.S., 31, Rodney-street.

1883 Berey, T. Bickesteth, 145, Edge-lane.

1889 Birks, Thomas, 25, High Park-street.

1892 Blake, W. H., 15, Park-road.

1878 Botterill, Charles, 168, Bedford-street South.

1890 Brocklehurst, Henry, Aigburth-drive, Sefton Park.

1890 Brocklehurst, Septimus, 305, Edge-lane.

1868 *Carter, William, M.D., F.R.C.P., 78, Rodney-street.

1885 Clinch, John William, Douglas, Isle of Man.

1890 *Comber, Thos., F.L.S., Leighton, Parkgate.

1884 Cooper, Mrs. James T., 24, Shrewsbury-road, Oxton.

1887 Dalby, Miss, Talbot House, Mather-road, Birkenhead.

1874 *Davies, Edward, F.C.S., Chapel Chambers, Chapel-street.

1891 *Davies, Herbert E., M.A., B.Sc., Chapel Chambers, Chapel-street.

Elected.

1888 Davies, J., F.C.S., 28, Robarts-road, Anfield.

1887 Day, John H., Crosfield, Allerton-road, Tranmere.

1879 Deacon, H. Wade, Appleton House, Widnes.

1890 Dumergue, A. F., 7, Montpelier-terrace, Upper Parliament-street.

1889 *Dwerryhouse, Arthur R., 19, Seaton Buildings, Water-street.

1871 Edmonds, William, 69, The Albany, Oldhall-street.

1871 Evans, W. H., Wyllisholm, Huyton Hey-road, Huyton.

1892 Forshaw, F. H., 64, Merton-road, Bootle.

1882 Fullerton, James, 87, Brighton-street, Seacombe.

1882 Gardner, Willoughby, C 18, Exchange Buildings.

1868 Glynn, T. R., M.D., M.R.C.P., 62, Rodney-street.

1879 Goodwin, Gilbert Smith, Rockville, 23, Anfield-road.

1884 *Gould, Joseph, Littledale-road, Egremont.

1885 Gray, George Watson, 14, Argyle-road, Garston.

1882 Grisewood, William, 40, Falkland-road, Egremont.

1873 Harpin, Edward, c/o Messrs. Bates, Stokes and Co. 14, Water-street.

1892 Haydon, W. T., 15, Great George-square.

1868 Hayward, E. K., National Steam Ship Company, Water-street.

1869 Healey, George F., Oakfield, Gateacre.

1887 Houlgrave, Henry, Crosby-road South, Seaforth.

1893 Howell, John Job, Branksome, Cearns-road, Birkenhead.

1893 Hughes, Peter, 31, Brownlow-road, New Ferry.

1882 Johnson, Alfred, 3, Melrose-terrace, Rake-lane, Liscard.

1874 Jones, C. W., Field House, Prince Alfred-road, Wavertree.

1892 Jones, Hugh R., M.D., 58A, Grove-street.

1893 Jones, Robert, Birkdale.

1892 Knight, Charles, 45, Bury New-road, Manchester.

1886 *Larkin, Frederick Charles, F.R.C.S., 54, Rodney-street.

1892 Lee, H. P., Queen's-road, Great Crosby.

1875 *Leicester, Alfred, 1, Priory-gardens, Weld-road, Birkdale.

1891 Liversedge, Louis, Crosby.

1885 Lloyd, Thomas Isaac, L.D.S., 36, Bold-street.

1887 Mahon, George, 14, Newsham-drive, Newsham Park.

1890 Marsh, Peter W., 1, Courtney-road, Waterloo.

1893 Mason, Wm., Jun., Liverpool-road, Formby.

1868 Masters, F. H., Fairfield-terrace, Tranmere.

1890 Morgan, Joseph B., F.R.M.S., Stand House, Childwall.

1891 *Morton, G. H., 209, Edge-lane.

1883 Mossop, Thomas, 7, Westmorland-road, Liscard, Cheshire.

1880 *Narramore, William, F.L.S., 5, Geneva-road, Elm Park.

1889 *Newton, John, M.R.C.S., 44, Rodney-street.

1878 *Nicholson, Robert, 11, Harrington-street.

Elected.

1893 Nuttall, F. R. Dixon, F.R.M.S., Queen's Park, St. Helens.
1879 *Oelrichs, Wm., F.R.Met.Soc., F.R.M.S., Sunnyside, Wexford-road, Oxton.
1883 Oliver, Thomas, Woodland Cottage, Roby.
1883 Padley, Fred., 15, Church-street.
1879 Paul, Frank T., F.R.C.S., 38, Rodney-street.
1880 Pendlebury, William Martin, 17, Tithebarn-street.
1891 Philpots, H., M.D., 56, Shrewsbury-road, Oxton.
1888 Pierce, F. N., F.E.S., 143, Smithdown-lane.
1886 *Read, William H., Eden Cottage, Holland-road, Liscard.
1868 *Roberts, Edward, Clifton Villa, Halewood-road, Gateacre.
1885 Robertson, Helenus R., Springhill, Wavertree.
1886 Routledge, Tom, Crosby-road South, Seaforth.
1868 Ryland, William, 5, Eldon-terrace, Rock Ferry.
1879 Scholefield, Joshua William, J.P., 33, Pembroke-road, Bootle.
1884 Shillinglaw, William, L.D.S., Hamilton-square, Birkenhead.
1879 *Smith, Andrew T., Jun., 13, Bentley-road, Prince's Park.
1889 Smith, J. Forrester, Newstead, Wavertree.
1891 Smith, Rev. Wm. Hodson, 29, Hope-street.
1884 Stead, Edward F., 10, Adelaide-terrace, Waterloo.
1886 Stewart, W. H., L.D.S., 37, Rodney-street.
1893 Stone, Fred. R., F.C.S., 58, Upper Parliament-street.
1873 Stone, John, Huyton.
1893 Tate, Francis Henry, 9, Hackins-hey.
1868 Thomas, George, 30, King-street, Rock Ferry.
1873 Thompson, Isaac Cooke, F.L.S., F.R.M.S., Woodstock, Waverley-road.
1879 Vicars, John, 8, St. Alban's-square, Bootle.
1889 *Walker, Charles H. Hesketh, 5, Church-lane.
1886 Walker, George E., F.R.C.S., 43, Rodney-street.
1868 Walmsley, G. G., 50, Lord-street.
1890 Wardleworth, Theo. H., 56, Hanover-street.
1871 *Williams, J. Michael, F.R.M.S., 156, Chatham-street.
1886 Williams, Thomas, F.C.S., A, Queen Insurance Buildings.
1891 Willmer, Miss J. H., Fernleigh, Westbourne-road, Birkenhead.
1887 Willmer, Miss Laura, Fernleigh, Westbourne-road, Birkenhead.
1879 Wilson, Henry, M.D., M.R.C.S., 22, High-street, Wavertree.
1893 Wilson, Joseph, 4, Dryden-road.
1869 Wood, J. J., 20, Lord-street.
1892 Woolcott, William, 166, Grove-street.
1872 Wyllie, Andrew, 1, Leicester-street, Southport.

ASSOCIATE MEMBER.

Mortimer, Captain (care of the Curator, Free Museum).

TWENTY-SIXTH ANNUAL REPORT

OF THE

LIVERPOOL

MICROSCOPICAL SOCIETY.

ABSTRACT OF PROCEEDINGS,

AND LIST OF MEMBERS.

JANUARY, 1895.

LIVERPOOL:

TURNER, ROUTLEDGE AND CO. PRINTERS.

MDCCCXCV.

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MDCCCXCV.

Liverpool Microscopical Society.

SESSION XXVII. 1895.

Past Presidents:

JOHN BIRKBECK NEVINS, M.D.
REV. WM. BANISTER, B.A.
REV. DR. DALLINGER, F.R.S., Hon.Sec.R.M.S.
JOHN ABRAHAM.
J. J. DRYSDALE, M.D., F.R.M.S.
JOHN NEWTON, M.R.C.S.
REV. HENRY H. HIGGINS, M.A.
GEORGE F. CHANTRELL.
J. S. HICKS, F.R.C.S., F.L.S.
WILLIAM CARTER, M.D., F.R.C.P.
W. H. WEIGHTMAN, F.R.M.S.
FRANK T. PAUL, F.R.C.S.
CHARLES BOTTERILL.
REV. F. BALLARD, M.A., B.Sc., F.G.S., F.R.M.S.
A. NORMAN TATE, F.I.C., F.C.S., F.R.M.S.
ISAAC C. THOMPSON, F.L.S., F.R.M.S.
F. CHARLES LARKIN, F.R.C.S.

OFFICERS AND COUNCIL ELECTED 25th JANUARY, 1895.

President:

JOHN NEWTON, M.R.C.S.

Vice-Presidents:

EDWARD DAVIES, F.C.S.
J. M. WILLIAMS, F.R.M.S.

Hon. Treasurer:

ROBERT NICHOLSON.

Hon. Secretary:

ANDREW T. SMITH, JUN.

Hon. Curator:

ALFRED LEICESTER.

Council:

WM. CARTER, M.D., F.R.C.P.
H. E. DAVIES, M.A., B.Sc.
A. R. DWERRYHOUSE.
JOSEPH GOULD.
W. T. HAYDON.
H. R. JONES, M.D.
F. CHARLES LARKIN, F.R.C.S.
G. H. MORTON, F.G.S.
WILLIAM NARRAMORE, F.L.S.
F. R. DIXON NUTTALL, F.R.M.S.
WILLIAM H. READ.
C. H. HESKETH WALKER.

TWENTY-SIXTH ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

In presenting their Twenty-sixth Annual Report the President and Council are glad to be in a position to say that during the past year the Society's work has been satisfactorily carried on.

The papers presented have not fallen short of their usual standard, and were much appreciated by the Members who attended the various meetings.

With the view of increasing the popularity of the Society the Council decided to have a special meeting last February in the shape of a Soirée, which should take the place of the ordinary meeting. Many objects of interest were kindly lent for the occasion by Members and others. A musical programme was arranged, and two special popular lectures were delivered. There was also an exhibition of interesting objects under nearly 50 microscopes, as per list in synopsis of proceedings attached. The Soirée was well attended, and the innovation seemed to be much appreciated.

Three field meetings have been held during the year.

1st, 28th April, at Knowsley Park.

2nd, 16th June, at Bromborough and Eastham.

3rd, 8th September, at Hooton.

The attendance at these meetings was as follows:—Knowsley 30, Bromborough and Eastham 6, Hooton 13.

During the year one new Member has been elected, whilst the Society has lost through deaths and resignations twelve members. The list now stands at 6 Honorary and 85 Ordinary Members.

It is with deep regret the Council again has to record the loss through death of two old and highly esteemed Members of the Society, viz. Mr. CHARLES BOTTERILL, who was twice President of the Society, and Mr. GEORGE THOMAS, whose figure was at one time so well known at our meetings.

Members are reminded that an invitation from Liverpool and the University and Learned Societies of Liverpool has been accepted by the British Association to visit the City in 1896, and as our Society is on the list of Corresponding Societies of that Association it is hoped that during the coming Session each Member will make an effort to increase the strength of the Society, and so bring its membership roll up to figures more worthy of its antecedents.

The Council desires to take this opportunity of thanking those Members and friends who have added to the interest of the meetings by contributions of papers and other communications of value and by exhibiting at the conversaziones.

They also desire to record their thanks to donors of Books to the Library and Slides to the Cabinet.

The following is a *precis* of the proceedings at the meetings.

January 19*th*.—The President, Dr. JOHN NEWTON, delivered his Inaugural Address, subject, "The Life History of some of our Common Insects," and at its conclusion a vote of thanks was accorded to the President for his address

February 2nd.—Soirée. The following is a Synopsis of Proceedings :—

7 p.m. Reception in Old Bird Room by the PRESIDENT and Mrs. NEWTON.

7.30 p.m. in the Upper Lecture Room, Exhibition of Fresh water Living Objects under a Lantern Projection Microscope, with short description by Messrs. A. T. SMITH, Jun. and W. NARRAMORE, F.L.S.

8 p.m. Concert—

Song.................. "Out on the deep." ....*Lohr.*
Mr. CHARLES WILLIAMS.

Song...... .... "Beauty's Eyes." ....*F. Paolo Tosti.*
Miss LEICESTER.

Song........................ Selected ....
Mrs. W. DODD, Jun.

Song .... "The Coming of the King." ....*Roeckel.*
Mr. J. A. CHADWICK.

8.45 p.m. Mr. EDWARD DAVIES, F.C.S. delivered a lecture on "Glass."

9.30 p.m. Concert—

Duet............"The moon hath raised."............*Benedict.*
Messrs. C. WILLIAMS and J. A. CHADWICK.

Song...............“When Love is kind.”..................*A. L.*
Miss LEICESTER.

Song............"The Arrow and the Song."............*Balfe.*
Mr. CHARLES WILLIAMS.

Song....................."Margarita."..........................*Lohr.*
Mr. J. A. CHADWICK.

Accompanists—Miss HUDSON and Mr. W. DODD, Jun.

Short intervals were allowed for promenade in the Bird Room and inspection of Microscopes and Curios.

Refreshments were served in the Library during the evening.

In Old Bird Room were exhibited the following Minerals, Shells, Books, Old Prints, Drawings, Curios, &c. kindly lent for the occasion by the gentlemen against whose names they stand :—

A collection of old Mezzotints and Prints, illustrating social life in the last century, after Collett, Morland, Cruikshank, &c. Some old Miniatures and Illuminated Manuscripts, and an ancient German Bible, with pictures, 1483. The PRESIDENT (Dr. John Newton).

Sketch Book of Sir Christopher Wren. Specimen of Shorthand 150 years ago. Mr. WM. GRISEWOOD.

Old Black Letter Bible (French), and a Universal Sundial —Mr. W. H. READ.

Old fashioned Microscope and Apparatus.—Mr. C. H. HESKETH WALKER, Mr. WM. NARRAMORE and Mr. GEO. RAE ANDERSON.

British Lepidoptera.—Messrs. F. N. PIERCE and C. H. HESKETH WALKER.

Collection of Minerals.—Mr. HERBERT E. DAVIES, M.A., B.Sc.

Specimens of Rocks occurring as Boulders in this neigbourhood.—Mr. A. R. DWERRYHOUSE.

Two cases of Shells, illustrating Genera Cypræa and Oliva.—Mr. J. M. WILLIAMS, F.R.M.S.

Shells from the Boulder Clay around Liverpool and their recent representatives. Mr. G. H. MORTON, F.G.S.

Collection of Original Drawings of Rotifera.—Mr. F. R. DIXON NUTTALL, F.R.M.S., St. Helens.

Cultivation of *Micrococcus prodigiosus* on Bread (*the Bleeding Host of the Middle Ages*).—Dr. H R. JONES.

List of objects exhibited under microscopes :—

Vorticetla nebulifera; also, Cyclosis in *Nitella translucens*	Dr. PHILPOTS.
Foraminifera, from Hilbre	J. GOULD.
Foraminifera, from Waterloo	E. F. STEAD.
Diatoms	Mrs. J. T. COOPER.
Glyciphagus plumiger *Navicula didyma*	ROBT. JONES.
Pigment Cells of Choroid (Human Eye)	HUGH R. JONES.
Closterium lunula *Cosmarium botrytis*	FRANK TATE.
Sting of Hive Bee	F. H. FORSHAW.
Head of Fly *(Musca domestica)*	WM. MASON, Jun.
Sting of Hornet Leg of Honey Bee Butterflies' Eggs	A. F. DUMERGUE.
Entire Diamond Beetle The Sound-producing organ of the Cricket	C. H. H. WALKER.
Yeast (*Saccharomyces cerevisæ*)	F. R. STONE.
Stem of *Eucalyptus globulus*	Miss M. E. DALBY.
Floral Beauties Ciliated Epithelium Lung of Frog	WM. NARRAMORE.
Stem of Oak (transverse section)	Miss L. WILLMER.
Leaf of *Cycas revoluta* (transverse section)	Miss J. H. WILLMER.
British Mosses, typical specimens	J. WILSON.
Microscope and Projection Microscope	W. H. READ.
Crystallization of Stearine (Polariscope)	W. GRISEWOOD.
Section of Tooth	HERBERT E. DAVIES.
Rock Sections (polarised)	A. R. DWERRYHOUSE.
Melicerta ringens	WM. OELRICHS.
Head and Tongue of Horsefly	P. HUGHES.
Multiplied Images seen through the Eye of a Fly	Dr. NEWTON.
Eyes of a Jumping Spider	J. M. WILLIAMS.
Circulation in Frog's Foot, and Pathological Specimens.	Dr. LARKIN.
Under side of Wing of Butterfly (Orange tip)	F. N. PIERCE.
Dragonfly Larva	R. NICHOLSON.
Testaceous Mollusca, *Cæcum glabrum, Homalogyra rota*, &c.	ALFRED LEICESTER.
Lophopus crystallinus Spiracle of *Dytiscus marginalis*	A. T. SMITH, Jun.
Volvox globator	W. WOOLCOT.
Stellate Hairs of *Croton stenophylla*	T. H. WARDLEWORTH.
Reticulated Veins in Leaf	J. DAVIES.
Scale of Sole under Microscope of 1800-5	G. RAE ANDERSON.

March 2nd.—Mr. HUGH R. JONES, M.D. read a Paper, "The Architecture of Bone." At the Conversazione the following objects were exhibited :—

Section of Human Cartilage	J. GOULD.
Longitudinal Section of Human Femur	WM. WOOLCOTT.
Transverse do. do. do.	F. H. TATE.
Do. do. do. Bone	R. NICHOLSON.
Do. do. Spinal Cord of Ox	Miss J. H. WILLMER.
Section of Foot of Foetal Kitten (Development of Bone)	C. H. H. WALKER.
Do. Bone of Goose, Walrus, &c.	WM. NARRAMORE.
Do. Bone	A. F. DUMERGUE.
Human Bone and Whalebone	J. M. WILLIAMS.
Embryonic Bone	W. T. HAYDON.
Floscule ornata	A. T. SMITH, Jun.

April 6th.—Mr. F. C. Larkin, F.R.C.S. read a Paper on "Functionless Organs."

At the Conversazione the following objects were exhibited :—

Development of Tooth	H. E. Davies.
Alga, *Ptilata plumosa*	F. N. Tate.
Leg of Honey Bee	A. F. Dumergue.
Lung of Frog (injected)	
Argas pipistrellae	R. Jones.
Amphioxus—the lowest vertebrate	W. Grisewood.
Rotifera	J. Newton.
Parasite of Seagull	Miss J. H. Willmer.
Miliolina secans	Jos Gould.
Section of Thyroid gland	Robt. Nicholson.
Do. Thymus gland	A. T. Smith, Jun.
Do. Pineal eyes	F. C. Larkin.

May 4th.—Mr. W. H. Read read a Paper, entitled, "A Note on the Sea Lilies (*Encrenites*) and their Allies." At the Conversazione the following objects were exhibited :—

Spine of *Echinus*	W. H. Read.
Ophiocoma neglecta	F. N. Pierce.
Asterina gibbosa	F. Padley.
Holothurian Spicules in Situ	R. Nicholson.
Wheel plates of *Chirodota violacea*	J. M. Williams.
Transverse and Longitudinal Section of Sunflower	J. Gould.
Nitella translucens	A. F. Dumergue.
Melicerta ringens (living)	John Newton.
Melicerta ringens (mounted)	A. T. Smith, Jun.
Recent Cabinet Slides	A. Leicester.

October 5th.—Mr. John Newton, M.R.C.S. was re-elected President of the Society. Short communications were made by the President and Messrs. Alfred Leicester, W. Narramore, Frank Tate and A. T. Smith, Jun. in reference to the objects found at the Hooton Field Meeting on the 8th of September. At the Conversazione the following objects were exhibited :—

Melicerta ringens	Living	John Newton.
Stephanoceros eichornii		Wm. Narramore.
Polystomella crispa		J. Gould.
Planorbis nautileus (Lin)		Alf. Leicester.
Plumatella repens		A. T. Smith, Jun.
Oscillatoria		Frank Tate.
Haematopinus eurysternus		R. Jones.
Various Spicules *(polarised)*		A. Dwerryhouse.
Stigma and ovary of Geranium		W. H. Read.
Phthirius inguinalis		C. H. H. Walker.
Larva of a Dipteron		R. Nicholson.

November 2nd.—Mr. W. T. Haydon read a Paper on "Plant Parasitism, with Special Reference to *Lathrea squamaria.*" At the Conversazione the following objects were exhibited :—

Aphis pierced by *Ichneumon fly*	F. Padley.
Insect Structure	F. N. Pierce.
Living *Rotifers*	John Newton.
Noctiluca miliaris (living)	J. Gould.

ILLUSTRATING PAPER.

Rootlet of *Pedicularis sylvatica* attached to Grass Root...	R. NICHOLSON.
Orobanche caryophyllacea attached to *Gallium*	W. H. READ.
Orobanche major attached to Broom	FRANK TATE.
Cuscuta europea attached to Clover................................	WM. WOOLCOTT.
Cystinus hypocistus attached to *Cistus vulgare* ....; Rootlet of *Lathrea squamaria* attached to Rootlet of Hazel, and other specimens of Parasitic Plants, dried and in spirits	W. T. HAYDON.

December 7th.—Mr. THEO. H. WARDLEWORTH read a Paper on "Vegetable Hairs, Stellate and Otherwise." At the Conversazione the following objects were exhibited :—

Stellate Hairs of *Deutzia gracilis*	J. GOULD.
Do. *Onoana laurica*..................................	T. H. WARDLEWORTH.
Do. *Croton stenophylla*	ROBT. NICHOLSON.
Hairs of *Elegans reflexus* and *Rhododendron ciliatum* ...	W. H. READ.
Hairs from surface of a leaf of Lavender (stained)	F. TATE.
Hairs of *Cerinthe aspera*	A. T. SMITH, Jun.
Eyes of the Scorpion	G. H. H. WALKER.
Living Objects	JOHN NEWTON.

THE LIVERPOOL MICROSCOPICAL SOCIETY

IN ACCOUNT WITH

ROBERT NICHOLSON, HON. TREASURER.

Soirée, 2nd February, 1894.

Paid Advertisements	£1	4	0
,, Piano, Messrs. James Smith and Son	0	15	0
,, Music, ,, ,, ,, ...	0	4	6
,, Oxygen, Messrs. Archer and Son..................................	0	6	8
,, Decorations, Messrs. G. H. Morton and Son..........................	2	10	0
,, Plants, B. Riding	0	10	0
,, Refreshments, W. J. Holmes	7	10	3
,, Messrs. Copplestone and Co., Men moving Tables	0	4	0
,, Attendance, &c. E. Dohling..	0	15	0
,, Circulars, Programmes and Tickets, &c. included in Messrs. Turner, Routledge and Co.'s General Account.			
	£13	19	5
CR.			
By Sale of Tickets at 1s..	5	13	0
Debit carried to General Account..	£8	6	5

Audited and found correct.

J. GOULD.

W. H. READ.

THE LIVERPOOL MICROSCOPICAL SOCIETY,

Dr. IN ACCOUNT WITH ROBERT NICHOLSON, HON. TREASURER. Cr.

Dr.	£	s.	d.
1894.			
To Rent of Rooms	10	10	0
,, Refreshments and Attendance	9	5	6
,, Sub-Librarian's Fee	1	0	0
,, Printing Annual Report, 1893	4	1	0
,, Circulars and Stationery	12	7	6
,, Addressing and Postage	5	13	7
,, Subscription Sinel and Hornell's "Micro. Studies"	1	1	0
,, Ray Society Subscription, 1894	1	1	0
,, Quarterly Journal of Microscopical Science	2	0	0
,, Franklin's Microscopical Organisms	0	15	0
,, J. Knott and Co. for lantern, &c.	2	2	0
,, Fire Insurance Premium	0	5	0
,, Debit Balance from Soirée Account	8	6	5
,, Postages per Hon. Treasurer	0	3	0
,, Collector's Commission	0	12	0
,, Balance	97	11	6
	£156	14	6

Cr.	£	s.	d.
1894.			
By Balance from last Account	109	18	4
,, 83 Subscriptions for 1894	43	11	6
,, 1 Half do.	0	5	3
,, Arrears	0	10	6
,, Entrance Fees	1	11	6
,, Bank Interest	0	17	5
	£156	14	6
1895.			
By Balance	97	11	6
,, Suspense Account	5	5	0
	£102	16	6

Audited and found correct,

J. GOULD.
W. H. READ.

LIVERPOOL, 25*th January*, 1895.

LIVERPOOL MICROSCOPICAL SOCIETY.

LIST OF MEMBERS,

JANUARY, 1895.

HONORARY MEMBERS.

WITHAM M. BYWATER, 5, Hanover-square, London, W.

W. G. CORTHELL, Tremont Temple, Boston, U.S.A.

Rev. Dr. DALLINGER, F.R.S., Hon. Sec. R.M.S., London.

W. H. GRATTANN, 32, Torwood-street, Torquay.

Professor THOMAS TAYLOR, Chief of the Microscopical Staff, Agricultural Department, Washington, U.S.A.

WASHINGTON TEASDALE, Headingley, Leeds.

ORDINARY MEMBERS

* *Members of Council.*

Elected.

1881 Abraham, Miss Emma C., Grassendale Park.

1880 Allen, Francis Birkbeck, 53, Newsham-drive.

1883 Barron, Alexander, M.B., M.R.C.S., 31, Rodney-street.

1883 Berey, T. Bickesteth, 145, Edge-lane.

1889 Birks, Thomas, Moss Lodge, King's-road, Rochdale.

1892 Blake, W. H., 15, Park-road.

1890 Brocklehurst, Henry, Aigburth-drive, Sefton Park.

1890 Brocklehurst, Septimus, 305, Edge-lane.

1868 *Carter, William, M.D., F.R.C.P., 78, Rodney-street.

1885 Clinch, John William, Douglas, Isle of Man.

1890 Comber, Thos., F.L.S., Leighton, Parkgate.

1884 Cooper, Mrs. James T., 24, Shrewsbury-road, Oxton.

1887 Dalby, Miss, Talbot House, Mather-road, Birkenhead.

1874 *Davies, Edward, F.C.S., Chapel Chambers, Chapel-street.

1891 *Davies, Herbert E., M.A., B.Sc., Chapel Chambers, Chapel-street.

Elected.

1887 Day, John H., Crosfield, Allerton-road, Tranmere.
1879 Deacon, H. Wade, Appleton House, Widnes.
1890 Dumergue, A. F., 7, Montpelier-terrace, Upper Parliament-street.
1889 *Dwerryhouse, Arthur R., 49, Islington.
1871 Edmonds, William, 69, The Albany, Oldhall-street.
1871 Evans, W. H., Wyllisholm, Huyton Hey-road, Huyton.
1892 Forshaw, F. H., 64, Merton-road, Bootle.
1882 Fullerton, James, 87, Brighton-street, Seacombe.
1868 Glynn, T. R., M.D., M.R.C.P., 62, Rodney-street.
1879 Goodwin, Gilbert Smith, Rockville, 23, Anfield-road.
1884 *Gould, Joseph, Littledale-road, Egremont.
1885 Gray, George Watson, 14, Argyle-road, Garston.
1882 Grisewood, William, 40, Falkland-road, Egremont.
1873 Harpin, Edward, 119, Moscow-drive, Tuebrook.
1892 *Haydon, W. T., 15, Great George-square.
1868 Hayward, E. K., National Steam Ship Company, Water-street.
1869 Healey, George F., 32, Croxteth-grove, Sefton Park.
1887 Houlgrave, Henry, Crosby-road South, Seaforth.
1893 Hughes, Peter, 31, Brownlow-road, New Ferry.
1882 Johnson, Alfred, 3, Melrose-terrace, Rake-lane, Liscard.
1874 Jones, C. W., Field House, Prince Alfred-road, Wavertree.
1892 *Jones, Hugh R., M.D., 58A, Grove-street.
1893 Jones, Robert, 9, Westbourne-road, Birkdale.
1894 Jones, W. B., Jun., Luxmore, Penkett-road, Liscard.
1886 *Larkin, Frederick Charles, F.R.C.S., 54, Rodney-street.
1892 Lee, H. P., Queen's-road, Great Crosby.
1875 *Leicester, Alfred, 30, Weld-road, Birkdale.
1885 Lloyd, Thomas Isaac, L.D.S., 36, Bold-street.
1887 Mahon, George, 14, Newsham-drive, Newsham Park.
1893 Mason, Wm., Jun., Liverpool-road, Formby.
1890 Morgan, Joseph B., F.R.M.S., Stand House, Childwall.
1891 *Morton, G. H., 209, Edge-lane.
1883 Mossop, Thomas, 7, Westmoreland-road, Liscard, Cheshire.
1880 *Narramore, William, F.L.S., 5, Geneva-road, Elm Park.
1889 *Newton, John, M.R.C.S., 44, Rodney-street.
1878 *Nicholson, Robert, 11, Harrington-street.
1893 *Nuttall, F. R. Dixon, F.R.M.S., Queen's Park, St. Helens.
1879 Oelrichs, Wm., F.R.Met.Soc., F.R.M.S., Sunnyside, Wexford-road, Oxton.
1883 Oliver, Thomas, Woodland Cottage, Roby.
1883 Padley, Fred., 15, Church-street.
1879 Paul, Frank T., F.R.C.S., 38, Rodney-street.
1891 Philpots, H., M.D., 56, Shrewsbury-road, Oxton.

Elected.

1888 Pierce, F. N., F.E.S., 7, The Elms, Dingle.
1886 *Read, William H., Sunnyside, Withins-lane, Liscard.
1868 Roberts, Edward, Clifton Villa, Halewood-road, Gateacre.
1885 Robertson, Helenus R., Springhill, Wavertree.
1886 Routledge, Tom, Crosby-road South, Seaforth.
1868 Ryland, William, 5, Eldon-terrace, Rock Ferry.
1879 Scholefield, Joshua William, J.P., 33, Pembroke-road, Bootle.
1884 Shillinglaw, William, L.D.S., Hamilton-square, Birkenhead.
1879 *Smith, Andrew T., Jun., 13, Bentley-road, Prince's Park.
1889 Smith, J. Forrester, Newstead, Wavertree.
1891 Smith, Rev. Wm. Hodson, 29, Hope-street.
1884 Stead, Edward F., 10, Adelaide-terrace, Waterloo.
1886 Stewart, W. H., L.D.S., 37, Rodney-street.
1893 Stone, Fred. R., F.C.S., 58, Upper Parliament-street.
1873 Stone, John, Huyton.
1893 Tate, Francis Henry, 9, Hackins-hey.
1879 Vicars, John, 8, St. Alban's-square, Bootle.
1889 *Walker, Charles H. Hesketh, 5, Church-lane.
1886 Walker, George E., F.R.C.S., 43, Rodney-street.
1868 Walmsley, G. G., 50, Lord-street.
1890 Wardleworth, Theo. H., 56, Hanover-street.
1871 *Williams, J. Michael, F.R.M.S., 156, Chatham-street.
1886 Williams, Thomas, F.C.S., A, Queen Insurance Buildings.
1891 Willmer, Miss J. H., 20, Lorne-road, Oxton.
1887 Willmer, Miss Laura, 20, Lorne-road, Oxton.
1879 Wilson, Henry, M.D., M.R.C.S., 22, High-street, Wavertree.
1892 Woolcott, William, 166, Grove-street.
1872 Wyllie, Andrew, 1, Leicester-street, Southport.

THIRTY-SEVENTH

ANNUAL REPORT

OF THE

LIVERPOOL

Microscopical Society.

ABSTRACT OF PROCEEDINGS.

Paper, entitled:

"COMMERCIALISM AND SCIENCE,"

Being the PRESIDENT'S ADDRESS, January, 1906.

Paper:

"ABNORMAL VARIATIONS IN THE CORPUSCULAR ELEMENTS OF THE BLOOD,"

BY JOHN HAY, M.D., Ch.B. (Vic.)

Paper:

"GERM-CELLS, WITH SPECIAL REFERENCE TO THE RECENT RESEARCHES OF DR. JOHN BEARD,"

BY W. T. HAYDON.

LIST OF MEMBERS.

JANUARY, 1906.

LIVERPOOL:

WILLIAM H. SPELMAN, PRINTER, 36 TO 44 THOMAS STREET.

1906.

Price to Non-Members - 1/-

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1906.

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Liverpool Microscopical Society.

SESSION XXXVIII., 1906.

Past Presidents.

JOHN BIRKBECK NEVINS, M.D.
REV. WM. BANISTER, B.A.
REV. DR. DALLINGER, F.R.S.
JOHN ABRAHAM.
J. J. DRYSDALE, M.D., F.R.M.S.
JOHN NEWTON, M.R.C.S.
REV. HENRY H. HIGGINS, M.A.
GEORGE F. CHANTRELL
J. S. HICKS, F.R.C.S., F.L.S.
WILLIAM CARTER, M.D., F.R.C.P.
W. H. WEIGHTMAN, F.R.M.S.
FRANK T. PAUL, F.R.C.S.
CHARLES BOTTERILL
REV. F. BALLARD, M.A., B.Sc. F.G.S., F.R.M.S.
A. NORMAN TATE, F.I.C., F.C.S., F.R.M.S.
ISAAC C. THOMPSON, F.L.S., F.R.M.S.
F. CHARLES LARKIN, F.R.C.S.
EDWARD DAVIES, F.C.S., F.I.C.
WM. NARRAMORE, F.L.S.
W. T. HAYDON
HERBERT E. DAVIES, M.A., B.Sc., F.I.C.
R. J. M. BUCHANAN, M.D., M.R.C.P.

Officers and Council Elected 19th January, 1906.

President.

JAMES D. MACPHAIL.

Vice-Presidents.

WM. GRISEWOOD.
JOHN HAY, M.D., Ch.B. (Vic.).

Hon. Treasurer.

A. H. DUDLEY.

Hon. Secretary.

W. T. HAYDON.

Hon. Curator.

C. F. BURNE.

Council.

R. J. M. BUCHANAN, M.D., M.R.C.P.
R. CROSTON.
H. E. DAVIES, M.A., B.Sc.
J. R. HAYDON.
A. G. HAYWOOD, LT.-COL., V.D.
T. A. JONES.
A. E. LEWIS, B.A., F.I.C.
WM. OELRICHS, F.R. MET. SOC.
F. N. PIERCE, F.E.S.
WILLIAM H. READ.
J. E. TURNER.
J. M. WILLIAMS.

Lantern Committee.

F. N. PIERCE, J. R. HAYDON, C. F. BURNE, C. E. GRISEWOOD.

THIRTY-SEVENTH ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

IN presenting their Thirty-Seventh Annual Report, the President and Council have much pleasure in recording that during the past year the work of the Society has been continued in a gratifying manner.

The meetings have been well attended; great interest having been taken in the papers read, as also in the numerous objects exhibited.

The papers in several instances, have been the outcome of original work.

The objects shown, have been in the majority of cases, prepared by the exhibitors, many of the slides being of considerable beauty and excellence. This essential feature in the Society's work, indicates that there is sustained interest in the various methods of preparation now available.

A Field Meeting was held at Barnston, on June 24th, 1905. The meeting was well attended, and many good specimens were secured.

The Lantern Sub-Committee have rendered excellent service to the Society by making all necessary arrangements connected therewith.

A Sub-Committee has been appointed to revise the Society's collection of slides, and they are at present busy with the work, which, when completed, will, it is hoped, make the collection more readily available and more useful.

With a view to affording visitors increased facilities of attendance at the ordinary meetings Rule 18 was altered at a specially convened meeting, to read as follows:—"Members shall have the privilege of introducing visitors at the ordinary meetings and are requested to enter their names in the visitors' book."

The number of slides that may be taken at one time from the cabinet is now twenty-four, instead of twelve as heretofore.

Hoping to increase the value of the Annual Report, the Council have decided to publish therein all such papers prepared by the members as shall be deemed of sufficient general interest. Two Papers, in addition to the Presidential address, have been chosen—one by Dr. John Hay, entitled "Abnormal Variations in the Corpuscular Elements of the Blood;" the other by Mr. W. T. Haydon, entitled "Germ-Cells, with Special Reference to the Recent Researches of Dr. John Beard." The Presidential address, entitled "The Draughtsman's Art in Relation to Biological Science," was printed in the last Annual Report; the other two papers are printed herewith.

The following additions have been made to the Library. By Presentation:—Publications from the Royal Microscopical Society, the Quekett Club, and the Manchester Microscopical Society. These have been duly acknowledged.

By purchase:—"The Annals of Botany." Set of the Manchester Microscopical Society's Proceedings. Ray Society's Publications.

During the past session, one Honorary Member, Mr. R. Newstead, F.Z.S., Liverpool University, and four ordinary Members Messrs. F. Armstrong, A. Dearsley, W. J. Bowman, and R. Stopforth have been elected, while the loss through resignation is three. There were at the close of the year, four Honorary Members and sixty-one Ordinary Members.

The following is a brief account of the meetings:—

January 13th—The President (Mr. J. D. Macphail) delivered his inaugural address, on "The Draughtsman's Art in Relation to Biological Science." The address was printed with the last report.

February 3rd—A Paper, entitled "What is a Diatom," was read by Mr. Helenus R. Robertson, F.R.M.S. By means of some most beautifully executed lantern slides, and a brief but interesting paper, Mr. Robertson gave a very clear conception of the Diatomaceæ.

A large number of Diatoms, mostly from the Society's own cabinet were shown at the Conversazione held at the close.

Dr. R. J. M. Buchanan exhibited a very beautiful preparation of Human Leucocytes, in which centroromes were demonstrated.

March 3rd—A Paper, entitled "Nitrogen-Fixing Micro-Organisms," by Mr. A. E. Lewis. The life history of Bacillus radicicola was admirably described, and some excellent photo-micrographs exhibited in illustration. At the Conversazione, various preparations of root nodules and bacteria were shown.

April 7th—A Paper, entitled "ABNORMAL VARIATIONS IN THE CORPUSCULAR ELEMENTS OF THE BLOOD," was read by DR. JOHN HAY. A series of hand-drawn, coloured lantern slides, made by DR. R. J. M. BUCHANAN, were shown in illustration of the subject. The paper is printed with the present report.

May 5th—This meeting was held jointly with the members of the Lancashire and Cheshire Entomological Society, and was chiefly devoted to the exhibition and study of living organisms. MR. H. E. DAVIES gave an interesting account of a remarkable organism growing in a 10% solution of sulphuric acid, and this he had had under observation eight months.

The meeting proved most interesting, and many were the expressions signifying a desire for more gatherings of a like nature.

The exhibits (too numerous to record) were well chosen and admirably displayed.

The following members of the Lancashire and Cheshire Entomological Society were exhibitors: MISS BIRCH, DR. BELL, DR. TINNE, MR. H. B. PRINCE, MR. H. B. SCORE, MR. R. WILDING, and MR. E. J. B. SOPP.

October 6th—A Paper, entitled "GERM-CELLS, WITH SPECIAL REFERENCE TO THE RECENT RESEARCHES OF DR. JOHN BEARD," was read by MR. W. T. HAYDON. The lantern slides and the preparations shown at the conversazione in illustration of the Paper were kindly lent for the purpose by Dr. Beard. The paper is printed with the present report.

November 3rd—A Paper, entitled "PLANT HAIRS AND THEIR FUNCTION," was read by MR. R. CROSTON, in which he described in a lucid and interesting manner the numerous forms and varied functions of plant hairs. A number of well-chosen photo-micrographs were shown in illustration.

At the conversazione a large number of preparations of plant hairs were exhibited.

December 1st—This meeting was devoted to a Demonstration of Methods of Preparation. Dr. R. J. M. Buchanan described his method of preparing Sections of Blood, and Dr. F. C. Larkin gave a demonstration of the preparation of tissue, detailing the various processes from fixing to straining. Mr. Oulton Harrison, of the Lancashire and Cheshire Entomological Society, exhibited and described a series of photographs of living Lepidoptera, taken by Hugh Main, Esq., B.Sc., F.E.S. These demonstrations were appreciated by a large audience.

At this meeting, Mr. F. Armstrong exhibited some new Microscopes and a quantity of useful apparatus.

Mr. J. B. Garnett, of Manchester, also exhibited specimens of the various stains and appliances necessary for the production of finished sections.

THE LIVERPOOL MICROSCOPICAL SOCIETY.

Dr. IN ACCOUNT WITH THE TREASURER. **Cr.**

1905.	£	s.	d.	£	s.	d.
To Rent of Rooms				10	10	0
,, Printing, Stationery, and Postage ...				15	6	7
,, Sub-Librarian				1	0	0
,, Attendance				2	2	0
,, Binding Society's Reports..	0	2	9			
,, Annals of Botany ...	1	10	0			
,, Subscription Ray Society	1	1	0			
,, Manchester Microscopical Society's Reports ...	0	9	0			
,, Boxes for Slides ...	0	18	0			
				4	0	9
,, Archer & Son				0	16	2
,, Fire Insurance Premium				0	5	0
,, Balance				41	14	8
				£75	15	2

1905.	£	s.	d.
By Balance from last Account	40	19	2
,, 2 Subscriptions for 1903	1	1	0
,, 6 Subscriptions for 1904	3	3	0
,, 51 and 2 Half Subscriptions for 1905	27	6	0
,, 5 Entrance Fees	2	12	6
,, Bank Interest	0	13	6
	£75	15	2
By Balance	41	14	8
,, Suspense Account	5	5	0
	£46	4	2

Examined and found correct, W. GRISEWOOD.
J. M. WILLIAMS.

A. H. DUDLEY,
Hon. Treas.

COMMERCIALISM AND SCIENCE.

By JAMES D. MACPHAIL,

Being the Presidential Address, delivered on the 19th January, 1906.

"*It is almost as presumptious to think you can do nothing as to think you can do everything.*"—LORD ACTON.

"*I hold every man a debtor to his profession.*"—LORD BACON.

A SPECIAL privilege attaches to the occupant of this presidential chair, inasmuch as he is freed from the fetters of a specialized address, and left to his will to survey and criticise the whole realm of scientific inquiry that usually finds utterance in the meetings of the Society over which he is called upon to preside. And this "fancy-free" position has its advantages if wisely used. One is impressed repeatedly by the fact that it is so easy and so natural for a gentleman bent upon one set line of investigation to lead his hearers quickly beyond their ken, and to impress upon them the conviction that they have been invited to explore cavernous depths and mysterious passages and galleries, the end and safety of which are subjects of grave doubt, to say nothing of the feelings of considerable trepidation that arise as a necessary consequence. The annual address from the chair, however, has the advantage of taking you out, as it were, into the fresh air and the mountain side, and showing you the whole domain—in other words, presenting to you a landscape. In this age of specializing one runs the danger of burrowing in a small hole, forgetful of the fact that, knowing everything about a *part*, and otherwise being profoundly ignorant of the *whole*, is not true knowledge. In our researches, as in every sphere of inquiry, there is need to keep in mind the necessity of balance. Lack of perspective is apt to render a man as unquestionably stupid as he is dogmatic.

I would, therefore, invite your attention to a survey of the difficulties attaching to scientific inquiry amongst non-professional men ; keeping in view the advantage of a life devoted to more than one pursuit, and freed from the bias, prejudice, and jealousy that are apt to be engendered amongst those whose career is one of severe professional competition, stimulated by personal ambition. In the cases of both professional and non-professional men, brain, resolution, dauntless courage and untiring industry are factors immeasurably more important than either title or social status, or even the set routine of a certain type of university education. There is no place to-day in any department worthy of the name "honourable," for the weak or lazy man. The democratic element is entering into every phase of life—I mean life in its higher and nobler forms—and more and more it is becoming evident that the ranks of all professions are being filled with men keen to run the race and to win the crown upon the merits of their personal intellectual endowments.

It is to be admitted that there is a latent contempt, felt if not expressed, amongst professional and commercial men when either side ventures to intrude upon the domain of the other. There is an irony and bite in the allusion to "the scientific young man" when it falls from the lips of a leading physician. There is equal commiseration experienced by the business man when he beholds the chaotic muddle in simple ordinary commercial routine resulting from the efforts of his professional fellow-citizens. The fact is we appear as children to one another; and only good manners prevent us from calling each other names, until we find ourselves in an atmosphere of kindred interests, and then, in all probability, we give full vocal rein to our thoughts. And it must be admitted that both sides have justification for the attitude they take up. Half-knowledge is a curse to the human family, and men have a right to condemn it. The science odium and the "*odium theologicum*" are cases in point. Both owe their existence to the ignorance each one labours under of the true position of the other side. A resolution to seek truth at any cost, and to admit truth when once it is found, would save men many stupidities, to say nothing of bad temper.

Notwithstanding all this there is a territory of scientific inquiry, a middle-land so to speak, which is the common pasturage of both sides. A land of mountain chains and verdant valleys where professional and commercial men may meet as upon their native soil. And it is to offer facilities for mutual intercourse and friendly rivalry, for discussion and research, that a Society like ours exists, situated as it is in one of the greatest trading centres ever known in the history of the world. Liverpool, as many of you know, up to the last two or three decades gave nearly the whole of its attention to commercial pursuits—in plain parlance, to money-making. Education and scientific inquiry had (to my own knowledge) a feeble, flickering existence thirty years ago, and yet outside the markets there foregathered small coteries of men whose souls could not be satisfied by accumulating wealth or by labouring *solely* for creature comforts. Yea, many of them were poor men, as the world counts poor; but life to them was more than eating and drinking. Their path truly was one of plain living; but who shall gauge the joy of their high thinking, the delights, the unalloyed happiness they experienced! It was men such as these that formed the bone and muscle of our Society long years ago, and, I would venture to say, still form an equally important element in its present-day constitution. Zoology, botany, geology, entomology, history, natural physics, these were and still are the common meeting grounds of professional and non-professional men; and no small part of the intellectual advancement of the past century may be traced, in our own city at anyrate, to those men who, in their spare time, explored further and further into the realms of the sciences to which I have just made reference. These pioneers were not greedy of their acquisitions, for with lavish hand have they shared their treasures of knowledge with those who have come after them, their sheer love of getting being only equalled by their delight in giving.

Within well-defined limits the non-professional worker has a distinct place in scientific investigation, and what he lacks in depth, due to want of time and opportunity, he in great measure makes up in breadth, freshness and enthusiasm. But he must never forget his limitations. He would do well to be strong on one side –his commercial side. A man who is only half-and-half, who would try and make his science studies a kind of semi-commercial pursuit, and his business projects an effete form of science, will never succeed—and he does not deserve to do. A man cannot be master in both worlds, and it is as well, first as last, to recognise the fact. On the one hand he works for money, his daily bread; on the other hand he studies for the sheer love of his subject; and each of these spheres will be best engaged in when the least friction is occasioned as a result of honest observance of boundary lines.

More than most men, then, has the non-professional worker need to show a profound spirit of humility. Conceit is a foe to all sound work. We know so little and there is so much to be known that we run the danger of falling into an opposite extréme, and allowing our hearts to fail us by reason of despair. Even a prince of scientists like Lord Kelvin deplores the failures that have marked his efforts! G. F. Watts, lately in the first rank of living English artists, was continually belittling self by reason of his high ideals, the haunting sense ever clinging to him of never having reached the heights of the masterly exposition his soul longed after. And with this constant self-depreciation he was found frequently eulogising others. Yes, this sense of failure tended to plunge him into an egoism that was neither healthy nor honest—I mean honest to himself. And if this sense of failure is observable in science and art on the part of those who have given all their lives to one pursuit, how much more should we who have only "the stolen hours" for our studies observe an attitude of strict reserve. The late Lord Salisbury devoted his leisure time to the study of electrical energy; the late Mr. Gladstone to Homeric Greek, yet neither of them was ever found placing his knowledge in these directions above a modest, and may I say, apologetic position. One of Charles Darwin's greatest charms, as revealed in his biography, was his child-like eagerness to learn. In like manner have I found a similar spirit manifested in the ranks of this Society—not once or twice, but frequently. And how refreshing has this absence of superiority been to some of us!—I mean to those of us who were receivers, not givers.

Again, we non-professional men have the pleasure, and it is a real one, of "ganging our ain gait," doing our own work in our own fashion (frequently a very poor fashion, I admit), feeling ourselves free to follow new paths, and being equally at liberty to abandon old traditions. But one thing we are never freed from, and that is the need to *study nature at first hand.* No amount of reading will compensate us for lack of *experimental* knowledge: for that deftness of touch, steadiness of hand, quickness of perception, sensibility to surrounding circumstances, which are begotten by *handling and seeing.* As much might you expect a commercial man to become an anatomist by simply reading—perhaps doggedly and intelligently enough—through Gray's "Anatomy," as you would expect a surgeon to become an efficient banker by ploughing through a work on foreign exchanges. The great thing is in the *doing of it*. And it is this sense of the absence of practical experience that makes one shun to assume a knowledge which is only backed by reading. Speaking for myself I hesitate when necessity compels me to consult a member of the medical profession even to make use of technical terms, although they may by long study have become familiar to me. It is assuming a knowledge I do not possess; for is not the position plainly this—he knows the *goods*, I know the *labels*? And, besides, it is nothing short of nonsense to rattle about big words, when it is only too evident you have nothing solid behind them.

But on the other hand it is a mistake to suppose that a professional man knows *everything*. Were they living to-day, a cobbler like Thomas Edward and a stonemason like Hugh Miller could put many a professional scientist through his facings. A business man can have his native heath even in the scientific world. In pond, in hedgerow, in field, in quarry, by the sea shore and in the quietness of his own home, he—the non-professional man—can claim the mastery of his position. He *knows*, not simply because he reads but because he *works*. How great, for instance, are the mysteries contained in the study of "the cell"; and yet how frequently do our discussions reveal a knowledge of the subject—the outcome of long patient investigation—on the part of members whose days are spent in the bustle of commercial life. These men are *workers*; and their words are listened to with respect by one and all who are not fettered by the traditions of professional exclusiveness.

A good deal, of course, depends upon what view we take of life, and more especially what estimate we place upon life's enjoyments. That life is meant to be enjoyed, and is capable of being enjoyed by every sane man I have no hesitation in affirming. But it must not be an enjoyment of mere self-gratification, of accumulation, of ruthless ambition. Enjoyment of this type brings with it surfeit and stagnation. On the other hand we have had given to us the whole realm of nature to enjoy: and who shall exhaust its treasures or fully gauge its delights! One of the first duties of every man—apart from his pursuit in life—is to know something of *where* he is as well as *what* he is; and this in plain words defines (in its terrestrial relations), the whole realm of science. Students of Ruskin will remember a pregnant passage on modern education in one of the appendices to "The Stones of Venice." Here are the words:—

> "Our present European system of so-called education "ignores, or despises, not one, or the other, but all the "three, of these great branches of human knowledge. "First, it despises natural history. Until within the last "year or two, the instruction in the physical sciences given "at Oxford consisted of a course of twelve or fourteen "lectures on the elements of mechanics or pneumatics, and "permission to ride out to Shotover with the Professor "of Geology. I do not know the specialities of the system "pursued in the academies of the Continent, but their "practical result is, that unless a man's natural instincts "urge him to the pursuit of the physical sciences too "strongly to be resisted, he enters into life utterly ignorant of them. I cannot, within my present limits, even "so much as count the various directions in which this "ignorance does evil. But the main mischief of it is, that "it leaves the greater number of men without the natural "food which God intended for their intellects. For one "man who is fitted for the study of words, fifty are fitted "for the study of things, and were intended to have a "perpetual, simple and religious delight in watching the "processes, or admiring the creatures of the natural "universe. Deprived of this source of pleasure nothing is "left to them but ambition or dissipation; and the vices "of the upper classes of Europe are, I believe, chiefly to "be attributed to this single cause."
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> ("S. of V.," vol. III., appendix 7).

The study of God's creation in very truth is man's natural food; and no instrument to further this much-desired end has ever been devised equal in importance to the compound microscope. As we all know, the instrument is not the device of one man or one age, but it is the outcome of numberless inventors and improvers, commencing, say, with Galileo, who, Viviani informs us, sent a microscope to Sigismund, King of Poland, in 1612.

The possession of a microscope, not as a plaything but as a companion— I mean as an instrument to be used for honest and continuous investigation—places within the power of a non-professional man a means of investigating nature's secrets otherwise utterly unknown to him, and indicates lines of inquiry which the professional man has neither the time nor inclination to pursue. One has only to commence his researches in order to find out the superabundant riches that lie on all sides of him ; and to lament, too, the shortness of life—so much to be attained, so little acquired ! It would be well if the spirit of pure commercialism could be controlled by a power truly cognisant of man's place and destiny, could be made to understand that existence and life, animal and man, accumulation and wisdom, idolatry and lawful pursuit, are not terms of equal value or have any relation whatsoever. Thousands of scholars, not, say, of Oxford or Cambridge, but of the University of Experience, qualified by reason of pinched means, clear heads, and dogged wills, men who have been *forced* to know the value of things, are to-day quietly pursuing the study of the great mysteries that surround them, and more especially that chief of mysteries, the phenomenon of vital existence. It makes them none the less good servants, considerate masters, successful traders, keen competitors. The layman claims scientific inquiry as his legitimate field, simply because he himself is part of nature (although above it), and he has a right to know himself and what is akin to him. It keeps, doubtless, many a man from despair, and I am confident it cheers and ennobles many a life. Allow me to illustrate this to you :—

It is, say, early summer time. The day has been an arduous one. Business relations have proved awkward ; or the markets have been depressed ; or rates have proved prohibitive. Perhaps on the contrary one has lived at high pressure from breakfast time, and there is the sense of fag, so well-known to many of us. Under circumstances like these what is the best method of obtaining rest? It will be recognised at once that the "rest" needed is not passivity, but changed activity; an absolute reversal of occupation. To a man possessed with a love of nature, the all-needful channel of recuperation is entered upon at once. Through country lane, over stile and ditch, by river side or by the shore, he wends his way, all eyes and ears for flower and bird; for every glorious experience that prodigal nature is never slow to reveal to every seeker after her hid treasures. And who shall tell of all the wonders of her treasure house! Here in this wayside pond is a wealth of life—of indescribable beauty and activity—so prolific that it forms in itself a veritable little world. Daphnia and Floscule, Rotifer and Polyzoön—so common as, I fear, to be despised by some of us. And yet the humblest of these living creatures, hidden to natural sight, is "a thing of beauty and a joy for ever." The same may be said of aquatic microscopic plants, which to the tyro appear as so much filthy slime until their structure and action have been revealed to him. Similar attention is devoted to the wayside flower—its form, its classification, its place in the economy of nature, its method of propagation. A bank of wild flowers to the passer by may have a temporary attraction, but to a botanist (to the student who knows something of function and structure) it offers a delight almost beyond words. If the bent of mind be not in the direction of plant and animal, there remains the whole realm of entomology to be explored, or failing this, geology. Nor does the profit end with the walking or the ingathering. Somewhere in the man's house is a place, tidy or untidy, it matters not, which for all practical purposes is regarded as sacred. It contains instruments and apparatus and seemingly countless odds and ends which are all needed. Housewife and housemaid stand in awe of that spot; if they see it at all it is on sufferance, and they are made to realize their profound ignorance. But it is in that spot that our business man takes the second step in his study of nature.

If I mistake not, Ruskin in one of his wayward moods declared that what could not be seen with healthy unaided sight was not meant to be seen at all! But no wise man could be guilty of a more unwarranted assertion. Be it under 2 inch objective or under 1-15th inch oil immersion objective, a revelation of hitherto unseen wonders is made manifest. It is amusing to experienced students to observe the faces and listen to the exclamations of man or woman who watches, for instance, the movements of *Melicerta ringens*, or the graceful action of *Lophopus Crystallinus*. Equally delightful to *any* student, even the most "hardened" in these investigations, is the streaming of protoplasm in *Tradescantia* or *Anacharis*. No surprise then need be experienced at work so detached from the routine of commercial life, affording, not alone rest of brain, but absolute fitness for the sterner and more prosaic duties that call for our attention day by day.*

My words are addressed to those who participate in no small degree in the phase of studious pleasure I have just referred to. We know of one gentleman who has devoted so much time to the *Radiolaria* that he is gradually submerging himself in micro-slides. Another is, hyberbolically speaking, already "lost to sight" in the preparation of Conifer sections, to say nothing of other branches of biological study, that send some of us into a condition of despair. A third devotes all his spare time to the *Diatomaceæ* and the production of marvellous photo-micrographs. And yet these three cases are not alone actual in their existence, but typical, too, of many gentlemen (I may safely say thousands throughout Great Britain and Ireland) who are first and foremost commercial men, and students afterwards. Should you care to question any of them as to the utility or otherwise of their studies they will quickly respond that the study of science has been to them a source of unending joy and mental refreshment.

Nor should we, in speaking of science, be forgetful of departments other than those already referred to. Take,

* "A fellow and his business should be bosom friends *in* the office and sworn enemies *out* of it."—*George Horace Lorimer.*

for instance, physics, chemistry, philology, archæology, mechanics, political economy, mathematics—any one of these is sufficient to call forth the most vigorous mental powers; and yet these sciences possess an alluring attraction and offer a rich feast to the jaded business man, who may be only able to devote to them what he is pleased to call his "play time."

In these remarks sole reference has been made to scientific studies as distinguished from those which are purely literary; not that the former is one whit of more importance than the latter, or that the one should be studied to the exclusion of the other. Charles Darwin made a confession of regret of how his mind had become blunted to nearly every literary pursuit by reason of his long continued effort in the direction of scientific investigation. The love of letters forms one of the joys of existence. History, Poetry, Philosophy, Belles-Lettres, who shall tell sufficiently of the solace and joy to be found in them; of the love of books, as well as of the love of nature! One pities the man to whom both these avenues of delight offer no attraction; to whom the mere love of accumulation and the exercise of commercial power is the first and last consideration of the daily routine.

No excuse is offered for laying emphasis upon what is still the need of more attention being paid by the business men of Liverpool to the higher educational life of their city. If our country is to keep in the van of the nations it will have to do so by means other than mere material prosperity; it will have to remember that brains count for much; and that it is not the mental development of the few—the so-called learned classes—but the development of the many, and not least the commercial classes, that will place our beloved land in the position we would have her occupy, a position not attained by the spoils of war but by the victories of peace. Ame ica to-day is presenting a spectacle of how the sordid love of gain is hurrying the nation to a crisis. I am well aware of the huge endowments for educational purposes that come from the hands of her millionaire magnates, but the broad fact remains that the higher and better qualities of her business men are being blunted by reason of being wholly absorbed in the one sole exercise of money-getting. The medieval alchemist, in his vain search for the secret of the transmutation of metals was no more a visionary *then* (I would not say the same to-day) than your modern "hustler," whose one aim in life is to end it, and that by smothering himself in a pile of dollars. To him and to those like him nothing is "immune from the menace of destruction under the Juggernaut wheels of a Mammonish commerce."

Before closing, I would like to emphasize a special feature in our methods of scientific research relative to the study of the human subject. It is a mistake to suppose that the most fruitful results of the recondite investigation of man, considered purely on his physical side, will ever fully account for the *whole* man. Man is allied to nature we all know, but even with this admission a vast sphere has yet to be accounted for. The mysteries of vital phenomena (which I hold form a legitimate field of scientific inquiry of the most careful and unbiassed character) must be approached by and through the channel of microscopic research. But, supposing that the secret of life is eventually discovered, man in his *social* and *moral* aspects remains a complex being, beyond and apart from physical nature. The older School of Economists failed to see this; but I have good reason to believe that modern scientists are not blind to the fact. Biology and Philosophy, Physiology and Ethics, may at first sight present the appearance of ill-assorted couples, most absurd unions; but the apparent absurdity lies in the novelty, not the fact. Human nature is a factor in the world's history that cannot be too often insisted upon, man being not a mere mathematical conundrum, fit only for the sport of those theorists, who, possessed with small knowledge, proceed upon the plan of guessing half and then multiplying by two. The scientific spirit to-day (extravagant doubtless in some quarters), is on the whole sound and sane. The spirit of empiricism, too, is abroad, but never was it more hated; and the same may be said of scientific dogmatism. Emmanuel Kant's dictum remains true—"On earth there is nothing great but man, in man there is nothing great but mind." Philosophy has a right to a voice in the world of science, and upon no theme more rightful than in relation to him who is its earthly temple.

The right position of the layman in the sphere of science is to patiently work and wait. Only a portion of his life is devoted to investigation, and while it engenders a spirit of detachment it should also produce a profound sense of shy level-headedness. The professional world is engaged in a severe conflict; and it is not for us less favoured in experience to sneer at its failures and laugh at its frequent ephemeral successes.

Truth has been often gained by means of countless blunders, success by repeated failures; but I doubt if such a thing as failure, in a good and honest cause, can be said to exist at all. It is for every man, according to his means and opportunities, to keep in the great work of discovering nature's secrets, in adapting human requirements and shaping human aspirations to the great and beneficent end of à strenuous and noble career.

Abnormal Variations in the Corpuscular Elements of the Blood:

By JOHN HAY, M.D., Ch.B. (Vic.), M.R.C.P.

Read January 7th, 1905.

Mr. President, Ladies and Gentlemen,

THE study of the blood has advanced very considerably during the last 10 or 15 years, and when Mr. Haydon, our worthy secretary, asked me to read a paper before this Society I thought that possibly it would be of interest to you to hear something of the more recent progress.

I approach the subject with considerable trepidation in presence of our vice-president—one well known as a hœmatologist of the first rank. To him I am much indebted for some beautiful lantern slides which enable me to cover the ground more rapidly and efficiently.

I need hardly say that I refer to Dr. Buchanan.

The special point to which I wish to draw your attention this evening is that of "abnormal variations in the corpuscular elements of the blood."

It is one that, perhaps, interests me more than some others, because these variations, which are constantly taking place, have often very great significance, and, from a careful observation of them, one is frequently enabled to draw inferences of great value, both in diagnosis and also in the treatment of disease.

The blood, as we know, is a tissue whose constitution is constantly fluctuating and changing, not only in its corpuscular elements but also in its every constituent.

I propose, first, to describe the normal corpuscular elements of the blood, and then to refer to some of the more marked variations.

There are two large classes of corpuscules, the red and the white.

The red are to be counted by billions, 5,000,000 being found normally to the cubic millimetre. Each corpuscle appears in a specimen of fresh normal blood as a "homogeneous biconcave disc-shaped body, with opaque, yellowish rim and nearly transparent centre."

They are elastic, and capable of being folded and indented without rupture. After infancy they are invariably non-nucleated.

Their usual size is 7·5 micro millimetre, and in fresh specimens tend to form rouleaux.

Each cell contains a substance called hæmoglobin, which has the power of combining loosely with oxygen, and acts as an oxygen carrier to the tissues.

The variations to which the red cells are liable are :—

1. A change in the relative amount of hæmoglobin,
2. A change in shape—poikilocytosis.
3. The appearance of nuclei. Normoblasts—signifying an attempt at rapid new formation, megoloblasts—signifying degeneration.
4. *Variation in number.*

So much for the red corpuscles. What of the white?

They are of even more interest than the red. Of the leucocytes there are six varieties to be briefly described, it is most essential to have these clearly in our minds before we proceed to discuss the variations in their number and relative proportions.

1. Lymphocyte, small or large, usually small and of the size of a red corpuscle. Rounded nucleus; no granules. 22-25 %.

2. Large mononuclear leucocyte with no granules, also called a hyaline cell. Twice or thrice the size of a red corpuscle. These have nothing to do with lymphocytes. 1 %.

3. Transitional cell. A cell intermediate between the hyaline cell and the "polymorphonuclear cells." The nucleus tends to become somewhat irregular and there are fine granules (oxyphile) in the protoplasm. 2-3 %.

4. "Polymorphonuclear cells." The "neutrophile" cells of Ehrlich. Finely granular eosinophil leucocytes with a divided or multiform nucleus, consisting of several oval or round nuclei connected by thin threads of chromatin. The fine granules stain with acid dyes; these cells are actively amœboid and have the power of phagocytosis. 70-72 %.

5. Eosinophil cells characterised by the presence of coarse granules staining with acid dyes. Nucleus usually irregular, may appear double. They are amœboid but not phagocytic; they are a little larger than red corpuscles. 2-4 %.

6. Basophil cells. Leucocytes containing granules of an unequal size and irregular distribution, staining with basic dyes. ·5 %.

Sometimes the granules are very large. The "mast cells" of Ehrlich.

Two other cells may with advantage be described here. They occur in the blood under abnormal conditions, and are of great importance in the normal development of the finely and coarsely granular eosinophil cells.

I refer to the myelocyte or marrow cell of which there are two important varieties:

1. A large mononuclear cell with fine oxyphil granules—the nucleus frequently centrally placed.

There is little or no amœboed movement on the warm stage.

2. A similar cell in which the granules are large and coarse.

At this point I think it would be well to emphasize that there are two large groups of leucocytes in the normal blood.

First. Mononuclear lymphocytes, large and small, free from granules, they have not the power of contraction.

Second. Polymorphonuclear cells with either fine or coarse eosinophil granules.

The origin of these two groups is entirely different, and a few words may with advantage be said on this subject before proceeding to the matter of the paper.

Many different views are held as to the genesis of the leucocytes. I shall not attempt to discuss them, but briefly state one, that held by Ehrlich, the great master in hæmatology.

He holds that the lymphocytes of the blood originate in the lymphatic system. Any increase in their number is probably due to the local stimulation of certain glandular areas.

Lymphocytosis—that is an increase of the lymphocytes in the blood—is due to a raised lymph circulation occurring in a more or less extended area of lymphatic glands. It must be regarded, therefore, as the result of a mechanical process.

The common leucocyte or polymorphonuclear cell has nothing to do with the lymphocyte or lymph gland in its development, but has two sources of origin, the first and most important being the myelocyte, containing the fine eosinophil granules.

These myelocytes change in the marrow into the polymorphonuclear cells, and the marrow is, therefore, a reserve store as well as factory of the polymorphonuclear cells, which can be called on to supply a leucocytosis at a moment's notice.

In normal conditions only the ripe or fully developed forms of polymorphonuclear cells are found in the blood—the mononuclear and transitional forms remaining in the marrow.

The other and disputed source of the common leucocyte is the large mononuclear cell. It is said that a small proportion of the polymorphonuclears arise by transitional stages from this hyaline cell.

The coarsely granular eosinophil cells of the normal blood are derived from the coarsely granular myelocyte.

Looking at the matter broadly we have therefore the lymphocytes arising in the lymph structures, and the ordinary polymorphonuclear cells arising in the bone marrow,

Having thus briefly described the character and origin of the cells of the blood, let us turn to the question of the variations, both in total number of white cells and also in the relative proportion of the cells.

Normally there are 7,000 to 10,000 leucocytes in the cubic millimetre of blood, giving a proportion of one white to 500 or 600 red cells.

If there is a definite increase of these cells the condition is termed "leucocytosis;" if a diminution, "leucopaenia" or hypoleucocytosis.

Where it happens that the leucocytosis is chiefly due to an increase in the number of the lymphocytes, the term lymphocytosis is employed.

This fact of leucocytosis is one of the most interesting in all hæmatology. From the time when Virchow first described it up to the present numberless workers hvve been engaged upon it.

Following Virchow, Metschnikoff stimulated many to renewed efforts by his discovery of phagocytosis. He taught us to regard the leucocyte as a digestive cell This view has been greatly modified in recent years ; but Metschnikoff's view that the leucocyte is a protective agent still holds the field, though it is recognised now that it does much more than simply gorge itself on bacteria. Leucocytosis may be termed a protective reflex of a marvellous kind.

Certain poisons, bacterial or chemical, and some bodies other than poisons, are able, when circulating in the blood, to attract the leucocytes from the marrow, their home of origin, into the blood stream. These bodies may also stimulate the marrow to a rapid formation of new leucocytes.

This is the fundamental factor in leucocytosis and in infective disease this knowledge can be utilized to enable us to form an opinion as to the power of the body to re-act favourably or otherwise to a specific bacterial poison.

Metschnikoff as you all know believed that phagocytosis is the essential feature of inflammation and the chief mechanism in immunity and gave exclusively to the leucocytes and the endothetial and other phagocytic cells a function of vast importance.

This view has been modified in one important particular by more recent research which has demonstrated that an extra cellular influence is exerted upon bacteria which is sometimes a necessary preliminary to phagocytosis.

The phagocytes have themselves the power of elaborating in a large degree the bactericidal principles which assist and on some occasions act as the precursor to the phagocytosis.

Leucocytosis therefore represents Nature's attempt to rid the blood and the system by means of the leucocytes and their products of the bacterial and toxic causes of disease.

In the majority of instances a leucocytosis is an abnormal condition, a response to some foreign body, poisonous or otherwise. In a few instances however a leucocytosis occurs as a normal physiological process. To these I will briefly refer.

Firstly, there is a digestive leucocytosis. It is found that, as a rule, within one hour of a meal, more especially a meat meal, the number of leucocytes begins to increase. This continues for several hours, reaches its maximum in three or four hours, and then gradually declines.

This leucocytosis rarely reaches a higher figure than 15,000 or 16,000 per cubic millimetre.

In its character it is a mixed leucocytosis. Both the lymphocytes and the polynuclear cells are increased, more especially the lymphocytes.

The explanation of this phenomenon is that, with the process of digestion the lymph tissues of the intestinal tract, and they are extensive, become stimulated, and a raised lymph circulation occurs. "In consequence of this increased flow more elements are mechanically washed out of the lymph glands."

The increase of the polynuclears, on the other hand, is due to a positive chemiotaxis, the assimilated products of metabolism, stimulate the marrow and cause an outpouring of the polynuclear cells into the blood stream.

I need only mention in passing a few other well-organised forms of physiological leucocytes, for example that occurring during the later months of pregnancy and that found during the first year of life. In neither is the leucocytosis at all marked. A leucocytosis is also found to occur after bodily exertion and following cold baths.

Apart from these few exceptions leucocytosis is an abnormal condition, and as previously suggested is probably of the nature of a protective reflex.

Two forms are described—(1) A passive leucocytosis, in which the cells are simply washed into the blood stream by mechanical forces. Of this class are the different kinds of lymphocytosis.

In direct contrast there is the "active leucocytosis," in which the cells involved are capable of spontaneous movement and activity, and emigrate into the blood in response to a stimulus.

The "active" form of leucocytosis is divided by Ehrlich into the following groups:—

A. Polynuclear leucocytosis.

1. Polynuclear neutrophil.
2. Polynuclear eosinophil.

B. Mixed leucocytosis, "myelæmia."

The subject of leucocytes covers too large an area for one to attempt, even in the most sketchy way, to deal with it adequately. I shall, therefore, give one or two examples of each of the above divisions.

First, the polynuclear "neutrophil" leucocytosis. This is called by some, Ewing, for example, an "inflammatory leucocytosis," and is present in the majority of febrile infectious diseases, typhoid fever and measles being two notable exceptions.

When a patient is attacked by pneumonia the pneumococcus or microorganism, which is the ultimate cause of the disease, pours out a toxin into the blood. This toxin acts on the marrow in a specific manner. The marrow responds to this stimulus by an increased outflow and production of the polynuclear "neutrophil" cells.

It is the duty of these cells to meet and counteract the poison of the pneumococcus by producing an antitoxin, and also, possibly, to digest the cocci themselves. In favourable cases the leucocytosis reaches 20,000 or 30,000 per cubic millimeter. If, however, the poison is very virulent the marrow may fail to respond, and there is no increase in the number of the white cells in the blood. It is then said that the patient has re-acted badly and the outlook is grave. Shortly before the crisis the leucocytosis begins to diminish, and during the drop in the number of the polynuclear "neutrophils" there is an increase in the number of the coarsely granular eosinophil cells. This contrast in the response of the two forms of polynuclear cells is most interesting and is noted in many of the inflammatory leucocytoses.

The second form of active leucocytosis is that of an increase of the coarsely granular eosinophil cells with a polynucleus. It is termed an *Eosinophilia.*

Last year I had the pleasure of showing this Society a portion of the human diaphragm, studded with small opaque bodies. These were formed of small worms, coiled up and surrounded by a thickened capsule. The worm was the immature form of the " trichina spiralis."

The musculature of that man was dotted throughout with these worms—which had probably been lying there for some five years.

Some weeks ago I had the opportunity of examining the blood of a patient who was recovering from an attack of trichinosis—the small worms were then all settling down for their long quiet rest in his muscles.

The blood showed a very marked eosinophilia of 24%.

It is truly marvellous that the presence of these small worms in the muscular tissue should be able to produce such a specific change in the blood.

Either the worms themselves or the inflamed muscles produce a foreign body of some kind, which, when present in the blood, acts specifically on the coarsely granular cells of the marrow to the exclusion of the other form of cells.

Eosinophilia is one of the most interesting of the forms of leucocytosis. It occurs under the most varied conditions—in bronchial asthma, in many skin diseases, in postfebrile conditions, and, perhaps, most interesting of all, in patients who have certain varieties of parasite in their intestinal canal, such as the round and threadworms.

Here the parasite is in reality outside of the body, and yet this eosinophilia demonstrates conclusively that some toxic substance is being produced by it and absorbed and acting in a specific manner on the marrow. According to Ehrlich the direct cause of most forms of eosinophilia seems actually to lie in a destruction of tissue and the products thus produced.

Leukæmia : Mixed leucocytosis. This is probably the most interesting of all the changes in the blood.

Here we have a profound alteration in the number and quality of the corpuscular elements. The blood is so charged with white cells that, on allowing it to stand a few minutes, a thick, white scum rises to the surface, having the appearance of matter or pus. In fact, at one time it was looked upon as pus in the blood.

The number of the red cells is greatly diminished, there being sometimes only 1 or 2 millions instead of 5 to the cubic millimeter.

One finds many red cells with nuclei deeply stained by methylene blue or hæmatoxylin. Some of these show mitosis.

On the other hand, the leucocytes are enormously increased, the number reaching 400,000 to 800,000. In fact, they are sometimes as numerous as the reds instead of the normal ratio of 1 to 500 or 700. This leucocytosis is of the mixed type and, moreover, contains other elements not normally found in the blood.

There are certain specific changes in the composition of the white cells which make it possible to give a definite diagnosis from the examination of a blood film, irrespective of the leucocytosis.

First—all three types of granulated cells—the finely granular and coarsely granular eosinophil and the mast cells are increased.

Second, in addition to the polynuclear cells, their early stage, the large mononuclear granular corpuscle or myelocyte is found in the blood.

Third, atypical cell forms appear, *e.g.*, dwarf forms of all kinds of white corpuscles.

Fourth, numerous nucleated red corpuscles.

I have placed several slides under the microscopes, showing these points.

I wish to emphasise that in these cases we are not simply dealing with a very marked leucocytosis of the ordinary type, such as is found in pneumonia, &c., and made up of the polymorphonuclear cells.

This condition of leukæmia is a specific reaction of the blood and marrow. Formerly it was held that leukæmia was nothing more than a leucocytosis, in which the proportion of the whites to the reds was greater than 1 white to 50 reds. It is possible, however, to recognise this specific condition of leukæmia in bloods where the proportion is far less than 1 to 50—say 1 to 100, or 1 to 200. That is where the leucocytosis does not amount to more than 20,000 or 30,000. I will not press this matter, but will now refer to the important question as to the origin of this myelæmia, the flooding of the blood with marrow cells.

It is suggested by some that there is a passive inflow of bone marrow elements into the blood stream, by others that there is some specific leukæmic agent which attracts these elements in the blood, and that really this condition of leukæmia should be classed with the active leucocytoses. There is, however, a form of leukæmia in which the leucocytosis is in all probability of the passive type, namely, that called lymphatic. Here there is a great preponderance of lymph cells, both of the small and large varieties, more especially the large.

In these cases the number of whites is rarely so great as in the marrow form of leukæmia. One interesting point about them is that they sometimes begin quite suddenly. The blood is examined to-day and found normal to-morrow. Instead of 7,000 leucocytes per cubic millimeter there may be 50,000, and those nearly all lymph cells.

There is one most interesting point to be referred to in conclusion. The wonderful effect of the X rays on the blood of these leukæmic patients.

I have up to now carefully observed seven or eight patients suffering from this disease, in whom the treatment by the X rays was employed. The result is very striking.

The X rays are applied to the thickened ends of the long bones, to the knees and shoulders and thigh bones, and also over the stern and ribs. That is to those regions in which the marrow is found in great abundance. The spleen is also rayed.

The condition of the patient improves, he puts on weight, looses his breathlessness, and feels a new man.

Marked changes occur in the blood. A leucocytosis of perhaps 400,000 to 800,000 is slowly and steadily reduced, till I have seen the blood practically normal. Let me give one example :—

Mr. P., July 17, '04. R. C. 3,000,000
W. C. 320,000

			Oct. 10.
Polymorphonuclear cells	37½%	...	72%
Myelocytes	36%	...	4% ?
Lymphocytes	3%	...	20
Large mononuclear	8%	...	3
Eosinophil, coarse	3%	...	·6
Basophil	4%	...	None.
Transitional	6%	...	None.

9% of all reds nucleated.

In Oct. 10. R. C. 3,050,000
W. C. 7,188

The X rays in this case produced a blood to all intents and purposes normal, but still a little anæmic. The patient felt quite well. The action of the Rontgen rays is to alter the condition of the marrow and bring it back more or less to its normal condition, As a consequence of this, those cells in the blood, due to excessive production by the marrow, tend to disappear from the general blood stream.

The myelocytes, both finely and coarsely granular, together with the mast cells (with their basophil granules), cease to be present in the systemic circulation.

In leukæmia we have a specific response of the marrow to a specific stimulus. The X rays in some occult manner remove this specific stimulus and permit the marrow to return to its normal.

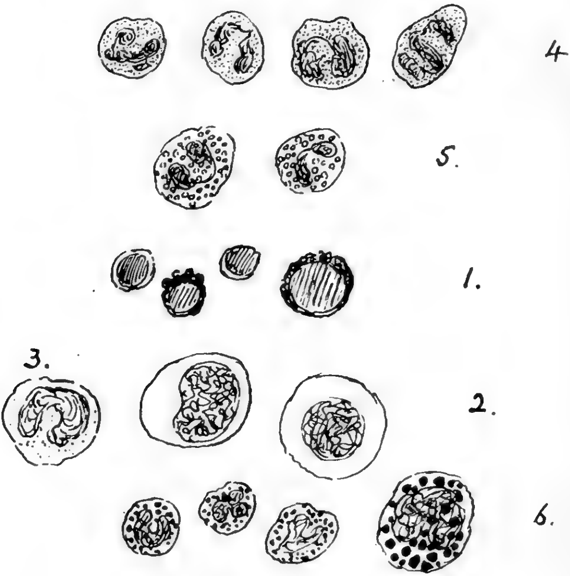
I have noticed also that, after the application of the X rays to the long bones, there is much greater difficulty in staining the cells of the blood. Dr. Buchanan has made some interesting observations on this point, which, I hope, he will give in detail to this meeting.

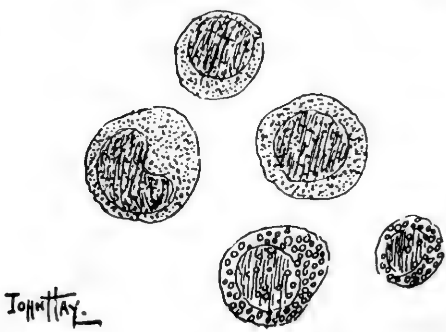
Ladies and gentlemen, to me the blood is one of the most interesting of all tissues. The more one works at it the more numerous are the paths it opens out, full of the possibilities of pleasure and reward. I have only touched on the fringe of a very large subject.

I realise that I have been somewhat disjointed, and possibly here and there too technical. I sincerely hope not, and if I have unwittingly been guilty of such offences I must rely on your kindly forbearance and trust to your generous forgiveness.

DIAGRAM OF THE WHITE CORPUSCLES FOUND IN THE BLOOD.

1—6 in normal blood, numbered as in the text.





1. Myelocyte. Fine Granu

2. Myelocyte Coarse Gr

GERM-CELLS:

WITH SPECIAL REFERFNCE TO THE RECENT RESEARCHES OF

Dr. JOHN BEARD,

University Lecturer in Comparative Embryology, Edinburgh.

This paper is an attempt to summarize the recent researches of Dr. Beard on Germ-cells, and the many problems related thereto. Although of necessity brief, it may be regarded—so far as it goes—as representing his views.

The paper when read was illustrated by means of a number of lantern-slides—diagrams and photographs; and at the conversazione afterwards a number of micro-preparations showing germ-cells in various phases of wandering were exhibited. Both lantern and micro-slides were kindly lent for the purpose by Dr. Beard.

I am indebted to Dr. Beard for his great kindness in revising and correcting the proof-sheets, and for the loan of the plates of illustrations; and I wish here most heartily to thank him for his very kind and generous help.

W. T. HAYDON.

GERM-CELLS.

IN order that full significance be attached to the discoveries made by Dr. John Beard in the course of his embryological researches, it will be necessary—or at least convenient—to review briefly some of the generally accepted views regarding the subjects treated; it would of course be quite impossible in one brief paper to refer to them all, neither, indeed, is it necessary; it will be sufficient in many cases simply to note in passing the new light thrown upon them by Beard's work.

Let us first get a clear idea of what is understood by the term germ-cells.

Germ-cells are unicellular bodies borne by the gametophyte of plants and the gametozoon of animals, and borne for the most part in specially adapted receptacles.

Germ-cells are of two forms, viz., eggs or germs, and sperms; their function is reproduction, one sperm uniting with one germ setting in motion that wonderful and mysterious development that eventually culminates in the reproduction of a plant or animal similar to that which gave rise directly or indirectly to the germs and sperms. Thus it follows that all the cells of any multicellular organism must have arisen from the body of the united germ and sperm—fertilized egg—known as a zygote.

It is generally considered that the most important part of the zygote is the chromatic material of the nucleoplasm. This chromatic material is of course derived from the germ and sperm.

Here, note must be taken of the phenomena of mitosis; all cells are derived from other cells by division. Cell division is effected by one of two methods: (*a*) direct division, known as fission; (*b*) indirect division, or mitosis.

It is the indirect method only that claims our present attention. During mitosis the chromatic material of the nucleus—chromatin—breaks up into a number of thread-like bodies, known as chromosomes; and the cells of every species of plant or animal has a definitely fixed number of these bodies. This number is always even in the cells of the sporophyte and in the somatic cells of animals. In the cells of the gametophyte and gametes of plants and animals it is frequently uneven, where the number may be as low as one. When a cell is about to divide each chromosome splits longitudinally, the cell thus for a brief period containing double the normal number; when division ensues the doubled number of chromosomes is equally divided between the daughter cells, reducing the number once again to the normal. This brief and obviously incomplete description of mitosis applies to soma—body—cells only. Germ-cells—eggs and sperms—are multiplied in the same way, *i.e.*, by mitosis, but with this essential difference, excepting in parthenogenesis they contain but half the normal number of chromosomes, for at a certain period of their history the number of chromosomes normal to the soma cells is halved, the products—daughter cells—germ-cells—thus containing only half the original number; this is the reduction division, to which reference will be made later. Cells possessing this reduced number are generally regarded as incapable of further division, and eggs and sperms alike degenerate and die, unless one of each are brought together, thus providing the full complement of chromosomes in the zygote.

The chromatic material of the nucleus is now generally regarded as the material basis of heredity, the substance bearing the characteristics of the race, and at the same time apparently carrying also the peculiarities of the parents. If, however, the results of the experiments of Boveri and Delage must be accepted as conclusive, the importance of the nucleus and its contents have been somewhat over-rated; for they have shown that denucleated eggs of the sea-urchin can be fertilized, and that normal larvæ are the result. Further, that if spermatozoa of a different sub-species be used, the characteristics of the larvæ are those of the male. This must suffice as to the nature of the germ-cells.

Now, as to their origin, whence are they? Referring to any recent text book on the subject, we shall learn that eggs and sperms are derived from certain cells known as primordial germ-cells. That these primordial germ-cells have their origin in a germinal epithelium, which in the higher animals is a specialized region of the peritoneal epithelium, and consists of two more or less pronounced ridges. These ridges ultimately form part of the genitalia.

We shall learn further that the primordial germ-cells are sexually indifferent, *i.e.*, neither male nor female, and that the chief factor in the determination of sex is the external stimulus provided by nutrition, high feeding producing females for the most part, while spare diet tends to the production of males. There are also many other causes regarded as determining sex.

We shall also learn that from the zygote—fertilized egg—is developed an embryo. With regard to the method of this development, two rival theories at the moment hold the field—Epigenesis and Evolution.

Epigenesis regards the development as "a new formation of complexity," receiving its control from without, *i.e.*, the development of its various organs, tissues, etc,, is due to environment. This view is championed by Oscar Hertwig and other eminent biologists.

The other, Evolution, an unfolding, or as its opponents are pleased to miscall it, preformation, contemplates the development as being controlled from within, *i.e.*, it regards the zygote as containing the potencies of the adult, and is in a sense "the becoming visible of complexity previously invisible to us." This invisible complexity must not, however, be regarded as a miniature organism as did the preformationists of old, but rather as of organized material bearing the latent potencies of the adult, which is a very different thing.

This view Weismann has elaborated into a very complete and fascinating theory; he recognizes in his Germ-plasm theory all the forces necessary for the explanation of "Heredity," and "Evolution" in its wider sense.

This germ-plasm according to Weismann, constitutes the chromatin of the nucleus of the sexual cells; it is an exceedingly complex living substance, capable of growth, and is of a very high degree of stability, *i.e.*, it is little liable to change.

The chromosomes formed during the process of cell division from the chromatic substance Weismann designates idants. Idants are made up of a number, varying for each species, of ids.

Ids are capable of growth and multiplication. Theoretically, one id would suffice for the development of one individual. These ids are made up of determinants, and these again are divided into biophores, the whole combination forming a definite and complex architecture. Of determinants there exists one for every different organ and parts of organs contained in the adult; their function is, therefore, to determine the character and structure of the organism. The biophores are the ultimate particles of living matter, endowed with the *vital force*, whatever that may be.

This brief sketch, incomplete as it is, will enable us the better to understand that which is to follow.

The first question naturally asked in connection with this theory is: What then is the history of the germ-cells from one generation to the next? Weismann's teaching seems to be capable of, at least, two answers; at any rate, two different conclusions may be assumed. One aspect—method (*a*)—represents the zygote dividing into two exactly similar daughter cells, (*a*) and (*b*); one of these (*a*) grows and divides, this repeatedly, but the products remain unaltered, *i.e.*, they are all similar to the zygote from which they were produced. In other words, at each division all the characteristics of the zygote are doubled.

The cell (*b*) also divides; here, however, doubling does not take place, but exactly the opposite, for the characteristics represented by the determinants are halved in number, and this continually until all the determinants have been distributed.

DIAGRAM No. 1.

ap

ap ap[1]

ap ap ah ip[1]

ad eh il mp[1]

ap ap ap ap ab cd ef gh ij kl mn op[1]

and so on: a b c d e f g h i j k l m n o p[1]

Germ-plasm. Idioplasm.

Idioplasm + Germ-plasm = Embryo.

Diagram of a developing embryo according to Weismann. Method (a). The ids functioning are supposed to consist of 16 determinants: a.-p.

DIAGRAM No. 2.

ap

ah ip

ad eh il mp

ab cd ef gh ij kl mn op

a b c d e f g h i j k l m n o p

Germ-plasm is here represented as equivalent to a determinant.

Diagram of a developing embryo according to Weismann. Method (b). The ids functioning are supposed to consist of 16 determinants: a.-p.

Diagram No. 1 illustrates this method; the ids functioning are supposed to consist of sixteen determinants, represented by the letters a. to p. It will be seen that the zygote a.p. divides into cells, a.p. and a.p[1]; a.p. gives rise to cells exactly similar, and are therefore represented by the letters a.p.; this series contains Weismann's *germ-plasm*. Cell a.p[1] in the first division becomes cells a.h. and $i.p^1$, each containing but half the characteristics—determinants—of a.p., and so on, until the determinants are all distributed. The products of $a.p^1$ are known to Weismann as *idioplasm.* The germ-plasm and idioplasm combined constitute the embryo. In course of development the germ-plasm ultimately reaches the germinal epithelium, and there initiates the primordial germ-cells.

The other aspect—method (*b*)—of the history of the germ-cells from one generation to another is set forth in diagram No. 2. It is here supposed that no doubling division whatever takes place, but that qualitative halving—differentation—commences with the first division. In this method it must be assumed that the primordial germ-cells are provided for by certain determinants, in exactly the same way as for eyes, lung tissue, etc.

It matters little which of these views we accept—both may be assumed—for in each case *continuity of germ-plasm* is provided for. Really, however, neither of these views has any support in the actually observed facts.

Weismann writes:—"The transmission of the germ-"plasm from the ovum to the place of origin of the "reproductive cells takes place in a regular manner, through "perfectly definite series of cells which I call *germ tracks* "These are not actually recognisable, but if the pedigree of "the cells in the embryogeny is known they may be traced "from their termination to the germ-cells backwards to the "ovum.

"This assumption is supported by the fact that a direct "or, at any rate, very close connection can be proved to exist, "although only in rare instances, between the germ-cells of "two consecutive generations. In the *Diptera* the first "division of the egg-cell separates the nuclear material of the "subsequent germ-cells of the embryo from that of the "somatic cells, so that in this case a direct continuity can "be traced between the germ-plasm in the germ-cells of the "parent and offspring." *

* Weismann: "The Germ-plasm," p. 184.

You will learn further that the segmenting egg gives rise, first, to a layer of cells known as epiblast, to which is in due course added another layer, the hypoblast; and later still a third is added, the mesoblast, these three forming together the *germinal layers*, so called because they are regarded as containing the germs from which all parts of the embryo will be developed. For instance, the epiblast gives rise to the nervous system, etc.; the mesoblast to the skeleton, etc.; and the hypoblast to the lungs, etc., each layer giving rise to definite structures. These germinal layers must not, however, be confounded with the germ-cells, notwithstanding the fact that it is the mesoblast which is regarded as giving rise to the peritoneum, from which in turn arises the germinal ridges and the primordial germ-cells. Further, you will find reference to certain stages in the development known as blastula, gastrula, etc.

This text-book teaching many of us have proved for ourselves, for have we not made macro-dissections and micro-sections galore, in which we have found the confirmation we sought?

From this brief sketch of text-book teaching, and our own studies, we will turn to Beard's researches.

In 1888 Beard commenced the researches described in his own words "as undertaken solely with a view of determining "by observation the apparently simple question of the mode of "development of a vertebrate animal. They had not proceeded "very far before it came to be recognized that whether or not "a 'direct development' was possible, that presently carried "out in the higher animals had every appearance of being "anything but direct; indeed, of being based in an antithetic "alternation of generations. This was of such a kind that the "fertilized egg gave rise to an asexual foundation or larva, "termed by me the phorozoon or bearing-animal, and that in "some way or other upon the latter there arose an organism, "termed the embryo, which by reason of its endowment with "sexual organs may be described as the sexual form or "generation."*

* John Beard, "A Morphological Continuity of Germ-cells as the Basis of Heredity and Variation."—*Review of Neurology and Psychiatry*. Jan., 1904; p. 1.

This unexpected discovery of Beard's was but the forerunner of many others, for in quick succession following the demonstration that the embryo was *not the direct* product of the egg, it was demonstrated that germ-cells are not derived from soma-cells; that there is a morphological continuity of germ-cells from one generation to another; that a law exists underlying the number of primary germ-cells; that sex is determined before the embryo commences its growth, and that it is therefore beyond the control of its environment; that no such process as that known as metamorphosis ever takes place. That this so-called metamorphosis which professes to explain the changes which take place during embryonic development, and which endeavours to account for the changes by a process known as a substitution of organs, is in fact a substitution of organisms.

Further as a result of Dr. Beard's work we may at once put aside Darwin's provisional hypothesis of Pangenesis, Galton's theory of Stirp, Spencer's theory of Physiological units, Haeckel's Perigenesis of the Plastidule, de Vries's Pangenes, and Weismann's Continuity of Germ-plasm, *and substitute the demonstrated fact of the Continuity of germ-cells from one generation to another*, and therewith accept the solution of the problem of heredity. It includes also the demonstration of the source of like-twins; throws new light upon the problems involved in parthenogenesis; and explains the course of oogenesis and spermatogenesis in hermaphroditism. Further as a result of his work it may be assumed that the probability of Epigenesis is reduced to at best a mere possibility.

It may in brief be stated that Beard's discoveries will prove to be as revolutionary to biology as was the teaching of Darwin fifty years ago.

Now, what evidence does Dr. Beard offer in proof of the results just set forth?

Beard's published work on germ-cells refers chiefly to his researches in the embryogeny of the smooth skate *(Raja* *batis).* He has, however, studied the two dog-fishes *(Scyllium canicula* and *Pristiurus melanostoma*), the spiny dog-fish *(Acanthias vulgaris)*, the torpedo fish *(Torpedo ocellata)*, the chick, etc., etc. His work on Pristiurus is ready for the press.

For the past twenty years Beard has been a most energetic student of the structure and development of the Elasmobranch fishes. He may thus claim to write with an authority derived from actual first-hand knowledge. As already stated, Beard commenced his researches with a view of determining by observation the "apparently simple question "of the mode of development of a vertebrate animal." His object was to trace the entire course of development, from the egg of one generation to the egg of the following generation. This had never previously been done. Its accomplishment would solve many outstanding problems, and, as the sequel proves, many unforseen results have been attained. It must be particularly noted that Beard worked for years holding the generally accepted view of direct development. We have already noted the text book teaching on this, that eggs give rise to embryos which are but phases in the development of the individuals, that the individuals give rise to germ-cells, and so on.

The study—by Beard—of serial sections of a very large number of embryonic skates revealed the fact that germ-cells were not confined to the germinal ridge alone, but were to be met with in almost every organ of the body, "Sometimes they "may be found in the head, head-somites, brain, the gill-region, "the skin of the trunk or head, the pericardium, the liver, even "occasionally in the blood, the kidney-tubules, the body-cavity, "myotomes, spinal-cord, gut-epithelium, especially of the yolk-"stalk and of the rectum, etc., etc.—in fine, there is hardly a "place in the whole trunk or head in which such aberrant "germ-cells have not been observed."* If then these abnormally placed germ-cells are the products of the peritoneal epithelium they have evidently migrated from their place of origin; they

* John Beard, Morph. Con. *Rev. Neur. and Psych.*, Jan., 1904; p. 19

may, however, not be the exclusive products of the peritoneal epithelium, but the products of a variety of soma cells; or not being products of soma cells at all, they must have had their origin elsewhere, and have wandered into the various positions they finally come to occupy.

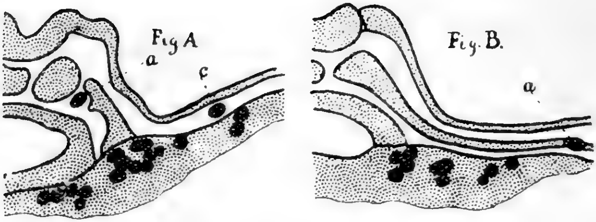
This latter Beard regards as being the true explanation. If this be so, it must follow that the germ-cells have their origin outside the embryo, and that at some period they migrate into it.

What then, are the observed facts leading to such a conclusion?

Now, the germ-cells of the skate are easy of identification, for they possess very distinctive features. They are glassy, contain a number of yolk-plates, their nuclei are of a bilobed type, and they are considerably larger than the largest somatic cells. These peculiarities are shared by the other elasmobranch fish embryos in some degree. These distinctive characters enable them to be counted, and Beard has found that there is a constant number of primary germ-cells for each species that he has up to the present studied.

In the skate, the number found in all females approximates to 512.

If the primary germ-cells are the products of the germinal epithelium and they migrate thence, it follows that the younger the embryo is the greater will be the number of germ-cells normally placed. But what are the facts? Beard has not only counted the germ-cells in a number of embryos, but he has also tabulated the positions they occupy. Briefly, the results are as follow:—In embryos about 30 m.m. in length nearly 30% of the germ-cells are abnormally placed, in those about 25 m.m. long nearly 40%, those only 20 m.m. long have quite 50% of their germ-cells misplaced, while very young embryos only 2·5 m.m. long are entirely without germ-cells. Beard describes one embryo 2·66 m.m. long very exhaustively. It is, however, but a representative example. It is shown diagrammatically in figs. A and B.



Somewhat diagrammatic sections of an embryo of *raja batis*, 2·66 m.m. in length.
a. Fig. A is a germ-cell near the site of the future germinal nidus : c, lying between the epiblast and hypoblast is in migration
a, Fig. B, is a germ-cell lying within the mesoblast.
The blastoderm is seen crowded with germ-cells (After John Beard).

This embryo contained but two germ-cells within the "embryonic foundation," one of these shown at a, Fig. A occupies the site of the future "germinal nidus." The upper part of the blastoderm just outside the embryo is crowded with germ-cells. From this crowd germ-cell a. has evidently migrated, while germ-cell c. has evidently commenced migration. Further, at the close of the segmentation, before there is any embryo at all, the germ-cells are represented by cells 0·02 m.m., or 0·036 m.m. diameter. Normal germ-cells have a diameter of 0·02 m.m.

To give emphasis to the fact that germ-cells cannot possibly be the products of the embryo, Beard makes the following statement with regard to embryos 2 or 3 m.m. in length. "*In the growing zone of the developing embryo there* "*are no cells at any time large enough to be the progenitors of* "*the germ-cells.*" *

The presence of misplaced germ-cells in the embryo has long been known. Little note, however, has been taken of the knowledge. The cells referred to by Beard as germ-cells in pre-embryonic and early embryonic development have also long been known. They have not, however, been recognised as such, but have been regarded as pertaining to other structures. Beard, however, in his published papers deals satisfactorily with these. For instance, Rückert in his work on *Torpedo* embryos, makes reference to certain large yolk-laden

* John Beard, "The Germ-cells, Part I," *Journal of Anatomy and Physiology*. Jan., 1904, p. 218.

PLATE 1.

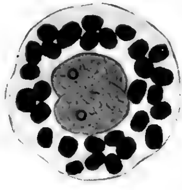


FIG. 1.

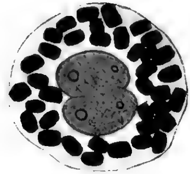


FIG. 2.

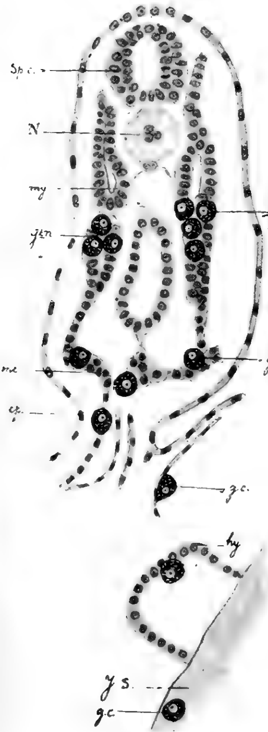


FIG. 3.

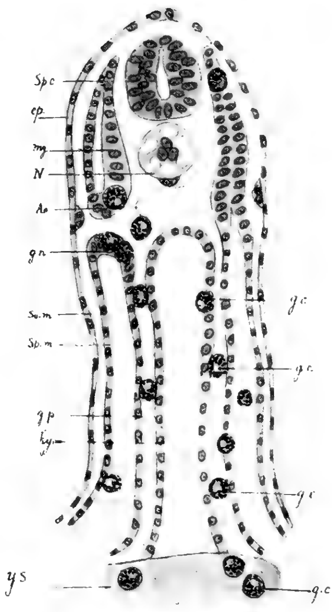


FIG. 4.

FIG. 1.—Primary germ-cell of *Pristiurus melanostomus.* The cytoplasm is glassy in character and contains a large number of (blackened) yolk-plates. The nucleus exhibits duplication, *i.e.*, autonomy of paternal and maternal portions.

FIG. 2.—Primary germ-cell of the skate, *Raja batis.*

FIG. 3.—The conditions seen in two transverse sections (the 39th and 41st sections of a row) of a 4½ mm. embryo of *Pristiurus.* The lettering is as follows: sp. c. = spinal cord, n. = notochord, my. = myotome, g. n. = germinal nidus, me. = mesoblast, e.p. = epiblast, hy. = hypoblast, y. s. = yolk-sac, g. c. = germ-cell.

FIG. 4.—A *diagrammatic* section of an early skate-embryo. To illustrate the migrations of the germ-cells along the germinal path, g. p., and showing germ-cells in various abnormal situations. The lettering is as in Fig. 3, excepting so. m. = somatic mesoblast, sp. m. = splanchnic mesoblast, ao. = aorta. (After John Beard).

PLATE 2.

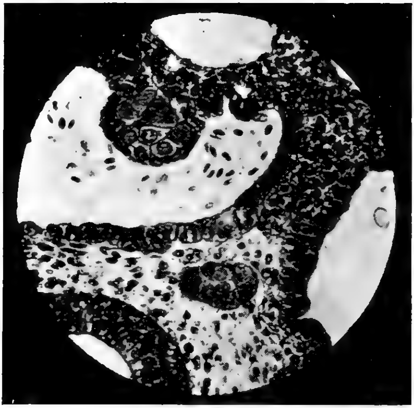


FIG. 1.

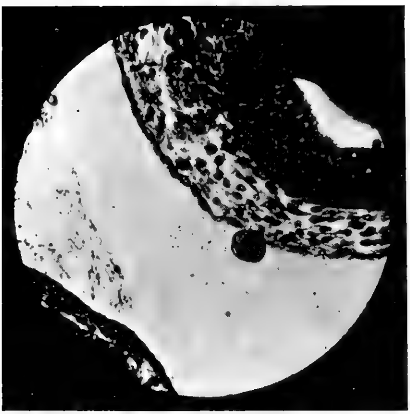


FIG. 2.

Transverse sections of an embryo of *Acanthias vulgaris*, 21 m.m. in length. FIG. 1 shows one germinal nidus (ridge) with secondary germ-cells; these are in the normal position. There is a "nest" of secondary germ-cells at the base of the mesentery, these are abnormally placed.

FIG. 2 shows two (?) secondary germ-cells attached ("stuck on") to the peritoneum of the gut; such abnormally placed germ-cells are of frequent occurrence (Photos by W. T. H.)

cells, termed by him megaspheres; these he identifies as merocytes, budded off from the yolk. Beard proves them to be in raja—germ-cells, or, if large, as the forerunners of such. He writes: "Apart from the resemblance between these "'Megaspheres' and germ-cells, there are also the facts of "similar features in their degeneration. We cannot account "for the small number of germ-cells in early embryos, or their "absence from the mesentery, where later on, they are so "abundant, without the inclusion of the wandering 'mega-"spheres' among the germ-cells. Moreover, *there is such an "unbroken transition from the ordinary germ-cells of my embryos "to the largest of the 'megaspheres,' and so many of the latter "agree so absolutely with ordinary germ-cells in every respect "except in position, that it is quite impossible to draw any line "between them.* In the normal position, in the germinal nidus, "one also encounters abnormally large germ-cells or 'mega-"spheres.'"* In the paper referred to, Beard at considerable length establishes the identity. Accepting Beard's observations as correct, *it is certain that germ-cells precede the existence of the embryo, and that they wander into the embryo later.*

PLATE 1: Illustrates the migration of the primary germ-cells in a young embryo of *Pristiurus*, 4·5 m.m. in length.

PLATE 2: Shows secondary germ-cells in normal and abnormal situations in an embryo of *Acanthias*, 21 m.m. in length. Migration has ceased.

Here it will be well to note that Beard has discovered an important period in the development of the embryo which he designates the "critical period." It is that time in the development of the embryo when all the various organs are fully laid down, but as yet are far from being complete.—Of which, more presently.—In the smooth skate this period is reached when the embryo is about 70 m.m. in length; the wanderings of the germ-cells have ceased, and their division into secondary germ-cells has commenced. In such embryos vagrant germ-cells are rarely found; they have probably for the most part degenerated.

* John Beard, "The Germ-cells, Part I," *Journal of Anatomy and Physiology.* Jan., 1904; p. 222.

If, then, our old idea with regard to the origin of germ-cells must be given up, may not the generally accepted view concerning the origin of the embryo itself have to be modified? Assuredly, yes! We have already noted the view taken by Weismann—that generally accepted—that from the fertilized egg an embryo is formed direct, as shown in diagrams 1 and 2.

It is just this direct development which Beard's work proves cannot take place, as we shall soon note. Seeing that the germ-cells exist before there is any embryo, they cannot possibly be its products. They must, therefore, be direct products of the zygote; whence then the embryo?

Before proceeding to answer this last question, it will be well to ascertain, as clearly as may be, what Beard understands by his "critical period" and his "larval forms." He has written a very lengthy and exhaustive description of the "critical stage" in *Scyllium canicula*. From it I will take a few extracts which will serve to give a rough idea of what is to be understood; time would fail for more lengthy detail. Beard writes:—

"All the organs of the fish were laid down, and "histological differentiation had begun in all. . . . . The "embryo is rapidly acquiring the adult form of body. . . . . "Finally, apart from many minor details, there remains one "event of far-reaching and fundamental importance to be "recorded. In stating this, I should like to be permitted to lay "unwonted emphasis upon its gravity. *At this period the embryo "annexes the contents of the external yolk-sac, an internal "yolk-sac is formed, and the yolk is gradually drawn into it and "thence into the gut, where, during the rest of the development "within the egg case, and for some time afterwards, it serves for "the nourishment of the young fish and is digested by the cells of "the gut.* Prior to this stage the embryo only obtained "nourishment from the yolk-sac by means of the yolk-sac "circulation, and not even directly through this, but indirectly, "by the intermediation of the 'yolk-hypoblast' and the "specialized parts of this, the merocytes. Taking the whole "of their characters into account, the embryo is now for "the first time a young fish, and it is independent of its "transitory, or larval, or asexual foundation. It can set about "feeding itself, and is powerful enough to begin the task of "suppressing the transient foundation, including the transient "nervous apparatus, the merocytes and yolk-hypoblast, and "other evanescent structures." *

This "critical period" holds good for mammals also, so far as they have been studied. In certain Marsupials it is coincident with the epoch of birth—the then immature condition being the epoch referred to.

In the higher animals—sheep, rabbit, man, etc.—it is certain that the allantoic placenta is an embryonic organ formed just prior to the "critical period" and which now commences to supersede or replace the ectoplacenta, or trophoblast, or in the words of Heisler: "The development of the allantois and its "accompanying system of blood vessels is simultaneous with "the decline of the yolk-sac and the vitelline circulation."** This in man begins to take place during the sixth week of gestation, in the rabbit on the 15th day, and in the sheep at the 30th day.

The point to notice here is that this ectoplacenta or trophoblast which is replaced by the allantoic placenta is regarded by Beard as the larval structure—phorozoon—asexual generation. This larval form must not, however, be regarded as the equivalent of the caterpillar or the tadpole; these must not be regarded as larval forms at all, for as Professor Miall first pointed out—these are really adult forms, and their transformation into imago and frog is a secondary transformation, connected with the development and maturation of the sexual organs.

* John Beard, "On Certain Problems of Vertebrate Anatomy." Published by Gustav Fischer. Jena, 1896.

** Heisler, "Text-Book of Embryology," p. 148.

This larval form—phorozoon—referred to by Beard is a far more simple structure, it consists essentially of the blastoderm and yolk-sac. Beard writes: "The blastoderm "grows over and encloses the yolk, and this may be interpreted "as the annexation of the yolk by the phorozoon or larva. "Thence, until the critical period the gametozoon or future "vertebrate is only nourished through the intermediation of "the phorozoon from the yolk."*

At the critical period, as we have already seen, the gametozoon commences to suppress the phorozoon, "the parts of the "larva atrophy and are either absorbed, starved to nothingness, "or digested.

"In those cases where there is no proper yolk-sac, and only "yolk-cells (parts of the phorozoon or larva), these latter from "the critical period onwards break down and degenerate, and "are digested, while in the same instances other parts of the "phorozoon atrophy."**

The asexual generation of the vertebrates, like the gametophytic generation of the higher plants, has been reduced during the process of evolution to comparative insignificance, for, as in the higher plants, the gametophyte is reduced in most instances to but a few cells, so in the vertebrates the asexual form, according to Beard, is represented by many of the cells of the cleaved egg of the amphibian, by the blastoderm of the fish and the bird, and by the trophoblast of the mammal, for these various structures he regards as being in the main homologous.

Having now got some idea of what is meant by the "critical period," and what is to be understood by "larval "forms," we will proceed to consider the origin of the embryo. We have already noted that it is of direct descent from the zygote; and here too, it may be noted, so also is the larva or phorozoon. The origin of both will be best understood by reference to a diagram drawn up by Beard, bearing in mind his warning that it is a diagram only.

* John Beard, "On Certain Prob. Vert. Embryology"; p. 51.

** Ibid. P. 52.

In this diagram (3) the zygote Z is, of course, the product of the united egg and sperm E.S. and the line onwards to the primitive germ-cell U.K.Z. marks the germinal track in Weismann's sense. The whole of the products of the zygote, including those to the left of the line, are assumed by Weismann to be cells of the embryo.

As we have already seen, the germ-cells are in existence prior to the formation of an embryo, the diagram so far is evidently incomplete. The diagram to U.K.Z. only takes us sufficiently far to account for the asexual generation and the primitive germ-cell. In the case of the female skate 512 primary germ-cells have to be provided. and these before there is any embryo at all. The primitive germ-cell U.K.Z. is probably one cell of the tenth cleavage. Only five divisions are shown in the diagram. After its origin it passes through nine further divisions—for convenience only seven are shown in the diagram—2, 4, 8, 16, 32, 64, 128, 256, 512. These last are 512 primary germ-cells, and are potential female skates.

Thus far Beard's diagram accounts for a larval—asexual form, viz., the cells to the left of the line Z., U.K.Z. and the primary germ-cells.

We are now in a position to answer the question: Whence the embryo? The embryo is the product of one of the primary germ-cells. "The remainder become the 'sexual "products' of this same embryo. They may be obliged, as in "the skate, to wander into the embryo, or, owing to the mode "of growth and evolution of the embryo, they may become "enclosed by it." If two or more primary germ-cells develop, as occasionally happens, the result is identical twins, triplets, etc.

The primary germ-cells which do not give rise to embryos or degenerate are for future generations. After a resting phase, during which the embryo develops, they divide and become secondary germ-cells. With this division "the "beginning of the determination of sex for the following "generation is bound up. After a certain, usually limited, "number of divisions these germ-cells become oocytes or "spermatocytes, in which the final step in the determination "of sex is taken at the reduction of chromosomes. When "this has been effected there remains nothing more to "complete the cycle of the germ-cells than that they should "form gametes, and this they usually do by two divisions." *

Although it has long been known that some animals possess two kinds of eggs, and that others possess two kinds of spermatozoa, the second form in each—except in a very few instances—has been regarded merely as a curiosity, or at most as but a survival from some ancient and ancestral form. The facts have, therefore, received but scant notice.

The accepted view that there is but one kind of egg and one kind of sperm finds its sanction and proof in their being the products respectively of the female and male organisms. Beard has shown, however, that the eggs and sperms are not the products of the organisms bearing them, thus sanction and proof both fail us and other facts must be sought. We have already noted the fact that if two or more primary germ-cells devolop normally their products are identical twins, triplets, etc., including not only identity of form and feature, but sex also. This in itself is significant.

If it be true that there is but one kind of egg and one kind of sperm, what is it that determines sex? It has been estimated that during the past two hundred years some five hundred different theories have been formulated to supply the answer, every one of them, be it observed, based upon the assumption of there being but one kind of egg and one kind of sperm. Starting, as Beard has now shown, from a wrong base, it is no wonder the solution sought gave rise to the legion of theories.

What, then, are the facts supplied by Beard which throw new light upon this important subject? Very briefly, then, and of necessity ignoring very much that is pertinent and of great interest, ignoring facts concerning hermaphroditism and parthenogenesis, which under the newer light find clear and reasonable explanation.

* John Beard. "The Determination of Sex in Animal Development." Published by Gustav Fischer, Jena, 1902. P. 707.

In the course of his researches upon the embryos of raja, and as the result of his painstaking labour of enumerating the primary germ-cells, he found that in every instance where it was possible to make an approximately correct count, the number was always either close upon 256 or 512. Further research resulted in the discovery that embryos containing about 256 primary germ-cells invariably gave rise to male skates, while those containing about 512 gave rise to female skates. Here, then, was demonstrated the existence of *two* kinds of eggs, eggs producing males, and eggs producing females. At first sight it would naturally be assumed that, in the event of the 256 primary germ-cells—potential males—undergoing a further division, they would give rise to potential female germ-cells, seeing that the number 512 is that which Beard found gave rise to female skates; or to reverse the order, if instead of 512 germ-cells—potential females—the division had stopped short at 256, then potential male germ-cells would have resulted. In other words it might be assumed that sex was determined by the division or otherwise of the 256 primary germ-cells. This, however, is not so; it is the egg prior to fertilization which bears the characteristics of sex, and is either male or female. It must therefore follow that the sex of the embryo is determined at fertilization: not by the act as a cause, but by the kind of egg—male or female—which has been fertilized, male-eggs giving rise to male organisms and female-eggs giving rise to female organisms. It must, of course, follow that when once the egg is fertilized *nothing whatever* can influence the sex of the offspring.

It must further be noted that the primary germ-cells of the skate, whether they belong to the 256 or the 512 series, are exactly alike in size, each being 0·02 m.m. in diameter, thus pointing to the probability of there being a difference in the dimensions of the germinal disc from which they arise. This is an established fact, for the segmented hemisphere giving rise to the 512 primary germ-cells has a diameter of 1·2 m.m., and that giving rise to the 256 has but a diameter of 0·95 m.m.

It must not be forgotten that the numbers 256 and 512 are not absolutely correct, for, in addition to the one used in the formation of the embryo containing them, a certain number degenerate.

Although it is demonstrated that the primary germ-cell giving rise to the male skate is one of the definite number of 256, and the female from one of 512, it would be unsafe to generalize and assume that the number of germ-cells from which arise females is always double the number giving rise to males, for in *Scyllium canicula* the number giving rise to males and females is the same, namely, 128.

Moreover, the number of primary germ-cells varies with the genera and species. Without definite knowledge as to the sex the following numbers of primary germ-cells are recorded: — *Rana esculenta*, 8; *Petromyzon Planeri*, 32; *Acanthias vulgaris* (64 & 128?); *Pristiurus melanostomus*, 128; *Cyclops*, 2; *Ascaris*, 2; *Cecydomyia*, 4; and *Chironomus*, 4.

Time will not permit me to pursue this interesting subject further, it must suffice to indicate in a few words from Beard, where, in the course of development, sex is determined.

He writes:—" From the facts concerning the number of " primary germ-cells, and from certain other factors, ... " it may be concluded that sex is actually differentiated " and decided during oogenesis. The facts point to the last " division of the oogonia, and the formation of oocytes, as the " particular epoch at which this happens. That is, the oocytes " are differentiated into two categories, destined to become male " and female eggs respectively."*

Beard is of opinion that the initiation of the process with the change from primary to secondary germ-cells, accounts for the inability of the secondary germ-cells to undergo independent development.

* John Beard, "The Determination of Sex, etc.," p. 713.

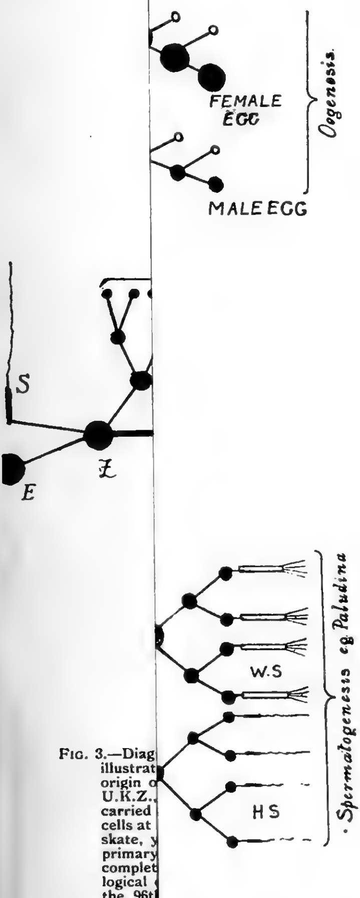


FIG. 3.—Diag
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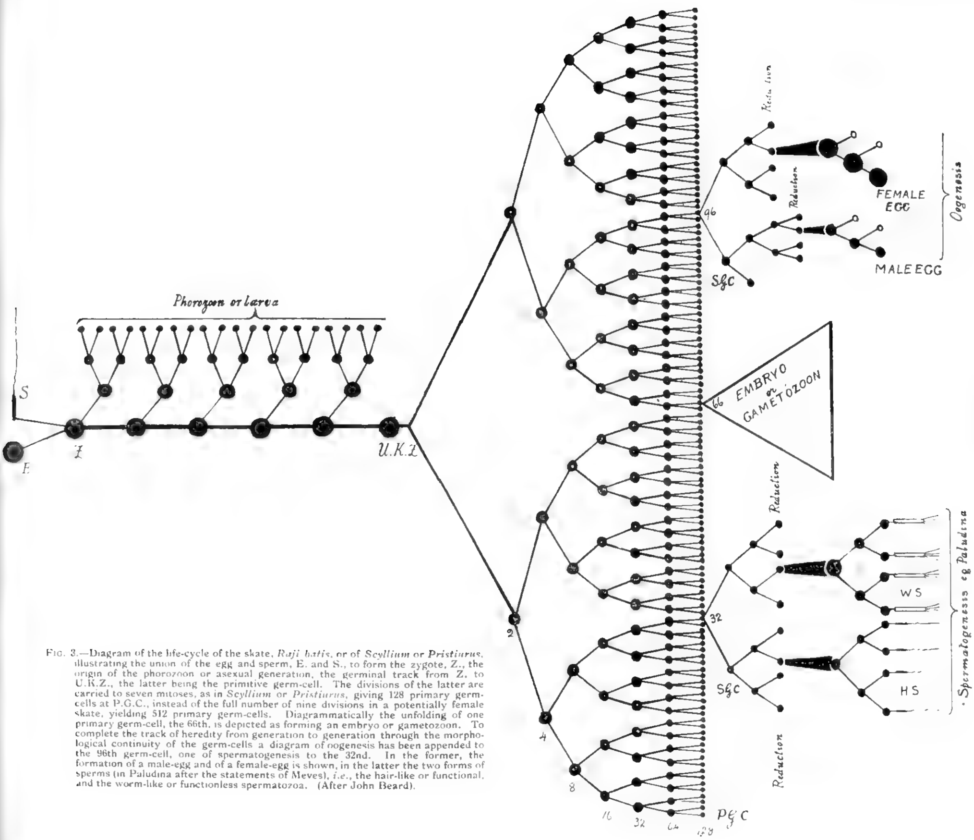

FIG. 3.—Diagram of the life-cycle of the skate, *Raji batis*, or of *Scyllium* or *Pristiurus*, illustrating the union of the egg and sperm, E. and S., to form the zygote, Z., the origin of the phorozoon or asexual generation, the germinal track from Z. to U.K.Z., the latter being the primitive germ-cell. The divisions of the latter are carried to seven mitoses, as in *Scyllium* or *Pristiurus*, giving 128 primary germ-cells at P.G.C., instead of the full number of nine divisions in a potentially female skate, yielding 512 primary germ-cells. Diagrammatically the unfolding of one primary germ-cell, the 66th, is depicted as forming an embryo or gametozoon. To complete the track of heredity from generation to generation through the morphological continuity of the germ-cells a diagram of oogenesis has been appended to the 96th germ-cell, one of spermatogenesis to the 32nd. In the former, the formation of a male-egg and of a female-egg is shown, in the latter the two forms of sperms (in Paludina after the statements of Meves), *i.e.*, the hair-like or functional, and the worm-like or functionless spermatozoa. (After John Beard).

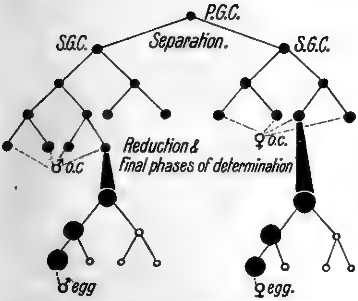

FIG. 4.—Oogenesis and determination of sex in *Raja batis*.

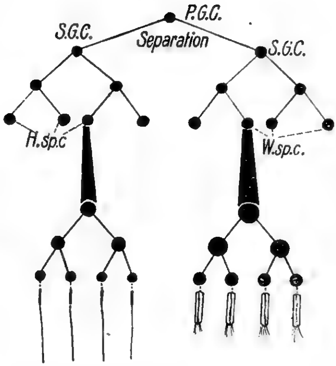

FIG. 5.—Probable course of spermatogenesis in *Paludina* (after the statements of F. Meves).

Diagram 4 will help to make clear the determination: P.G.C. is a primary germ-cell, it divides and becomes two secondary germ-cells; the products of the secondary germ-cell destined to be male eggs pass through one division more than those producing female eggs, as indicated on the lines marked O.C. The lower part of the diagram refers to the ripening of the egg, preparing it for the reception of the spermatozoon. At the first division half its chromatin is cast out as a polar body —the small round circle; the chromatin again divides and casts out the second polar body, at the same time the first polar body divides, thus giving one functional egg and three functionless ones.

I must here point out that Beard's research only refers to the morphological determination of sex, and in no way attempts to explain its origin.

Diagram 5 indicates, according to Beard, the probable course of spermatogenesis and the determination of the two sorts of spermatozoa in Paludina and other organisms known to possess two sorts of male gametes.

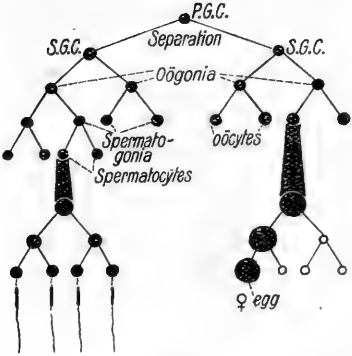

FIG. 6.—Supposed course of oogenesis and spermatogenesis in hermaphroditism.

Diagram 6 shows the course of oogenesis and spermatogenesis in hermaphroditism.

Here it will be seen "that instead of the production and maturation of two "kinds of eggs, male and "female in destination, we "witness the maturation of "one kind only, the female "egg. The germ-cells, which "here should have become "male-eggs, are converted "into spermatogonia, and from these spermatozoa are ultimately "produced." *

According to Beard, any one or more of the four gametes may be suppressed at any period of the life history. This faculty supplies the explanation of the phenomena of hermaphroditism and parthenogenesis. In hermaphroditism there is the partial or complete suppression of the male-egg, or rather its conversion into spermatogonia and (ultimately), sperms. In parthenogenesis there is the occasional or cyclical arrestment of one or other of the gametes of the female.

"A comparison of parthenogenesis and hermaphroditism "demonstrates that in the former there is what may be "termed a precocious development of an embryo, male or "female. In the latter, the precocious development of male-"eggs or their forerunners to form male gametes or sperma-"tozoa without the intermediation of the otherwise necessary "male embryo or sexual person. In hermaphroditism the "males tend to disappear, because the male-eggs, which "should have gone to form them, have been used in the "development of spermatozoa. In parthenogenesis the males "disappear for another reason, because their production may "become unnecessary." **

* John Beard, "The Determination of Sex, etc.," p. 715.

** John Beard, "The Determination of Sex, etc.," p. 716.

That there are difficulties to be removed from many minds if Beard's teaching is to be accepted, no one knows better than Beard himself. They are, however, more apparent than real, they must be.

There are the wonderfully exhaustive experiments of Mendel and of de Vries, and more recently those of the Royal Society's Evolution Committee on Variation. These presented a difficulty to Beard that for a time appeared insurmountable. But when it was recognised that the environment was constant, it was seen that each of the characters dealt with was equally suitable and adapted to it, and no one character could be selected to the exclusion of the other. "Therefore, each would "be equally favoured, and the results would come about "according to the mathematical laws of probability, which "Mendel and his successors found to be the case."*

The equally complete experiments of Vöchting on regeneration, and the explaining of the well-known secondary sexual characters are other difficulties that will present themselves; they will, however, vanish with further knowledge.

Any sketch, however brief, of Beard's work would be very incomplete without reference to its bearing upon the great cancer problem.

Briefly, it is as follows:—We have already noted the fact that many primary germ-cells are found in places where they really have no business; that these, however, as a rule degenerate and disappear, but occasionally here and there one becomes encapsulated and escapes degeneration. It is in these encapsulated primary germ-cells Beard discovers the origin of most—if not all—neoplasms, whether bearing the name of dermoid cyst, teratoma, sarcoma, or carcinoma. Although the primary germ-cells of any given organism should be—they have been in past ages—identical germ-cells, they have fallen on evil times; if normal development took place they would produce identical normal embryos, this occasionally happens, as in the case of the armadillo, where in one recorded instance seven identical embryos were found.** More often, however, cases

* John Beard, "Morph. Cont., etc.," *Rev. Neu. and Psy.*, March, 1904, p. 209.

** Dr. Beard has at present one such example in his possession, viz.: Seven identical fœtuses in one chorion of the armadillo, Praopus hybridus.

occur in which one normal embryo is accompanied by, or bears one or more abnormal embryos—embryomata; these are incomplete "embryos" or individuals and may occur in almost any part of the body. One such instance is on record where three embryos hung as more or less incomplete parasites from the palate of a fourth. According to Beard, germ-cells which develop neoplasms have undergone some modification—they have lost their "memories."

These "memories" must not, however, be considered as the equivalents of Weismann's determinants. Beard does not believe in these supposed entities; he holds "life and its "phenomena to be due to the 'memories' of what we call "living matter. What living matter really is no one knows."

This loss of "memory" is shared in degree by a certain unknown number of the germ-cells, constituting them "retrograde or rudimentary embryonic cells." It is these retrograde embryonic cells (these must not be confounded with the "lost germs" of the pathologists) that give rise to neoplasms, whether benign or malignant. "This," according to Beard, "explains "why in one development a certain germ-cell will produce an "identical twin, while the corresponding germ-cell in another "instance develops into a monster, or into an embryoma, or "into such with a malignant tumour, or into a mixed and "malignant neoplasm, or, lastly, into a simple sarcoma or car-"cinoma. All depends upon the amount of unconscious memory "retained by those retrogressive germ-cells, which formerly "gave birth to normal embryos, identical twins, triplets, etc."*

In other words, a germ-cell which ultimately gives rise to a tumour is an "embryonic cell," identical sister of that which became an embryo. It should have developed when the embryo arose. A germ-cell can only do one of two things and *live*. (1) It can develop. (2) If it should not have done so but gets encapsulated, it can ultimately only develop (Beard doubts if it ever does) or go on with the cycle of germ-cells. If it cannot form gametes, it may skip this part and go on to the next stage—trophoblast, with its unlimited power of malignant growth.

* John Beard, "The Problems of Cancer." *The Lancet*, Oct., 29th, 1904.

All malignant neoplasms are, therefore, the abortive attempts of germ-cells to develop anew a life cycle. They are for the most part incapable, however, of producing anything other than trophoblastic tissue. Such neoplasms Beard "regards as irresponsible trophoblasts."

If all this be true, what light, if any, does it shed upon the cancer problem in regard to curative treatment?

When during the normal development of an embryo the critical period is reached, as we have already noticed, the trophoblast commences to degenerate. If the cause of this degeneration were known, Beard was (1902) of opinion we should be in possession of the key by which to solve the problem of curative treatment. Now, what are the facts bearing upon this momentous question? It appears to be fully proved that up to the "critical period" digestion has been the result of what is known as an intracellular (acid) digestion, the digestive ferment of which in fishes is the product of the merocytes of the yolk. The "critical period" witnesses the advent of a new organ in the embryo, the pancreas, and with it pancreatic function. In reference to this, in 1905, Beard writes:—"At this epoch, the critical period, the fish commences to feed itself on yolk, not by an (intracellular) acid peptic digestion but by an alkaline pancreatic one. . . . . The commencing activities of the pancreas during fœtal life initiate an alkaline digestion by means of the most powerful and important of all the digestive juices, the pancreatic. To which of its ferments the observed results be due does not concern us. If the secretion be absent, neither the asexual structures of a fish development nor the cells of chorio-epithelioma do or can degenerate. . . . . The solution of the problem of the functional relation of embryo and trophoblast, how the latter nourishes itself by an (intracellular) acid digestion and degenerates slowly by a pancreatic digestion, becomes at the same time the embryological, if not the medical, resolution of the problems of malignant neoplasms, as well as of chorio-epithelioma." *

* John Beard, "The Cancer Problem." *The Lancet*, Feb. 4th, 1905.

If ultimately all this be proved to be true, and by its obviously suggested method of treatment a ferment, trypsin, have been discovered capable of effectively dealing with cancer in its many appalling forms, the name of Dr. John Beard will be handed on to posterity with reverence and gratitude as one who, scorning ridicule and ignoring opposition, pursued the even tenor of his way, seeking truth for its own sake, and thereby leading the way to the discovery of that which, in its results for the good of mankind, will prove to be beyond estimation.

Note.—Since this paper was read, my attention has been directed to the work of Dr. John A. Shaw-Mackenzie ("The Nature and Treatment of Cancer," London, 1905). From this it would appear that in trypsin has been discovered the ferment required for the suppression of cancer, and in this work he gives some account of his method of treatment with trypsin. At the close of 1904, and thus at the same time as Dr. Beard, Dr. Shaw-Mackenzie had independently, and for different reasons, arrived at the same conclusions as to the import of trypsin in the medical treatment of cancer; and Dr. Beard informs me "that Dr. Shaw-Mackenzie and he have agreed to share equally the credit or discredit of the discovery." Let us hope the latter may find no place.

List of Memoirs upon the Metazoan Life-Cycle, By Dr. John Beard, 1889-1905.

1. The Early Development of *Lepidosteus osseus*, in *Proc. Roy. Soc.*, London, Vol. 46, p. 108-118, 1889.

2. The Transient Ganglion-Cells and their Nerves, in *Anat. Anz.*, Vol. 7, p. 91-206, 1892.

3. On a Supposed Law of Metazoan Development, in *ibib.*, Vol. 8, p. 22-29, 1892.

4. On the Phenomena of Reproduction in Animals and Plants, on Antithetic Alternation of Generations, etc. (with J. A. Murray), in *Ann. Botany*, Vol. 9, p. 441-468, 1895; also in *Anat. Anz.*, Vol. 11, p. 234-255, 1895.

5. The History of a Transient Nervous Apparatus in certain Ichthyopsida: An Account of the Development and Degeneration of Ganglion-Cells and Nerve-Fibres, Pt. 1, *Raji batis*, in *Zool. Jahrb. Morph. Abteil.*, Vol. 8, p. 1-106, 8 plates, 1896.

6. Further Remarks upon the Phenomena of Reproduction in Animals and Plants, *Anat. Anz.*, Vol. 11, p. 634-641, 1896.

7. On Certain Problems of Vertebrate Embryology (The Critical Period, etc.), p. 1-77, Jena, Gustav Fischer, 1896.

8. The Yolk-Sac, Yolk, and Merocytes in *Scyllium* and *Lepidosteus*, in *Anat. Anz.*, Vol. 14, p. 334-347, 1896.

9. On the Disappearance of the Transient Nervous Apparatus in the series: *Scyllium*, *Acanthias*, *Mustelus*, and *Torpedo*, in *ibib.*, Vol. 12, p. 371-374, 1896.

10. The Span of Gestation and the Cause of Birth, p. vii. and 132, Jena, Gustav Fischer, 1897. (Abstract of the foregoing in *Anat. Anz.*, Vol. 14, p. 97-102, 1897, under the title: "The Rhythm of Reproduction in Mammalia").

11. The Birth-Period of *Trichosurus vulpecula*, in *Zool. Jahrb. Morph. Abteil.*, Vol. 11, p. 77-96, 1897, 1 plate.

12. The Morphological Continuity of the Germ-Cells in *Raja batis*, in *Anat. Anz.*, Vol. 21, p. 465-485, 1900.

13. The Germ-Cells of *Pristiurus* in *ibib.*, Vol. 21, p. 50-61, 1902.

14. The Numerical Law of the Germ-Cells, in *ibib.*, Vol. 21, p. 189-200, 1902.

15. The Germ-Cells, Pt. 1, *Raja batis*, in *Zool. Jahrb. Morph. Abteil.*, Vol. 16, p. 615-702, 2 plates, 1902. Re-published in *Journ. Anat. & Physiol.*, Vol. 38, 1903-04.

16. Heredity and the Epicycle of the Germ-Cells in *Biol. Ctrlbl.*, Vol. 22, p. 321-328, 353-360, 398-408. Also in *Trans. Bot. Soc.*, Edinburgh, 1902.

17. The Determination of Sex in Animal Development, in *Zool, Jahrb, Morph, Abteil.*, Vol. 16, p. 703-764, 1 plate and 3 text figures, 1902. Like Nos. 7 and 10 this has been separately published by Herrn Gustav Fischer, Jena. Abstract of the above in *Anat., Anz.*, Vol. 20, p. 556-561, 1902.

18. Embryological Aspects and Etiology of Carcinoma in *Lancet*, June 15th, 1902.

19. The Embryology of Tumours, in *Anat. Anz.*, Vol. 23, p. 487-494, 1903. Also in *Journ. Anat. & Physiol.*, 1904.

20. A Morphological Continuity of Germ-Cells, as the Basis of Heredity and Variation, in *Rev. Neur. Psych.*, 1904. Also with sundry alterations and corrections in the Bulletin of Iowa Institutions, 1905.

21. The Problems of Cancer, in *Lancet*, Oct. 29th, 1904.

22. The Cancer Problem, in *Lancet*, Feb. 4, 1905.

23. The Germ-Cells, Pt. 11, *Pristiurus melanostomus*, with 1 plate and 14 figures in text. (Ready for the Press).

Liverpool Microscopical Society.

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JANUARY, 1906.

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R. NEWSTEAD, F.Z.S., Liverpool University.

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1897 Williams, W. Collingwood, B.Sc., 68 Grove Street.

THIRTY-NINTH

ANNUAL REPORT

OF THE

LIVERPOOL

Microscopical Society.

ABSTRACT OF PROCEEDINGS,
PRESIDENT'S ADDRESS ON "FLORAL DEVELOPMENT AND EMBRYOGENY IN WHEAT,"
AND LIST OF MEMBERS.

JANUARY, 1908.

LIVERPOOL:
C. TINLING & CO., LTD., PRINTERS, 53, VICTORIA STREET

1908.

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1908.

Liverpool Microscopical Society.

SESSION XL., 1908.

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Officers and Council Elected 24th January, 1908.

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THIRTY-NINTH ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

The President and Council in presenting the thirty-ninth Annual Report have pleasure in being able again to give a satisfactory statement as to the work of the Society.

The Meetings during the Session have been well attended, a keen interest taken in the Papers read, and the exhibits shown at the Conversaziones were much appreciated.

Five excellent Papers have been given, every one of them being the outcome of original research. All were elaborately illustrated by original drawings and photographs. To these gentlemen the Council hereby tender their hearty thanks.

In March Mr. A. H. Dudley gave some very useful and excellent demonstrations, showing how to prepare temporary mounts; to avoid plasmolysis, and to exhibit cell contents; also how to cut "hand sections," &c., &c.

Mr. W. H. Read described and demonstrated a useful method of making drawings and diagrams for lantern illustrations.

The Annual Conversazione was held in May. The members of ten kindred Societies co-operating helped to make this meeting a great success. In addition to the numerous living organisms shown by members, a large number of miscellaneous objects of scientific and artistic interest were exhibited by the visitors. Instruments, apparatus, &c., were shown by Messrs. Thomas Armstrong and Brother, Messrs. Flatters & Garnett, Messrs. Ross Ltd., and Messrs. W. Watson & Sons.

The Meeting in November also took the form of a Conversazione, a number of visitors being present. Numerous preparations of a specially interesting character were exhibited.

The Council note with pleasure the increased interest taken in the preparation of material for histological study. No longer is the art of preparation confined to the hands of the professional, it being within the reach of everyone having the desire to learn.

Four new members have been enrolled during the past year.

By death the Society has lost two members: Mr. William Oelrichs and Mr. Arthur E. Lewis. Mr. Oelrichs had been a member for nearly 30 years, during a portion of which time he served the Society as its Honorary Secretary, and for a lengthened period was a most useful and energetic member of the Council. His genial helpfulness was always at the disposal of his friends, and his loss to the Society is felt to be a great one. Mr. Lewis, although a member of but a few years' standing, had won the esteem and regard of those members with whom he came into contact.

Three members have resigned, among them Dr. William Carter, who is leaving Liverpool. From the formation of the Society in 1868 Dr. Carter has been a member, and has more than once occupied the Presidential Chair. The Council feel that such honour as is at the Society's disposal should be conferred upon him, and they cordially recommend his election to the list of Honorary Members.

There were at the close of the year four Honorary Members and fifty-four Ordinary Members.

The following additions have been made to the Library:—

By presentation: Publications of the Quekett Club, Manchester Microscopical Society, Royal Microscopical Society.

By purchase: Annals of Botany, and the Ray Society's issue.

To Mr. F. N. Pierce and the members of the Lantern Committee the Council hereby express their thanks for their ready assistance and helpfulness.

The following is a brief account of the various meetings:

January 18th—The President, JOHN HAY, M.D., M.R.C.P., delivered his Inaugural Address, entitled "The more recent views as to the manner of the Heart's Activity." The address was printed with the last Report.

February 1st—A Paper, entitled "Steel Tramway Rails, an Unsolved Problem in its Microscopic Aspects," was read by Mr. F. T. AMAN. Mr. Aman discussed the nature and causes of the corrugations formed in the Tramway Rails. A number of preparations, showing the microscopic structure of the rails were of great interest.

March 1st—Mr. H. E. DAVIES described a mechanical method of producing Homogenised fat globules. The fat globules of milk so treated were exhibited.

Mr. A. H. DUDLEY gave a demonstration in the preparation of Temporary Mounts; and Mr. W. H. READ described and demonstrated the making of Diagrams and Drawings for the Lantern.

April 5th—Dr. P. F. TINNE read a Paper entitled "Nerves." The structure and function of nerves was admirably treated, and a number of excellent lantern slides were used in illustration.

May 3rd—This meeting, as usual, was devoted for the most part to the Exhibition of Living Organisms. Ten other Societies co-operated, and exhibited a large number of objects of scientific and general interest. In point of numbers and in interest shown the meeting was a great success.

October 4th—Mr. W. D. BROWN read a most interesting and useful Paper, entitled "Some Wind-etched, and other Stones from the Boulder Clay at Burscough." Mr. Brown illustrated his paper by a number of wind-etched stones and a series of rock sections. These were very kindly shown by Mr. F. N. Pierce by means of his Micro-Lantern.

November 1st—The meeting took the form of a Conversazione. The Rev. CHS. DOWDING gave a short sketch of his experiences on a Whaling Ship, and briefly described one of the Parasites infesting the intestines of the Whale. Mr. DUDLEY described the Apical Cell of a Fern Root. The exhibits were numerous and excellent. A new Engineering Microscope, made by Messrs. T. Armstrong and Brother, was exhibited by Mr. A. H. Dearsley.

December 6th—A Paper entitled "Further Thoughts on Plant Hairs" was read by Mr. R. CROSTON. The Paper was illustrated by numerous Micro preparations and lantern slides.

THE LIVERPOOL MICROSCOPICAL SOCIETY.

Dr. IN ACCOUNT WITH THE TREASURER. **Cr.**

Dr.				£	s.	d.
To Rent of Rooms ...				10	10	0
,, Printing, Stationery and Postages				15	9	8
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,, Annals of Botany	£1	10	0			
,, Subscriptions, Ray Society	1	1	0			
				2	11	0
,, Lantern Expenses				0	11	0
,, Fire Insurance Premium				0	5	0
,, Balance ...				31	5	2
				£63	13	10

Cr.	£	s.	d.
By Balance from 1906	29	10	7
,, 2 Subscriptions, 1905 ...	1	1	0
,, 5 ,, 1906 ...	2	12	6
,, 46 ,, 1907 ...	24	3	0
,, 3 Entrance Fees	1	11	6
,, Bank Interest ...	1	1	3
,, Advertisements in Annual Report	3	14	0
	£63	13	10
By Balance ...	31	5	2
,, Suspense Account	5	5	0
	£36	10	2

Examined and found correct,

W. GRISEWOOD,
J. R. HAYDON.

A. H. DUDLEY,
Hon. Treas.

LIVERPOOL, 22*nd January*, 1908.

PRESIDENTIAL ADDRESS.

Floral Development and Embryogeny in Wheat,

BY

ARTHUR H. DUDLEY.

> "For nature also, cold and warm,
> And moist and dry, devising long,
> Thro' many agents making strong,
> Matures the individual form."
> —*Tennyson.*

AT this Annual Meeting we congratulate our Society on the attainment of its Fortieth Birthday. Its past shows a continuous record of good work, the present, instinct with living interest in all branches of microscopical science, inspires confidence in a future of great usefulness.

I am proud that at this special juncture in its history you have conferred upon me the honour of being president. I thank you heartily, and it will be my aim to maintain, so far as I may be able, its honourable traditions.

The address it is my privilege to submit to you to-night is far from complete, through limited time for preparation and lack of suitable material to illustrate important stages of development.

For the lantern slides and many useful suggestions I am indebted to our good friend the Secretary.

The slides are from micro-preparations of material gathered at various times and places, fixed in the field in chrom-acetic acid solutions, embedded in paraffin, sectioned serially, and stained in Heidenhain's Iron-alum haematoxylin and safranin; brazilin and safranin; or safranin, gentian violet and orange G. The first gave the best results. At some stages, especially after the stiff hairs on the ovary and the dehiscing layer of the anther had appeared, it was extremely difficult to cut even tolerable sections.

INFLORESCENCE AND FLOWER.

Wheat flowers are found in spicate inflorescences arranged on the axis in two or more rows of 3-5 flowered spikelets. The flowers are sessile, borne alternately upon rachillæ, and two large glumes enclose the whole of the flowers in a spikelet. Each flower is inserted in the axil of the outer palea or flowering glume, and is subtended by the inner or superior palea (Figs. 1-2). Of the paleæ, one or both may terminate in a long pointed awn giving the characteristic feature to "bearded wheat." The inner palea is succeeded by two small bracts, or lodicules, generally looked upon as constituting the perianth of the flower, three such members being found in some grasses, as *Stipa*, the feather grass, and larger grass-like plants, as bamboos.

The bases of the lodicules become enlarged by the development of masses of parenchyma, and at the time of flowering become much swollen, press open the glumes, and the stamens being extruded, often with considerable force, hang outside the flower by their long slender filaments.

Of the three stamens inserted at the base of the ovary, two are placed in the postero-lateral plane, the third is median. Opposite to this is inserted the single carpel, the body of which constitutes the one-celled ovary; its upper portion being prolonged into the style bears two lateral, much-branched, feather-like stigmas. The single ovule is slightly ascending from the placenta-like suture and becomes later more or less inverted into the campylotropous form.

The grain or ripe fruit is termed a Caryopsis (Fig. 3). The ovary wall and shrivelled remains of the two ovular integuments adhere closely around the floury endosperm of the seed—they constitute the familiar bran removed during milling operations. The highly differentiated embryo has a slightly curved axis, with its root and shoot portions separated by the hypocotyl, several primordial leaves sheathing the plumule, and often the primordia of several rootlets. It is set obliquely at the lower end of the grain and encased in a membranous sheath formed by the scutellum and coleorhiza. The epiblast, a small cellular outgrowth inserted opposite to the cotyledon, is supposed to represent a second cotyledon, but its homology has not been determined.

Post-embryonic developments, those following germination of the grain, show the now more conspicuous coleorhiza pierced by the growing rootlets (Fig. 4). The pointed apical end of the cotyledon appears above the soil, and the first foliage leaf pushes its way through the cotyledonary sheath, followed by the plumule, which develops into the stem or main axis, and finally bears the terminal head or spike of flowers.

THE MICROSPORANGIUM.

The primordia of the three stamens arise as minute papillæ upon the rachilla of a spikelet beneath the carpel, and are extensions of its dermatogen and periblem cells. The part destined to form the anther, or sorus of Microsporangia (Fig. 5), takes an oblong, slightly hour-glass form with rounded corners indicating the positions of the four microsporangia. It shows in longitudinal section some 10-12 rows of periblem cells, and in transverse section 6-8, with a central plerome initial of the connective. Beneath the epidermis at each of the four corners the archesporial cells are now mapped out, and differentiation of the sporangia proper begins from these specialised hypodermal cells. A cross-section gives one archesporial cell only for each sporangium, as Cannon[1] found in *Avena fatua*, the wild oat; in vertical section three or more are shown. Each archesporial cell enlarges and divides (Fig. 6) into an outer primary parietal or wall cell and an inner primary sporogenous cell. The parietal cells undergo two successive divisions (Fig. 7), resulting in the formation of the sporangium wall, consisting of three distinct layers of cells, endothecium, middle layer, and the innermost tapetum—a jacket of nourishing cells filled with dense granular cytoplasm in which 1-2 nuclei are embedded.

Meanwhile the primary sporogenous cells become deep-seated and active; their nuclei, passing through two or three mitoses, form a central rounded mass of polyhedral sporogenous cells, radially arranged and surrounded by the wall layers, the whole being covered by the exothecium or epidermis.

Movements within the nuclei of the sporogenous cells indicate their transformation directly into the so-called microspore mother-cells. By the rounding off and separation of their walls, the mother-cells come to lie free in the loculus of the Microsporangium (Fig. 8) as large rounded or oval cells, each having a central vacuole containing the now free nucleus. This mother-cell condition may be retained for some time, and has been termed the "resting" stage. It is reached about the time the archesporium makes its appearance in the megasporangium; synapsis of their nuclei is about coincident with the megaspore tetrad, and the spireme stage may be found as late as the first division of the embryo-sac mother-cell. However, it may be stated generally that the mitoses of the megaspore and microspore nuclei run nearly concurrently, so that when the embryo-sac is mature the unshed pollen grains are complete, and contain the tube nucleus and the two generative or male nuclei (Figs. 9-11a). It is thus observed that the early microspore mother-cell stages are prolonged during the passage of the archesporial cell of the megasporangium through its tetrad-forming divisions up to the differentiation of the functioning megaspore or embryo-sac cell.

Let us for a moment revert to the significance of the mysterious transition of the sporogenous cells *directly* into spore mother-cells without apparent changes observable microscopically. The cells they now produce become altogether different in character and function from sporogenous cells, phenomena comparable with the equally remarkable changes that take place in the development of the sporophyte embryo from the fertilised egg. Just what happens in them, and when the change actually occurs, are, as yet, beyond our ken. These problems, closely associated with the phenomenon of alternation of generations, are largely physiological; and Dr. John Beard, in his most recent pamphlet "On the Asymmetry of Life,"[2] has some cogent suggestions as to the part the asymmetric carbon atom may play in the stereo-chemical aspects of the constitution of their saccharine, amyloid and albuminous food substances. There is work here for the bio-chemist to confirm or disprove the contention that the dextro-sugars, dextro-starch and lævo-albumins of the sporophyte are replaced by their opposites, lævo-sugars, lævo-starch and dextro-albumin, in the gametophyte.

His comparative table is as follows:—

PLANT.

Asexual Generation (flowering plant or fern).	Sexual Generation (fern prothallus).
Lævo-albumins.	Dextro-albumin.
Dextro-starch.	Lævo-starch.
Dextro-sugars.	Lævo-sugars.

That there are also biological considerations is patent. Why the life-energy of these sporogenous cells should at this particular period in their history be diverted to the formation of highly specialised reproductive cells, instead of continuing to produce the simpler sporogenous ones, is the more staggering question, of which the chemical aspect would appear to be the complement. The fact of their transformation is undoubted, and facts are stubborn things. A later reference to this feature of alternation will be made when considering the endosperm.

THE MEGASPORANGIUM

Is first observed as a primordial extension of the superficial layer of dermatogen lining the ovary cavity, a little to one side of the base. It is followed by hypodermal periblem cells, and the nucellus thus differentiated (Fig. 12) is usually some 7-9 rows of cells across, including the epidermis, each row being made up of six or more cells. The median row soon bears evidence of archesporial features in the activity and enlargement of its cells; the uppermost hypodermal cell broadens out at the top and also elongates downwards, at the expense of surrounding nucellus tissue, into a large wedge-shaped cell, the archesporium or forerunner of the embryo-sac. In numerous plants the archesporium develops directly into the embryo-sac; here, it divides twice, four cells being derived from it, one of these, the lowest, becoming the sac (Figs. 13-15).

The archesporium is stated by some observers to give off at its apex a parietal cell similar to that described for the micro-sporangium archesporial cells. Coulter and Chamberlain[3] state that a parietal cell is very generally cut off in grasses, and that Koernicke and others find this to be the case with wheat. My preparations do not confirm this in the varieties examined, the nearest approach thereto being the upper part of the apical *non-nucleate* archesporial cytoplasm (Fig. 16), but no dividing wall can be seen. Cannon describes *Avena fatua* as being without a parietal cell. Further, Koernicke is said to find a large development of "parietal" tissue around the deep-seated embryo-sac; this tissue, however, appears to be derived from active division of the surrounding nucellus cells. In all stages from the first division of the archesporium to the mature embryo-sac, median sections always show the apex abutting directly on to the epidermis of the nucellus. Outside, the four layers of the two integuments closely press upon the nucellus, practically closing the micropyle, and might easily be mistaken for parietal tissue (Fig. 17). Transverse sections of the ovule may be particularly misleading in this respect.

The transition of the archesporial cells into megaspore mother-cells corresponds to the transition of micro-sporogenous cells into microspore mother-cells. By two successive mitoses the archesporium first becomes two celled (Fig. 13), and then gives rise to a tetrad row of four megaspore mother-cells separated from one another by distinct walls (Fig. 14), as figured also by Koernicke[4] in his thesis on the sexual organs in wheat. No sooner does the tetrad become evident than its upper three cells begin to disintegrate and disappear, whilst the fourth, lowest and innermost, nourished by their substance, enlarges greatly and becomes, as already stated, the embryo-sac cell. At this stage it is observed (Fig. 15) deeply embedded in the nucellus, lying at the bottom of a channel formed by the decay of the three overlying cells of the tetrad. The top of this funnel-shaped tube is capped by a disorganised mass of cytoplasm derived from the deleted tetrad cells.

During these changes the integuments of the ovule or megasporangium become differentiated, and by the time the tetrad stage is reached the inner one is some 6-8 cells long, the outer 2-4 cells; each is two rows of cells wide, and remains so throughout the whole course of development up to the time of fertilisation.

MEGASPORE OR EMBRYO-SAC.

The first mitosis of this large cell appears to be Koernicke's reduction-division, *i.e.*, the mitosis in which the number of chromosomes in the nuclei of each of the two resulting cells is reduced by one-half, and indicates the inception of the gametophyte or sexual generation.* The number of chromosomes found by him in the nuclei of the sporophyte or asexual generation, was generally 16, that in the gametophyte nuclei 8. Unfortunately my preparations have not shown the chromosomes clearly enough to count. In the first division of the microspore mother-cell nucleus he gives the same number (8), and this I have found to be the case (Fig. 10). Golinsky[5] gives for *Secale cereale*, the rye, 16 and 8 chromosomes for the respective generations.

Germination of the embryo-sac follows the usual course in the first three divisions of its nuclei. The daughter nuclei of the first mitosis (Fig. 18) take up

*Meiotic is now being somewhat generally applied to the reduction division in either a megaspore or microspore mother-cell; pre-meiotic and post-meiotic denoting the mitoses preceding and succeeding that phase.

positions at the opposite micropylar and antipodal—ends of the sac. Each now passes through two simultaneous divisions (Figs. 19 and 20), resulting first in two nuclei being formed at each pole, then two groups of four. The upper or micropylar series differentiates into an egg-apparatus consisting of two pear-shaped synergids and a rounded, more centrally placed egg, the fourth nucleus remaining free. Three cells of the antipodal group take walls and become arranged in inverted pyramid form, the fourth nucleus here also remaining free. The two free extra-polar nuclei by slow movements gradually come together and fuse. At the time of fertilisation they are probably joined by one of the generative nuclei from the pollen tube, the complex of three forming the endosperm nucleus.

ANTIPODAL CELLS.

Up to the eight-celled stage the course of development in the sac is normal. Afterwards an unusual number of antipodal cells appear, probably, as Koernicke[3] seems to think, by amitosis or direct division of their nuclei; at least in the many hundreds of antipodal nuclei examined he did not observe a single spindle stage. On the other hand, he failed to see a "typical" direct-division nucleus. Hofmeister found 6-12 antipodals, Koernicke 36 or more, in a mature embryo-sac, and Cannon reports like numbers for *Avena fatua*. The antipodal cells enlarge enormously and form an arched plate of tissue at the chalazal end of the sac. They "serve to transform the foodstuffs brought to the embryo-sac." The chromatin of their nuclei is very irregular, and the peculiar plate-like bodies (Fig. 21) have been figured and described as nucleoli[4]. They stain light brown with Flemming's triple-combination. This vigorous development of antipodal tissue is said to be common in the gramineæ, and if the cells be regarded as of prothallial nature, support is given to the modern view that the grasses should be considered primary rather than reduced forms, the higher angiosperms having normally only three antipodals.

POLLINATION.

Although the gramineæ have highly specialised organs (Fig. 1) well suited to wind-pollination, and it has been generally held that wind-borne pollen is the fertilising medium, there have ever been those who have contended that cereal grasses, as wheat and barley, are pollinated with pollen from their own flower, *i.e.*, they are self-pollinated, and, as a consequence, also self-fertilised. Some of these investigators have not sufficiently discriminated between these two distinct phenomena, and rendered much of their work vain.

In the "Gardeners' Chronicle" of 14th and 21st March, 1874, A. S. Wilson gives a series of interesting field and other experiments to show that the flowers of wheat and barley in particular rarely fully open, some not at all, and usually only a stamen or two with an occasional stigma protrude. He found that barley plants removed before their flowers were open or pollinated, afterwards set seed as freely in the still air of a room as those in the field; a difference of about 2 per cent. being probably due to neglect in watering the plants. Rye flowers open much more fully, and by him considered to be less adapted to self-pollination, under similar conditions yielded 20 per cent. of seed, against 78 per cent. given by those in the field.

Others, as Gartons of Warrington, 1880 forward, have remarked on the absence of new varieties occurring naturally, but freely appearing under artificial cross-pollination. They found stigmas of unopened flowers with pollen tubes freely developing upon them. Abraham Flatters, in a paper on "Microscopical Research," read in 1906 before the Manchester Microscopical Society, likewise maintained, and illustrated this point with micro-preparations from unopened flowers.

Rendle (1904), Vol. I. "Classification of Flowering Plants," pp. 230-1, states—"Grasses are self- or wind-pollinated. . . . The species of wheat are generally self-pollinated, and in some cultivated races of barley the flowers never open." But evidence is not advanced in support. I have seen notes of lectures given in February, 1901, by Professor M. C. Potter, Newcastle-on-Tyne, in which self-fertilisation is recorded for barley.

The number of flowers and their arrangement in the spikelet make it difficult to devise means for field experiments whereby all error in observation may be prevented. It has been readily assumed that the self-received pollen is also that which effects fertilisation, but I have not seen any micro-preparations the history of which can be called conclusive on the matter. The fertilisation process is quite normal, and there is no evidence of parthenogenetic or other adventitious conditions of embryogeny.

The pollen grains in wheat before being shed from the anther contain the vegetative or tube nucleus and the two generative or male nuclei (Figs. 11 and 11a)," not unlike the antherozoids of a fern or of chara," as Golinsky suggests and figures for rye. This stage appears about 20th to 30th June, fertilisation becoming general about the latter date; on the 3rd July, 1906, young embryos of six or more cells were freely developing; those in material of July 14th, 1900, were much further advanced (Figs. 28-29).

Shortly after deposition of self- or wind-borne pollen upon the stigma, a tube is protruded through a specialised germ pore in the extine or outer wall of the pollen grain. It grows down an intercellular space between the four rows of cells composing one of the feathery branches to the inner conducting tissue of the style as in rye (Fig. 22). On reaching the ovary cavity the tube bends round and takes a course between the inner wall and outer integument of the ovule till it reaches and enters the micropyle, which has already been forced open by the adjacent egg-apparatus nuclei (Figs. 24 and 23).

FERTILISATION.

The pollen-tube passes into one of the synergids and discharges its contents (Fig. 25). Although double fertilisation could not be demonstrated, there is undoubtedly the suggestion that it does take place in the prompt appearance of the endosperm. Guignard[6] described *Zea*, Indian corn, as being "double" fertilised and remarked that he was unable to follow the course of division in the endosperm nucleus, as this took place so rapidly. The foremost generative nucleus probably unites with the two extra-polar nuclei to form the nucleus that initiates this formation of endosperm. Its simultaneous mitoses soon produce a layer of nuclei embedded in dense granular cytoplasm, and this lines the sac wall on all sides.

The second generative nucleus effects fertilisation with the egg, and their fusion seems to be very quickly consummated, for the zygote produced soon shows a single central nucleus lying in a dense reticulum of deeply staining cytoplasm (Fig. 26).

EMBRYOGENY.

The fertilised egg occupies a cup-shaped depression in the apical part of the endosperm. Its divisions to form the embryo do not begin until a large number of endosperm nuclei have been produced. The first segmentation is transverse, and the resulting cells become separated by a marked basal wall (Fig. 27). The lower or hypobasal cell lies next to the micropyle, and simply grows into a large suspensor cell. The epibasal or apical cell gives rise to all the members of the embryo. The order of its divisions appears to follow the course described by Cannon for the development of the embryo in *Avena fatua*,[1] as given by Coulter and Chamberlain.[3] "In this species the cotyledon and stem-tip are both derived from the apical cell, the entire root-tip (including root-cap) from the adjacent cell, and the coleorhiza from the third cell, the suspensor consisting of only the primary basal cell." Whilst these features may be illustrated in wheat by reference to an embryo plate of six cells, it must not be concluded that the course has been actually traced and demonstrated, the gaps in my material having prevented this from being accomplished (Fig. 28).

sr is the large suspensor cell, the separating line 1 - 1 is the original basal wall; of the complex mass of five cells above that line, *cn* represents the cotyledon initial, *s* the stem, *r* the root, whilst *co* probably gives rise to the coleorhiza or root sheath; 2 - 2 is the first transverse wall of the embryo cell, 3 - 3 its first longitudinal one.

This order of segmentation does not appear to be always followed; other embryos may have longitudinal walls succeeding each other at right angles giving rise to a solid mass of cells.

Figure 29, taken from an embryo of 14th July, 1900, shows not only the different parts much more clearly marked off, but the primary tissues, dermatogen, periblem and plerome, being differentiated.

THE FRUIT.

The husk or shell, composed of the ovary wall and the remains of the two ovular integuments, is closely adherent to the endosperm, which becomes differentiated into two distinct portions (Fig. 3). The outer consists of a single layer of large, somewhat brick-shaped cells arranged end on to the lining of the seed. They contain large numbers of minute rounded aleurone grains, the nitrogenous food material. The aleurone layer encloses on all sides, except that occupied by the adjacent surface of the scutellum, the great mass of starchy endosperm, the flour of domestic use. The latter is contained in large thin-walled parenchyma cells and within the vacuoles of their now scanty cytoplasm. The nucleus is still usually present. The starch grains of the endosperm are spherical with a central hilum, and the concentric arrangement of their body substance around that point gives them the characteristic cereal-starch form.

The scutellum surrounding the embryo is formed of the basal part of the cotyledon, and that portion lying against the floury endosperm functions in breaking down, absorbing, and transferring its contents to the seedling plant on germination. It acts in like manner on the single layer of aleurone endosperm where they come into contact.

The morphology of the endosperm is a difficult question, but its functions are closely connected with the nutritive aspects of the alternation of generations, in which the sporophyte or asexual form of the plant and the gametophyte or sexual form succeed each other in the life-cycle. The endosperm is at first accompanied by the unusual development of antipodal cells, which are separated from all other contents of the embryo-sac by the formation of walls around them. Outside the sac in numerous plants other reserves of food material derived from the nucellus, and known as perisperm, are found. D. S. Johnson[7] has investigated the functions of the endosperm in many such perisperm-yielding plants, in its relation to the nourishment of their sporophyte generations, and the following extract from his work given in the "Morphology of Angiosperms" is of interest and importance:—

"Observations thus far made lead me to believe that in the perisperm-containing seeds mentioned the embryo sporophyte of the second generation is never nourished by the parent sporophyte directly, but always through the intermediate gametophyte. In general, then, we find that the food substance supplied to the embryo by the nucellus may pass through the endosperm and be stored in the embryo during the ripening of the seed, as in *Cucurbita* and *Phaseolus*; or, secondly, the food may be stopped in transit between the nucellus and the embryo and stored in the endosperm, there to be held during the resting period of the seed and delivered over to the embryo only at the time of sprouting, as in *Ricinus*, *Zea*, and apparently all Gymnosperms; or, finally, the food supply for the developing embryo may be stored in the nucellus itself until the time of germination, when it is passed on to the embryo through the endosperm, as in *Saururus*, *Peperomia*, *Phytolacca*, *Canna*, and others."

SUMMARY.

1. The Microsporangia show but one primary sporogenous cell in transverse section; the tapetum is derived from the parietal cells; the sporogenous cells undergo 2-3 divisions before merging into spore mother-cells; the significance of the transition.

2. The Megasporangium is of 7-9 rows of cells; the hypodermal cell of the central row is the archesporium; it

does not cut off a parietal cell; a tetrad row of megaspore mother-cells separated by walls is produced; the lowest one of the four functions as the embryo-sac.

3. The Embryo-sac divisions are normal up to the 8-celled stage; number of chromosomes in the reduction division, 8; there is a large development of antipodal tissue.

4. Evidence in favour of self-pollination and self-fertilisation; the pollen-tube grows down an intercellular canal of a stigma branch; passes through stylar-conducting tissue; enters the ovary cavity and takes a course between the lining layer and the outer integument; strikes through the micropyle already forced open by the egg-apparatus.

5. Pollen-tube passes into a synergid and discharges contents; the foremost generative nucleus probably unites with the two extra-polar nuclei to form the endosperm nucleus—"vegetative fertilisation." The second sperm nucleus combines with the egg nucleus — "sexual fertilisation."

6. Divisions of the fertilised egg seem to follow Cannon's description given for *Avena fatua*; the embryo is derived from the apical cell only; the suspensor is the original primary basal cell.

7. The antipodal tissue and endosperm act as conveyors of food material to the embryo; their physiological connection with the question of alternation of generations; the chemical nature of the carbonaceous and nitrogenous reserves.

CONCLUSION.

If apology be needed for emphasising physiological considerations of nutrition and reproduction in their relations to the question of alternation of generations, it is the vast importance attaching to those phenomena in the interpretation of life-histories in both plants and animals. The subject is fraught with far-reaching consequences to biological science, and in the future is likely to take a prominent part in the solution of difficult problems. And every fresh conquest is an inspiration and call to higher service.

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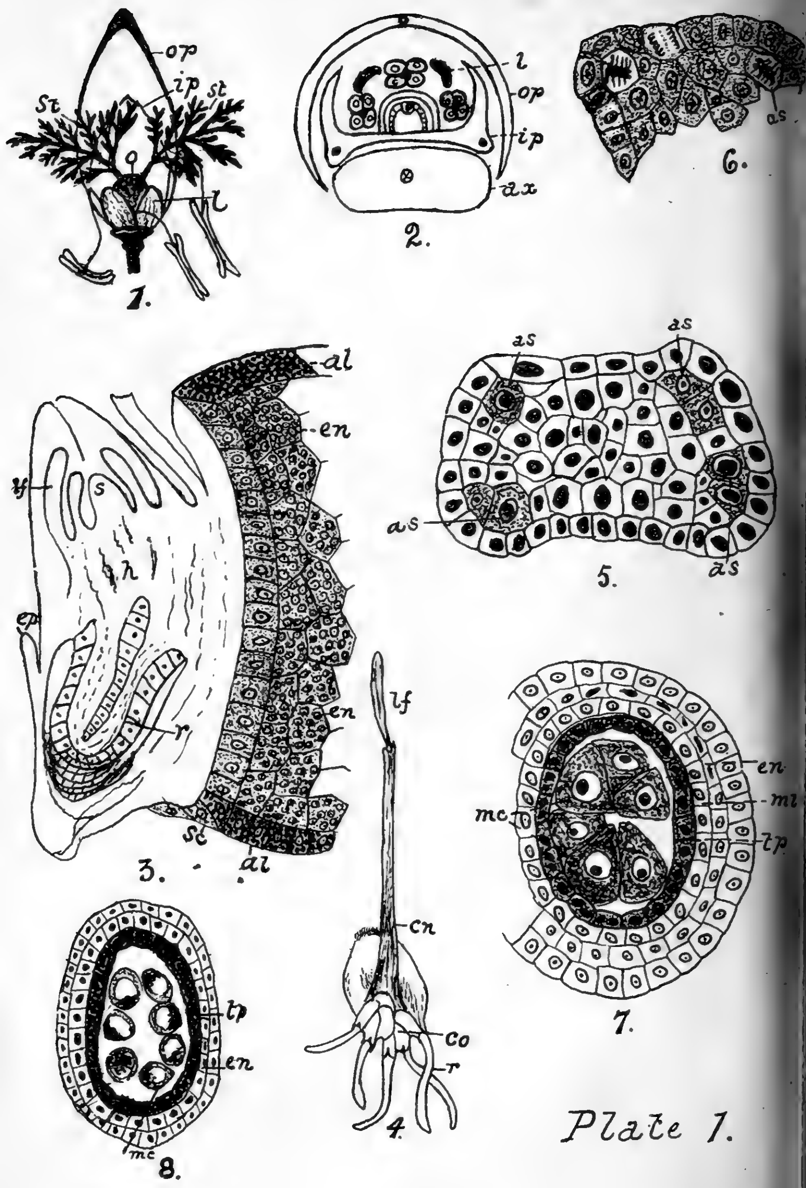
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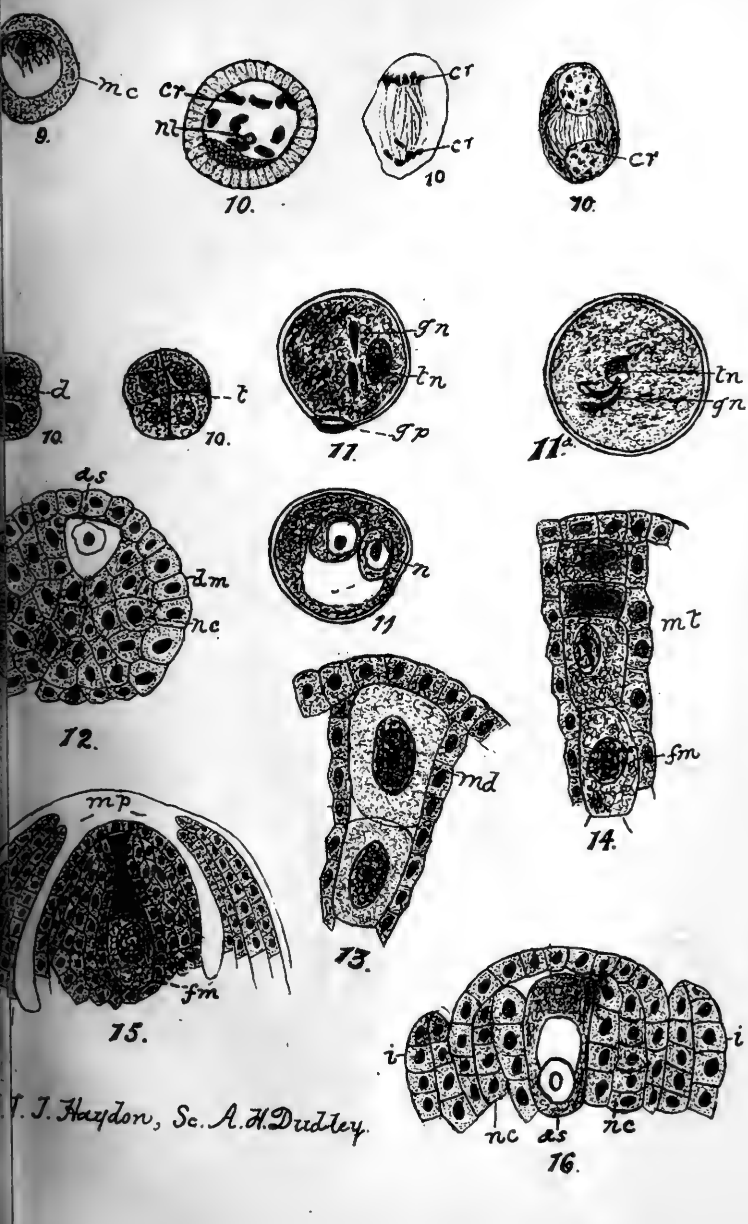
Plate 1.



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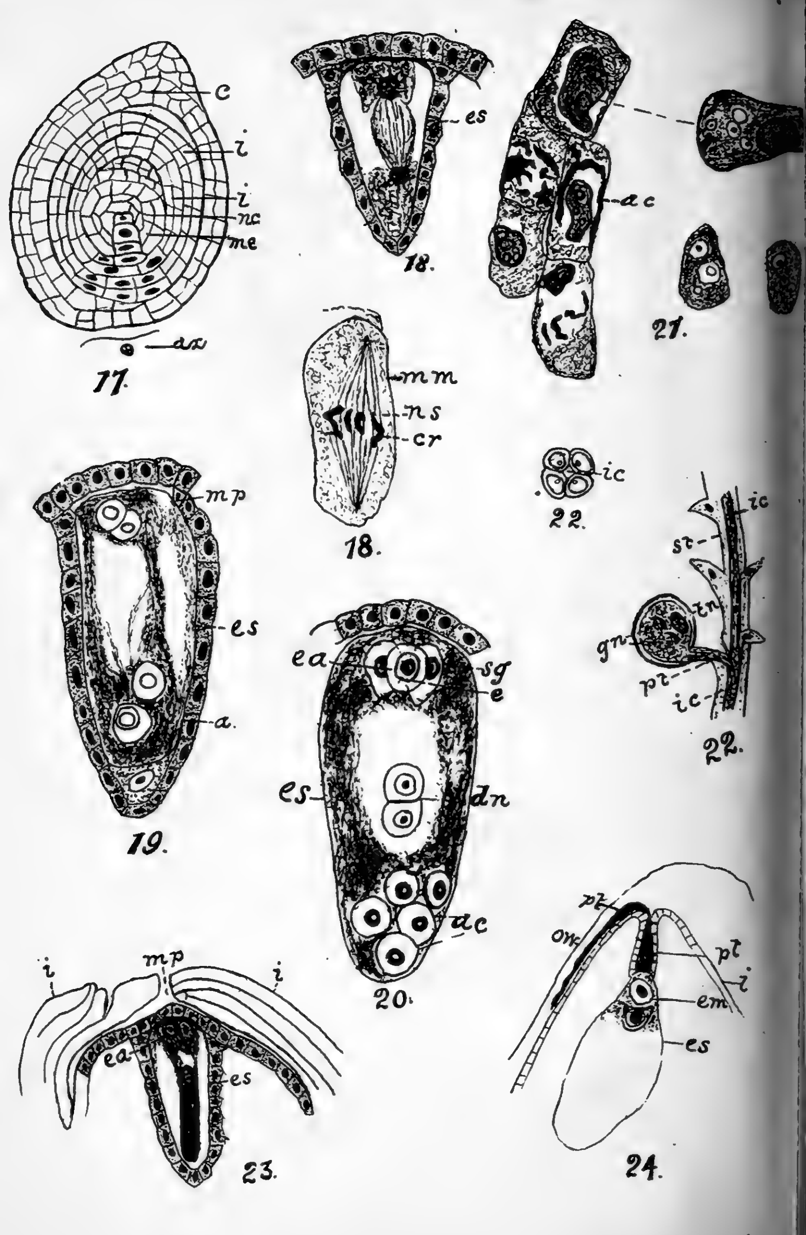
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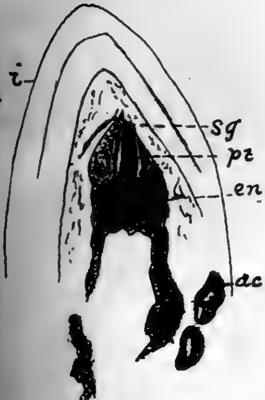

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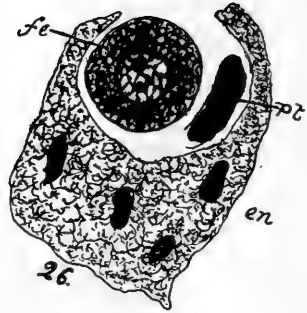

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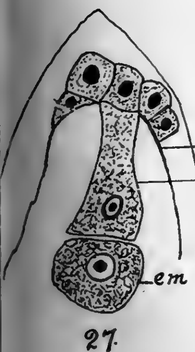

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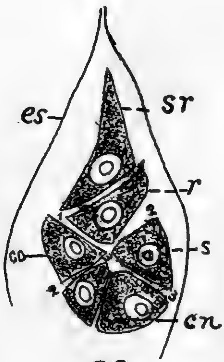

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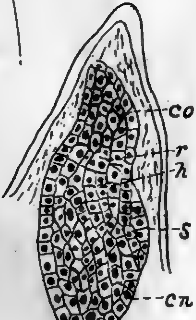

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Plate II.

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EXPLANATION OF PLATES.

a Antipodal; *ac* antipodal cells; *al* aleurone layer; *as* archesporium; *ax* axis; *c* carpel; *cn* cotyledon; *co* coleorhiza; *cr* chromosomes; *ct* conducting tissue; *d* dyad; *dm* dermatogen; *dn* definitive nucleus; *e* egg; *ea* egg apparatus; *em* embryo; *en* endosperm; *ep* epiblast; *es* embryo-sac; *et* endothecium; *fm* functioning megaspore; *fn* female nucleus; *gn* generative nucleus; *gp* germ pore; *h* hypocotyl; *i* integument; *ip* inner palea; *l* lodicule; *lf* leaf; *m* microsporangium; *mc* microspore mother-cell; *md* megaspore dyad; *me* megasporangium; *mm* megaspore mother-cell; *mt* megaspore tetrad; *mp* micropyle; *n* nucleus; *nc* nucellus; *ns* nuclear spindle; *op* outer palea; *ow* ovary wall; *p* pollen grain; *pb* periblem; *pl* plerome; *pp* primary parietal-cell; *ps* primary sporogenous cell; *pt* pollen-tube; *r* root; *s* stem; *sg* synergid; *sr* suspensor; *st* stigma; *t* tetrad; *tn* tube nucleus; *tp* tapetum.

PLATE I.

Fig. 1. Sketch of a wheat flower.
2. Floral diagram sketch.
3. Longitudinal section of a grain, showing embryo and endosperm.
4. Developing seedling.
5. Sorus of young Microsporangia in transverse section. × 445.
6. Dividing archesporial cells. × 445.
7. Transverse section of a Microsporangium showing wall layers. × 445.
8. Microspore mother-cells free in the loculus, synapsis.
9. Microspore mother-cells dividing.
10. Dividing Microspore mother-cells showing chromosomes. × 687.
11. Pollen grain of wheat showing vegetative nucleus and two generative nuclei. × 445.
11a. Do. do. of *Secale cereale* rye (after Golinski).
12. Section of nucellus showing archesporium. × 533.
13. Dyad archesporium. × 553.
14. Tetrad of megaspore mother-cells. × 533.
15. Inner functioning megaspore.
16. Archesporium with apical non-nucleated cytoplasm.

PLATE II.

17. Transverse section of Ovule showing closly appressed integument layers.
18. Spindle (× 1125) and Telophase (× 445) Mitoses in first division of embryo-sac cell.
19. Four-celled embryo-sac. × 445.
20. Ten-celled embryo-sac. × 300.
21. Antipodal cells (× 183) with plate-like contents, × 687.
22. Germinating pollen grain on a stigma branch. × 183.
23. Egg apparatus pressing open the micropyle to admit pollen-tube. × 183.
24. Course of pollen-tube in the ovary
25. Pollen-tube lying within a synergid. × 183.
26. Fertilised egg.
27. First segmentation of the fertilised egg.
28. Longitudinal section of an embryo-plate of six cells. × 445.
29. Older embryo showing differentiation of parts. × 183.

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ABSTRACT OF PROCEEDINGS,
PRESIDENT'S ADDRESS ON "THE NUCLEUS IN PLANT CELLS," WITH TWO PLATES,
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Officers and Council Elected 22nd January, 1909.

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FORTIETH ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

The President and Council in presenting the Fortieth Annual Report are pleased to record satisfactory progress of the Society.

The Meetings have been well attended, and the papers read were followed with close attention and appreciation, a pleasing feature being the greater interest taken in the exhibits. The five papers read during the session were excellent, and each maintained the character of originality. Most of them were illustrated by numerous photographic slides. The Council hereby express to these gentlemen their hearty thanks.

Two interesting and instructive demonstrations were closely followed by a large number of members—one by Mr. J. B. Garnett, of the Manchester Microscopical Society, on the use of the hand microtome, and the other by Mr. W. T. Haydon on serial section cutting. Both gentlemen showed themselves masters of the manipulation of the instruments, and the practical hints given by them were of great value to the members, many of whom received very useful information in reply to queries on points of difficulty.

At the Annual Conversazione, held in May, many members of kindred societies were present and contributed to the success of the meeting by exhibiting microscopic and photographic slides of scientific and general interest. Our Society was well represented in the number and in the useful and varied character of exhibits by the members.

A number of instruments and a variety of apparatus were also shown by Messrs. Thomas Armstrong and Brother and Messrs. Flatters and Garnett.

The October Meeting was also devoted to the exhibition of objects under the microscopes, several of the members giving a brief explanation of their exhibits, which were much appreciated by the members and a number of visitors.

There were two Field Meetings held in conjunction with the Science Students' and Geological Associations, one on May 16th to Hilbre, and the other on June 20th to Formby.

It is very gratifying to note the disposition of the younger members to avail themselves of the experience of the older ones with regard to difficulties they have in the preparation of material and mounting of slides, also in the manipulation of the microscope, focussing, lighting, etc.

Two Honorary and two Ordinary Members have been enrolled during the past year.

The Society has lost two members by death, and the present membership consists of six Honorary Members and forty-nine Ordinary Members.

Mr. W. T. Haydon having retired from the position of Honorary Secretary, after serving the Society in that capacity for eight years, the Council desire to place on record their sense of deep appreciation of his valuable services rendered so ungrudgingly and with such far-reaching results. His enthusiasm and personal assistance to the members generally have placed the Society under a debt of gratitude, and the thanks of the Council are warmly accorded to him.

By death the Society has lost two members—Mr. Alfred Leicester and Dr. John Newton. Mr. Leicester joined the Society 33 years ago, and was its only life member. For a period of 18 years he rendered valuable service as Curator and Librarian. Though of late years he has not been so frequently with us, his loss is much felt. Dr. Newton had been associated with the Society from the first, and occupied the Presidential Chair in 1875 and in 1894-5. He was a most active member, and remained a member of the Council until a few years ago.

The following additions have been made to the Library:—

By presentation: Two Minute Books of the Liverpool Natural History and Microscopical Society, formed in 1853, which ran concurrently with our Society (founded in 1868) until its dissolution in 1888. The books are of peculiar interest, and the Council is deeply indebted to the kindness of Messrs. J. T. Norman-Thomas and J. M. Williams for presenting such a valuable memento connected with the early life of our Society.

Also by presentation: Publications of the Royal Microscopical Society, Queckett Club, and Manchester Microscopical Society.

By purchase: Annals of Botany, and the Ray Society's issue.

To Mr. F. N. Pierce and the members of the Lantern Committee the Council again acknowledge with thanks their ready assistance and helpfulness.

The following is a brief account of the various meetings:—

January 24th—The President, Mr. A. H. DUDLEY, delivered his Inaugural Address, on "Floral Development and Embryogeny in Wheat," with lantern illustrations. The address was printed with the last Report.

February 7th—Mr. J. B. GARNETT, of the Manchester Microscopical Society, gave a demonstration on the use of the hand microtome, and this was followed by a demonstration by Mr. W. T. HAYDON in serial section cutting.

March 6th—A paper, entitled "The Morphology of the Radiolaria," was read by Mr. J. D. Macphail, and was illustrated by a series of beautiful lantern slides, kindly lent by Mr. J. T. Norman-Thomas, from whose preparations they had been photographed.

April 3rd—Mr. W. T. HAYDON read a paper, entitled "The Life Story of a Pine Tree, as told by itself," and a number of excellent lantern slides were shown in illustration.

May 1st—The Annual Conversazione was held. The exhibits of members were, as usual, chiefly living microscopic organisms; other objects of more general scientific interest shown by members of kindred societies added greatly to the success of the gathering.

October 2nd—This meeting was devoted entirely to microscopic exhibits, and several members briefly described the objects they were showing.

November 6th—Mr. C. F. BURNE read a digest of Professor Francis Darwin's Presidential Address to the British Association at their Annual Meeting this year. A discussion followed.

December 4th—Mr. H. W. GREENWOOD delivered an address on "Some Developments in Modern Petrology," which was illustrated by a number of lantern slides. A lantern slide photographed in colours by the "Lumiere" process from a micro. slide under polarised light was shown on the screen. This was prepared by Mr. DRIVER.

THE LIVERPOOL MICROSCOPICAL SOCIETY,

IN ACCOUNT WITH THE TREASURER.

Dr.

				£	s.	d.
To Rent of Rooms...				10	10	0
,, Printing, Stationery and Postages				16	17	3
,, Sub-Librarian				1	0	0
,, Attendance				2	2	0
,, Annals of Botany	£1	10	0			
,, Subscription, Ray Society	1	1	0			
				2	11	0
,, Lantern Expenses				0	8	8
,, Fire Insurance Premium				0	5	0
,, Cost of Tea, December Meeting				0	9	0
,, Cheque Book				0	2	1
,, Balance...				33	10	5
				£67	15	5

Cr.

	£	s.	d.
By Balance from 1907	31	5	2
,, Suspense Account	5	5	0
,, 4 Subscriptions, 1907	2	2	0
,, 39½ ,, 1908	20	14	9
,, 5 Entrance Fees	2	12	6
,, Part Cost of Reprints of President's Address	1	0	0
,, Advertisements in Annual Report	4	6	6
,, Bank Interest	0	9	6
	£67	15	5
By Balance...	£33	10	5

Examined and found correct,

W. GRISEWOOD,
J. R. HAYDON.

A. H. DUDLEY,
Hon. Treas.

LIVERPOOL, 24*th January*, 1909.

"The Nucleus in Plant Cells,"

BEING THE

PRESIDENTIAL ADDRESS

Delivered to the Liverpool Microscopical Society on 22nd January, 1909,

BY

ARTHUR H. DUDLEY.

THE greatest incentive to microscopic investigation, and attended by such splendid results during the latter half of last century, is to be found in those researches which established the "CELL" to be the structural and physiological unit of the organism—plant or animal (Fig. 1).

Interest first centered around the wall as the essential part of the cell, later, when some cells ("globules") were found which never formed walls, it was transferred to the viscid contents of the cell, and finally to the nucleus as its functions came to be understood.

The discovery of the nucleus in plant cells is ascribed to Robert Brown, an eminent English botanist, in 1833, although it seems to have been observed by Fontana in 1781. He first found it in the epidermal cells of some orchids, then in their pollen cells and in cells of numerous other plants, both Monocotyledons and Dicotyledons. His investigations, together with those of Schleiden and Schwann,[1] the founders of the cell-theory, and other observers, quickly demonstrated that the nucleus was a normal organ in both plant and animal cells—at least, all in a young state. It was supposed to originate within, and from the viscid plasmic cell contents, named protoplasm by Von Mohl in 1846. The protoplasm, in the form of a very fine network enclosing cell sap between the meshes, is now distinctively known as cytoplasm, which term also distinguishes it from the similar network of nucleoplasm (linin) in the nucleus. Out of the cytoplasm first arose the nucleolus, a minute more or less spherical body, around which the nucleoplasm was "precipitated," somewhat as crystals might be from a mother-lye, the outer portion consolidating into the nuclear membrane, and this in turn was surrounded by the protoplasm of the cell. Closer observations failed to show that any such apparent spontaneous formation of nuclei ever took place, rather the reverse, that every nucleus was derived from a parent nucleus, hence the formula *omnis nucleus e nucleo* became established. This was later extended to cover the fact that in all plants with normal sexual reproduction every nucleus produced during the ontogeny or development of the individual is primarily descended from the nucleus of the fertilised egg, *i.e.*, a nucleus formed by the union of egg and sperm nuclei. Attempts to further apply this dictum to the origin of the nucleolus have so far not been successful, its functions are still imperfectly understood and the subject of various interpretations.[2]

Concentration of research upon the nucleus brought into relief its composite nature and complex construction; its physical characters and varying chemical composition at different stages of its history. With improved instruments and methods of fixing and staining material, the parts played by the nucleus are seen to be of the first importance in every aspect of development, nutrition and reproduction in the organism. Our present concern being with the microscopic features of the nucleus, its detailed structure will now be considered.

STRUCTURAL FEATURES.

The nucleus, typically spherical, may take a form corresponding somewhat to the contour of the cell, elliptically or otherwise lengthened in elongated cells, &c., or may even show amœboid characters (Fig. 4). Its position is usually central in egg and other reproductive cells, also in young tissue cells, as well as in those of mid-life, being maintained in position by connecting protoplasmic threads. Finally, in mature cells it lies alongside the cell wall imbedded in the lining layer of cytoplasm.

THE NUCLEOPLASM.

The basis of nuclear construction is a fine network of nucleoplasm termed linin, like the meshwork found in the cytoplasm of the cell, and from which it is said to differ but slightly, either in chemical or staining properties. Some investigators believe them to consist of the same material, and have found evidence of their connection by means of filaments that pass from both into the nuclear membrane.[3] And when the membrane disappears, as during the course of nuclear division, the nucleoplasm and cytoplasm are brought into direct contact (Fig. 17). At the close of the division the cytoplasm of each daughter cell undoubtedly receives a portion of the dispersed nucleoplasm shut out from their nuclei, and this, as some have pointed out, may have a bearing upon the question of inheritance by the cytoplasm.[5]

In well-fixed and typically-stained preparations the nuclear reticulum is seen to consist of linin filaments studded with minute granules, microsomes, the intervening cavities being filled with nuclear sap or nutrient material (Fig. 2-3). Bütschli[4] considered this net-like appearance to be due to the section of minute globules—alveoli—of protoplasm enclosed in another substance of different consistency, as in an emulsion, and which formed the walls of the net. Both of these and other forms have been described.

THE CHROMATIN

is so named because of its strong affinity for taking up stains, haematoxylin and certain basic stains as methyl green, safranin, &c. It occurs in the form of minute granular bands lying across linin threads (Fig. 5), and both constitute in the nucleus the fine more or less deeply-staining reticulum, the movements of which are such prominent features in the early stages of the complex processes of mitotic or indirect nuclear division. During these changes it becomes deposited at different points in much larger masses, karyosomes or net-knots, eventually it is located in the chromosomes, and sometimes appears to be homogeneous.

THE NUCLEOLUS.

Enclosed within vacuolar spaces of the nucleus are one or more rounded bodies with a dense central part surrounded by a hyaline ring and bounded by a wall of nuclear substance—these are the nucleoli (Fig. 5). In active young cells they are comparatively large, taking up a great portion of the nucleus. They undergo dissolution, partial or complete, during the first stages of nuclear division; others appear during the later phases, and become the nucleoli of the daughter nuclei (Fig. 17).

In certain stages of development in pollen mother-cells and embryo-sac mother-cells, a single, very large nucleolus-like mass alone occupies the nuclear cavity, and is probably an extreme phase of synaptic contraction (Fig. 6). This stains deeply, and seems to correspond to the nucleolus-like features presented by the densely concentrated nuclei of a spermatozoid or spirogyra. Sometimes the nucleolus becomes vacuolated.

MITOSIS.

It will here be convenient to enter into a brief description of the intricate phenomena of nuclear division, and trace the varying phases that the chromatin and other substances pass through in the process.

There are two forms of mitosis, known respectively as heterotype, dealing with the first or reduction division of a spore mother-cell, *i.e.*, the division which ushers in the gametophyte—sexual forms of the plant, whose nuclei contain only one-half the number of chromosomes found in those of the sporophyte or asexual form; and the homotype, which takes place in sporogenous cells preceding the mother-cell stages and those (sporogenetic) immediately succeeding to form the spores, also in vegetative or tissue cells generally. Four stages of mitosis are usually described, namely:—Prophase, metaphase, anaphase and telophase.

HETEROTYPE MITOSIS.

In order to trace this form of nuclear division, which may conveniently be done in pollen mother-cells, it will be necessary to briefly describe their origin. Certain cells (Fig. 7) lying just beneath the epidermis of a very young anther—hypodermal cells—enlarge as archesporia, *i.e.*, cells marked off for the ultimate production of reproductive cells or spores. They divide into a layer of outer cells, the primary parietal or wall layer of the anther, and an inner primary sporogenous layer, whose cells after several divisions produce a mass of sporogenous cells, each of which apparently without further division developes into a pollen mother-cell (Fig. 8).

PROPHASES.—Selecting a sporogenous cell to illustrate the heterotype form of mitosis, we find a state of more or less constant duration reached after division of a mother-nucleus and the starting point of the succeeding division in the daughter-nuclei (Fig. 9). This, the so-called resting stage of the nucleus is characterised by a fine reticulum of linin, upon which the chromatin is deposited in the form of minute granules termed chromomeres—Weismann's Ids. These are considered to be aggregations of still smaller and ultra-microscopic particles variously named. The network gradually becomes more prominent, increases in staining power, and larger irregular masses of chromatin known as karyosomes or net-knots (Fig. 10) appear at intervals along the linin strands. These chromatin depositing centres when found to equal in number the specific number of chromosomes characteristic of the plant, have sometimes been termed "prochromosomes."[13]

The chromosome is a thickened segment of the nucleus spirem, and consists of a linin basis in which the chromatin lies imbedded (Fig. 15). One or more nucleoli are present, usually free from the network, the thickening walls of the net lose their reticulate appearance and change into a more or less continuous thread or spirem (Fig. 10), at least ends of the spirem are very difficult to find if present.[6]

Some observers [8, 9] describe for some pollen mother-cells two spirem threads lying side by side, supposed to represent the male and female parts of the chromatin; others[7] that the thread is single but undergoes a longitudinal split, which, however, closes up, and later segmentation into chromosomes takes place. Gates' investigations on Œnothera[10] incline him to the latter view rather than that of the presence and lateral approximation of two separate spirems. Probably single or double threads may characterise different plants (Fig. 11). Contraction and consequent thickening bring the thread or threads into a tangled skein or ball, which takes up a position at one side of the wall surrounding the nuclear cavity (Fig. 12). The nucleolus is usually caught and held within the thread, a little later it becomes free and finally disappears. In this first contraction of the spirem, known as the synapsis stage, one is always sure of dealing with the cell as a spore mother-cell, and not with its earlier form of a sporogenous cell.

Coming out of synapsis the convoluted thread loosens into a shorter and thicker hollow spirem (Fig. 13), and about this time the first or second longitudinal splitting, as the case may be, takes place. Preceding this division of the thread a bipartation and pairing of the chromatin granules is described, resulting in a double row of chromomeres running along the linin strands (Fig. 14). The thread now breaks up into segments representing the reduced number of chromosomes characteristic of the gametophyte forms of the plant. At first the chromosomes may be variously twisted and looped, and each such segment seems to consist of two somatic chromosomes of the sporogenous cell that were arranged end to end along the spirem (Fig. 15). These are cut off in pairs, which bend round, or otherwise come to lie side by side and form double or "bivalent" chromosomes, thus by their union reducing the number to one-half of that contained in the sporogenous cell. They gradually pass into typically **V**-shaped forms, move towards the equator of the cell, and there constitute the nuclear plate (Fig. 16).

This breaking up of the nucleus is accompanied by the dissolution of its membrane, thereby permitting of direct contact taking place between the nucleoplasm and cytoplasm of the cell. Series of fine granulated threads appear diverging from one polar centre towards the median circumference of the cell, then converging at a similar point in the opposite pole to form the well-known achromatic nucleus spindle. In general several such "polar" points are described as first appearing, giving a multipolar spindle, which later becomes bipolar (Figs. 17-18). The origin of these spindle filaments is the subject of various explanations. Strasburger thought they were derived from the nucleolus, others that they were threads of nuclear linin or possibly came from the cytoplasm. To these threads the chromosomes are attached, and their movements appear to be regulated by them.

METAPHASE.—Whilst the chromosomes form the nuclear-plate of the spindle they divide and the halves separate; of these one is drawn towards one pole, the other to the opposite pole to form the chromosomes of the daughter nuclei. This division really appears to be a re-separation of the end-to-end chromosome pairs that united to form the "reduced" bivalent chromosomes of the mother-cell. If so, the next—"homotype"—mitosis will divide each of these single or univalent chromosomes and distribute their respective halves to the grand-daughter nuclei of the four pollen cells (Fig. 20).

ANAPHASES.—These stages may be viewed as the reverse of the later prophases. They have to do with the movements of the separated chromosomes from the equator towards opposite poles of the cell, there to be utilised in the formation of a chromatin thread in each daughter nucleus (Fig. 18). The spindle threads attached to the chromosomes draw them apart and to the respective poles.

A longitudinal split is described as occurring in them earlier or later in this period. Mottier is convinced that this is the longitudinal split observed in the earlier prophase, and Miss Nichols in Sarracenia[12] looks upon it as the dividing line that separates the daughter chromosomes of the next or homotype division.

TELOPHASES are stages dealing with the movements of the chromosomes within the daughter nuclei. The chromosomes apparently join ends[8] and form a new temporary spirem, but in this heterotype mitosis nothing approaching an ordinary resting nucleus is reached (Fig. 19) A membrane now covers in each daughter nucleus and the division is completed. Allen did not find a nucleolus in the daughter cells of Lilium at this stage.

The heterotype form of mitosis is sometimes viewed as a qualitative division, *i.e.*, that there are differences in the construction of the chromosomes, which may be of physical, chemical or other nature, but to what extent is an open question. Mottier thinks that as all the chromomeres in a spirem are not always paired, especially the smaller ones (Fig. 14), the probabilities are that these may become part of one chromosome or another, and "if we are in anyway justified in ascribing some individual quality or qualities to these apparently unpaired granules, then we are justified in concluding that some chromosome or chromosomes are to that extent hereditarily different from others."[7]

In Monocotyledons coincident with the telophase stages, an equatorial plate of minute granules, microsomes, appears generally; this develops into a wall separating the two daughter cells—successive division—each of which therefore receives one-half of the divided spindle threads. These fibrils remain outside the nucleus, and merge with the cytoplasm of the cell (Fig. 20).

In Dicotyledons the rule is for the four pollen nuclei to be formed before they are divided by cell walls—simultaneous division (Fig. 21).

HOMOTYPE MITOSIS.

In this form of nuclear division applicable to tissue or somatic cells, *i.e.*, the ordinary or body cells of the plant and those cells immediately preceding and succeeding the spore mother-cells, and in which there is no stage comparable to synapsis so characteristic of the prophase in mother-cells. The number of chromosomes is always alike in parent and daughter nucleus; in cells of the gametophyte the reduced number obtains, in the sporophyte cells twice as many.[11] For Lilium the numbers given are respectively 12 and 24.*

Immediately following the telophase of the previous heterotype mitosis in the mother-cell, the spirem of the daughter cell breaks across (Fig. 22) the prior points of union into chromosomes corresponding in external features with those from which the spirem originated, and are believed to be identical by Allen in Lilium, Gates in Œnothera, also by others. Spindle threads appear attached to the chromosomes, which move to the equator of the cell and form the nuclear plate, both together constitute the spindle ending the prophase (Fig. 23).

Each chromosome now splits longitudinally into two equal halves—equation division (Fig 24). The line of separation is considered to be the same as that seen in the anaphase of the previous mitosis.[7, 12] The chromosomes are now drawn apart and towards the respective poles by or along the spindle fibrils, there they become closely pressed together (Fig. 25) and enter upon the telophase.

* For numbers in many other plants, see Morphology of Angiosperms, Pt. 2, 1904, pp. 81-2.

The massed chromosomes quickly begin to show vacuolisation (Fig. 26), and their chromatin thus broken up into irregular portions is arranged along the linin reticulum, a nuclear membrane is formed and the resting stage of the daughter nucleus is reached. One or more nucleoli which appeared during the anaphases enter each new nucleus. In some instances nucleoli may remain outside the nucleus in the cytoplasm (Figs. 17 and 19), where they soon disappear altogether.

MITOSIS IN VEGETATIVE CELLS.

The resting nucleus, as already described, contains one or more nucleoli and the characteristic reticulum, which gradually passes into a thickened convoluted spirem. This splits longitudinally and into elongated, more or less bent chromosomes with spindle fibrils attached to the ends, which point towards the respective poles of the cell where they converge in a cap of kinoplasm, and from which they were probably derived. In Sarracenia[12] the spindle filaments probably come from the nuclear linin, no break in the membrane taking place until they have begun to appear (Fig. 27).

The chromosomes lying side by side in the nuclear-plate are, in the anaphase, drawn by spindle fibrils end-on towards the poles, their free bent ends pointing towards the equator, or to the sides of the cell (Fig. 28). They shorten, thicken and unite more or less compactly into the daughter spirem. After vacuolisation has taken place and the chromatin has been distributed, the linin thread takes on the net-like appearance and constitutes the reticulum of the daughter nucleus. Spindle threads stretching across the equator of the cell connect the two groups of chromosomes.

Minute granulated microsomes appear at points along these fibrils in the mid-region of the cell forming the cell-plate, and are gradually formed into a partition wall which divides the two daughter cells (Fig. 29). Nucleoli reappear usually in the polar regions of the daughter cells, a nuclear membrane is formed, and the resting nucleus is completed

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This brief account of mitosis is of general import only and not descriptive of what may take place in any particular plant, but includes phases observed in several.

AMITOSIS

is another form of nuclear division known as direct, where the nucleus separates into two parts, each of which either goes to form the nucleus of a new cell or the old cell becomes binucleate, and if the process be repeated, multinucleate (Fig. 30). This mode, at first thought to be of almost universal occurrence, was, after the discovery of mitosis, first described by Anton Schneider in 1873, found to be of limited application, at least in cells of the higher plants. It is chiefly observed in cells in apparently abnormal physiological conditions and others too old for the ordinary stages of mitosis to take place as many large cells of vegetative tissues, and is also commonly seen in the large cells surrounding developing sporogenous cells and spores, *e.g.*, the tapetum of anthers and sporangia of higher cryptogams (Fig. 31).

The process begins with a median constriction in the nucleus, which gradually deepens until the division is complete, and the daughter nuclei usually remain in close proximity to each other. There is no division of the cytoplasm, except in those cases where walls are formed, the cells simply becoming multinucleate. In some instances there may be stages suggestive of mitosis, where attempts appear to be made to first break up the thread into chromosomes. And experiments with cultures of spirogyra showed that either mode of division might be induced in the nuclei by altering the medium of growth. When ·5 to 1 per cent. of ether was added to water containing the plants they began to divide amitotically, and mitosis was resumed on replacing them in water under normal conditions.[14]

Amitosis "is characteristic of highly-specialised or degenerating cells in which development is approaching its end." It appears to be a process needing quick accomplishment, due in a measure in degenerating cells to their lower vitality and probable lack of food supplies (Fig. 30). On the other hand, where these supplies are abundant and rich, they may possibly incite to very rapid growth and attendant direct division of the nuclei, *e.g.*, tapetum cells (Fig. 31). Here also the physiological conditions surrounding the sporogenous cells are unique, initiating, as they do, those remarkably striking phenomena, which result in the biological transition of cells with sporophyte characters into those of the gametophyte. The change results as a consequence of the inter-relations between the physiological and biological conditions in the cells accompanying this aspect of the alternation of generations. The contra-aspect attendant upon the phenomena of fertilisation, by which the sporophyte characters are restored in the fertilised egg, has also its equally complex nutritive and biological changes.

THE CENTROSOME

is an extremely minute body with dark centre, usually lying in a hyaline matrix; it is situated just outside the nuclear membrane of animal cells, and is freely described also in those of many cellular plants. It is very active in connection with the earliest stages of mitosis, appearing often to start the process, particularly in reference to certain fibrils, astral and spindle, and has itself characteristic division figures (Figs. 32). Some observers have described its occurrence in the higher vascular plants, but its presence in their cells is generally discredited.

In form it is like a very small nucleolus, and suggestions of possible relationships between them have been made. The nucleolus is intra-, the centrosome extra-nuclear.

Ikeno[15], according to Yamanouchi, finds a centrosome developed within the nucleus of sporogenous cells in *Marchantia polymorpha*, but passes outside where it functions in mitosis.

FUNCTION AND INHERITANCE.

Nuclear studies have, in the main, tended to invest the nucleus with the kinetic energy, which not only originates, but also largely controls the physiological activities of nutrition and reproduction within the cell; and, as a morphological contribution, to locate the characters of inheritance in the chromatin. Both of these aspects are still the subject of diligent research, and are far from settlement. The special physiological relations that exist between cells of the asexual and the sexual generations must be of importance in understanding their biological significance, as already indicated and also considered in my paper on "Adoxa" read in April, 1906, and last year's address on "Wheat."

Investigations into the uses and parts played by the cytoplasm have had varying modifying effects upon the all-controlling powers ascribed to the nucleus. The interactions between them, both in regard to development and inheritance, according to numerous observers, show that the cytoplasm has still a large share in the interpretation of these problems.[5] The acquirement of new characters and the vexed questions of their inheritance, or non-inheritance, with the Mendelian and many other considerations, all centre around the nucleus for solution.

SUMMARY.

The cell-theory of Schleiden and Schwann gave the greatest impetus to microscopic investigations, particularly those centering around the nucleus; discovery of the nucleus and further research established it to be the essential factor of the cell; it was supposed to originate within and from the cytoplasm, the nucleolus first appearing and the nucleoplasm precipitating around it; proof accumulated that there was no *de novo* formation of nuclei, and that every nucleus in the organism descended from the fertilised-egg nucleus.

THE NUCLEUS is of diverse shapes, complex structure, and shows different physical and chemical characters during stages of its history and development.

THE NUCLEOPLASM.—Its structural basis is in the form of a linin reticulum, similar to the network found in the cytoplasm; both are supposed to be of the same material, and commingle during division of the nucleus. The nuclear-sap, or nutrient material, is enclosed within the meshes, and may show the alveolar appearance of Bütschli.

CHROMATIN.—The staining material of the nucleus is deposited along the specialised linin walls of the reticulum of the resting nucleus, the spirem thread in mitosis and in the chromosomes. It is usually in the form of fine granules—chromomeres or ids, karyosomes, &c., or it may appear homogeneous. The granules lie in bars or bands across the fibrils, and are separated into more or less equal pairs, with the longitudinal split in the spirem.

THE NUCLEOLUS, a granular body enclosed in a hyaline matrix and surrounded by a wall of nucleoplasm, is comparatively large in young cells, and undergoes partial or complete dissolution during early mitosis. It is replaced in later stages by new ones, which become the nucleoli of the daughter nuclei, or some may be dispersed in the cytoplasm and disappear. An extreme form, probably of nuclear synapsis, in pollen mother-cells and embryo-sac mother-cells gives condensed nucleolus-like nuclei, similar to those observed in spirogyra or spermatozoids.

MITOSIS, or indirect nuclear division, is of two kinds:—Heterotype, characteristic of spore mother-cells; and homotype, of all other cell nuclei. The leading features are described under four stages. PROPHASE: dealing with changes in the nuclear reticulum, spirem (and synapsis—heterotype or reduction division), chromosome formation, spindle and nuclear-plate; METAPHASE: the longitudinal splitting of each chromosome in the nuclear-plate; ANAPHASE: separation of the daughter chromosomes, and their movements from the equatorial region of the cell to its opposite poles; TELOPHASE: massing of the chromosomes at the poles, their union into a temporary spirem (heterotype process) or into the network of a resting nucleus (homotype). The heterotype division is reducing, the daughter nuclei containing half the somatic number of chromosomes, and characterises the change from sporophyte to gametophyte in the alternation of generations. It may be a qualitative division, the homotype is equational. In Monocotyledons the pollen mother-cells are separated by a wall after each mitosis—successive division; in Dicotyledons the four pollen cells are formed before they are parted by walls—simultaneous division.

AMITOSIS, direct division of the nucleus, is shown in cells dividing under exceptional conditions. It occurs in many large tissue and other cells too old for ordinary mitosis to take place. There are probably graded stages in attempts of some nuclei to form chromosomes; binucleate or multinucleate cells usually result. The process characterises cells with impoverished food supplies; and on the other hand by the copious and rich nutritive material connected with those nuclear changes in the alternation of generations, as tapetum cells, some endosperm cells, &c.

THE CENTROSOME is a minute granular extra-nuclear body of common occurrence in animal cells and those of many lower plants. It appears to initiate the mitotic phenomena, and has itself characteristic astral and spindle figures; an intra-nuclear origin has been described for the centrosome of Marchantia. The possible connection between nucleoli and centrosomes has been discussed.

FUNCTION AND INHERITANCE.—Nuclear studies are of the first importance in the interpretation of the physiology and biology of the cell. The heterotype nuclear changes are directly concerned with the transition from sporophyte to gametophyte cell. There are probably modifying influences in the cytoplasm to be taken into account in the modern problems of inheritance, &c., gathered around the nucleus.

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EXPLANATION OF DIAGRAMS.

PLATE I.

FIG.

1. A plant cell. *a*, Cytoplasm; *b*, nucleus; *c*, centrosomes; *d*, nucleolus; *e*, linin.

2-3. Alveolar Cytoplasm, after Wilson.

4. Tissue Cells, with variously-shaped nuclei.

5. Vegetative cell, with resting nucleus. *a*, chromatin threads; *b*, nucleus of Spirogyra.

6. Condensed nuclei in pollen mother-cells of wheat. 1-3, nuclei, *t*, Tapetum; *a*, Nucleus (Spirogyra).

7. Transverse section of a young Anther, 1-4, Archesporial stages.

8. Sporogenous cells in Anther loculus, surrounded by the Tapetum, *t*.

9. Resting Nucleus in Pollen mother-cell.

10. Spirem and net-knots in Pollen mother-cell nucleus.

11. Double spirem.

12. Pollen mother-cell in synapsis. *a*, nucleolus.

13. Contraction after synapsis, shorter and thicker thread

14. Linin strands, with single and double rows of chromomeres.

15. Spirem, with end-to-end Chromosomes.

16. Mitotic spindle of a mother-cell. *a*, spindle threads; *b*, nuclear-plate of V-shaped chromosomes.

17. Multipolar Spindle. *a*, outside Nucleoli.

18. Anaphase: Movement of Chromosomes towards the poles.

PLATE II.

19. Telophase. *a*, Nucleoli.

20. Successive division in Pollen mother-cells—Monocotyledon.

21. Simultaneous division in Pollen mother-cells—Dicotyledon.

22. Telophase: Chromosomes forming into Spirem of daughter-cells. *a*, cell-plate.

23. Nuclear-plate of Homotype mitosis. *a*, nucleoli.

24. Anaphase: Separated Chromosomes receding towards opposite poles.

25-26 Late telophase: Vacuolisation of chromosomes in daughter-cells. *a*, cell-plate; *b*, spindle fibrils.

27. Spindle threads formed from linin, after Nichols.

28. Vegetative-cell Nucleus in Anaphase mitosis.

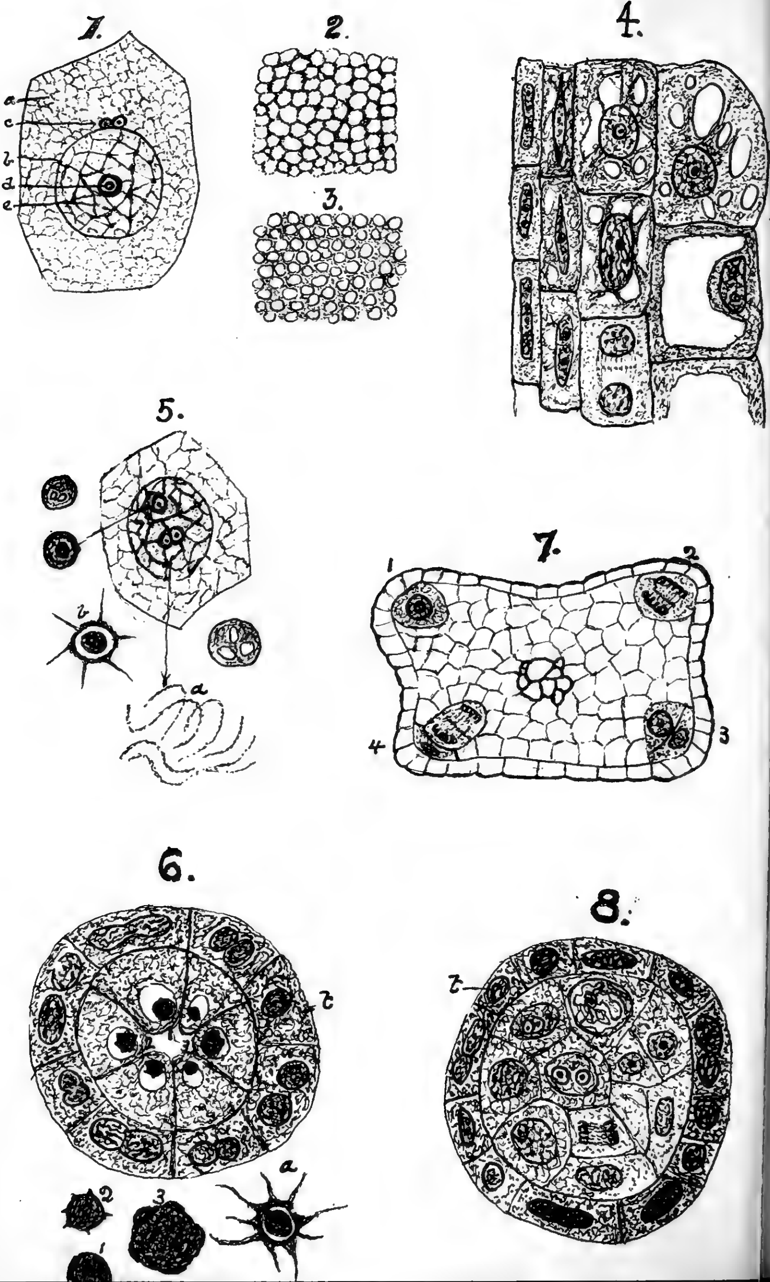
29. Cells showing later stages of division.

30. Binucleate and Multinucleate cells showing Amitosis.

31. Amitosis in Tapetum cells of Adoxa—surface view.

32. Cells showing Centrosomes. *a*, resting nucleus; *b*, metaphase spindle; *c*, daughter nuclei; *d*, centrosomes.

Plate I



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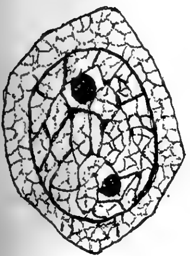

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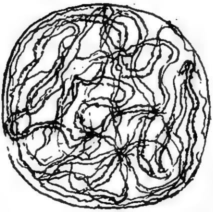

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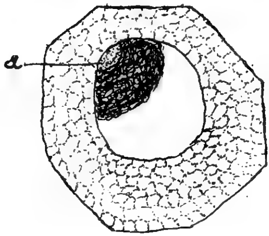

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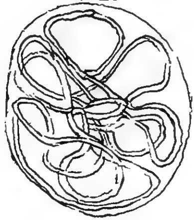

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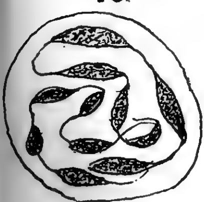

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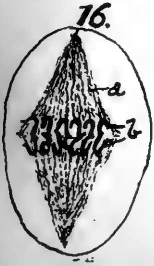

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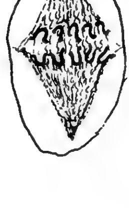

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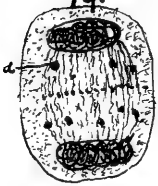
Plate 2.

19.



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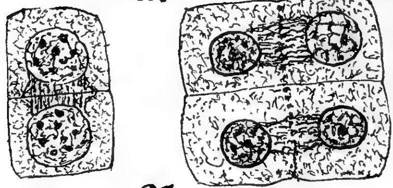

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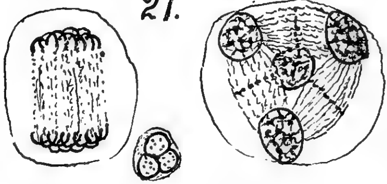

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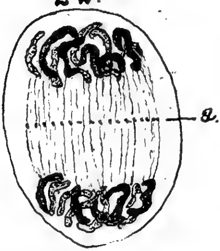

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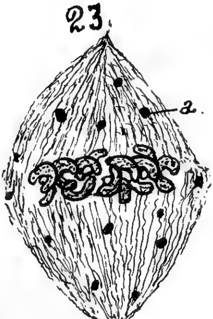

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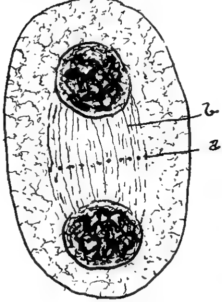

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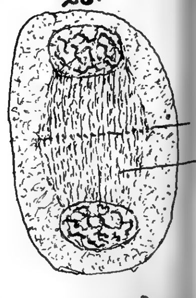

Plate 2.

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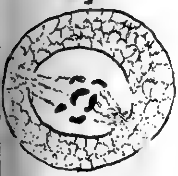

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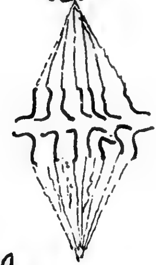

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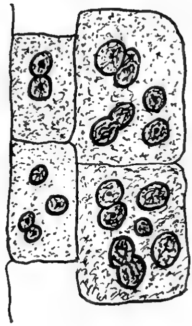

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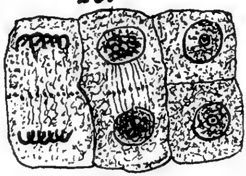

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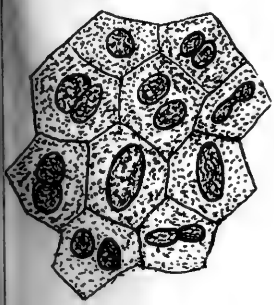

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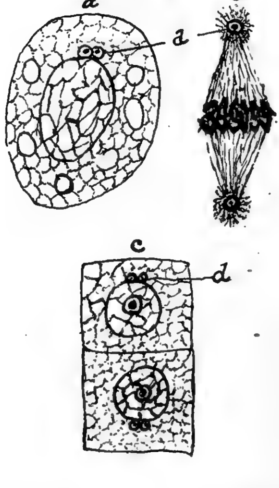

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was founded in the year 1869, having for its object the cultivation and advancement of Microscopy.

The ordinary Meetings are held at the Royal Institution, Colquitt Street, on the first Friday evening in every month, at Half-past Seven o'clock, except in the months of June, July, August, and September.

Candidates for Membership must be proposed by three or more Members, one of the proposers from personal knowledge of the candidate.

The Society possesses a useful Library, and numerous Microscopical preparations.

Further information may be had from the Hon. Secretary.

FORTY-FIRST

ANNUAL REPORT

OF THE

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ABSTRACT OF PROCEEDINGS,

PRESIDENT'S ADDRESS

ON

"OLD ENTOMOLOGICAL LITERATURE,"

AND LIST OF MEMBERS.

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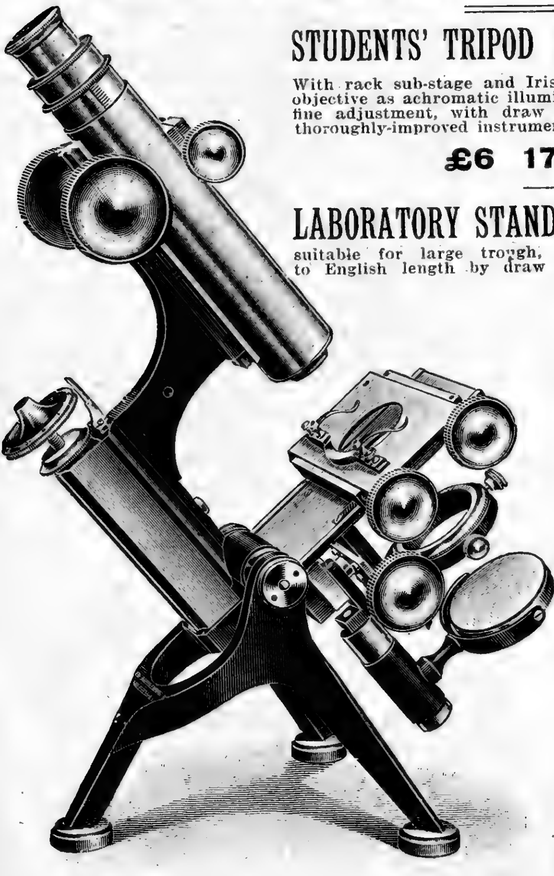

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FORTY-FIRST ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

The President and Council in presenting their Forty-first Annual Report are pleased to record that the progress of the Society continues satisfactory.

The attendance at the Meetings has been very gratifying, and the new arrangement, affording an extended period for the examination of exhibits, has been much appreciated. The members have freely availed themselves of the opportunities to show slides of their own preparation, thus furnishing favourable opportunities for mutual criticism and discussion. It is the Council's sincere desire that this spirit of inquiry should be fostered in every way possible.

The variety of subjects treated on in the papers and demonstrations has added considerably to the pleasure and instruction afforded. The papers read were all good, the illustrations by lantern slides being much enjoyed and of considerable merit. The Council hereby express to the various gentlemen who have read papers or given demonstrations their hearty thanks.

At the Annual Conversazione, held in May, members of kindred societies were present, some of whom exhibited objects of interest. A large number of our members exhibited under the microscopes slides of a varied and useful character.

A number of instruments and a variety of apparatus were shown by Messrs. Thos. Armstrong & Brother and Flatters & Garnett, Ltd.

A very successful and enjoyable Field Meeting was held on June 12th. Under the able leadership of Mr. Wm. Narramore, F.L.S., a large number of members visited several ponds at Bromborough, and numerous interesting objects were collected.

The evenings devoted to demonstrations continue to be very popular, and much useful information on preparation of material and mounting of specimens is derived from them.

During the past year four new members have been enrolled, and three have resigned.

The present membership consists of five Honorary and fifty Ordinary Members.

The Society has sustained a great loss by the death of the Rev. Dr. Dallinger, F.R.S., who was one of our earliest Presidents and for a long period took a very active interest in the Society. After his removal from this district he was made an Honorary Member, and remained so until his death.

The entrance fee has been abolished, and the Council hope that this will encourage the proposal of new members.

The following additions have been made to the Library:—

By presentation: Dr. Buchanan's work on the blood, by the author; also three numbers of Donkin's British Diatomacæ, by Messrs. F. N. Pierce and E. Leonard.

Also by presentation: Publications of the Royal Microscopical Society, Queckett Club, and Manchester Microscopical Society.

By purchase: Annals of Botany and the Ray Society's issue.

To Mr. F. N. Pierce and the members of the Lantern Committee the Council again acknowledge with thanks their ready and efficient helpfulness.

The following is a brief account of the various meetings:—

January 22nd—The President, Mr. A. H. DUDLEY, delivered his inaugural address, on "The Nucleus in Plant Cells," with lantern illustrations. The address was printed with the last Report.

February 5th—A paper was read by Mr. F. N. PIERCE, F.E.S., on "Scales of Butterflies," illustrated by numerous lantern slides, followed by a demonstration of the method of preparation and mounting.

March 5th—Mr. T. A. JONES read a paper on "Natural Glass," illustrated by lantern slides.

April 2nd—Mr. J. D. MACPHAIL delivered an interesting address on Diatoms, illustrated by a number of very beautiful lantern slides (kindly lent by Mr. Helenus R. Robertson). This was followed by a demonstration of "dark ground" illumination by Mr. Macphail.

May 7th—The Annual Conversazione was held. A number of living objects and others of general interest were shown by the members and visitors.

October 1st—Mr. E. Leonard gave a demonstration on the "Mounting of Diatoms," which was much appreciated by the members present, and he explained many practical difficulties.

November 5th—Mr. W. H. Read read a paper entitled "Medusæ and Family," illustrated by a large number of very beautiful lantern slides, most of which were hand drawn.

December 3rd—Mr. A. H. Dudley gave an interesting demonstration on "Preparation and Staining of Botanical Sections," a number of slides being shown under the microscopes in illustration of the subject.

THE LIVERPOOL MICROSCOPICAL SOCIETY,

Dr. IN ACCOUNT WITH THE TREASURER. **Cr.**

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,, Lantern Expenses				0	9	2
,, Fire Insurance Premium				0	5	0
,, Amount sent for copy of Haeckel's "Radiolaria"				3	3	0
,, 1 Entrance Fee for 1909 returned ...				0	10	6
,, Balance forward				31	7	5
				£68	4	8

Cr.	£	s.	d.
By Balance from 1908	33	10	5
,, 45 Subscriptions for 1909	23	12	6
,, 5 ,, 1908	2	12	6
,, 1 ,, 1907	0	10	6
,, 1 Entrance Fee, 1909	0	10	6
,, Amount returned for Haeckel's "Radiolaria"	3	3	0
,, Bank Interest	0	7	9
,, Advertisements in Annual Reports ...	3	17	6
	£68	4	8
By Balance	£31	7	5

Examined and found correct,

W. GRISEWOOD.
T. A. JONES.

January 21, 1910.

A. H. DUDLEY,
Hon. Treas.

"Old Entomological Literature,"

BEING THE

PRESIDENTIAL ADDRESS

Delivered at the Royal Institution, Liverpool, to the Members of the

LIVERPOOL MICROSCOPICAL SOCIETY,

On Friday, the 21st day of January, 1910,

BY

F. N. PIERCE, F.E.S.

It was not without considerable hesitancy that I consented to occupy the highly honoured position of President of the Liverpool Microscopical Society, a position which, in the past, has been filled by many men of learning, whose names I hold with bated breath. Among them are those whose works live after them, though they have passed to their long rest; and others who have climbed the ladder of fame and are looked upon as experts in their several studies: whereas in my own case I have remained stationary, a mere student, learning but slowly the great mysteries of nature, lost in wonder, and grasping but dimly all the marvels revealed by the microscope.

In the twenty-one years that I have been a member of this Society it is natural to conclude I have arrived at man's estate. On the contrary, I still feel to be but a child in science, realising the littleness of my knowledge and the vast field open for investigation. It is this feeling of weakness that makes me hesitate to address you upon any microscopical branch of study. I choose rather as my subject "Old Entomological Literature," and desire to speak of books written on my favourite pursuit, which, so far as our Society is concerned, has few followers. Possibly the hope may be fulfilled that some of our members will be induced to enter the ranks of Entomology, which offer so many unique opportunities of studying the great Mendelian question of variation, inasmuch as it is possible to produce many generations of a species in a comparatively short period.

The metamorphosis of insects seems to have attracted the attention of authors from the earliest times. Allusion is oftentimes made in the Bible to insects of almost every one of the modern known orders. The locust, fly, bee, lice, moth, are all mentioned, but not butterflies. This is probably accounted for by its being a more recent name. Even Swammerdam, in 1735, speaks of them as " day moths." Aristotle appears to have accumulated a number of facts relative to the science, and it is to be regretted we have but an imperfect account of his studies. Several centuries later, Pliny gives us what was then known of insects, and mentions Apollodorus as the first monographer of insects, and it is from Ælian we learn that artificial flies were used by the Grecian anglers.

From that time for nearly 1,500 years we have an almost absolute blank in Entomological literature. About the middle of the 15th century, some attention appears to have been paid to insects, notably by one Ulysses Aldromandus, who died in 1605. He wrote a great Zoological work, which death prevented him from finishing, and he made probably the first attempt at a systematical arrangement since the days of Aristotle. From this time onward great activity was shewn in Entomology. Though Mouffet's "*Theatrum insectorum*" was only published in the 17th century, it may be regarded as the pioneer of English works, having had a long and chequered career previous to reaching the public. It was commenced by Dr. Edward Wotton, of whom we know but little. The next we hear of it is that the manuscripts fell into the hands of Dr. Thomas Penery, an eminent physician and botanist in the reign of Queen Elizabeth, who seems to have devoted a good deal of time to the study of insects, but in 1589 he was snatched away by an untimely death. His unfinished manuscripts were purchased at a considerable price by Thomas Mouffet, who reduced them to order, and added about 150 additional figures: but here again he died before he was able to send his material to the press. The work remained buried in dust and obscurity until it fell into the hands of Sir Theodore Mayerne, a Court physician in the time of Charles the First, who at length published it in 1634, in Latin, and it was so well received that in 1658 an English translation was published. One part treats of *De Papilionibus*, and occupies about 20 pages, in the margins of which are inserted 112 woodcuts of the rudest execution imaginable, yet for the most part perfectly intelligible to the present-day entomologist.

In 1662 Goedart published in Middleburg a work on insects, which was translated into English in 1685. Goedart in stated to have spent 40 years in the study of insects, and his drawings are far superior to those of his predecessors.

John Ray, son of a blacksmith, born at Black Netley, in 1628, began his work on insects at the advanced age of 75, but died two years afterwards, when his work was nearly ready for the press. He enumerates 50 species of butterflies, and in a letter to Dr. Derham, who subsequently published it, he gives a list of books available on the subject at that time.

One of Ray's friends, James Petiver, published an entirely entomological work, in which he enumerates about 80 British butterflies, the figures being (for these times) well executed. Fifty of them are undoubted British species, the remaining 30 figures are varieties, or the opposite sex to those figured. This was a common fault in those days, depicting and describing the male and female as two distinct species.

The next work that arrests our attention is that of Eleazar Albin, a painter of no small ability, who in the year 1720 published a "*Natural History of English Insects*," illustrated with 100 copper plates, engraven from the life.

A copy of this book I exhibit this evening. It is the first work with coloured illustrations of English insects, and contains such Lepidopterous insects as the author and his friends reared from caterpillars, exhibiting them picturesquely on the proper food plants. They are highly coloured by hand, and show what good colours were obtainable in those days.

Albin dedicated the plates to various persons, who bore the expense of the plates, and the entire work to Her Royal Highness the Princess of Wales.

In the preface he informs the reader that Mr. Dandridge employed him in painting caterpillars; and that he had painted "a lot of these and flys for Mr. How, and likewise several things relating to Natural History for Sir Hans Sloane," and that the Duchess Dowager of Beaufort was the first to persuade him to undertake the work. This excellent lady encouraged him by procuring subscriptions from persons of the first quality. He pathetically adds:—"Whilst this good lady lived it went on apace, and I am persuaded had been finished long since, if it had pleased God to have spared her, but after the loss of my patroness, subscriptions coming in slowly, and my circumstances (having a great family to provide for) not being able to carry it on without, retarded it." He criticises his predecessors as follows:—"All my drawings I have copied exactly after the life, having observed it a great fault in those who have gone before me in this way, that they either did not look often enough at their pattern, or effected to make the picture outdo nature." He seems to have used the microscope, for in his concluding remarks he says—"The colours of moths and butterflies which to our eyes seem as dust, if they be examined by the microscope every particle of them is a perfect feather. From the whole we cannot but conclude that they are the work of Infinite Power, and not the effect of mere chance, or the product of corruption."

This peculiar term "product of corruption" is due to a theory prevalent at that time, that insects were spontaneously generated from decaying vegetable matter.

He publishes a long list of subscribers, which shows the influence of his friend the Duchess, or the interest taken in the work by the aristocracy, as it includes Dukes, Duchesses, Earls, Lords, &c., His Grace the Duke of Westminster and the Right Honourable the Earl of Derby figuring side by side; several gardeners, apothecaries, chymists, members of the Bar, and "Mr. John Marshall, maker of optick glasses to his Majesty, at the Archemides in Ludgate Street." I take this to mean spectacles, or is it possible that His Majesty was a microscopist?

Contemporary with Albin, John Swammerdam appears to have been working in Holland, diving deeply into the mysteries of the science, his strong point being dissection and anatomy. He was evidently the first to have studied the anatomy of insects, and to have used a microscope for their dissection. That he was a keen observer, and a systematist of the most advanced ideas, is evident by his argument on the metamorphosis of insects, in which he was able to trace the perfect insect throughout all its mutations. His biographer, Herman Boerhaave, says:—"His singular sagacity in stripping off the skin of caterpillars deserves particular notice. This he effected by letting them drop by their threads into scalding water, and suddenly withdrawing them, for by this means the epidermis peeled off very easily, and when this was done, he put them into distilled vinegar and spirit of wine, mixed together in equal parts, which, by giving firmness to the parts, gave an opportunity of separating them without any damage to the viscera, so that, by this contrivance, the nymph could be shewn wrapped up in the caterpillar, and the butterfly in the nymph."

Previous to this, Mouffet, following Aristotle and all previous writers, had written:—"It is very remarkable that in this metamorphosis, which is performed by means of an aurelia, the silkworm's head becomes the butterfly's tail, and the head of this last the tail of the former, and the same thing happens in all other caterpillars that become Aureliæ." Swammerdam seems to have grasped one of the great

Darwinian truths, that animals are largely built after the same plan, and devotes some chapters to show that there is little difference in the anatomical construction of a frog, a man, and an insect.

John Swammerdam was born at Amsterdam in 1637, and he inherited the love of natural history from his father James, who is spoken of as a great naturalist, and the possessor of an extensive private museum.

John was intended for the Church, but after a serious examination of his own dispositions and talents, thought himself unequal to so important a work, and decided to apply himself to Physic. His relations with his father appear to have been far from happy, and this, coupled with the fact that he suffered a great deal from ague, seems to have had such an effect upon his constitution that, after devoting the best years of his life to collecting material for his great work, he suddenly took so violent a dislike to natural history that he could not bear even the sight of his most treasured specimens and preparations. Boerhaave says:—" The last day of September of this year 1673, our author finished his treatise on Bees, which proved so fatiguing a performance that he never after recovered even the appearance of his former health and vigour, and, indeed, it was an undertaking too great for the strongest constitution, to be continually employed by day in making observations, and almost constantly engaged by night recording them by drawings and suitable explanations." After entirely giving up the study of nature, " the remaining portion of his life was devoted to that of serving God, which alone he delighted in."

Boerhaave's description of his microscopes and method of manipulation is interesting. He says:—" For dissecting of very small subjects he had a brass table made on purpose. To that table were fastened two brass arms, movable at pleasure to any part of it, and the upper portions of these arms were likewise so contrived as to be susceptible of a very slow vertical motion, by which means the operator could readily alter their heighth, as he saw most convenient to his purpose.

The office of one of these arms was to hold the little corpuscle, and that of the other to apply the microscope. His microscopes were of various sizes and curvatures, his microscopical glasses being of various diameters and focuses, and, from the least to the greatest, the best that could be procured, in regard to the exactness of the workmanship and the transparency of the substance. He was so incomparably dexterous in the management of these useful instruments that he made every observation subservient to the next, and all tend to confirm each other, and complete the description. But the constructing of very fine scissors, and giving them an extreme sharpness, seems to have been his chief secret. These he made use of to cut minute objects, because they dissected them equably, whereas knives and lancers are apt to disorder delicate substances. His knives, lancets, and styles were so very fine that he could not see to sharpen them without the assistance of the microscope; but with them he could dissect the intestines of bees with the same accuracy and distinctness that others do those of large animals."

There is little doubt Swammerdam mounted microscopic slides. Boerhaave says:—" He discovered that the fat of all insects was perfectly dissolvable in oil of turpentine, and that they could not be preserved in balsam, and this discovery he always made the greatest secret of, because the fat of insects, when melted and then dried, looks like lime scattered over the parts, so as to obscure the viscera, and make it impossible to examine them. Thus he began, carried forward, and perfected without any assistance, in a private and middling station of life, more discoveries than all the writers of all the preceding ages." The book is profusely illustrated with beautiful copper-plate engravings.

Shortly after, in 1758, Moses Harris published "*The Aurelian or Natural History of English Insects, namely, Butterflies and Moths, Together with the Plants on which they feed. A faithful account of their respective changes: their usual Haunts, when in the winged state; and their Standard names as given and established by the worthy and ingenious Society of Aurelians.*" The name of Moses Harris is memorable in the annals of British Entomology. He was one of the first who endeavoured to form an Aurelian Society in this country, and was their first secretary. Like other works of this age, many of the plates are dedicated to some titled person. The insects are beautifully drawn, and some of them are well coloured; others are very crude and fancifully painted. The smaller species especially seem to have had very little care bestowed upon them. He was undoubtedly a careful observer. In describing the change of butterfly larvæ to the chrysalis, he says:—"The caterpillars, when ripe for their transformation, some hang up by the tail, with their heads perpendicularly downward, which are those of the thorny or spiked kind; the others fix themselves by the tail with their heads perpendicular upward, a silken string going round the middle, to support them. It may be observed that should the caterpillars of the branched kind fasten themselves to change, with a thread round the middle like the smooth class, they would never get their skin off them, being interrupted by the silk thread; therefore nature, to avoid that inconvenience, directs them to hang themselves perpendicular by the tail, that they may be free from everything which might obstruct them in their time of transformation."

His description of the various kinds of nets used in collecting is quaint. He gives a description of the clap net, or, as he calls it, "the bat folding net," as follows:—"The method of using the bat folding net is thus:—On seeing the insect coming toward you, you must endeavour to meet it, or lay yourself in its way, so that it may come rather to the right side of you, as if you intended to let it pass; then, having the net in your hands, incline it down to your right side, turning yourself a little to the right ready for the stroke, not unlike the attitude in which a batsman in the game of cricket stands when he is ready to strike the ball. When the fly is within your reach, strike at it forcibly, receiving the fly in the middle of your net, as it were between the two sockets of the benders, that being the part of the net which best receives the insect; and not only so, but should the fly strike against the wider part of the net, the course of air caused by the motion of the net would carry the fly with it, out of the net, between your hands, which I have often experienced. The motion of your hands in catching must be from your right hip to your left shoulder, not at all retarding the motion, till it is as it were spent, closing the net in the motion." I have no doubt these instructions were necessary for using the clumsy two-handled net. Nowadays, of course, only the ring net is used.

The descriptions of the insects are fair, and for the most part generally accurate, though in some cases he has fallen into error, notably in the Bedstraw Hawk. He says:—"It has been long in dispute whether the spotted elephant was a native of this Island, but it is now past doubt, as I had the good fortune to find a caterpillar of this moth, in marshy ground, at Barnscray, in Kent. I tried various herbs to bring it to feed, but my attempts were fruitless, and it died for want. The chrysalis on the plate was sent me from France, and the moth is produced." He correctly draws the larva he had found, but figures the Spurge Hawk which emerged from his French pupa. In plate XI., for some unaccountable reason, he introduces a variety of odds and ends, a broken clay pipe, a fragment of a decorated cup, a steel buckle, and a mussel shell!

He records the story of Lady Glanville. Speaking of the Glanville Fritillary, he says:—"This fly took its name from the ingenious Lady Glanville, whose memory had like to have suffered for her curiosity. Some relations that were disappointed by her will, attempted to set it aside by acts of lunacy, for they suggested that none but those who were deprived of their senses would go in pursuit of butterflies. Her legatees cited Sir Hans Sloan and Mr. Ray to support her character: the last gentleman went to Exeter: and on the trial satisfied the judge and jury of the lady's laudable inquiry into the wonderful works of the Creator: and established her will." The Death's Head Hawk he calls the Bee Tiger, from which it is evident that its propensity to visit bee hives for the purpose of stealing honey was then known. He uses the Linnæan names, but does not appear to follow any distinct order.

And here it will be necessary to introduce the greatest naturalist the world has ever been graced with, the immortal Karl Linne Linnæus. This illustrious philosopher came into the world on the 24th of May, 1707, in Sweden, and was a born naturalist. To him we owe the arrangement of the animal kingdom, which has been preserved ever since. His first edition of "*Systema Naturæ*" was published in 1735, which quickly ran through a number of editions, the twelfth being published in 1766. Before his time names were given indiscriminately, and it was no uncommon thing to call a butterfly by its description, the Black-veined White Butterfly being styled *Papilio albus venis nigris.* Linnæus devised a system of nomenclature that needed but two words for each species, the generic and specific names. The twelfth edition of this great work was decided upon for the starting point of nomenclature, which is upheld by the laws of Priority.

In 1781 James Barbut published "*The Genera Insectorum of Linnæus, exemplified by various specimens of English Insects, drawn from Nature.*" This book appears to be but little known. I am indebted to the Rev. Charles Dowding for drawing my attention to it, and lending me the copy exhibited to-night. The work is written in parallel columns of English and French. There is a long list of subscribers, which include names from both nations. Besides several titled people, there is also "Joseph Banks, Esq., President of the Royal Society." The plates are hand coloured, and the illustrations of the so-called neglected orders are, as far as I can judge, really good, but the single plate devoted to Lepidoptera is poor in the extreme, the colouring being wretchedly bad. The author, in a quaint preface, in which he occasionally breaks off into ecstasies over some point, seems to have been firmly convinced that insects are endowed with the same senses as mankind, and goes to great lengths to prove his theory. He states it is a long-established and received opinion that hearing is denied to insects, because certain insects utter sounds of buzzing, and "the Death's Head, which squeaks when hurt in a most plaintive tone, naturally shocks the human heart, and makes it shudder at the thought of destroying inoffensive animals," and further quotes Shakespeare, "The poor beetle, crushed beneath the foot, feels the pangs of death as great as when a monarch falls" [sic], then adds: "Gentle reader, pardon this digression; my feelings commanded my pen." He proceeds to prove that these cries are heard by their fellow insects, which either come to their assistance, as wasps and bees, or are warned to keep away from danger.

He gives a most graphic description of watching a spider, with an elaborate web, entangling a fly, which made a considerable buzzing noise in its efforts to escape, and argues that the noise must have been *heard* by the spider, which quickly advanced and bit off one of the diptrons haltera: "but," he says, "suppose the spider to be alarmed only by the vibration of the web, the wind having continual power upon so small and so light a thread as the web is composed of, the spider would be in continual alarm without procuring any subsistence," therefore it must have been the noise of the fly in distress that alarmed the spider. He next apportions the parts of the insect's head to the various organs of sense, the antennæ being those of hearing, and the palpi those of smell. "As to form, that matters not: nature, far superior to the utmost soaring of human wisdom, sports luxuriant with her celestial fancy, and locks up the most delicate organs in invisible meandering membranes, the outer parts or extremities of which organs, appear only as an ornament to the form of the animal, the least deficiency in which deforms the creature. O nature! heaven-created! thy works declare thy origin! All holiness, knowledge supreme, wisdom inexplicable! permit me, only a fashioned atom of thy animated matter, to wish for knowledge sufficient to explain thy wondrous works!"

In 1773, Benjamin Wilkes published one hundred and twenty plates of "*English Moths and Butterflies.*" This work I have not seen. Previous to this, in 1742, he published some twelve plates which I exhibit to-night. They are dedicated to the worthy members of the Aurelian Society. He writes:—"Permit me the honour of laying before you twelve new designs of English Butterflies, creatures whose elegance and variety of beauty demand our admiration. Ignorance long imagined them spontaneous production of putrifying matter and undesigned chance, causes as little able to form an animal as to create a world; but your discoveries have rectified that mistake, and proved them to proceed from parents like themselves, after a constant though wonderful order of generation."

The figures on the plates are arranged in geometrical patterns, known as "Picture-making," a practice in vogue among working men until quite recently, and still adopted by the soldiers in India. The figures are beautifully and accurately engraved. His advertisement states: "Sets, plain and coloured from the real flyes, sold by B. Wilkes, against the Horn Tavern in Fleet Street, where any gentleman or lady may see his collection of insects."

In 1839 was published the celebrated "*Index Entomologicus*," by William Wood, F.R.S., F.E.S. This book served as the great popular guide to the entomologists of the early part of the 19th century. The author conceived the idea of delineating all the British species in a uniform size, reducing the larger ones, and enlarging the smaller species. By this means he was able to figure 1,755 species, which, in many cases containing both sexes, increased the number to some 3,000 figures, in a small 8vo book. The plates are hand coloured, and accurately done, though in some cases the white lead of the yellow pigments has oxidised and become discoloured with age. The letterpress consists of the Linnæan names of the species, as well as the English names, with synonyms, and about half a dozen words of description of the habitat and date of appearance. The number of known species is greatly increased owing to his including many local varieties as distinct species. In speaking of the great expense attending works on natural history, the author claims that "in this work, this objection is removed, since the figures, though drawn and coloured with the greatest possible care, do not exceed one penny each." At the end of the volume he enumerates seventy-two doubtful species, of which eight species are still included in the British lists, though only four of them are generally obtainable.

Following Wood, it is to Henry Tibbatts Stainton, born in 1822, that we owe the great stimulus given to Entomology in the 19th century. Stainton was a man possessed of ample means, and he devoted himself to popularising his favourite study. In 1856 he originated the "*Entomologists' Intelligencer*," a penny weekly periodical, which he conducted for ten years, at the same time bringing out a manual of British Butterflies and Moths, a model of ingenuity for compressing into two small 12mo volumes a full account of all that was then known in the classification of our British Fauna. This work is still largely used, and some workers even yet regret that a re-issue is not made, bringing the information up to date in the same style. His acumen for minute distinctions is unsurpassed, and he is still a court of appeal for deciding knotty points. He also produced the yellow-backed "*Entomologists' Annual*," which, besides supplying all the latest information on the science, served as an Entomological Directory. An obituary notice at the time of his death in 1892 graphically describes the man. It says:—"He had essentially the mind of a true scientist, industrious, exact, and scrupulous in publishing nothing he was not prepared to support by the strictest rules of evidence: it is most remarkable that scarcely anything he ever wrote has been controverted. Dealing as he did with no speculative views, he was singularly freed from the necessity of dissipating his energies in mere wordy contests." For many years he had monthly meetings at his house, to which all workers in Entomological Science were welcomed.

The natural result of so much energy was the publication of many handbooks relating to Lepidoptera. The wood engravings in the first edition of Edward Newman's work assisted the less scientific workers, whilst the Rev. J. G. Wood catered for the populace in many readable books, such as "*Insects at Home*" and "*Insects Abroad.*" In 1893 my friend Charles Golding Barrett commenced his large and expensive work on the "*Lepidoptera of the British Isles.*" This work, which is contained in eleven volumes, consists of full descriptions of the British Insects (excluding the *Tineæ*), with beautifully drawn and hand coloured plates of the species, including many varieties. As a natural history for reference it is of the greatest use, but its price naturally precludes its coming into general use. Unfortunately, he did not live long enough to see it finished, but left sufficient material to enable Mr. Richard South to complete it as far as the end of the *Tortrices.*

In 1895 Edward Meyrick published "*A Handbook of British Lepidoptera.*" This work is a masterly attempt to classify Lepidoptera by the structure of the wings, and there is no doubt that in time Entomologists will appreciate its value. A criticism in the "*Entomologists' Record*" shows to what an extent this book was meant to revolutionise old ideas. It reads:—"We have nothing but praise for the man who can step straight out of the old ruts. and produce a book which entirely uproots the treasured shibboleths of a school of Entomologists who were suckled on Newman and Stainton in their entomological babyhood, fed on Newman and Stainton in their youth, starved on Newman and Stainton in their manhood, and are still striving manfully to obtain nutriment from them in their old age."

The last complete work published is Richard South's "*Butterflies and Moths,*" for which he has used the very latest methods of photo-printing in colours. The insects are photographed direct, and are then coloured with the three-colour process, with wonderfully natural results. The work is good, and has the advantage of being of moderate price.

The most recent book, now in course of publication, is J. W. Tutt's "*Natural History of British Lepidoptera*," which he commenced in 1899. It is a veritable encyclopædia of Lepidopterology, and contains a collection of nearly everything that has been written about the various species. It also includes the original descriptions of the authors of the species, with descriptions of all the known named varieties, besides descriptions of new forms. Up to the present time this indefatigable writer has produced seven volumes, containing nearly 500 pages apiece, but he has only treated of a comparatively few species in each volume. The latest issue, published last year, dealing with seven species, will give some idea of the extent of the work. Presuming, at a moderate computation, that there are 3,000 species, we can reasonably hope to see the work, at the present rate of publication, completed in about 400 years!

Such is a brief outline of some of the more prominent works dealing with Lepidoptera. In addition to these, all the other orders of Entomology have had their votaries. It is difficult to find any branch of natural history that has had more attention paid to it than the numerous family of insects; their easy mode of collecting, the simplicity of setting and preserving, and the great diversity of form and colour has no doubt drawn into the field many students. And we may reasonably ask after all this work:—What do we know? It is a question that is easily answered by two small words—Very little. Each year some new point is added to our existing store of knowledge: but the great bulk of the work has still to be done. Who can truthfully assert that an insect can hear? That it possesses senses of a highly organised nature is evident, but what they are is yet uncertain; and when we look back to our old authors, with their primitive instruments, we are amazed at their having been able to accomplish so much. Our modern improvements in lenses, the greater accuracy of mechanical movements, and the wonderful contrivances for manipulation, point to a time when greater discoveries shall yet be made; but do we find this to be so? I fear not. If our present-day naturalists were weighed in the balance, I am afraid we should be found wanting. Golf, late dinners, social functions, and other hundred and one excuses are made. Only here and there do we find the real student, working quietly at his particular branch of study. *He* is not content to show the ordinary stereotyped slide that has been exhibited thousands of times before; he wants to dive deeper into the wonders of nature. The superficial view has little interest for him. His aims are higher; always probing here and sifting there to add another link to our chain of knowledge. And the reward? Money could not buy it. What cared our ancestors for money? Can we imagine such master-minds as Linnæus, Swammerdam, Albin, or Stainton taking this into consideration for one moment? No. They gave of their best. No need to mark their last resting-place with a block of granite: their work lives on. We have only to open one of their books, and the great master is by our side guiding us through the woods; while he points out the glittering gems as they flit from flower to flower—the same insects, the same flowers, that he knew. Modern science may have changed their names; but Nature, that good old dame, still continues to produce the same colours, the same forms. Her work is perfect, and perfection cannot be improved.

Liverpool Microscopical Society.

LIST OF MEMBERS.

January, 1910

HONORARY MEMBERS.

Witham M. Bywater, "Invicta," 33, Telford Avenue, Streatham Hill, London, S.W.

William Carter, J.P., M.D., F.R.C.P., Talavon, Deganwy, N. Wales.

R. Newstead, A.L.S., F.E.S., Hon. F.R.H.S., Liverpool University.

J. T. Norman-Thomas, F.L.S., 15 Fenwick Street.

Wm. Narramore, F.L.S., M.R.S.Inst., "Devonia," Cambridge Avenue, Great Crosby, Liverpool.

ORDINARY MEMBERS.

**Members of Council.*

ELECTED

1881 Abraham, Miss Emma C., Grassendale Park.

1900 Aman, F. T., Assoc. Mem. Inst. C.E., City Engineer's Office, Municipal Buildings, Dale Street.

1905 Armstrong, Frank, 112 Bold Street.

1907 Astbury, E., 72 Athol Street.

1908 Atkinson, Raymond F. M., 9 Esplanade, Waterloo.

1901 Bridger, Robert, 55 Seabank Road, Liscard.

1897 Buchanan, R. J. M., M.D., M.R.C.P., 6 Rodney Street.

1903 *Burne, Charles F., "Culver," Sunningdale Road, New Brighton.

1907 *Brown, W. D., "Holmleigh," Burscough.

1909 Bustard, Ralph, 25 Broughton Drive, Grassendale.

1904 *Croston, R., 13 Derby Lane, Stoneycroft.

1874 Davies, Edward, F.C.S., F.I.C., Chapel Chambers, Chapel Street.

1891 *Davies, Herbert E., M.A., B.Sc., F.I.C., Chapel Chambers, Chapel Street.

1879 Deacon, H. Wade, J.P., 8 Ullet Road.

1905 *Dearsley, A. H., 112 Bold Street.

1908 *Dowding, Rev. Charles, Fairholme Road, Great Crosby.

1902 *Dudley, A. H., 62 Selborne Street.

1892 Forshaw, F. H., Riverside, Halebank, nr. Widnes.

1882 Fullerton, James, 44 Clarendon Road, Egremont.

1879 Goodwin, Gilbert Smith, 23 Anfield Road.

1885 Gray, George Watson, F.I.C., "Allendale," Clarendon Road, Garston.

1882 *Grisewood, William, "Langdale," Rudgrave Square, Egremont.

1900 *Haydon, James Richard, 91 Ampthill Road.

1869 Healey, George F., "Oaklyn," 27 Cearns Road, Oxton.

1904 Haywood, Lieut.-Colonel Arthur Grimshaw-, V.D., "Rearsby," Blundellsands.

1904 *Jones, T. A., 27 Rockfield Road, Anfield.

1910 Kenworthy, A. B., "Avondale," Durning Road.

1905 Langley, Bertram, 51 North John Street.

1886 Larkin, Frederick Charles, F.R.C.S., 54 Rodney Street.

1907 *Leonard, Edward, 2 Cannon Mount, Claughton, Cheshire.

1910 Lunt, George, "Cropton," Formby.

1898 *Macphail, James D., 40 Moss Lane, Walton.

1909 Mason, T. D., 37 Handfield Road, Waterloo.

1893 Nuttall, F. R. Dixon-, F.R.M.S., "Ingleholme," Eccleston Park, near Prescot.

1888 *Pierce, F. N., F.E.S., 1 The Elms, Dingle.

1897 Powell, W. H., 2 Lord Nelson Street.

1909 Pryce, George, 75 Seymour Street, Birkenhead.

1902 Rappart, D. B., Mere Bank, Promenade, Liscard.
1881 *Read, W. H., "Lisadel," Caithness Drive, Liscard.
1885 Robertson, Helenus R., F.R.M.S., Upton Grange, Chester.
1908 Robertson, T. W., Burnton, North Mount Vernon, Glasgow.
1879 Scholefield, Joshua William, J.P., 33 Pembroke Road, Bootle.
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1907 *Tinne, Philip F., M.A. (Oxon), M.R.C.S., 4 Mayfield Road, Cressington.
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The Liverpool Microscopical Society

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Further information may be had from the Hon. Secretary.

FORTY-SECOND

ANNUAL REPORT

OF THE

LIVERPOOL

Microscopical Society.

ABSTRACT OF PROCEEDINGS,
PRESIDENT'S ADDRESS
ON
"THE STUDY OF THE STRUCTURE OF THE HEAD AND THORAX OF LEPIDOPTERA,"
AND LIST OF MEMBERS.

JANUARY, 1911.

LIVERPOOL:
DAILY POST AND MERCURY" PRINTING WORKS, FLEET STREET.

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LIVERPOOL MICROSCOPICAL SOCIETY.

SESSION XLIII., 1911.

Past Presidents.

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Rev. WM. BANISTER, B.A.
Rev. Dr. DALLINGER, F.R.S.
JOHN ABRAHAM.
J. J. DRYSDALE, M.D., F.R.M.S.
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JAMES D. MACPHAIL.
JOHN HAY, M.D., M.R.C.P.
A. H. DUDLEY.
F. N. PIERCE, F.E.S.

Officers and Council Elected 20th January, 1911.

President.

F. N. PIERCE, F.E.S.

Vice-Presidents.

P. F. TINNE, M.A., M.R.C.S.
J. M. WILLIAMS.

Hon. Treasurer.

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W. H. READ.
F. W. STRUMPEL.

FORTY-SECOND ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

The President and Council, in presenting their Forty-Second Annual Report, are pleased to note that the satisfactory progress of the Society continues.

The Meetings have been well attended, and the papers read during the year have been very good and varied in character, and often illustrated by capital lantern slides. The Council hereby express their hearty thanks to the gentlemen who have given demonstrations and read papers. An experiment has been made of devoting the entire evening occasionally to the illustration of exhibits under the microscopes, with satisfactory results, the members having entered heartily into the spirit of the arrangement, and made the meetings very enjoyable; and as members were encouraged to say a few words about their own exhibits, it has been advantageous in affording opportunities of bringing before the members many interesting exhibits, which would ordinarily not have been brought to the meetings, as they would usually not be considered to bear upon the subject of the paper. As this encourages individual observation and experiment, it is very desirable.

The evenings devoted to demonstrations continue to be well attended, and the special opportunities of acquiring technical knowledge of processes not familiar to many members are appreciated, and encourage the Council to continue them.

At the Annual Conversazione, held in May, members of kindred societies were invited, and many attended, contributing to the success of the meeting by exhibiting objects of interest.

Messrs. Thos. Armstrong & Brother and Flatters & Garnett, Ltd., showed a variety of apparatus.

Owing to the unfavourable weather during the summer no Field Meeting has been held, although it had been the intention of the Council to hold at least one.

During the year two new members have been enrolled and two have resigned.

The present membership consists of five Honorary and fifty-one Ordinary Members.

The following additions have been made to the Library:—

By presentation: "Marine Zoology of Okhamandal (India)," Part I., 1909, James Hornell, F.L.S.

Mr. W. Narramore, F.L.S., presented a copy of his work on "Preliminary Physiology."

By purchase: "Annals of Botany" and the Ray Society's issue.

The Council again acknowledge with thanks the ready and efficient services of Mr. F. N. Pierce and the members of the Lantern Committee.

The Council and Members showed their appreciation of the long connection and services of Mr. W. Narramore, F.L.S., M.R.S.Inst., by electing him an Honorary Member of the Society.

The following is a brief account of the various meetings:—

January 21st—The President, Mr. F. N. PIERCE, F.E.S., delivered his inaugural address on "Old Entomological Literature." The address was printed in the last Report.

February 4th—A paper was read by Mr. C. E. WALKER, M.Sc., M.R.C.S., L.R.C.P., &c., on "Mendelism," with lantern illustrations.

March 4th—A paper was read by Mr. F. W. STRUMPEL on "Bacteriology," illustrated by lantern slides, and also by cinematograph of Dr. Comandon's films of living bacteria, the films being exhibited by permission of Messrs. Pathe Frères.

April 1st—Demonstration of the Tongue of the Blow Fly, by Mr. F. N. PIERCE, F.E.S.; demonstration of the preparing and mounting of botanical sections, by Mr. A. H. DUDLEY; demonstration of "Slide Finishing," by Mr. C. F. BURNE.

May 6th—The Annual Conversazione was held. Many living objects and others of general interest were shown by the members and visitors.

October 7th—A paper was read by Mr. R. NEWSTEAD, M.S., A.L.S., &c., on "Tsetse-Flies (*Glossinæ*): Their Structural Characters and Bionomics," illustrated by lantern slides, diagrams, and specimens.

November 4th—The meeting was devoted to the exhibition of objects under the microscopes.

December 2nd—Mr. F. R. DIXON-NUTTALL, F.R.M.S., delivered an address entitled "A Talk about Rotifers," illustrated by drawings.

THE LIVERPOOL MICROSCOPICAL SOCIETY,

Dr. IN ACCOUNT WITH THE TREASURER. **Cr.**

Dr.		£	s.	d.
To Rent of Rooms		10	10	0
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By Balance from 1909	31	7	5
,, 3 Subscriptions 1908	1	11	6
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,, ,, 1910...	4	1	3
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W. GRISEWOOD & SON,
Chartered Accountants.

A. H. DUDLEY,
Hon. Treas.

"The Study of the Structure of the Head and Thorax of Lepidoptera,"

BEING THE

PRESIDENTIAL ADDRESS

Delivered at the Royal Institution, Liverpool, to the Members of the

LIVERPOOL MICROSCOPICAL SOCIETY,

On Friday, the 20th day of January, 1911,

BY

F. N. PIERCE, F.E.S.

It is gratifying to me to feel that you are able to place such confidence in me as to elect me to preside over our meetings for another year. And I must admit that I accept the honour with less reluctance than I did a year ago. This is entirely due to the loyal way in which you have rallied round me, overlooking my shortcomings, and ignoring my errors of omission and commission, that, while being so palpable to me, are probably no less observable to you. Still, with all this, uppermost comes the feeling that there is a harmonious chord of sympathy between us all, that the tide of our thoughts is swimming in the same channel, and that all are working for the common weal of our Society, therefore, with your continual help, I trust the coming year may see us wiser for the ideas we have exchanged, strengthened by an increased membership, and encouraged to prosecute our studies, knowing that we shall find an appreciative audience in the members of the Liverpool Microscopical Society.

The subject I have chosen to speak about in my address to you this evening, is " The Study of the Structure of the Head and Thorax of Lepidoptera "—a field of observation of wide and varied character, much of which has been entirely untrodden. I had hoped to have confined myself to the wing structure alone, but the amount of original work that was necessary was too large an undertaking for the short time I have had for the preparation of the address, and to-night I must be content to merely touch upon the ground in the most superficial way.

Lepidoptera have been classified as:—Insects with four sealed wings, Mandibles absent in the image, very rarely present in the pupa, first maxillæ with galeæ much lengthened and grooved, forming when united a perfect sucking tube, complete metamorphosis. The larvæ are eruciform (caterpillars), with three pairs of thoracic legs, and two to five pairs of abdominal prolegs. The eggs are of various shapes, some beautifully sculptured, others shining smooth, like mother o' pearl; the time of hatching varies according to species, some producing young larvæ in a few days, others lying over the winter before the eggs hatch. Experiments have been made which show that cold retards and heat accelerates the hatching; eggs that have been frozen have kept for a long period without affecting the larva. Unlike some other orders of insects, I know of no instance of a lepidopteron being vivparous.

The young larva on hatching is fully developed, and has its body segmented; these segments are observable during the different transformations, but owing to the segments sometimes being fused together, the division is not always apparent. In the larval state certain segments have spiracles, and others have not; this system is fairly constant throughout the whole order. The head is usually spoken of as the first segment, although in reality it is composed of several sclerites, fused together. Attached to this are the three thoracic segments, which carry on the upper tergite the wings, and on the lower sternite the three pairs of legs, as seen in the larva. Then there are the eight abdominal segments, each of which usually bears a pair of spiracles, concluding with the two genital segments. The head has a number of appendages. At either side is a large eye, the size apparently being regulated by the speed at which the insect travels, the swiftest having the largest eyes. The eye is built on a strong chitinous ring, and is covered with the facets so well known to microscopists, and present the appearance of honeycomb; sometimes the eyes are naked, sometimes clothed with hairs which project between the sutures of the hexagons. The eyes of insects have been the subject of much investigation, but I do not remember seeing a record of the chitinous ring. In some species the eyes are beautifully coloured, in shades of grey and black on part of the surface; the eye is largely loose, and can be turned round to expose a surface that is not ornamented. The markings do not appear to be constant, but vary in individuals as much as do the markings on birds' eggs. Between the eyes are the antennæ, which are so diverse in form that they alone would form a life-long study. They are undoubtedly an organ of sense, but whether analogous to one of our five known senses is still a mystery. There is one significant point that is worth noting, that wherever variation exists in the sexes the antennæ of the male are always more elaborate than those of the female. We now come to the mouth organs, which consist of a long tongue composed of two halves of a cylinder, which together form a complete sucking tube, at the tip of which are usually a number of papillæ; the tongue curves up vertically, and is protected at either side by a palpus. The palpi are often pointed, and generally possess an organ that, so far, I have not seen noticed. In the lepidoptera we are so constantly on the look-out for scent organs and scent glands that it is quite customary to put down any ornamentation confined to one sex as a scent organ; as this organ in the palpi is not confined to either sex. I think we can safely conclude it is not a scent organ, though it may prove to be an organ of smell. This, I think, disposes of the appendages of the head, the mandibles, so prominent a feature of the caterpillar state, entirely disappearing in that of the imago.

We now come to the thorax. The three segments are joined by a series of joints, which are wonderfully complex in their structure, many partaking of a crescent, with a central footstalk. To each of the sternites are attached a pair of legs; the forelegs are the most variable, and are in other orders often of great physical value—for instance, the comb and brush joint in the bees, which are used for cleaning the antenna. This in the lepidoptera is replaced by a hinged spur, the use of which is so far unknown; the legs are jointed, terminating in a pair of hooks or claws. In some families of butterflies the forelegs have become atrophid, and are apparently useless; the toe claws have disappeared, the entire leg being flattened and covered with scales, and are pressed tightly against the forepart of the thorax.

At the junction of the tergite and sternite of the first segment project the wings.

The wings of lepidoptera are mostly unfolded, except the hind wings of the Noctuid group and some of the smaller groups, but in no instance do they assimilate the beautiful fan-like arrangement of the earwig's hindwing, which not only closes like a fan, but folds over with two opposite joints. The folding is alleged to be done by the callipers at the tail of the insect, but whether this is so or not I have never had an opportunity of judging. To return to lepidoptera wings. These on first emerging from the pupa are small and crumpled, soft and flabby, but in a few minutes they rapidly extend, and a further few minutes serves to stiffen the secretion, and leave them perfectly rigid. For this process the newly-emerged insect crawls to a place that will enable it to obtain a firm grasp, sometimes with only the forelegs, sometimes with the first two pairs, where its wings can hang straight down, giving them an occasional shake, until they are fully expanded. This expansion has interested many entomologists, and was dealt with at some length by my friend, and a former member of our Society, Mr. Charles Walker. He paid considerable attention to it microscopically, and came to the conclusion that the expansion was due to air and fluid. "The nervures," he says, "are pierced in innumerable places by filaments and branched tracheæ, spreading all over the adjacent membrane. When expansion takes place, the enclosed tracheæ serve for the passage of the air while the fluid is pumped through the unoccupied space between the boundary walls and the tracheæ." Thus it will be observed that Mr. Walker's theory is that the growth depends on fluid being pumped, that is, forced through the membrane. I cannot agree with him. Nature does not use mechanism when natural laws will suffice, and in this case the whole trend of the operation appears to me to point to the natural law of gravity. The position taken by the insect is significant: the lavish amount of fluid would be unnecessary unless it was there for weight. Then again, what becomes of the pumping apparatus? which, apparently, would only be used for the few moments of development, afterwards to become utterly useless. It was these difficulties, so hard to understand and believe, that made me interested to confirm or refute by experiment; but the work is great, and I have only touched upon the fringe of this wonderful subject, but sufficient to show that we must not take all that has been written as authentic. Much must be unlearned and much discovered before we can say how a moth's wings grow.

To quote Mr. Walker again, he says: "The general structure of the wings is very similar throughout all orders. They consist of two membranes, united at their edges, and traversed by a series of horny rays which run between them, the upper of which is more strongly attached to them than the lower. These wing rays, or nervures, as we are accustomed to call them, are hollow tubes, convex on the upper surface, flat, and of a slighter texture on their underside."

All authorities seemed to agree that the wings were in the shape of a bug which had been flattened. And the question arose in my mind as to whether the two surfaces were quite separate, or whether they were joined along the nervures. Prolonged masceration in potash, I found separated the upper from the under surface, except a slight attachment at the margin, and by gently pulling I was able to divide the wing completely in half, and by floating the two halves on a slip was able to mount them. The next question was to decide as to the formation of the nervures. Three solutions presented themselves to me as being likely: First, that they were tuburlar, being an attachment of one surface, the other surface being merely a covering; second, that they were tubular, but on both surfaces superimposed; third, that they were half tubes on each surface but joined, forming a tube when united together. This latter I found to be the correct solution in certain cases, but so far I have failed to satisfy myself that the open part of the tube is not covered with an exceedingly fine transparent membrane. But in other cases the tube is confined to the under surface, the upper one being merely covered with a slight thickening where it comes in contact with the true nervure.

There also appears to be two methods of expansion of the wings. I find in *Pavonia carpini*, the emperor moth, there are valves at irregular intervals, similar to those in our veins, the nervures may be telescoped or introverted, as is so often found in insects. In *Sesia bomblyleformis*, the bee clearwing moth, I found a different construction. No valves are visible, but in place there is a straited tube running inside the hollow nervure, which is evidently elastic and capable of stretching. In either of these structures the weight of a fluid running into the wings would be sufficient to expand them to their full capacity, the superfluity finding its way into the tubes, where it would congeal.

The wings always start drying nearest the body, finishing at the tip. It would be as well to mention here if the insect is disturbed during the developing process, or if it is unable to get a foothold where the wings can hang down, crumpled, deformed wings will result.

The hind wings are attached to the forewings in the male only by a strong spine of various length, called the frenulum, which fits into the retinaculum, a long curled loop, which arises from the under surface of the base of the fore-wing, which varies a good deal in shape, and is often densely clothed with long, strong scales. This attachment is peculiar to certain families of moths, and, I believe, does not occur in the butterflies. In other orders different methods of attachment are adopted, suitable for their flight. For instance, the well-known row of hooks on the central margin of the hind wings of the hymenopter, which fit into a fold of the forewings, that of the wasp and bee being an example well-known to microscopists. It is a general rule among lepidoptera that the male frenulum consists of one strong spine, made up of several fine spines aglutinated together. In the female these spines are separate, and consist of three to five or six, in the form of a brush, and in this sex the retinaculum is absent. A notable exception to this rule occurs in the *Pterophoridæ*, or plume moths, where the wings are so deeply cleft as to make the insect appear to have five or more distinct wings or plumes; in this family the male frenulum is not confined to a single spine.

We must now consider the marvellous joints of the wing at its junction with the thorax, that enables the moth to vibrate its wings with so much velocity as to permit of its flight. The hard chitinous joints seem to be as nearly as possible like the vertebrate bones in animals. In order to obtain a satisfactory view of these, it is necessary to render the whole thorax transparent; any attempt to remove the wings first would of course destroy the mechanism. The costa, that is the strong upper edge of the wings, ends in a tongued ball and socket joint, which acts on a short joint, which in turn acts on another short and curiously-shaped joint, and so on, often for five or six joints; to these, no doubt, are attached strong muscles. It must be evident, with this large number of small joints, that the wings are capable of very complicated movements. Here is no simple up and down movement, but a series of gyrations and reflex actions that propel the body with such surprising speed, and at the same time enables the insect to remain hovering over a flower with such precision and balance that, as in the case of the convolvulus hawk moth, it can unfurl its two-inch tongue and drive it into a flower, in order that it may sip the sweet nectars with the same ease and stability as if it were standing on its solid edge, whilst at the least interruption it is away like a flash of lightning. At either side of the thorax, attached to the first tergite, is a loose shoulder-piece densely clothed with scale hairs that cover and protect the joints.

This is a short description of the head and thorax of lepidoptera, and offers an immense field of study in any one part, as each species will show a certain amount of variation best fitted for the insect's requirements, and I am sure would form the subject of great interest to anyone who would specialise on a particular part, and would yield a valuable contribution to science to any microscopist who can afford the time for investigation.

Liverpool Microscopical Society.

LIST OF MEMBERS.

JANUARY, 1911

HONORARY MEMBERS.

WITHAM M. BYWATER, "Invicta," 33, Telford Avenue, Streatham Hill, London, S.W.

WILLIAM CARTER, J.P., M.D., F.R.C.P., Talavon, Deganwy, N. Wales.

R. NEWSTEAD, M.Sc., A.L.S., F.E.S., Hon. F.R.H.S., Liverpool University.

J. T. NORMAN-THOMAS, F.L.S., 15, Fenwick Street.

WILLIAM. NARRAMORE, F.L.S., M.R.S.Inst., "Devonia," Cambridge Avenue, Great Crosby, Liverpool.

ORDINARY MEMBERS.

**Members of Council.*

ELECTED.

1881 Abraham, Miss Emma C., Grassendale Park.

1900 *Aman, F. T., Assoc. Mem. Inst. C.E., City Engineer's Office, Municipal Buildings, Dale Street.

1905 Armstrong, Frank, 112, Bold Street.

1907 *Astbury, E., 72, Athol Street.

1901 Bridger, Robert, 1, Sea Road, Wallasey.

1897 Buchanan, R. J. M., M.D., M.R.C.P., 6, Rodney Street.

1903 *Burne, Charles F., "Culver," Sunningdale Road, New Brighton.

1907 *Brown, W. D., "Holmleigh," Burscough.

1904 *Croston, R., 13, Derby Lane, Stoneycroft.

1874 Davies, Edward, F.C.S., F.I.C., Chapel Chambers, Chapel Street.

1891 *Davies, Herbert E., M.A., B.Sc., F.I.C., Chapel Chambers, Chapel Street.

1879 Deacon, H. Wade, J.P., 8, Ullet Road.

1905 Dearsley, A. H., 112, Bold Street.

1908 *Dowding, Rev. Charles, Fairholme Road, Great Crosby.

1902 *Dudley, A. H., 62, Selborne Street.

1910 Firth, Wm. A., 348, Ravenhill Road, Belfast.

1892 Forshaw, F. H., Riverside, Halebank, near Widnes.

1882 Fullerton, James, 44, Clarendon Road, Egremont.

1879 Goodwin, Gilbert Smith, 23, Anfield Road.

1885 Gray, George Watson, F.I.C., "Allendale," Clarendon Road, Garston.

1882 *Grisewood, William, "Langdale," Rudgrave Square, Egremont.

1900 *Haydon, James Richard, 91, Ampthill Road.

1892 Haydon, W. J., 55, Grey Road, Walton.

1869 Healey, George F., "Oaklyn," 27, Cearns Road, Oxton.

1904 Haywood, Lieut.-Colonel Arthur Grimshaw-, V.D., "Rearsby," Blundellsands.

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1910 Lunt, George, "Lincluden," Formby.

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1909 Mason, T. D., 37, Handfield Road, Waterloo.

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Further information may be had from the Hon. Secretary.

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PRESIDENT'S ADDRESS

ON

"A SHORT HISTORY OF THE MICROSCOPE AND WHAT IT HAS DONE FOR US,"

JANUARY, 1912.

LIVERPOOL
SPEIRS & GLEDSDALE, PRINTERS, EDMUND STREET, OLD HALL STREET.

1912.

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JANUARY, 1912.

LIVERPOOL

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1912.

LIVERPOOL MICROSCOPICAL SOCIETY.

SESSION XLIV., 1912.

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Officers and Council Elected 20th January, 1912.

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FORTY-THIRD ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY

The President and Council, in presenting their Forty-third Annual Report, are pleased to record continued satisfactory progress of the Society.

The attendance at the meetings has been unusually good throughout the past year, indicating greater interest in the papers and exhibits. The demonstrations also are still very popular, and a continuation of them appears to be desired by the members generally, who appreciate the opportunities afforded of acquainting themselves with the practical side of microscopy and of becoming familiar with the advantages and defects of various makes of microscopes and apparatus, also of best utilizing such apparatus as they possess and recognizing its possibilities and its limitations. Very useful hints are sometimes given on how to improvise simple home-made substitutes for expensive apparatus, which, although not intended to rival the usual appliances, often save the cost of purchasing an instrument which may hardly ever be required.

Another pleasing feature is the growing desire of members to take up with observation and experiment on original lines, and this is deserving of encouragement. The Council desire to assure the less experienced members of their wish to help them as far as possible in pursuing their studies and in overcoming their difficulties.

The evenings devoted exclusively to the exhibition of objects under the microscopes are still much enjoyed, and are very interesting and instructive. The Council would like to see more of the younger members exhibiting at the meetings.

The Hon. Curator would like to call attention to the valuable collection of books and periodicals and of microscopical slides which are not nearly so much used as they might be to the advantage of the members.

The Council hereby express their hearty thanks to the gentlemen who have read papers and given demonstrations during the year.

Social or "open" meetings, to which kindred societies are invited, have proved very enjoyable, and it is hoped that opportunities may arise of holding them more frequently.

The Annual Conversazione, held in May, was well attended, and, as usual, very interesting exhibits were kindly shown by members of our own and of kindred societies.

A variety of new microscopes and apparatus have been shown at some of the meetings by Messrs. Thos. Armstrong & Bro., and by Messrs. Flatters & Garnett.

A very successful Field Meeting was held at Maghull on August 12th, 1911, under the leadership of Mr. W. Grisewood.

During the year four new members have been enrolled, and three have resigned.

The Society has sustained the loss of an Honorary Member, of many years standing, by the death of Mr. Witham M. Bywater.

The present membership consists of four Honorary and fifty-three ordinary Members.

The following additions have been made to the Library:—

By presentation: Publications of the Quekett Club, Manchester Microscopical Society and Royal Microscopical Society.

By purchase: "Annals of Botany," and the Ray Society's issue.

The Council again acknowledge with thanks the ready and efficient services of Mr. F. N. Pierce and the members of the Lantern Committee.

With a view to giving an opportunity to the young people of becoming acquainted with, and possibly interested in, microscopy, the Council have invited the attendance at our meetings of a limited number of pupils from schools in Liverpool and district, and there has been a very fair response, a number of the pupils attending having come from considerable distance.

The following is a brief account of the various meetings:—.

January 20th — The President, Mr. F. N. PIERCE, F.E.S., delivered his inaugural address on "The Study of the Structure of the Head and Thorax of Lepidoptera." The address was printed in the last Report.

February 3rd—A paper was read by Mr. W. D. BROWN on "The Examination of Rocks by the Microscope," with lantern illustrations. Mr. Brown also exhibited two Petrological Microscopes and a large number of specimens of rocks.

March 3rd—A paper was read by Mr. F.W. STRUMPEL on "Bacteria in Air, Soil and Water," with lantern illustrations.

April 7th—There was no paper read, the evening being devoted to exhibits by the members.

April 21st—A paper was read by Dr. P. F. TINNE, M.A., M.B., on "Colour Photography," illustrated by lantern slides and transparencies in colour.

May 5th—The Annual Conversazione was held. The exhibits by our own members and by visitors were very numerous and interesting, and the attendance was large.

October 6th—The winter session commenced with the "Opening Conversazione," at which refreshments were kindly provided by the invitation of the President. The exhibits were numerous, and the attendance was good.

November 3rd—A paper was read by Mr. F. N. PIERCE, F.E.S., on "Viviparity of Butterflies," illustrated with the micro-lantern.

December 1st—A number of Demonstrations were given by several members on "The Microscope and its Accessories." Mr. C. F. Burne organized the Demonstrations.

THE LIVERPOOL MICROSCOPICAL SOCIETY,

IN ACCOUNT WITH THE TREASURER.

Dr.

				£	s.	d.
To Rent of Room				10	10	0
" Printing, Stationery & Postages				11	8	10
" Sub-Librarian				1	0	0
" Attendance				2	7	0
" Annals of Botany	£1	10	0			
" Subscription, Ray Society	1	1	0			
				2	11	0
" Lantern Expenses				0	11	6
" Fire Insurance				0	5	0
" Balance				32	8	8
				£61	2	0

Cr.

	£	s.	d.
By Balance from 1910	36	2	0
" 41 Subscriptions 1911 ...	21	10	6
" 1 " 1910 ...	0	10	6
" 1 Advertisement, 1910 ...	0	8	0
" 4 " 1911 ...	1	16	0
" Bank Interest	0	15	0
	£61	2	0
By Balance down	£32	8	8

Audited and found correct,

W. GRISEWOOD & SON,
Chartered Accountants.

A. H. DUDLEY,
Hon. Treasurer.

LIVERPOOL, 18*th January*, 1912.

"A Short History of the Microscope, and what it has done for us,"

BEING THE

PRESIDENTIAL ADDRESS

By P. F. TINNE, M.A., M.B.

Delivered on the 19th January, 1912.

Ladies and Gentlemen,—

It is my privilege to-night to deliver an address to you as president of the Liverpool Microscopical Society, the traditions of which have been so ably upheld during the past two years by the retiring president.

I have not chosen to read you an address on what may be termed a specialist's subject, but rather on a subject which should prove of interest to all here present, and in which all may find some entertainment.

I thank you for the honour you have conferred upon me by electing me as your president, and welcome you at this opening meeting of our new session, a session which we all hope will add to the prosperity of the Society.

I feel most flattered that so many members and friends have turned out on this inclement night to give me a hearing, and hope that I shall say something to interest you on the "History of the Microscope, and what it has done for us."

"The Microscope" is a comparatively modern invention. Magnifying lenses were unknown to the Ancients. Aristophanes (500 B.C.) speaks of a "burning sphere." Seneca, about the time of Christianity, makes mention of objects appearing of larger size when viewed through a globe of glass filled with water. Pliny, the elder, mentions these same globes being used for producing fire.

In no case were these refracting globes considered as magnifying instruments. Spectacles, as improvements to poor eyesight, have their earliest reference in a manuscript dated 1299 from Florence. The writer says "I find myself so pressed by age that I can neither read nor write without those glasses they call spectacles, lately invented, to the great advantage of poor old men when their sight grows weak."

Roger Bacon, of Ilchester, a Franciscan monk, first used lenses to improve failing eye-sight in 1276, but true spectacles were the invention of Salvino d'Armato degli Armati, a Florentine.

These indispensable aids to nature were at first withheld from the public until one, Alexander Spina, in a spirit which, I am happy to say, permeates all medical society of the present day, divulged the secret of their construction and use to his own glory and the good of his fellow men.

Roger Bacon hardly had a fair chance, for his genius brought upon him the hatred of his contemporaries, who kept him for many years in prison. Finally, they shut him up in a convent of his order to the end of his long life of nearly eighty years.

The invention of spectacles, then, or the simplest form of microscope, may be divided between Roger Bacon and the Florentine.

Once the spectacles lens became an established fact, it was an easy transition to lenses of shorter and shorter focus, and eventually to the combination of lenses which go to form the compound microscope as we know it to-day.

It was between 1590 and 1609 that the first microscope as distinguished from a mere magnifying lens was invented.

Robin, of Paris, member of the Academy of Science, sums up the claim of the various inventors. He remarks: "The invention of the compound microscope goes back to the year 1590." It is to the Dutchmen, Hans and Zacharias Janssen—father and son, that the honour of it is due (qu'en revient l'honneur). Janssen offered one to the Archduke Charles Albert of Austria, who made a present of it to Cornelius Drebell, a Dutch Alchemist, mathematician to James 1st, who died in 1664. Drebell brought the instrument to England, showed it to Borelli and many professors, constructed microscopes in London in the year 1621, and passed himself off as their inventor, which was believed for a long time. (Ce dont la croyance dura longtemps.)

Cornelius Drebell's microscope was a copper tube, six feet long, and one inch in diameter, supported by three brass pillars in the shape of Dolphins; these were fixed to a base of ebony, on which objects to be viewed were placed.

Personally, I do not think that Cornelius Drebell has been fairly treated. He was a man of great genius, and even though he obtained his ideas from Holland, he made such use of his knowledge that he evolved some of the first compound microscopes in England.

Without his stimulating enthusiasm in this country, we should never have been able to keep pace with the Italian schools, schools which up to this time had been fully one hundred years ahead of us in scientific research.

England was given up to Charlatanism of every kind, Magic, black or otherwise, the transmutation of metals, the search for the philosopher's stone and elixir of life. Our science, in fact, was a compound of grey beards, skinny fingers, and ill-lit rooms, littered with the dust of ages, and retorts and vessels of quaint and curious shapes.

There was some excuse for secrecy in matters scientific. Roger Bacon, as I have already mentioned, spent most of his life in prison as a result of his labours, and even at a later period in history (1794) Lavoisier, in France, had his head removed by the guillotine.

Nearly all the English professors in the 16th century felt it incumbent on them to go to Padua for their scientific training. It was in this famous Italian school that such men as Vesalius studied anatomy on the bodies of criminals, whom he had killed as he required them. In this school Harvey studied the circulation of the blood, and owing to his discoveries, enabled us later to use the hypodermic needle, and to venture on the administration of anæsthetics, both dependent on the circulation of the blood, both the outcome of his work.

It is interesting to read that Sir Christopher Wren, the famous architect, was one of the first to use a hypodermic needle upon himself.

Before passing from the subject of simple lenses to microscopes proper, I should mention that in 1600 Kepler put forward the theory of the crystalline lens of the eye throwing an image on the back of the eye, the retina. He supposed that the lens moved backwards and forwards in focussing.

The earliest illustration of a simple microscope is given by Descartes, 1637, and is similar to one devised by Lieberkuhn a century later. This consists of a lens set in a concave polished metal reflector. It was shown at the last meeting of our Society. I now come to one who has aptly been described as the father of histology.

ANTONIUS LEEUWENHOEK (1632-1723). He had no title to be called doctor, nor did he claim one.

Dr. Carpenter, in the Ency. Brit., thought he was an optician, or maker of lenses. Dr. Benjamin W. Richardson proves this theory to be wrong, for his commission as Beadle or Chamberlain to the Sheriff at Delft is still in existence. The salary was £26 a year. The duties were "to open and shut the door of the chamber, to show honour and respect to the Councillors, to keep the chamber clean, to make the fires, and to do all that a good and faithful chamberlain should do." He held the post thirty-nine years.

Not the sort of man to make original discoveries; yet Peter the Great, Boerhaave and Bidloo called upon him to inspect his microscopes.

These instruments were all made with his own hands, even to the grinding of the lenses. An illustration of his microscope is figured in his opera. He bequeathed twenty-six microscopes, in a small cabinet, to the Royal Society. These are now lost.

He demonstrated the circulation of the blood in the rabbit's ear, the bat's wing, the tadpole and the frog; described the structure of bone, and explained the fibrous structure of the white matter of the brain. From his own teeth he extracted a white substance which, mixed with pure rain-water, showed some kind of small animalcules, the motions of which were "very pleasing to behold." He examined the spermatozoa from whales to spiders, and contested the theory of spontaneous generation.

The Royal Society of London, during a period of fifty years, received from him three hundred and seventy-five letters and papers. (*From notes by Mr. Jones, of the Liverpool Medical Institute*).

His lenses had a focus of ¼ inch, and it is wonderful how much he accomplished, and how minute the objects he observed.

The construction of the single microscope is so simple that it is susceptible of but little improvement, and has therefore undergone but few alterations.

Quoting again from the French, with reference to the compound microscope. The Neapolitan, Francois Fontana, was the first in 1646 who described the instrument in his "New Observations Terrestrial and Celestial." He pretended also to have discovered it in 1618, one year before Cornelius Drebell had brought it to England.

Several authors say that it was about this time that this instrument received from Demisiano the name of microscope, and that the name telescope is equally due to him. Professor Carpenter, however, ascribes the invention of the name to Giovanni Faber, 1625.

Amongst the first compound microscopes, one refers to those of Hooke (1656), Eustachio Divini (1668), Francois Grindelius (1687), and Philippe Bonani (1688).

In spite of the Dutch claiming the invention of the compound microscope, Carpenter states that there is plenty of evidence that Galileo either was the first or else simultaneously invented it.

Viviani, an Italian mathematician, states that "This great man was led to the discovery of the microscope from that of the telescope." In a letter of 1624, it was remarked that Galileo explained the use of Cornelius Drebell's microscope sent to the Cardinal of St. Susanna, who did not know how to use them. The writer, one Aleandro, further adds: "Galileo told me that he had invented an occhiale which magnifies things as much as 50,000 times, so that one sees a fly as large as a hen." As a matter of fact, this magnification reduced to our methods of mensuration, would have been an enlargement of 36 diameters, about the relative size of a fly and a hen. In any case, Galileo's familiarity with Drebell's instruments showed clearly a previous familiarity with the compound microscope as such.

In these days when so much is done by fixing tissues and cutting sections, I would put in a plea for the older methods, and encourage students of the microscope to view objects in the natural state before cutting them up.

The anatomy of a spider, and the web of a spider provide us with objects whose structure compels our interest; but we must not forget first to watch the spider itself, its habits, its strength of purpose; even, as Robert Bruce, we may learn of something to our advantage. The same applies to bacteria, whose movements and natural history are often of far greater importance than their staining reactions.

The use of the ultra-microscope and dark ground illumination, have of late made things so much easier for us in this respect.

I have with me this evening some very old books, whose illustrations give proof of the most painstaking and accurate observation. One book, dated 1741, was written by Wm. Cheselden, one of the foremost surgeons of the day in England. He lived 1688-1752, and this book is the sixth edition of his famous text-book. In it are figured arteries and veins, living sperm cells, and an admirable drawing of "the circulation of the blood in the fish's tail, as it appeared in a microscope."

The Liverpool Medical Institution has very kindly permitted me to show you Leeuwenhoek's works in four volumes. Leeuwenhoek, with his simple microscopes, taught us the value of minute observation, and upon his discoveries, Malpighi (1653) in England completed the proof of Harvey's circulation of the blood, showing how it flowed from the arteries to the veins. We hardly realize in these days the importance of this observation. Up till then the veins were known to be filled with blood, but the arteries were supposed to be filled with air,simply because they were empty after death. To-day the surgeon operates in comparative safety, and hardly a drop of blood is lost, but in those days post-operative hæmorrhage was a doctor's terror, and now all this is a thing of the past, just because we tie a ligature and stop the flow, which was so beautifully shown in the newt's tail, the frog's lung, or the bat's wing.

Another old book which will interest you is a volume of an Encyclopædia, dated 1797, in which are two admirable articles, one on medicine, the other on the microscope. The latter article shows illustrations of nearly all the microscopes, both single and compound, as used at that time in England.

With insular prejudice, however, the only continental names mentioned are Leeuwenhoek and Lieberkuhn.

Condensers placed so as to concentrate light upon the object were not thought of before 1691, when Bonnanus first used a condenser below the stage, so as to illuminate transparent objects. Up till this time compound instruments had to be used vertically, or else directed at the sky. Looking up to the heavens for any length of time through a microscope, especially Cornelius Drebell's 6ft. one, must have been most tiring.

The next notable advance in mechanism was the fine adjustment screw. This can be credited to Marshall, 1704. Previous to this, Hooke's microscope rotated in a screw socket, whereas Divini's and Cherubin's worked by sliding cylinders. In some cases the object was raised or lowered, to suit the focus of lens. In Marshall's instrument the condenser was on the swing-out principle, being fixed to a jointed arm. One bad feature was the illumination by candle under the stage, which must have been bad for the observer's face; almost as bad as our oil lamps are in the matter of igniting ladies' hats.

The use of a mirror does not seem to have come in till 1716, when Hertel used this valuable adjunct both above and below the stage. He also used the bull's-eye pattern of condenser. He was responsible for the "mechanical stage" also, by means of which an object could be moved to and fro, and rotated on the stage by screws.

Still later, 1738, Lieberkuhn revived the single microscope, which still has a considerable range of utility, as shown by our president at the last meeting. His lenses were fixed in concave mirrors.

Wilson, 1746, was a good example of the age of pocket microscopes. In these the reflecting substage mirror is regularly employed.

Martin, 1780, shows a good example of the tripod stand.

Adams, 1871, introduced diaphragms, and also the button system of combining objectives to increase magnification. To increase the magnifying power, the objective has an extra lens screwed on. He also used a nose piece for carrying three objectives.

The next improvement of note was in the quality of objectives. Achromatism was studied, 1759, by Martin, but no really good results eventuated till 1823, when Chevalier produced Selligues' achromatic objectives. Six years later J. J. Lister read a paper on this subject to the Royal Society, which profoundly influenced the study of achromatism in England.

Improvements now began, one after the other, both optical and mechanical, too numerous to mention, but important enough to remind us of such men as Pritchard, Ross, Powell, James Smith, Swift, Watson, Baker, and Professors Quekett and Carpenter, in this country, of Zeiss and Leitz, on the continent.

America, too, has not been behindhand in adding to constructive excellence.

I now come to the wonders revealed by the microscope, and their value to the sum of human knowledge. The field is almost too vast and the advantages too numerous to particularize in every branch. The earliest observers were chiefly concerned with the wonder of seeing flies as large as hens. Poor men, such as Leeuwenhoek, it is true, ground their own lenses and made their own apparatus, but for many years the microscope was regarded (in the words of Hogg) more in the light of a costly toy; it is now the inseparable companion of the man of science.

To the chemist new certainties have been added in the testing of fluids and solids, in the minute observation of the form and deposition of crystals, and in the identification of substances by the nature of their particles. Polarization enables the chemist on a large sugar estate to estimate beforehand how many tons of sugar per acre can be obtained from the juice of a few sugar canes chosen haphazard from the miles of waving reeds.

To the study of botany has been added the power to differentiate the structure and uses of the different tissues in the plant.

Theory is reduced to certainty, classification is made easier. Foodstuffs are analysed, and impurities can be detected; so that the rascally purveyor of adulterated foods can no longer impose upon the public. One starch is like another, but under the microscope how different! It is now so easy to see the change in the single cell, and as we watch the protoplasm streaming in the hairs about the stamen of Tradescantia, we have almost unravelled the mystery of life itself.

How different from the days when Malpighi first described the plant as made up of "utricles." His utricle, our cell, but unlike our cell, the wall alone mattered to him. To-day we are more concerned about its contents, which, early in 1800, Robert Brown observed. To him may be accorded the honour of noticing the nucleus, though the protoplasm which surrounded it he thought no more of than to call it gum.

From 1810-1882 Schleiden and Theodore Schwann worked hard at the theory of cells, and the latter's book has been published by the Sydenham Society. He was a pupil of Johannes Müller, a famous professor of physiology, from 1801-1858, first at Bonn and then at Berlin, and Schwann's attention to the cell was directed by this eminent professor, who began life as a shoe-maker.

To the Zoologist the microscope is indispensable, and in this branch of study held an honoured place from its earliest origin, fathered by such men as Leeuwenhoek and Galileo.

In this branch our Society has lately achieved a notable success, and Mr. Pierce's book is not unknown to Entomologists on the continent and elsewhere.

To the Geologist the microscope reveals (in the words of Hogg) "That our large coal-beds are the ruins of a gigantic vegetation, and the vast lime-stone rocks, which are so abundant on the earth's surface, are the catacombs of myriads of animal tribes."

The engineer can teach us something, too, and points with no uncertain finger to the flaw where careless workmanship forged the faulty metal. A slice of steel and his microscope shows the reason why a bridge collapsed, or a ship broke loose from its moorings.

In medico-legal investigations the fate of a human being may tremble in the balance whilst the microscope tenders its unshakable evidence. Is the stain on the prisoner's coat blood? Yes! A little glacial acetic acid mixed with the sodden cloth crystallizes under the microscope, and the dark hæmin needles defy dispute. Here is a spot where the blood is still wet. A little smear on the glass slide. Stain it, and look. Is it human blood? No! The corpuscles have nuclei. Not guilty. The prisoner is acquitted, a stain on his coat, but none on his character.

And what can I say of the calling to which I have apprenticed myself? The study of medicine.

Here indeed some of the grandest results have been achieved. Who now believes that Scrofula, the King's Evil, is due to "bad water, or crude indigestible food," as my ancient Encyclopædia has it? or that the Royal touch will cause the swollen glands to vanish. Koch and Pasteur have altered all that, and the microscopic tubercle bacillus is to-day, under the supervision of the microscope, hunted and slaughtered by fresh air, Finsen light, vaccines, and even the Chancellor of the Exchequer. Slowly, but surely, consumption is growing less, sanitation and the microscope are winning a victory over one of mankind's most deadly and insidious foes.

No longer the surgeon goes his daily round in the hospital, knife in hand, letting out the laudable pus from the wounds which he treated with such ineffectual skill. Pasteur, again, and Lister have shown us how carbolic acid clears the microscopic field of germs, and have paved the pathway with prevention which anticipates cure.

The day is past when a compound fracture meant almost certainly the loss of a limb, and an operation was synonymous with a lengthy and tedious convalescence. The bacteria that vitiated our dressings have been discovered and defeated by the microscope.

With what amazement would Ambroise Paré, the foremost military surgeon of his day (1580), regard the surgical methods of a Japanese ambulance officer on a Manchurian battlefield. The latter might be no match for the great master in either dexterity or boldness, but his results, based on microscopic discovery, would astound no less than they would shame so great a surgeon. Anatomical knowledge and surgical procedure may not have changed so much, but many a wounded soldier has emerged from the valley of the shadow of death unconscious of the thanks due to the microscope, and the providence that has taught us how to fight the enemy that lurks within the camp.

These microbes, most of which we can see, some of which are still to be seen, have largely been enslaved by means of the microscope. The sewage that fostered their growth, and bred the seeds of typhoid and diptheria, is used to grow our cabbages and lettuces on the sewage farm. The patch of land which yielded its increase in hundreds, is watered with nitrifying bacteria, and thereafter yields its thousands.

The Black Death that swept the land, and especially London, in the middle ages, which altered the rates of wages and the conditions of labour far more effectually than any strike—that is stopped on the threshold.

The Port Sanitary Authority and his ally, "the Microscope," allow no case of plague to enter this country. Smallpox, which used to ravage the country, by the simple expedient of vaccination, is almost a forgotten fear. True, its life history is not yet revealed by the microscope, but by analogy we guess the story of its origin, and the results of our treatment bear out the accuracy of our surmise. Recent events have turned our thoughts to the tropics, and there again the microscope has done a noble work. India, Africa, America, even in their scorching and pestilent areas, have been conquered by the microscope. Ismalia, a few years ago one of the most malarious districts on the earth's surface, is now a safe and healthy spot. Sir Patrick Manson and Professor Ross, of our tropical school of medicine, have used their microscopes to some purpose. The malaria parasite has been identified, and its life history made plain. Sir Rubert Boyce, so recently an honoured citizen, has done noble work in teaching us the source of yellow fever. At the present time hopes are held of controlling the sleeping sickness of Africa. All this research work would have been impossible without the microscope. In London Sir Almroth Wright has shown us how to identify a special disease by its bacteria, how to prepare a vaccine from those bacteria, and with it to antidote the poison of the disease by successive injections into the patient from whom they were obtained. This is a remarkable piece of work, and has profoundly influenced medical treatment.

Much yet remains to be done; both at home and abroad there are problems for our microscopes to solve.

The living things that Leeuwenhoek saw in the tartar extracted from his teeth are as great a marvel to the dentist of to-day as they were to him.

When some dental altruist prevents their growth, our suffering molars will rival in whiteness and hardness those of the beasts of the field.

Last year's copy of *Punch*, which we read upside down whilst we waited our summons to the torture-chair, will moulder in a forgotten past. Ignorance is no excuse for breaking the jaw.

From America we have perhaps the most wonderful example of the value of the microscope to the surgeon.

At Rochester, the brothers Mayo have during their operations a special pathologist always present. Supposing a patient has a tumour, whose malignancy is doubtful; the pathologist pounces upon a small portion of it, which is removed under the anæsthetic, rushes into an adjoining room, freezes it, cuts a section, floods it with stain, and in four minutes by the clock (as I am informed), comes back to the operating room with a certain diagnosis. Upon this depends the extent of the operation, simple removal, or removal with a wide margin for safety, as in the case of cancer. What a truly marvellous application of the uses of the microscope.

Lastly, I would recall to you the entrancing Kinematograph Exhibition of Dr. Commandon's micro-photographs, as shown us by Mr. Strunpel, in this room. Galileo and his friend may have marvelled at the fly "as large as a hen," what would their thoughts be, could they have seen, as we have, the antics of organisms appearing the size of dogs, in reality, but 1,000th of an inch in length.

A French writer remarks: " In a general way, one gives the name of microscope to any instrument which, interposed between the eye and the objects brought near, has the property of making them appear greater than they are." To-night I have endeavoured to trace the history of the microscope and some of the things it has shown to us. I do not think I have made them appear greater than they are, but they are greater in importance than they appeared to our ancestors. Nevertheless, I would rescue from partial oblivion the names of some, who in their day were often subjected to ridicule, but who are still landmarks in the microscopist's world long after their critics have been forgotten.

At school it is easy to win a prize amongst the duffers in the lowest forms, but amongst the picked scholars, who strive for the honoured positions at the top, it is no small matter to have one's name mentioned in the list of honours.

In this Society of ours are men and women endowed with education and attainments, from whom we hope to learn much of value to us in our pursuit of microscopical science. Some of us may attain pre-eminence and become the picked scholars of the great School of Scientific Research, names deserving honourable mention. Others, who can only dabble in the subject during their moments of leisure, may not achieve renown; but they are none the worse for having passed an evening or two in distinguished company. Delicacy of touch, quickness of perception, accuracy of observation, all these may be learnt from some of those whom I see about me to-night. My one regret is that our Society is not larger in numbers, for no one who joins us need fear unkindly criticism, welcome and generous help is assured to the veriest beginner.

We can none of us set up to be a "Know all," but the next best thing is to know a great deal about one subject, and make it our own, and to know a little about everything else that we can fit in to our scheme of life. Cleverness has been defined as "the power of paying attention," but I would go even further and call it the power of paying attention to details. Everything to the minutest particular should find a place in the orderly mind of the man who will achieve success, and who would speak with authority; the skipped page as often as not contains the answer to our examination question. In this our Society can be seen the evidences of painstaking attention to details, beautiful preparations, beautifully finished.

The butterfly, the wayside flower, the shell upon the sea shore, the grain of sand—they are all the more beautiful to us in that the microscope has made them our daily companions; nay, more than that, our intimate friends.

Amidst the grey surroundings of our daily work the commonest objects may be found to be things of interest and beauty, when viewed as we view them in this room.

The microscope is no longer a mere toy, it has become the inseparable companion of the man of science.

Liverpool Microscopical Society.

LIST OF MEMBERS.

JANUARY, 1912.

HONORARY MEMBERS.

WILLIAM CARTER, J.P., M.D., F.R.C.P., Talavon, Deganwy, N. Wales.

R. NEWSTEAD, M.Sc., A.L.S., F.E.S., Hon F.R.H.S., Liverpool University.

J. T. NORMAN-THOMAS, F.L.S., 15 Fenwick Street.

WILLIAM NARRAMORE, F.L.S., M.R.S.Inst., "Devonia," Cambridge Avenue, Great Crosby, Liverpool.

ORDINARY MEMBERS.

**Members of Council.*

ELECTED.

1881 Abraham, Miss Emma C., Grassendale Park.

1900 *Aman, F. T., Assoc. Mem. Inst., C.E., City Engineer's Office, Municipal Buildings, Dale Street.

1905 Armstrong, Frank, 112 Bold Street.

1907 *Astbury, E., 72 Athol Street.

1901 Bridger, Robert, 1 Sea Road, Wallasey.

1903 *Burne, Charles F., "Culver," Sunningdale Road, New Brighton.

1907 *Brown, W. D., "Holmleigh," Burscough.

1904 *Croston, R., 69 Marlborough Road, Tuebrook.

1874 Davies, Edward, F.C.S., F.I.C., Chapel Chambers, Chapel Street.

1891 Davies, Herbert E., M.A., B.Sc., F.I.C., Chapel Chambers, Chapel Street.

1879 Deacon, H. Wade, J.P., 8 Ullet Road.

1905 Dearsley, A. H., 112 Bold Street.

1902 *Dudley, A. H., 62 Selborne Street.

1910 Firth, Wm. A., 348 Ravenhill Road, Belfast.

1892 Forshaw, F. H., Riverside, Halebank, nr. Widnes.

1882 Fullerton, James, 106 St. Helen's Road, Pennington, Leigh, Lancs.

1879 Goodwin, Gilbert Smith, 23 Anfield Road.

1885 Gray, George Watson, F.I.C., "Allendale," Clarendon Road, Garston.

1882 *Grisewood, Wm., "Langdale," Rudgrave Square, Egremont.

1900 *Haydon, James Richard, 91 Ampthill Road.

1892 Haydon, W.T., F.L.S., 55 Grey Road, Walton.

1869 Healey, George F., "Oaklyn," 27 Cearns Road, Oxton.

1904 Haywood, Lieut.-Colonel Arthur Grimshaw—, V.D., "Rearsby," Blundellsands.

1911 Hutton, F. W., 53 Greenway Road, Runcorn.

1910 Kenworthy, A. B., "Avondale," Durning Road.

1905 Langley, Bertram, 51 North John Street.

1886 Larkin, Frederick Charles, F.R.C.S., 54 Rodney Street.

1907 Leonard, Edward, 2 Cannon Mount, Claughton, Cheshire.

1910 *Lunt, George, "Lincluden," Formby, Lancs.

1898 *Macphail, James D., 40 Moss Lane, Walton.

1909 Mason, T. D., 37 Handfield Road, Waterloo.

1893 Nuttall, F. R. Dixon-, F.R.M.S., "Ingleholme," Eccleston Park, near Prescot.

1888 *Pierce, F. N., F.E.S., 1 The Elms, Dingle.

1897 *Powell, W. H., 2 Lord Nelson Street.

1909 Pryce, George, B.A., 16 Bentley Road, Oxton, Birkenhead.

1902 Rappart, D. B., West Lodge, Caldy, near West Kirby.

1881 *Read, W. H., "Lisadel," Caithness Drive, Liscard.

1885 Robertson, Helenus R., F.R.M.S., Upton Grange, Chester.

1879 Scholefield, Joshua William, J.P., 33 Pembroke Road, Bootle.

1911 Smith, Frank J., B.Sc., 36 Brelade Road.

1905 Stopforth, Richard, 71 Vauxhall Road.

1908 *Strumpel, F. W., 16 The Temple, Dale Street.

1893 Tate, Frank, 9 Hackins Hey.

1911 Thomas, Alfred, 69 Garmoyle Road, Wavertree.

1907 *Tinne, Philip F., M.A., M.B., Oak Cottage, The Serpentine, Grassendale.

1909 Wall, Joseph, 21 Norwood Grove.

1911 White, Henry T., 14 Princess Terrace, Oxton.

1871 *Williams, J. Michael, 31 Grove Park.

1897 *Williams, W. Collingwood, B.Sc., F.I.C., Beechfield, Roby.

1911 Wood, Norman W., 147 Kensington.

THE
LIVERPOOL MICROSCOPICAL SOCIETY

was founded in the year 1869, having for its object the cultivation and advancement of Microscopy.

The ordinary Meetings are held at the Royal Institution, Colquitt Street, on the first Friday evening in every month, at Seven o'clock, except in the months of June, July, August, and September.

Candidates for Membership must be proposed by three or more Members, one of the proposers from personal knowledge of the candidate.

The Society possesses a useful Library, and numerous Microscopical preparations.

Further information may be had from the Hon. Secretary.

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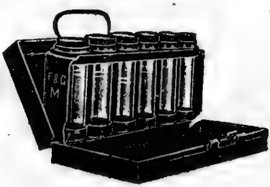

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FORTY-NINTH

ANNUAL REPORT

OF THE

LIVERPOOL

Microscopical Society.

ABSTRACT OF PROCEEDINGS.

JANUARY, 1918.

LIVERPOOL:
Speirs & Gledsdale Ltd., Printers, 18 Cable Street.
1918.

FORTY-NINTH

ANNUAL REPORT

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ABSTRACT OF PROCEEDINGS.

JANUARY, 1918.

LIVERPOOL:
SPEIRS & GLEDSDALE LTD., PRINTERS, 18 CABLE STREET.
1918.

Liverpool Microscopical Society.

SESSION L, 1918.

Past Presidents :	*Year :*
JOHN BIRBECK NEVINS, M.D.	1869, 1870
Rev. WM. BANISTER, B.A.	1871
Rev. Dr. DALLINGER, F.R.S.	1872, 1879
JOHN ABRAHAM	1873
J. J. DRYSDALE, M.D., F.R.M.S.	1874
JOHN NEWTON, M.R.C.S.	1875, 1894, 1895
Rev. HENRY H. HIGGINS, M.A.	1876, 1877, 1886
GEORGE F. CHANTRELL	1878
J. S. HICKS, F.R.C.S., F.L.S.	1880
WILLIAM CARTER, M.D., F.R.C.P.	1881, 1891, 1892
W. H. WEIGHTMAN, F.R.M.S.	1882
FRANK T. PAUL, F.R.C.S.	1883
CHARLES BOTTERILL	1884, 1885
Rev. F. BALLARD, D.D., B.Sc., F.G.S., F.R.M.S.	1887
A. NORMAN TATE, F.I.C., F.C.S., F.R.M.S.	1888
ISAAC C. THOMPSON, F.L.S., F.R.M.S.	1889, 1890
F. CHARLES LARKIN, F.R.C.S.	1893
EDWARD DAVIES, F.C.S., F.I.C.	1896
WM. NARRAMORE, F.L.S., M.R.S.Inst.	1897, 1898
W. T. HAYDON, F.L.S.	1899, 1900
HERBERT E. DAVIES, M.A., B.Sc., F.I.C.	1901, 1902
R. J. M. BUCHANAN, M.D., M.R.C.P.	1903, 1904
JAMES D. MACPHAIL	1905, 1906, 1914, 1915
JOHN HAY, M.D., M.R.C.P.	1907
A. H. DUDLEY	1908, 1909
F. N. PIERCE F.E.S.	1910, 1911
P. F. TINNE, M.A., M.B.	1912, 1913
THEODORE GARNETT, M.A.	1916
J. T. NORMAN-THOMAS, F.L.S.	1917

OFFICERS and COUNCIL

Elected 18th January, 1918.

President:

J. T. NORMAN-THOMAS, F.L.S.

Vice-Presidents:

F. J. SMITH, B.Sc., A.I.C. C. H. HESKETH WALKER.

Hon. Treasurer:

J. R. HAYDON.

Hon. Secretary:

R. CROSTON.

Hon. Librarian and Curator:

E. LEONARD.

Council:

FRANK BERTRAND.
EDWARD FRY.
THEODORE GARNETT, M.A.
W. E. HARPER.
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F. W. HUTTON.
JAMES D. MACPHAIL.
A. PALLIS, J.P.
F. N. PIERCE, F.E.S.
W. H. READ.
W. BOOTHMAN ROBERTS.
P. F. TINNE, M.A., M.B.

FORTY-NINTH ANNUAL REPORT

OF THE

Liverpool Microscopical Society.

IT is very gratifying to the President and Council that in presenting this, the Forty-ninth Annual Report, they are again able to report steady, continuous progress. The membership is increasing rapidly and there is every indication of further advance. Although we have entered upon the fourth year of this great war and the number of young men is being more and more reduced in the country, the awakening of our nation to the need of more intimate connection with and knowledge of scientific matters is evidenced by the greater desire of people generally to join the scientific and learned Societies. It is well that this should be so, in order that we may be able to make a better fight in the economic and commercial war which will inevitably follow the cessation of hostilities. The need is great, and it behoves the members of such societies to use every effort to encourage the advent of new members and to facilitate the development of the new attitude towards scientific thought. This is all the more necessary at the present time, so that when our young men return to peaceful pursuits they will find the way paved for their youthful energy and lines of thought laid out and prepared for them to explore and develop. It is unfair to permit them to make such sacrifices as they are doing, if we who are at home neglect anything that we can do to minimise the unfortunate result of the interrupted course of their education.

There has again been considerable increase in our membership.

The Council record with regret the death of Mr. James Fullerton who had been a member for 35 years.

One Honorary Corresponding Member, or Associate, has been elected.

During the year one Ordinary member has resigned, and 16 Ordinary members have been elected. The present membership is 6 Honorary and 77 Ordinary members.

There have been five successful Field Meetings, the attendance being very fair.

Seven papers were read.

To the gentlemen who have read papers and given demonstrations, also to Mr. F. N. Pierce and the members of the Lantern Committee, the Council tender their sincere thanks.

The following is a brief account of the meetings:—

JANUARY 19th, 1917.

The President, J. T. Norman-Thomas, Esq., F.L.S., delivered his inaugural address, entitled:—"RECOLLECTIONS" with special reference to some of our old-time worthies,— William Banister,—G. Mansfield Browne,—William Carter,— Arthur C. Cole,—William H. Dallinger,—J. Sibley Hicks,— H. H. Higgins,—J. Birdsall Jones,—George Thomas,— William H. Weightman.

"Though death, we dare contend, is not the all,
And naught that dies but blooms again serene,
Fain would we linger o'er this closing scene,
And when, perforce, we answer to the call,
And younger players fill our vacant parts,
Fain would we live awhile within your hearts,
Like lingering leaves."

(Arthur Scott Craven.)

MEMBERS' EXHIBITS—

Gold Leaf ... ... Sections of Spine of Echinus ... ... " " Shell—Alveolina	Edward Fry
Pond Life from beneath the Ice.—(Melicerta ringens and Stephanoceros Eichornii, etc.)	Theodore Garnett
Antenna of Male Gnat	J. A. Henderson
Diatoms from Celebes	E. Leonard
Radiolaria	J. T. Norman-Thomas
Section of Jaw of Mole, showing teeth in situ	W. H. Read
Herapathite Crystals	F. J. Smith

FEBRUARY 2nd, 1917.

A paper was read by Mr. William Doran, on "Aniline Dyes and their use in Microscopical Work."

MEMBERS' EXHIBITS—

Radiolaria	Frank Bertrand
Plant Sections	E. Fry
Pond Life.—Free swimming Rotifera from Sefton Park Lake	Theodore Garnett
Diatoms—"Orthosira arenaria" ...	J. A. Henderson
" from Celebes	E. Leonard
Minute Porcellanous shells (foreign)...	J. D. Macphail
Spines of Moth Catocala from West Africa	F. N. Pierce
Radiolaria	J. T. Norman-Thomas
Crystals and Cuticles	Henry T. White

MARCH 2nd, 1917.

Mr. E. Leonard read a paper on "The Distribution of Diatoms," communicated by Mr. F. W. Mills, F.R.M.S.

Sir Helenus R. Robertson, F.R.M.S., kindly lent a number of Lantern Slides of Diatoms which were shown on the screen.

MEMBERS' EXHIBITS—

Diatoms—Navicula Rhomboides ... ,, Pleurosigma Angulatum ... ,, Heliopelta	E. Fry
,, from Egypt	J. A. Henderson
A form of Granite (Felspar, Mica, Quartz) largely used in the manufacture of Pottery and commercially known as "China Stone" (Polariscope)	F. W. Hutton
Diatoms from Bay of Naples	E. Leonard
Diatomaceæ—Barbados and Oamaru deposits	J. D. Macphail
Isthmia enervis and Living Diatoms...	W. H. Read
Hydroquinone, dissolved in Acetone (Polariscope)	F. J. Smith
Diatoms—Oamaru—selected ... ... Young Trout—showing blood circulation	J. T. Norman-Thomas
Diatoms	C. H. Hesketh-Walker
Diatoms	Henry T. White

APRIL 13th, 1917.

P. F. Tinne, Esq., M.A., M.B., read a paper entitled "War Bread" (illustrated by Lantern Slides).

Synopsis:—Historical; Breadmaking; Cereals; Starches of Various Flowers; Our dependance on Corn from abroad; Legitimate or illegitimate Adulteration of Foodstuffs; Bread and War Bread; Waste and Economy.

MEMBERS' EXHIBITS—

Potato Starch ... ... Section of Bean	E. Fry
Starch (tous-les-mois) ... ... Pond Life (Rhinops vitrea, Synchætadæ and other Rotifera)	Theodore Garnett
Embryo Shell of Oyster...	J. A. Henderson
Starch—Various ... ... Sections of Indian Corn and Wheat...	W. Narramore

The Rings of the Earwig—What are they? ... ... Starch—Various	F. N. Pierce
Radiolaria	J. T. Normam-Thomas
Starch of Rice—Oryza sativa ... ... " " Oat—Avena " ... ... " " Wheat—Triticum æstivum ... " " Potato—Solanum tuberosum " " Sweet Potato—Convolvulus batatus	W. H. Read
Starch of Arrowroot	Dr. Tinne
Diatoms from Kamchatka	E. Leonard

MAY 4th, 1917.

There was not any paper read, but the evening was devoted to exhibiting under the microscopes "Living Organisms."

MEMBERS' EXHIBITS—

Tenants of the Oak Apple	James Brown
Living Organisms	C. F. Burne
Living Organisms—Melicerta ringens, Floscularia ornata, Hydra fusca ...	E. Fry
Pond Life—Brachionus pala, Sacculus viridis, Microcodon clavus, etc. ...	Theodore Garnett
Pond Life	J. A. Henderson
Living Organisms	Wm. E. Harper
Actinosphaerium, closely related to Actinophrys Sol but larger	F. W. Hutton
Living Organisms	E. Leonard
" "	Jas. D. Macphail
Hydra Viridis, budding	Wm. Narramore
Living Organisms	F. N. Pierce
Lemon scale insect	W. H. Read
Life ... ... Radiolaria	J. T. Norman-Thomas
Living Organisms	C. H. Hesketh Walker
Pond Life	Hy. T. White

SEPTEMBER 7th, 1917.

There was no paper read, but the evening was devoted to exhibiting under the microscopes "Living Organisms."

MEMBERS' EXHIBITS—

Species of Cynipidœ	James Brown
Living Organisms	C. F. Burne
" "	E. Fry
Pond Life	W. E. Harper
Cyclosis in Tradescantia	J. D. Macphail
Insect Structure	F. N. Pierce
Life ... ... Radiolaria	J. T. Norman-Thomas
Daphnia and Nauplius	W. H. Read
Living Organisms	Hy. T. White

OCTOBER 5th, 1917.

A paper was read, entitled:—"Some Notes on Fungi," by Wm. Narramore, Esq., F.L.S., M.R.S. Inst., with Lantern Illustrations.

MEMBERS' EXHIBITS—

Radiolaria	F. Bertrand
Fungi	Jas. Brown
Transverse Section—Coprinus ... Spiral Fungus—"Trichia chrysosperma" Spores—Meadowsweet Fungus ... " Periwinkle " ...	E. Fry
Fungus—Teleutospores from Bramble Pond Life (Brachionus Bakeri and other Rotifera)	Theodore Garnett
Wing of White Plume Moth	J. A. Henderson
Fungus	E. Leonard
Peziza—ascus and spores	J. D. Macphail
Pythium—Seedling disease	W. Narramore
Insect Structure	F. N. Pierce
Radiolaria ... ... Rose leaf Fungus	J. T. Norman-Thomas

NOVEMBER 2nd, 1917.

Mr. R. Croston read a paper on "Sphagnum as a Dressing for War Wounds."

MEMBERS' EXHIBITS—

Radiolaria	F. Bertrand
Pupal spiracle of Smerinthus populi ...	Jas. Brown

Plant Sections—Helianthus Annuus ...	E. Fry
Pond Life (Oecistes stygis, Oecistes pillula, Stephanops chlæna, Tardigrada, Ophridium sessile, etc.) ...	Theodore Garnett
Radiolaria	J. A. Henderson
Platino cyanide of Magnesium... ...	W. Larkin
Actinophrys sol ... ... Spirogyra, forming resting spores ...	W. H. Read
Insect Structure	F. N. Pierce
Radiolaria	J. T. Norman-Thomas
Sphagnum	J. D. Macphail

DECEMBER 7th, 1917.

Mr. W. T. Haydon read a paper on "Henry David Thoreau, an old time Naturalist," illustrated by Lantern Slides.

MEMBERS' EXHIBITS—

Dipteral halteres	James Brown
Rock Sections under polarized light:— Syenite ... ... Quartz Diorite ... ... Olivine Gabbro ... ... Olivine Dolorite	E. Fry
Pond Life (Philodina megalotrocha, Brachionus brevispina, Limnias myriophylli, Stephanops muticus, Rixicolo affinis, etc.	Theodore Garnett
Radiolaria	J. A. Henderson
Head of Spider, mounted without pressure	Thompson Muskett
Apteryogota—Campodea, Hydra fusca and Hydra viridis	W. H. Read
Radiolaria	J. T. Norman-Thomas
Diatoms in alimentary canal of Tadpole	C. H. Hesketh Walker

The following Field Meetings were held:—

May 26th, 1917.—At Bromborough	*Leader*—Mr. C. F. Burne
June 30th, „ „ Runcorn	„ Mr. F. W. Hutton
July 28th, „ „ Allerton, etc.	„ Mr. Theodore Garnett
Sept. 1st, „ „ Mollington	
Sept. 29th, „ „ Allerton	„ Mr. Theodore Garnett

Librarian's Report, 1st January, 1918.

During the past year the Library has been increased by the following works:—

By Presentation:—

Journals of the Royal Microscopical Society. Quekett Microscopical Club and The Manchester Microscopical Society.

By Purchase:—

Popular Handbook to the Microscope.
By Lewis Wright, 1910 Edition (making 2 copies).

Name this Flower, by Gaston Bonnier.

Principals of Plant Teratology, vol. 2, by W. C. Worsdell (Ray Society publication).

Optic projection, by S. H. and H. P. Gage.

Life of the Caterpillar, by J. Fabre.

Making a total of 321 volumes in the Library.

I am glad to be able to report that members evince an increasing interest in the Library, and that during 1917 69 works were taken out as against 50 in 1916 and 7 in 1915.

This is of course very gratifying to me and I hope the interest may continue, and even increase, in 1918. I shall be most happy to advise new members as to any works they may require, and if the latter are not already in the Library to try and obtain same should they appear likely to be of general interest.

As to slides I can only repeat what I said on this occasion a year ago, namely that very little use is being made of our extensive collection.

E. LEONARD,
Hon. Librarian.

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„ Advertisements for 1916	1	10	9
„ „ „ 1917	1	12	6
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Audited and found correct,

FRANK J. SMITH.

J. R. HAYDON,

Hon. Treasurer.

Liverpool, 18th January, 1918.

LIVERPOOL MICROSCOPICAL SOCIETY.

LIST OF MEMBERS.

JANUARY, 1918.

HONORARY MEMBERS.

R. NEWSTEAD, M.Sc., F.R.S., A.L S., F.E.S., Liverpool University.

*J. T. NORMAN-THOMAS, F.L.S., The Serpentine South, Blundellsands.

WILLIAM NARRAMORE, F.L.S., M.R.S., Inst., "Devonia," Cambridge Avenue, Great Crosby, Liverpool.

CORRESPONDING MEMBERS.

Miss Jane Weightman, M.A., Principal, "Mary Vaughan" High School, Hang Chow, Chekiang, China.

J. L. K. Pedder, Heywood's, St. Peter, Barbados.

Seabury Edwardes, Excise Dept., Bhamo, Upper Burma.

ORDINARY MEMBERS.

** Members of Council.*

ELECTED

1881 Abraham, Miss Emma C., Grassendale Park.

1917 Ahlborn, Miss Jane, 23 Ramilies Road, Sefton Park.

1900 Aman, F. T., Assoc. Mem. Inst., C.E., City Engineer's Office, Municipal Buildings, Dale Street.

1905 Armstrong, Frank, 112 Bold Street.

1907 Astbury, E., "Merok," 3 Belvidere Park, Great Crosby.

1915 Atkinson, Thomas, 70 Bold Street.

1914 *Bertrand, Frank, 34a Bold Street.

1901 Bridger, Robert, 1 Sea Road, Wallasey.

1916 Broadbridge, W. R., Central Buildings, 41 North John Street.

1917 Brodie., W., M.Inst., C.E., Dock Office, Liverpool.

1917 Brown, James, 7 Eltham Street, Fairfield.

1903 Burne, Charles F., 2 Park House, Nelson Street, New Brighton.

1917 Cook, Arthur, 50 Arnold Street.

1904 *Croston, R., 69 Marlborough Road, Tuebrook.

1918 Cunliffe, R. Foster, 28 Princes Avenue.

1913 Cunningham, W. J., Norman Road, Runcorn.

1891 Davies, Herbert E., M.A., B.Sc., F.I.C., Chapel Chambers, Chapel Street.

1879 Deacon, H. Wade, J.P., 8 Ullet Road.

1905 Dearsley, A. H., 112 Bold Street.

1916 Doran, William, 32 Rufford Road, Fairfield.

1913 Driver, W. R., 3 Mulgrave Street.

1918 Evans, John, 5 Parkbridge Road, Birkenhead.

1892 Forshaw, F. H., Riverside, Halebank, nr. Widnes.

1913 *Fry, Edward, 89 Penny Lane, Sefton Park.

1913 Garnett, Miss Amy, South Bank Road, Grassendale.

1912 *Garnett, Theodore, M.A., South Bank Road, Grassendale.

1916 Gladstone, Ernest S., Sandown Lodge, Olive Lane, Wavertree.

1916 Glover, Samuel, F.R.M.S., Olive Mount, St. Anns, St. Helens.

1917 Gould, Joseph, 73 Littledale Road, Egremont.

1885 Gray, George Watson, F.I.C., "Allendale," Clarendon Road, Garston.

1918 Greenough, James, 81 Byrom Street.

1916 Guest, Cecil F., 272, Westminster Road.

1917 Harrison, Miss J. Bertha, 78 Huskisson Street.

1912 *Harper, William E., 3 The Elms, Dingle.

1900 *Haydon, James Richard, Highbury, Ranelagh Drive, Grassendale.

1892 Haydon, W. T., F.L.S., 55 Grey Road, Walton.

1917 Headey, Rev. Walter A., 4 Slyne Road, Lancaster.

1869 Healey, George F., "Oaklyn," 27 Cearns Road, Oxton.

1917 Hepton, J. Cussons, M.R.C.S., Springfields, Waterloo.

1915 *Henderson, J. A., 18 Elm Hall Drive, Mossley Hill.

1917 Hilton, Miss Irene, "Montrose," Thingwall Road, Wavertree.

1918 Hughes, Miss Isabel, "Lisburn," Wavertree Nook Road, Wavertree.

1911 *Hutton, F. W., 53 Greenway Road, Runcorn.

1910 Kenworthy, A. B., 38 Egerton Road, Wavertree.

1912 Larkin, Wm., 29 The Moorings, Banks Road, West Kirby

1915 Leeson, Herbert Sefton, 2 Elm Bank, Everton.

1907 *Leonard, Edward, 14 Fairview Road, Oxton.

1913 Leonard, Mrs. F. E., 14 Fairview Road, Oxton.

1910 Lunt, George, "Lincluden," Formby, Lancs.

1916 McDonald, Archie W., L.R C.P. and S. (Edin.), L.R.F.P.S. (Glas.), "Glencoe," 55 St. Mary's Road. Huyton.

1916 McDonald, Mrs., "Glencoe," 55 St. Mary's Road, Huyton.

1898 *Macphail, James D., 40 Moss Lane, Walton.

1913 Marples, Joseph, 25 Ball's Road, Birkenhead.

1915 Muskett, Thompson, 101 Gwladys Street, Walton, 1914 Mussalli, A. J., "Clifton," St. Anthony's Road, Blundellsands.

1917 Newell, Alfred V., 28 Meadway, Garden Suburb.

1893 Nuttall, F. R. Dixon-, F.R.M.S., "Ingleholme," Eccleston Park, near Prescot.

1916 *Pallis, Alexander, J.P., "Tatoi," Aigburth Drive.

1917 Papamosco, Miss A., 78 Huskisson Street.

1888 *Pierce, F. N., F.E.S., 1 The Elms, Dingle.

1897 *Powell, W. H., 2 Lord Nelson Street.

1909 Pryce, George, B.A., 19 Fairview Road, Oxton, Birkenhead.

1917 Pritchard, E. O., 1 Banks Avenue, Great Meols, Cheshire.

1881 *Read, W. H., "Lisadel," Caithness Drive, Liscard.

1918 Rigbey, J. H., 47 Westbank Road, Birkenhead.

1913 Rimmer, C. Percy, 5 Devonshire Road.

1916 *Roberts, R. W. Boothman, Waverley, Kinross Road, Waterloo.

1885 Robertson, Sir Helenus R., F.R.M.S., Upton Grange, Chester.

1917 Rogers, David A., 113 Woodchurch Road, Birkenhead.

1879 Scholefield, Joshua William, J.P., 33 Pembroke Road, Bootle.

1916 Simpson, Thomas, M.D., Junior Reform Club.

1916 Sloan, Robert A., 40 Village Road, Oxton.

1911 *Smith, Frank J., B.Sc., 36 Brelade Road.

1913 Tinne, Mrs. E. M., Oak Cottage, The Serpentine, Grassendale.

1907 *Tinne, Philip F., M.A., M.B., Oak Cottage, The Serpentine, Grassendale.

1917 Tryhorn, Frederick G., M.Sc., 45 Hallville Road, Mossley Hill.

1913 *Walker, C. H. Hesketh, 41 South Castle Street.

1917 Ward, Edward H., 85 Victoria Road, Tranmere.

1917 Weightman, Miss F., Alexandra Road, Waterloo.

1911 *White, Henry T., 2 Reedville, Oxton.

1871 Williams, J. Michael, 31 Grove Park.

1897 Williams, W. Collingwood, B.Sc., F.I.C., Beechfield, Roby.

THE LIVERPOOL MICROSCOPICAL SOCIETY

was founded in the year 1868, having for its object the cultivation and advancement of Microscopy.

The ordinary meetings are held at the Royal Institution, Colquitt Street, at 7-30 o'clock on the first Friday evening in every month, except January, June, July and August.

The Annual General Meeting is held on the third Friday in January.

During the summer a number of Field Meetings are arranged, to which members are invited to bring their friends.

Candidates for Membership must be proposed by three or more members, one of the proposers from personal knowledge of the candidate.

The Society possesses a useful Library, and numerous Microscopical preparations.

Further information may be had from the Hon. Secretary.

FIFTY-FIRST AND FIFTY-SECOND

ANNUAL REPORTS

OF THE

LIVERPOOL

Microscopical Society.

ABSTRACT OF PROCEEDINGS.

JANUARY, 1921.

LIVERPOOL:
SPEIRS AND GLEDSDALE, LTD., PRINTERS, 18, CABLE STREET.

1921.

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LIVERPOOL MICROSCOPICAL SOCIETY
1869-1918
NIHIL TAM PARVUM QUIN
SIT INDAGATIONE DIGNUM
ZOOLOGY
BOTANY
MINERALOGY
CHEMISTRY
ISSUED IN
COMMEMORATION
OF THE
FIFTIETH ANNIVERSARY
OF THE SOCIETY

Liverpool Microscopical Society.

SESSION LIII, 1921.

Past Presidents:	*Year:*
JOHN BIRBECK NEVINS, M.D.	1869, 1870
REV. WM. BANISTER, B.A.	1871
REV. DR. DALLINGER, F.R.S.	1872, 1879
JOHN ABRAHAM	1873
J. J. DRYSDALE, M.D., F.R.M.S.	1874
JOHN NEWTON, M.R.C.S.	1875, 1894, 1895
REV. HENRY H. HIGGINS, M.A.	1876, 1877, 1886
GEORGE F. CHANTRELL	1878
J. S. HICKS, F.R.C.S., F.L.S.	1880
WILLIAM CARTER, M.D., F.R.C.P.	1881, 1891, 1892
W. H. WEIGHTMAN, F.R.M.S.	1882
FRANK T. PAUL, F.R.C.S.	1883
CHARLES BOTTERILL	1884, 1885
REV. F. BALLARD, D.D., B.Sc., F.G.S., F.R.M.S.	1887
A. NORMAN TATE, F.I.C., F.C.S., F.R.M.S.	1888
ISAAC C. THOMPSON, F.L.S., F.R.M.S.	1889, 1890
F. CHARLES LARKIN, F.R.C.S.	1893
EDWARD DAVIES, F.C.S., F.I.C.	1896
WM. NARRAMORE, F.L.S., M.R.S.Inst.	1897, 1898
W. T. HAYDON, F.L.S.	1899, 1900
HERBERT E. DAVIES, M.A., B.Sc., F.I.C.	1901, 1902
R. J. M. BUCHANAN, M.D., M.R.C.P.	1903, 1904
JAMES D. MACPHAIL	1905, 1906, 1914, 1915
JOHN HAY, M.D., M.R.C.P.	1907
A. H. DUDLEY	1908, 1909
F. N. PIERCE, F.E.S.	1910, 1911
P. F. TINNE, M.A., M.B.	1912, 1913
THEODORE GARNETT, M.A.	1916
J. T. NORMAN-THOMAS, F.L.S.	1917, 1918
C. H. HESKETH-WALKER	1919, 1920

OFFICERS and COUNCIL

Elected 16th January, 1920.

President:

C. H. HESKETH-WALKER.

Vice-Presidents:

THEODORE GARNETT, M.A.

EDWARD FRY.

Hon. Treasurer:

W. E. HARPER.

Hon. Secretary:

R. CROSTON.

Hon. Librarian and Curator:

THOMPSON MUSKETT.

Council:

JAMES BROWN.
ARTHUR COOK.
W. DORAN, B.Sc., A.I.C.
JOS. GOULD.
J. R. HAYDON.
J. A. HENDERSON.
E. LEONARD.
JAMES D. MACPHAIL.
E. O. PRITCHARD.
W. H. READ.
ROBERT A. SLOAN.
F. J. SMITH, B.Sc., A.I.C.
J. T. NORMAN-THOMAS, F.L.S.

OFFICERS AND COUNCIL,

Elected January, 1921.

President:

EDWARD FRY.

Vice-Presidents:

THEODORE GARNETT.

C. H. HESKETH-WALKER.

Hon. Treasurer:

W. E. HARPER.

Joint Hon. Secretaries:

R. CROSTON.

THOMPSON MUSKETT.

Hon. Librarian:

STANLEY LOWELL.

Hon. Curator:

ARTHUR COOK.

Council:

WM. HORTON.
J. M. LAMB.
J. R. J. TURNER.
W. H. WHITE.
J. T. NORMAN-THOMAS
JOS. GOULD.
J. R. HAYDON.
J. A. HENDERSON.
J. D. MACPHAIL.
E. O. PRITCHARD.
R. A. SLOAN.
F. J. SMITH.

FIFTY-FIRST ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

January, 1920.

SATISFACTORY progress has been made during the past year. The number of members has increased, and there is every reason for hoping that as soon as the nation becomes more settled, and reconstruction schemes begin to have the effect of removing many of the causes of unrest, there will be a still greater influx of candidates for membership. Although the number of resignations has been greater during the year, there is a probable explanation forthcoming in the difficulty of many members getting to the meetings owing to restricted train service. As this is not likely to continue long, we may expect that the improved facilities will be followed by increased attendances. Considering the inconvenience to the members who come from a distance, the attendance has been very good.

A large number of the medals struck to commemorate the Jubilee of the Society have been sold, and the Council would like those members who have not already applied for one to do so early, as it is contemplated destroying the dies, and reproductions will then be impossible.

Three Silver Medals have been struck, of which one has been presented to Mr. C. H. Hesketh-Walker and one to Mr. J. T. Norman-Thomas, in recognition of their services to the Society.

The remaining one has been placed in the Society Cabinet.

It is with deep regret that the Council have to report the death of Sir Helenus R. Robertson, who had been a member of the Society 34 years.

During the year 18 ordinary members have been elected and 10 have resigned. The present membership is 8 honorary members and 106 ordinary members.

There have been six Field Meetings during the year, the attendance being fair, but an increase in the number of members attending is desirable. The Council would like to see more of the members bringing their microscopes on meeting nights. The exhibits contribute so much to the interest of members and visitors.

JANUARY 17th, 1919.

The following Exhibits were shown at the meeting :—

Ova cocoon of Lumbricus terrestris...	JAMES BROWN.
Embryo of the Pig	A. COOK
Transverse, Radial and Tangential longitudinal sections of Pine ...	E. FRY.
Boxwood Model showing Transverse, Radial and Tangential longitudinal surfaces	do.
The living Larva of Glow-worm—Lampyris Noctiluca	do.
Pond Life...	THEODORE GARNETT.
Radiolaria...	J. A. HENDERSON.
Crystals of Hippuric Acid	W. LARKIN.
Diatom, Lepidodiscus elegans from Simbirsk, Russia	E. LEONARD.
Dalton's Exhibition Slides of Butterfly Scales	JAS. D. MACPHAIL.
Wood sections	E. O. PRITCHARD.
Teeth, in sections and otherwise ...	W. H. READ.
Radiolaria and sundry objects of interest	J. T. NORMAN-THOMAS.
Curious and rare Insects from Brazil.	C. H. HESKETH-WALKER.
Nest of Trap Door Spider	do.
The Structure of Steel...	do.
Ornamental Panel—Apple Blossom and Butterfly	do.

Section of Pitchstone, Arran, showing early arborescent forms of Crystallisation	H. T. WHITE.
Various Steels showing structure ...	JOSEPH M. LAMBE.
Demonstrations of difference in hardness of Metals by means of the Scleroscope	do.

And also a number of other interesting objects. Refreshments were also provided.

FEBRUARY 7th, 1919.

Mr. J. T. Norman-Thomas and Mr. C. H. Hesketh-Walker were presented with a copy of the Jubilee medal struck in silver.

The medals struck to commemorate the Jubilee of the Society were on exhibition, and issued to the members.

The President delivered a lecture entitled "The Fairyland of Science," illustrated by Lantern Slides, Colour Drawings on the Blackboard, and Chemical Experiments.

THE FOLLOWING WERE THE EXHIBITS—

Palpal mandible of Wild Bee	JAMES BROWN.
Posterior spiracles of the larva of the house fly	A. COOK.
Pond Life...	THEODORE GARNETT.
Sections of Ivy Stems	E. A. GIBSON.
Mitosis in root of Water Lily... ...	J. GOULD.
Electrolytic action	J. A. HENDERSON.
Hydrachna	W. LARKIN.
Diatoms	E. LEONARD.
Foraminifera (opaque)...	T. MUSKETT.
Coremata of Diasemia Ramburialis...	F. N. PIERCE.
Section of Granite (Polariscope) ...	W. H. READ.

MARCH 7th, 1919.

Mr. Geo. F. Healey presented to the Society a number of books, and also a cheque for £10, as an acknowledgment of pleasure he has received at our meetings through a number of years.

Mr. Leonard read a communication from Mr. Albert Mann (Corresponding Member) on the presence of Diatoms in Snow from a storm at Madison, Wisconsin.

Mr. Jos. Marples exhibited by means of lantern slides methods of demonstrating Acoustic Curves.

THE FOLLOWING WERE THE EXHIBITS—

Vacated Ova of Vapourer Moth ...	JAMES BROWN.
Transverse section, Leaf of Holly ...	CHAS. F. BURNE.
Pond Life...	THEODORE GARNETT.
Arachnoidiscus Japonicus in situ on Coralline	J. GOULD.
Chemical Affinity	J. A. HENDERSON.
Sphærozoum Punctatum	W. LARKIN.
Various Parasites	JAS. D. MACPHAIL.
Shells recently sent by J. L. K. Pedder, Esq., Barbadoes	do.
Insect Structure...	F. N. PIERCE.
Intestine of Serpent (injected) ...	W. H. READ.
Radiolaria	J. T. NORMAN-THOMAS.
Insect Structure	C. H. HESKETH-WALKER.
Insects, and detached portions ...	HY. T. WHITE.

And also a number of others.

APRIL 4th, 1919.

Mr. W. T. Haydon, F.L.S., delivered an address on Reproduction in Pinus Sylvestris, with lantern illustrations.

MEMBERS' EXHIBITS—

Diatoms—Gomphonema Germinatum, with photos	H. R. BOULTON.
Fragment of Flustra foliacea ...	JAMES BROWN.
Fertile Spike of Selaginella	A. COOK.

Medusa of Obelia geniculata	J. Gould.
Pond Life...	Theodore Garnett.
Eyes of Spider	G. F. Healey.
Electrolysis of Lead Acetate	J. A. Henderson.
Metal specimens—Steel, Brass, Copper	J. M. Lamb.
Pinus Sylvestris—Transverse section of Leaf	W. Larkin.
Pinus Sylvestris—Transverse section of Seed	do.
Diopsis apicalis	Jas. D. Macphail.
Liver (injected)	W. H. Read.
Radiolaria	J. T. Norman-Thomas.
Insect Structure	C. H. Hesketh-Walker.
Asparagin and others (polariscope)...	Ed. H. Ward.
Fresh Water Diatoms, Melosira, Synedra, Fragillaria...	E. G. Williams.

And others.

MAY 2nd, 1919.

Gossip meeting.

THE FOLLOWING WERE THE EXHIBITS—

Diatoms—Gomphonema Germinatum	H. R. Boulton.
Protococci	James Brown.
Eggs of House Fly	G. N. Coombs.
Eyes of do.	do.
Pond Life...	Theodore Garnett.
do.	J. Gould.
Living Organisms	W. E. Harper.
do.	J. A. Henderson.
Diatoms	E. Leonard.
Pond Life...	Jas. D. Macphail.
Life...	J. T. Norman-Thomas.
Radiolaria	do.
Some Dissections of the Flea, Pulex irritans	C. H. Hesketh-Walker.

SEPTEMBER 5th, 1919.

The President gave a short address welcoming the members to the opening of the winter session 1919/20, after which the meeting was thrown open.

MEMBERS' EXHIBITS—

Desmids—Closterium	JAMES BROWN.
Pond Life...	THEODORE GARNETT.
Living objects	J. GOULD.
Pond Life...	J. A. HENDERSON.
Diatoms	E. LEONARD.
Pond Life...	JAS. D. MACPHAIL.
Nereis—Polychæta, class Chætopoda.	W. H. READ.
Insects	C. H. HESKETH-WALKER.
Various	H. T. WHITE.

And others.

OCTOBER 3rd, 1919.

Mr. R. A. Sloan gave an address upon the methods of finding the focal length of lenses, illustrated with numerous diagrams on the blackboard.

MEMBERS' EXHIBITS—

Snakeshead Coralline (Aäeta anguina)	G. N. COOMBS.
Pond Life...	THEODORE GARNETT.
Leaf appendages of various plants...	E. A. GIBSON.
Fredericella sultana	J. GOULD.
West Indian Sponges, &c., sent by J. L. Pedder, Barbadoes	JAS. D. MACPHAIL.
Living Diatoms—Bacillaria paradoxa.	T. MUSKETT.
Lophopus crystallinum—mounted ...	J. T. NORMAN-THOMAS.
Plumatella repens do. ...	do.
Radiolaria	do.
Tongue and Lancets of Clegg or Horse Fly	E. GARDINER WILLIAMS.

And others.

NOVEMBER 7th, 1919.

Mr. F. W. Hutton read his paper (postponed from October meeting) on the History and Development of The Polyzoa, and illustrated same by lantern slides and specimens.

EXHIBITS IN ILLUSTRATION OF THE SUBJECT :—

Gemellaria loricata	J. A. Henderson.
Bowerbankia imbricata...	do.
Pedicellina cernua	F. H. Eccles.
Cellepora sp.	Theodore Garnett.
Flustra foliacea	do.
Flustra carbasea	W. H. Read.
Flustrella hispida	do.
Membranipora pilosa	J. T. Norman-Thomas.
Crisia eburnea	do.
Bugula Flabellata	Hy. T. White.
Bugula turbinata	do.
Flustra foliacea (section)	C. H. Hesketh-Walker.
Statoblasts—Cristatella mucedo ...	do.
do. Plumattela repens ...	do.

OTHER MEMBERS' EXHIBITS—

Inorganic structure of Bone	James Brown.
Moss showing gemmæ...	A. Cook.
Infusoria from Infusion of hay ...	do.
Australian Zoophyte	E. A. Gibson.
Proboscis of Blow Fly...	J. Gould.
Radiolaria	J. T. Norman-Thomas.
Bugula Flustra, &c., fresh cast up on shore	W. H. Read.

And others.

DECEMBER 5th, 1919.

Gossip meeting.

MEMBERS' EXHIBITS—

Torula	James Brown.
Paramoecia in conjugation	A. Cook.
Eggs of Lepidoptera and Diptera ...	do.
Stinging Hairs of Nettle	F. H. Eccles.
Pond Life...	Theodore Garnett.

Lungs and Ovipositor of Spider (Epeira diadema)	J. GOULD.
Pond Life...	W. E. HARPER.
Electrolysis of Stannous chloride ...	J. A. HENDERSON.
Aulacodiscus grandis	E. LEONARD.
Fern Sori...	JAS. D. MACPHAIL.
Radiolaria	J. T. NORMAN-THOMAS.
Crystals under polarised light ...	E. O. PRITCHARD.
Gorgonia spicules	W. H. READ.
Insect structure	C. H. HESKETH-WALKER.

And others.

FIFTY-SECOND ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

January, 1921.

IT is with gratification your Council submits their report for the past year, and in again placing on record the continued prosperity of the Society.

The membership continues in a growing condition, and while the increase in the roll has not been large, yet the enthusiasm of the members in regard to microscopical research remains unabated. It is the constant ideal of your Council to encourage vitality and original work, rather than aim at mere popularity and large attendances.

It is with special regret that the death of Mr. W. H. Read has to be reported. In addition to being one of the Society's oldest members, he rendered over a long period of years most valuable help, both at the Council meetings and the members' meeting. A man of marked originality and thoroughly unconventional, he was a diligent student of nature, a clever draughtsman and expert demonstrator, and a genial friend. His absence is much deplored.

A promising member in the person of Mr. W. R. Broadbridge has to be added to the obituary.

Mr. F. N. Pierce, who occupied the presidential chair in 1910 and 1911, and who was a member of the Council for many years, having removed from Liverpool, has been elected to our roll of honorary members.

Commencing the year with a membership of 114, there has been added 11 new members, while 4 members have resigned, three being due to removals.

The membership now is 4 honorary and 5 corresponding and 111 ordinary members, making a total of 120, being a net increase of 6.

The general meetings of the Society have been well attended. Six interesting papers have been read, and the exhibits have been of a high standard. A special feature at some of the meetings has been the exhibition of new apparatus and demonstrations of methods of working.

Six field meetings were held during the summer months and were well attended, the results adding to the enjoyment and instruction of the ordinary members. The younger members are specially invited to join these out-of-door gatherings.

The Council are arranging for an exchange of lecturers with other Societies during 1921, and it is confidently hoped that this mutual co-operation may be productive of the highest benefits.

A series of papers has been arranged for the second portion of 1920/1921 session, and your Council looks forward to a continuance of the enthusiasm, diligence, and good-fellowship that has characterised the Society's gatherings for a considerable period.

LIBRARIAN'S REPORT, 1st January, 1920.

During the past year the Library has been increased by the following works :—

By Presentation—

Journals of the Royal Microscopical Society and the Quekett Microscopical Club.

Presented by Mr. George F. Healey—

28 quarterly and 12 monthly parts, in 8 cases, Journals of Microscopy and Natural Science, 1890-7.

24 monthly parts, in 4 cases, Microscopical Journal and Transactions of Royal Microscopical Society.

12 Parts Microscopic Objects, figured and described by J. H. Martin.

7 vols. Journal Transactions of Victoria Institute, 1867-74.

17 loose parts, Transactions of Victoria Institute, 1895-1899.

"The Microscope." Dr. Hogg.

Evenings at the Microscope. Gosse.

British Beetles. E. C. Rye.

Entomology. Kirby and Spence.

10 vols., Proceedings of Liverpool Biological Society.

Guide to Exhibition of Galleries at the British Museum.

Life Histories and their Lessons. Dallinger.

Presented by Mr. George Fry—

"Jungle Peace." Beibe.

By Purchase—

Life of Grasshopper. Fabre.

The Sacred Beetle. Fabre.

Making a total of 361 Volumes in the Library.

The issue of Books to Members is still increasing. During 1919 94 works were taken out, as against 85 the previous year.

The issue of Slides has more than doubled. 32 lots, comprising 372 slides, were issued to Members during the year 1919, as compared with 15 lots (179 slides) for the year 1918.

E. FRY, Hon. Librarian.

LIBRARY REPORT, 1920.

The books in the Library have been in good demand during the past year. One hundred and four books were issued, against 94 in 1919.

The following new books have been added to the library :—

1 Vol. and 1 Set Plates from the Ray Society—British Fresh Water Rhizapods.

1 Vol. Life in Inland Waters, from the Publishers.

1 Set Journal R.M.S. for 1920.

1 ,, Quekett Club for 1920.

Making 375 volumes.

CURATOR'S REPORT, 1920.

The slides in the cabinet have been in greater demand, some 20 members taking out 474 slides, as against 372 in 1919 and 179 during 1918.

The increased work in this department makes it desirable to appoint a Curator in addition to the Librarian.

The following are the details of the meetings :—

JANUARY.

President's address, entitled "The Little Things that Count."

THE FOLLOWING WERE THE EXHIBITS—

Crystallisation of Coumarin (Polariscope)	G. M. BEAUMONT.
Red and White Corpuscles (Man) ...	JAMES BROWN.
Section of Potato—Starch grains in situ	CHAS. F. BURNE.
Eggs of Odenata from France ...	A. COOK.
Pond Life...	THEO. GARNETT.
Hippuric Acid (Polariscope)	J. GOULD.
Australian Gold Dust	J. A. HENDERSON.

Radiolaria	J. T. NORMAN-THOMAS.
Yeast	C. H. H. WALKER.
Sandy residue from washing currants	H. T. WHITE.
Sections from head of young mouse...	W. H. WHITE.
Circulation in sap in Valisneria Spiralis...	S. BLANCHFLOWER.

FEBRUARY.

Paper by W. H. Read. "An Introduction to the Lamellibrancha."

EXHIBITS—

Apex of palpus Mitylus edulis ...	JAMES BROWN.
Algae	ARTHUR COOK.
Sections—Lilium Martagon	E. FRY.
Pond Life...	THEO. GARNETT.
Anchors and plates of Synapta ...	J. GOULD.
Crystalline Silver	J. A. HENDERSON.
Cristatella mucedo mounted... ...	T. MUSKETT.
Lophopus Crystallinus do.	do.
Section of foot of mussel	W. H. READ.
do. gill do.	do.
do. liver do.	do.
Miscellaneous Objects	C. H. HESKETH-WALKER.
Transverse sections from head and throat of mouse	W. H. WHITE.

MARCH.

Gossip meeting.

EXHIBITS—

Polychæta (mounted)	S. BLANCHFLOWER.
Ova of Crangon vulgaris	JAMES BROWN.
Section of flower bud of Dandelion...	ARTHUR COOK.
Drosera	F. H. ECCLES.
Nerve and nerve cells	E. FRY.
Pond Life...	THEO. GARNETT.
Peristome of Moss (Funaria)	J. GOULD.
Living Organisms	W. E. HARPER.
Ruby Copper Ore	J. A. HENDERSON.

EXHIBITS *(continued)*—

Various	Stanley Lowell.
Radiolaria—The Southern Cross ...	T. Muskett.
Photomicrographical slides	J. T. F. Smith.
Grouped Diatoms	H. T. White.
Various stem sections	W. H. White.
Miscellaneous	C. H. Hesketh-Walker.

APRIL.

Paper by Mr. Arthur Cook. " A Few Notes on the Comparative Anatomy and Physiology of some common Invertebrates."

EXHIBITS—

Muscle in leg of Oniscus	James Brown.
Miscellaneous Objects	Arthur Cook.
Polycistina	F. H. Eccles.
Pond Life...	E. Fry.
Pond Life...	Theo. Garnett.
Head of garden spider (Eperiadiadema)	J. Gould.
Pond Life...	W. E. Harper.
Radiolaria	J. A. Henderson.
Miscellaneous (polariscope)	Stanley Lowell.
Colorado Beetle Doryphoradecom-lineata	J. D. Macphail.
Hydrozoa Obelia geniculata	T. Muskett.
Crustacea Mysis...	do.
Miscellaneous	C. H. Hesketh-Walker.
Rock sections	E. H. Ward.
Oxalate of Chromium and Potash (polar)	H. T. White.

MAY.

Gossip meeting.

EXHIBITS—

Living organisms	James Brown.
Antheridia and Oogonis of Nitella...	Arthur Cook.
Pond Life...	C. F. Burne.
Pond Life...	E. Fry.
Pond Life...	Theo. Garnett.
Living organisms	J. Gould.
Living organisms	W. E. Harper.

EXHIBITS *(continued)*—

Living organisms	J. A. Henderson.
Pond Life...	J. D. Macphail.
Miscellaneous	C. H. Hesketh-Walker.
Cotton, Wool, and Flax	H. T. White.

SEPTEMBER.

EXHIBITS OF LIVING ORGANISMS—

Diatome vulgare...	James Brown.
Living organisms	Arthur Cook.
Pond Life...	F. H. Eccles.
Pond Life...	E. Fry.
Pond Life...	Theo. Garnett.
Melicerta Ringens	J. Gould.
Living organisms	J. A. Henderson.
Volvox Globator (mounted)	T. Muskett.
Radiolaria	J. T. Norman-Thomas.
Plant Hairs	W. H. Read.
Living Fresh water Larvæ of Ephemera	C. H. Hesketh-Walker.

OCTOBER.

A paper by Mr. James Brown on " Mounting Media."

Exhibition of deep cell mounting by Mr. C. H. Hesketh-Walker.

Exhibition of new Turn-table by Mr. R. A. Sloan.

MEMBERS' EXHIBITS—

Various mounts	James Brown.
Living organisms	Arthur Cook.
Pond Life...	F. H. Eccles.
Living organisms in water	E. Fry.
Pond Life...	Theo. Garnett.
Cornuspira involvens	J. Gould.
Miscellaneous	W. E. Harper.
Electrolysis of metallic solutions ...	J. A. Henderson.
Cristatella mucedo (mounted) ...	T. Muskett.
Radiolaria	J. T. Norman-Thomas.
Deep cell mounts	C. H. Hesketh-Walker.
Rock sections	E. H. Ward.
Foraminifera	H. T. White.

NOVEMBER.

A paper by Dr. Alfred Holt on "Chemistry and Microscopy."

EXHIBITS—

Pond Life...	S. Blanchflower.
Down	James Brown.
Ichneumoned Aphides	Arthur Cook.
Various Diatoms	F. H. Eccles.
Crystals by polarised light	E. Fry.
Pond Life...	Theo. Garnett.
Miliolina pulchella	J. Gould.
Miscellaneous	W. E. Harper.
Electro-chemical decomposition	J. A. Henderson.
Berberine, sent by W. Larkin	T. Muskett.
Archegonia of Mnium, sent by W. Larkin	do.
Isotoma Grisea (Collembola Degeeridea)	do.
Slides showing structure of Tsetse Fly	J. D. Macphail.
Radiolaria	J. T. Norman-Thomas.
Amygdaline by polarised light	W. H. Read.
Brownian movement	J. R. Turner.
Chemical slides by polarised light...	H. T. White.
Various	C. H. Hesketh-Walker.

DECEMBER.

Exhibition of new Objective Changer by Mr. R. A. Sloan, with practical Demonstrations.

MEMBERS' EXHIBITS—

Chelifers (living)	Arthur Cook.
Cornea of Gad Fly	F. H. Eccles.
Fish scales	E. Fry.
Pond Life...	Theo. Garnett.
Polystomella Crispa	J. Gould.
Living organisms	W. E. Harper.
Electrolysis of Lead Nitrate	J. A. Henderson.
Crystals	T. Muskett.
Radiolaria	J. T. Norman-Thomas.
Miscellaneous	C. H. Hesketh-Walker.

THE LIVERPOOL MICROSCOPICAL SOCIETY.

Dr. IN ACCOUNT WITH THE TREASURER, 1919. *Cr.*

Dr.				£	s.	d.	Cr.	£	s.	d.
1919—										
To Rent of Rooms				10	10	0	By Balance forward	24	12	7
,, Printing, Stationery, Postages, etc.				34	13	1	,, Subscriptions 1—1915	0	10	6
,, Sub-Librarian				1	1	0	,, ,, 2—1916	1	1	0
,, Attendance				2	5	0	,, ,, 5—1917	2	12	6
,, Books for Library ...	0	15	0				,, ,, 11—1918	5	15	6
,, Sub. to Ray Society ...	1	1	0				,, ,, 1 half—1918	0	5	3
				1	16	0	,, ,, 90—1919	47	5	0
,, Electric Lamps—Repairing ...				0	8	10	,, ,, 8 half—1919	2	2	0
,, Fire Insurance				0	5	0	,, ,, 11—1920	5	15	6
,, Lantern Expenses				0	10	8	,, Advertisements for 1918	0	15	0
,, Refreshments...				5	0	0	,, ,, ,, 1919	1	3	0
,, Elkington's (Medals)				79	14	0	,, Donations	10	9	2
,, Expenses (in con. with medals) ...				3	16	5	,, Sale of Old Lamp	0	5	0
,, Balance				13	17	0	,, Bank Interest	0	5	0
							,, 68 Medals at 15/-	51	0	0
				£153	17	0		£153	17	0

Audited and found correct,

FRANK J. SMITH.

J. R. HAYDON,
Hon. Treasurer.

LIVERPOOL, *January 13th*, 1920.

THE LIVERPOOL MICROSCOPICAL SOCIETY.

FINANCIAL STATEMENT, YEAR 1920.

	£	s.	d.		£	s.	d.
To Subscriptions to Ray Society ...	1	1	0	By Balance from 1919	13	17	0
,, Receipt Books	1	2	6	,, Subscriptions—			
,, Electric Repairs	1	14	6	1919—4	2	2	0
,, Printing	16	5	6	1920—60	31	10	0
,, New Lamps and Attendances ...	3	6	0	1921—19	4	14	6
,, Gas for Lantern, Cheque Book, and Fire Insurance	0	13	0	,, Sale of 2 Medals	1	10	0
,, Rent of Rooms	11	11	0	,, Advertisements, 1919	0	15	0
,, Postages	2	7	7	,, Bank Interest	0	9	1
,, Balance in hand	16	16	6				
	54	17	7		54	17	7

LIVERPOOL MICROSCOPICAL SOCIETY.

LIST OF MEMBERS.

January, 1919.

HONORARY MEMBERS.

R. NEWSTEAD, M.Sc., F.R.S., A.L.S., F.E.S., Liverpool University.

*J. T. NORMAN-THOMAS, F.L.S., The Serpentine South, Blundellsands.

WILLIAM NARRAMORE, F.L.S., M.R.S., Inst., 33 Milton Road, Waterloo, Liverpool.

F. N. PIERCE, F.E.S., The Old Rectory, Warmington, Oundle, North Hants.

CORRESPONDING MEMBERS.

Miss Jane Weightman, M.A., Principal, " Mary Vaughan " High School, Hang Chow, Chekiang, China.

J. L. K. Pedder, Heywood's, St. Peter, Barbados.

Seabury Edwards, F.R.M.S., Supt. of Excise, Moulmein, Lower Burmah.

W. H. Harrison, Imperial Agricultural Research Institute, Pusa (Behar), N. India.

Albert Mann, Bureau of Plant Industry, Washington, U.S.A.

ORDINARY MEMBERS.

**Members of Council.*

ELECTED

1881 Abraham, Miss Emma C., Grassendale Park.

1917 Ahlborn, Miss Jane, 23 Ramilies Road, Sefton Park.

1900 Aman, F. T., A.M.Inst.C.E., City Engineer's Office, Municipal Buildings, Dale Street.

1905 Armstrong, Frank, 112 Bold Street.

1915 Atkinson, Thomas, 70 Bold Street.

1920 Beadle, Miss Margaret, 177 Clifton Street, Old Trafford.

1919 Beaumont, G. M., Bariviesdale, Hunts Cross.

1919 Blanchflower, S., 66 Garmoyle Road, Sefton Park.

1901 Bridger, Robert, 1 Sea Road, Wallasey.

1917 Brodie, W., M.Inst.C.E., Dock Office, Liverpool.

1917 Brown, James, 7 Eltham Street, Fairfield.

1919 Bullen, David, The Glade, Aughton.

1903 Burne, Charles F., 2 Park House, Nelson Street, New Brighton.

1920 Campbell, J. H., 20 Tatton Road, Orrell Park, Liverpool.

ELECTED

1918 Clark, Rev. E., 67 Salisbury Road, Wavertree.

1918 Collie, C. Holmes, Yew Tree Farm, Moreton, near Birkenhead.

1917 *Cook, Arthur, 50 Arnold Street.

1918 Coombs, G. N., 95 Romer Road.

1920 Cross, George, 20 Fieldway, Wavertree.

1904 *Croston, R., 69 Marlborough Road, Tuebrook.

1918 Cunliffe, R. Foster, 28 Princes Avenue.

1913 Cunningham, W. J., Norman Road, Runcorn.

1891 Davies, Herbert E., M.A., B.Sc., F.I.C., Chapel Chambers, Chapel Street.

1879 Deacon, H. Wade, J.P., 8 Ullet Road.

1905 Dearsley, A. H., 112 Bold Street.

1916 Doran, William, B.Sc., A.I.C., 32 Rufford Road, Fairfield.

1913 Driver, W. R., 3 Mulgrave Street.

1918 Drury, James D., 5 Suffolk Street, Hawthorne Road, Bootle.

1919 Eccles, F. H., 16 Abergele Road, Stanley.

1919 Ellison, George, 52 Serpentine Road, Liscard.

ELECTED

1920 Elledge, Harold M., 38 St. Nicholas Road, Wallasey.

1918 Evans, John, 5 Parkbridge Road, Birkenhead.

1920 Ewart, F. J., 71 Bold Street.

1892 Forshaw, F. H., Riverside, Halebank, near Widnes.

1913 *Fry, Edward, 89 Penny Lane, Sefton Park.

1913 Garnett, Miss Amy, South Bank Road, Grassendale.

1912 *Garnett, Theodore, M.A., South Bank Road, Grassendale.

1920 Gauld, James, 1 Thackeray Street.

1918 Gibson, E. A., 1 Sandon Road, Egremont.

1919 Gilbert, Miss M., Public Library, Chiswick.

1916 Gladstone, Ernest S., Woolton Vale, Woolton.

1918 Gleave, Miss E. L., 19 Meadowcroft Road, Wallasey.

1917 *Gould, Joseph, 73 Littledale Road, Egremont.

1885 Gray, George Watson, F.I.C., "Allendale," Clarendon Road, Garston.

1916 Guest, Cecil F., 272 Westminster Road.

ELECTED

1918 Guttridge, J. Mason, Trafford House, Serpentine South, Blundellsands.

1918 Harley, George K., 25 Park View, Waterloo.

1912 *Harper, William E., 3 The Elms, Dingle.

1900 *Haydon, James Richard, Highbury, Ranelagh Drive, Grassendale.

1892 Haydon, W. T., F.L.S., 55 Grey Road, Walton.

1919 Hayes, James, 109 Botanic Road.

1917 Heady, Rev. Walter A.

1869 Healey, George F., " Oaklyn," 27 Cearns Road, Oxton.

1915 *Henderson, J. A., 18 Elm Hall Drive, Mossley Hill.

1917 Hilton, Miss Irene, " Montrose," Thingwall Road, Wavertree.

1918 Horton, Wm., 17 Grove Park.

1920 Hutchison, H. A., 139 Priory Road, Anfield.

1911 Hutton, F. W., 53 Greenway Road, Runcorn.

1920 Joscelyne, Stanley G., 95 Botanic Road.

1910 Kenworthy, A. B., 38 Egerton Road, Wavertree.

1920 Kerr, C. H., Hayfield, Thingwall Road, Wavertree.

ELECTED

1918 *Lamb, J. Mundle, West View, Moor Park, Fazakerley.

1919 Lamb, Mrs., West View, Moor Park, Fazakerley.

1912 Larkin, Wm., Wingtrim, Slade, Ilfracombe.

1915 Leeson, Herbert Sefton, 2 Elm Bank, Everton.

1907 Leonard, Edward, 93 Shrewsbury Road N., B'head.

1919 *Lowell, Stanley, 18 Queens Drive, Stoneycroft.

1920 McCullagh, Rev. C. B., B.A., 38 Marmion Road, Sefton Park.

1916 McDonald, Archie W., L.R.C.P. and S. (Edin.), L.R.F.P.S. (Glas.), "Glencoe," 55 St. Mary's Road, Huyton.

1916 McDonald, Mrs., "Glencoe," 55 St. Mary's Road, Huyton.

1898 *Macphail, James D., 40 Moss Lane, Walton.

1920 Manson, S. J. D., 18 Great George Street, Waterloo.

1919 Mapplebeck, W., L.D.S., 50 Rodney Street.

1913 Marples, Joseph, 25 Ball's Road, Birkenhead.

1919 Mossman, E. H., 46 Stanley Street, Fairfield.

1915 *Muskett, Thompson, 101 Gwladys Street, Walton.

ELECTED

1917 Newell, Alfred V., 28 Nook Rise, Wavertree.

1893 Nuttall, F. R. Dixon-, F.R.M.S., " Ingleholme," Eccleston Park, near Prescot.

1916 Pallis, Alexander, " Tatoi," Aigburth Drive.

1921 Peel, Albert, 6 Ronald Road, Waterloo Park.

1919 Perry, Hanson, 16 Frogmore Road, Market Drayton, Shropshire.

1920 Pierce, Dr. K. R., M.D., 34 Prince's Avenue.

1918 Porter, Charles, Holly Bank, Greenhill Road, Allerton.

1919 Potts, Donald, J.P., Borrowdale, Warren Road, Blundellsands.

1909 Pryce, George, B.A., 19 Fairview Road, Oxton, Birkenhead.

1917 *Pritchard, E. O., 1 Banks Avenue, Great Meols, Cheshire.

1913 Rimmer, C. Percy, 5 Devonshire Road.

1916 Roberts, R. W. Boothman, Waverley, Kinross Road, Waterloo.

1916 Simpson, Thomas, M.D., Junior Reform Club.

1916 *Sloan, Robert A., 40 Village Road, Oxton.

1911 *Smith, Frank J., B.Sc., A.I.C., 36 Brelade Road.

1918 Smith, T. J. Forrester, Dublin Street.

ELECTED

1919 Thornton, John R. V., 122 Conway Street, B'head.

1913 Tinne, Mrs. E. M., Oak Cottage, The Serpentine, Grassendale.

1907 Tinne, Philip F., M.A., M.B., Oak Cottage, The Serpentine, Grassendale.

1919 Tharratt, George R., 17, Sydenham Avenue.

1919 *Turner, J. R. J., 33 Station Road, Liscard.

1913 *Walker, C. H. Hesketh, 41 South Castle Street.

1918 Wallace, R. W., Wyndcote, Elton Avenue, Crosby.

1917 Ward, Edward H., 85 Victoria Road, Tranmere.

1917 Weightman, Miss F., Alexandra Road, Waterloo.

1918 Weightman, H. H., Alexandra Road, Waterloo.

1911 White, Henry T., 2 Reedville, Oxton.

1918 *White, W. H., 1 Anfield Road, Stanley Park, Liverpool.

1919 Wilkinson, C. H., 58 Tunstall Street, Wavertree.

1919 Williams, E. Gardner, Fairmead, Formby.

1871 Williams, J. Michael, 31, Grove Park.

1897 Williams, W. Collingwood, B.Sc., F.I.C., Beechfield, Roby.

1920 West, David, 82 Woodcroft Road, Wavertree.

1920 Watkin, Harold G., 95 Durning Road.

THE

LIVERPOOL MICROSCOPICAL SOCIETY

was founded in the year 1868, having for its object the cultivation and advancement of Microscopy.

The ordinary meetings are held at the ROYAL INSTITUTION, COLQUITT STREET, at 7 o'clock on the first Friday evening in every month, except January, June, July and August.

The Annual General Meeting is held on the third Friday in January.

During the summer a number of Field Meetings are arranged, to which members are invited to bring their friends.

Candidates for membership must be proposed by three or more members, one of the proposers from personal knowledge of the candidate.

The Society possesses a useful Library, and numerous Microscopical preparations.

Subscription 10/6 per annum.

Further inormation may be had from the Hon. Secretary.

ANNUAL REPORTS

OF THE

LIVERPOOL

Microscopical Society.

FOR 1921-22-23.

ABSTRACT OF PROCEEDINGS.

JANUARY 1924.

LIVERPOOL:

J. C. McMILLAN, PRINTER, 22 DAULBY STREET.

1924.

ANNUAL REPORTS

OF THE

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JANUARY, 1924.

LIVERPOOL:

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1924.


LIVERPOOL MICROSCOPICAL SOCIETY
1869-1918
NIHIL TAM PARVUM QUIN
SIT INDAGATIONE DIGNUM


ZOOLOGY
BOTANY
ISSUED IN
COMMEMORATION
OF THE
FIFTIETH ANNIVERSARY
OF THE SOCIETY
MINERALOGY
CHEMISTRY

LIVERPOOL MICROSCOPICAL SOCIETY.

SESSION LVI., 1924.

Past Presidents :	*Year :*
JOHN BIRBECK NEVINS, M.D.	1869, 1870
REV. WM. BANISTER, B.A.	1871
REV. DR. DALLINGER, F.R.S.	1872, 1879
JOHN ABRAHAM	1873
J. J. DRYSDALE, M.D., F.R.M.S.	1874
JOHN NEWTON, M.R.C.S.	1875, 1894, 1895
REV. HENRY H. HIGGINS, M.A.	1876, 1877, 1886
GEORGE F. CHANTRELL	1878
J. S. HICKS, F.R.C.S., F.L.S.	1880
WILLIAM CARTER, M.D., F.R.C.P.	1881, 1891, 1892
W. H. WEIGHTMAN, F.R.M.S.	1882
FRANK T. PAUL, F.R.C.S.	1883
CHARLES BOTTERILL	1884, 1885
REV. F. BALLARD, D.D., B.Sc., F.G.S., F.R.M.S.	1887
A. NORMAN TATE, F.I.C., F.C.S., F.R.M.S.	1888
ISAAC C. THOMPSON, F.L.S., F.R.M.S.	1889, 1890
F. CHARLES LARKIN, F.R.C.S.	1893
EDWARD DAVIES, F.C.S., F.I.C.	1896
WM. NARRAMORE, F.L.S., M.R.S.Inst.	1897, 1898
W. T. HAYDON, F.L.S.	1899, 1900
HERBERT E. DAVIES, M.A., B.Sc., F.I.C.	1901, 1902
R. J. M. BUCHANAN, M.D., M.R.C.P.	1903, 1904
JAMES D. MACPHAIL	1905, 1906, 1914, 1915
JOHN HAY, M.D., M.R.C.P.	1907
A. H. DUDLEY	1908, 1909
F. N. PIERCE, F.E.S.	1910, 1911
P. F. TINNE, M.A., M.B.	1912, 1913
THEODORE GARNETT, M.A.	1916, 1923
J. T. NORMAN-THOMAS, F.L.S.	1917, 1918
C. H. HESKETH-WALKER	1919, 1920
EDWARD FRY	1921, 1922
FRANCIS J. BRISLEE, D.Sc., F.I.C., F.R.M.S.	1924

OFFICERS and COUNCIL

Elected January, 1922.

President :

EDWARD FRY.

Vice Presidents :

THEODORE GARNETT, M.A.

RICHARD CROSTON.

Hon. Treasurer :

W. E. HARPER.

Hon. Secretary :

THOMPSON MUSKETT.

Hon. Librarian :

G. N. COOMBS.

Hon. Curator :

ARTHUR COOK.

Council :

F. J. BRISLEE, D.Sc., F.I.C., F.R.M.S.
JAS. GAULD.
JOS. GOULD.
J. A. HENDERSON.
J. M. LAMB.
JAS. D. MACPHAIL.
R. A. SLOAN
F. J. SMITH, B.Sc., A.I.C.
J. R. J. TURNER.
C. H. HESKETH WALKER.
W. H. WHITE.
H. G. S. WRIGHT.

OFFICERS and COUNCIL

Elected, January, 1923.

President :

THEODORE GARNETT, M.A.

Vice-Presidents :

F. J. BRISLEE, D.Sc., F.I.C., F.R.M.S.
RICHARD CROSTON.

Hon. Treasurer :

W. E. HARPER.

Hon. Secretary :

THOMPSON MUSKETT.

Hon. Librarian :

G. N. COOMBS.

Hon. Curator :

ARTHUR COOK.

Council :

F. H. ECCLES.
ED. FRY.
JAS. GAULD
JOS. GOULD
J. A. HENDERSON
JAS. D. MACPHAIL.
C. HAY MURRAY. D.Sc.
F. J. SMITH. B.Sc., A.I.C.
R. A. SLOAN.
C. H. HESKETH WALKER
W. COLLINGWOOD WILLIAMS, B.Sc. F.I.C.
H. G. S. WRIGHT.

OFFICERS AND COUNCIL,

Elected January, 1924.

President :

F. J. BRISLEE D. Sc., F.I.C., F.R.M.S.

Vice-Presidents :

THEODORE GARNETT, M.A.

C. HAY MURRAY, D. Sc.

Hon Treasurer.

W. E. HARPER.

Hon Secretary :

H. G. S WRIGHT.

Hon Librarian :

G. N. COOMBS.

Hon Curator :

ARTHUR COOK.

Council :

G. M. BEAUMONT.

C. H. COLLIE.

F. H. ECCLES

Ed. FRY.

JAS, GAULD.

JOS. GOULD.

O. A. MORCH.

R. A. SLOAN.

F. J. SMITH B.Sc., A.I.C.

C. H. HESKETH WALKER.

A. V. WILKINSON.

W. COLLINGWOOD WILLIAMS, B.Sc., F.I.C.

FIFTY-THIRD ANNUAL REPORT

OF THE

LIVERPOOL MICROSCOPICAL SOCIETY.

January, 1922.

The Council of the Society is gratified to report that the past year has been marked by continued prosperity, the attendance and interest at the winter meetings leaving nothing to be desired.

The membership at the beginning of 1921 stood at 120. In the course of the year 16 new names were added to the roll, 12 were removed owing to death and resignation, leaving a total of 124, made up as follows :—116 ordinary, 3 honorary, and 5 corresponding members.

The Society has suffered severely by the death of three of its most active members, viz :—

(1) Mr. Joseph Marples, who had long been connected with the Society and was a frequent exhibitor. A man of wide culture and exact scientific attainments, his retiring disposition could not conceal his manifest worth.

(2) Mr. J. T. Norman Thomas, F.L.S., one of the " fathers " of the Society, having been connected with it since its inception over 50 years ago. During all that period his enthusiasm never flagged, and it was always a delight to him to aid all who came to him for material and help, or to gain benefit from his unique experience as a naturalist. His speciality was the study of Radiolaria, and his large stock of slides prepared and mounted by himself proved him to be an expert of an exceptional order. He was President during the years 1917-18, and held the Society's Silver Medal. He occupied quite a special position in the Society, and his presence will be sorely missed.

(3) Mr. Stanley Lowell's membership covered only a short period. He acted as the Society's Librarian with acceptance, and did good work on the Lantern Committee. His early death is much deplored.

The papers read at the winter meetings, and the work exhibited, have been of the highest excellence, and the Society has lived up to its standard of combining efficiency with living interest. It has been the constant policy of your Council to promote a practical and modern application of all the subjects relating to microscopical research, and to exclude pedantry on the one hand and mere idle curiosity on the other.

Among the varied engagements of the year were the following:—

JANUARY.—The Presidential Address by Mr. Edward Fry on "Cells and their development" with lantern illustrations.

FEBRUARY.—Dr. Tinne gave a lucid and humorous address on "Glands," with lantern illustrations.

MARCH.—Mr. F. N. Pierce, F.E.S., an honorary member, contributed a paper on "The Legs of Insects" illustrated with well-executed drawings.

APRIL.—Mr. T. Muskett gave a resumé of the Field Meetings of the previous summer, with lantern illustrations.

MAY.—Mr. F. Davidson, of London, gave a lecture and demonstration of his Micro-Telescope and Super-Microscope, which were much appreciated and discussed among the members.

SEPTEMBER.—Miss A. Evans, of the School of Tropical Medicine, gave an address on "The Classification of Insects," with mounted specimens illustrating the various classes.

OCTOBER.—The Manchester Microscopical Society gave us a return lecture in the person of Mr. R. A. Wardle, lecturer in zoology at Manchester University, who gave a very humorous and interesting lecture on "The Romance of Scientific Discovery," with lantern illustrations.

NOVEMBER.—Mr. W. Narramore, F.L.S., gave an interesting account of "Reproduction in Simple Green Plants," with lantern illustrations.

DECEMBER.—This was an open meeting, and was devoted to exhibitions under the microscopes and to general microscopical gossip.

The attendance at these meetings averaged 50 per cent of the membership. The Society has been laid under a deep obligation to Mr. R. A. Sloan for supplying a complete outfit of electric lamps, specially designed by himself, and furnished entirely at his expense. The warm thanks of the members are accorded to him for his generosity.

The six Field Meetings held during the summer months did not receive the support they deserved, although some were decided successes. It is hoped that this branch of the Society's activity may attract more attention during the forthcoming year.

CURATOR'S REPORT.

During the year 205 slides have been issued to 19 members, as against 474 and 572 in 1920 and 1919 respectively.

The slides in the cabinet have been enriched by the following welcome additions :—4 Slides of Polyzoa, presented by Mr. F. W. Hutton ; 35 Slides of Physiology and Pathology, presented by Mr. H. T. White.

The Society now possesses a large stock of slides, which represent practically every branch of microscopical science, and the members would be well advised to make as much use of them as possible.

It is hoped that the coming year will show a record in the demand for slides.

LIBRARY.

Owing to the sudden demise of the Hon. Librarian, we regret that no report can be prepared.

FIFTY-FOURTH ANNUAL REPORT

OF THE

Liverpool Microscopical Society.

JANUARY, 1923.

The Council of the Society, in submitting their report for the past year, have again to congratulate the members of the Society upon a very successful year.

The interest in the monthly meetings has been attested by the increased attendance, and by the high class of the exhibits.

We commenced the year with a total membership of 124, viz: 116 ordinary, 3 honorary, and 5 corresponding members.

During the year, 2 members have died, 10 members have resigned, and 1 ordinary member has been elected an honorary member. Twelve new members have been elected, leaving the membership as 115 ordinary, 4 honorary, and 5 corresponding members, a total of 124.

The Society has to mourn the loss by death of one member of the Council, Mr. J. R. J. Turner, which occurred on July 22nd last. He had been a very useful member of the Society and Council, having been actively engaged in the installation and operation of the electric lantern.

We have also to record the death by accident of Dr. W. R. Pierce.

The papers read at the meetings have all been of a very high standard. They were as follow:

JANUARY.—The meeting was devoted to a general re-union of the members, at which there was a very interesting exhibition of microscopes, apparatus, and objects.

FEBRUARY.—A very valuable lecture was given by Dr. George Tate, on "Micro-Fungi in Relation to Industry." A number of drawings and mounted objects illustrating the lecture were among the exhibits.

MARCH.—Dr. Alfred Holt gave a lecture upon "The Ultra-Microscope and its Uses in Chemical and Botanical Investigations," with numerous experiments. At the close many objects of general interest were exhibited.

APRIL.—A paper by Dr. C. Hay Murray on "The Bed-bug considered as a Microscopical Object" aroused much interest.

MAY.—The Society was visited by Professor J. McLean Thompson, of Liverpool University (Botanical Department) who gave a lecture on "The Conductive System of Ferns," illustrated by splendid lantern slides. The paper was followed with keen interest and pleasure, and the lecturer was warmly thanked.

SEPTEMBER.—The meeting was devoted to microscopical exhibits and a conversazione, at which many noteworthy objects were shown.

OCTOBER.—Dr. F. J. Brislee, F.R.M.S., gave a very instructive paper on "The Microscope as a Technical, Scientific, and Educational Instrument," dwelling upon the researches of the older amateurs, and advocating special tuition in the use of the instrument.

NOVEMBER.—Miss Annie Dixon, F.R.M.S., of the Manchester Microscopical Society, paid a return visit, and read a paper on her researches on the Protozoa, illustrating by lantern slides a large number of the lesser-known organisms and contrasting them with more familiar forms.

DECEMBER.—Dr. J. R. Logan entertained the Society with a paper on Buds, devoting chief attention to the appearance and disappearance of visible nutritive materials, and pointing out that oil is to be found in many buds, some containing large quantities.

The Field Meetings were fairly well attended, but the Council would like to see greater interest taken in these very instructive and enjoyable outings.

On March 16th and June 22nd, the members of the Society were entertained by Messrs. Pathé Frères with exhibitions of cinematograph films showing microscopic organisms and various methods of scientific manipulation.

On November 4th, the Society took part, with other Scientific Societies of Liverpool and District, in an Associated Soirée, held in the Liverpool Public Museums, which was a very great social success. About 30 members of our Society exhibited objects under their microscopes.

CURATOR'S REPORT.

During the year, an excellent set of 164 slides, consisting mainly of Diatoms, has, by the generosity of the widow of Mr. J. T. Norman Thomas, been added to the cabinets. The quality of these slides is of a very high order, and members of the Society will probably need no recommendation to make use of them.

In the present year 239 slides have been issued to 18 members, as compared with 205 slides and 19 members for the year 1921.

It is gratifying to note the slight increase in the number of slides loaned, and it is hoped that the year 1923 will show an improvement even on this.

FIFTY-FIFTH ANNUAL REPORT

OF THE

Liverpool Microscopical Society.

JANUARY, 1924

The Council of the Society begs to report that the past year has been marked by a series of lectures of great interest and value during the Winter Session, and by a gratifying increase in the attendance at the Field Meetings, in spite of the fact that bad weather marred several of the latter.

At the beginning of the year we had a membership of 124, viz: 115 ordinary, 4 honorary, and 5 corresponding members. During the year under review 12 ordinary members have resigned, 2 ordinary members have been elected honorary members, and 17 new members have joined the Society. There are now 6 honorary, 5 corresponding, and 118 ordinary members, a total of 129.

The honorary members elected during the year are: Mr. George F. Healey, who had been a member of the Society since 1896; and Mr. Thompson Muskett, who had acted as honorary secretary of the Society from 1921 to 1923 inclusive, and as assistant hon. secretary for some time prior to that.

At the January meeting, Professor R. Newstead, F.R.S., F.E.S., of the School of Tropical Medicine (University of Liverpool), gave a lecture on the Tse-tse Fly considered in relation to sleeping sickness. His remarks, based on personal observation and research, and illustrated by many striking lantern slides, were followed with the greatest interest. The subject of the lecture was demonstrated under numerous instruments.

The feature of the February meeting was an engrossing paper by Professor W. J. Dakin, D.Sc., F.Z.S. (University of Liverpool) on the visual organs of invertebrates, with special reference to insects' eyes. He imparted a great deal of out-of-the-way information, and employed a large number of lantern slides, the beauty of which excited general admiration.

In March, Mr. F. Davidson, of London, paid a return visit, and gave a lecture on "The Davon Super-Microscope," explaining the various refinements of this instrument effected since his previous lecture to the Society.

A paper on " Micro-Chemistry " was read at the April meeting by Mr. E. Gardner Williams, who covered much ground and showed a large number of singularly fine lantern slides.

The May meeting was of special interest. Dr. C. Hay Murray gave an account of the dehydrating and mounting of entomological objects, and this was followed by an informative and entertaining discussion in the course of which various members outlined the methods favoured by them. Questions submitted with reference to critical illumination and the image produced by the Super-microscope were answered by Mr. E. Fry, Dr. F. J. Brislee, and others.

In September the evening was devoted to the exhibition of objects shown under the microscopes, of which there was an excellent display, including very beautiful examples of pond and canal life taken by members at the last Field Meeting.

Sir William A. Herdman, F.R.S., was the lecturer at the October meeting, and gave a notable account of the work of Oceanographers in the waters round our coasts. Sir William paid special attention to the microscopic life of the Plankton, but his account gave an outline which embraced all the main features of the research in which he is so distinguished a pioneer.

A joint meeting of this Society and the Liverpool Botanical Society, was held in November, when Mr. J. A. Wheldon, M.Sc., President of the Botanical Society, gave a paper on Mosses and Hepatics, illustrated with lantern slides, and also by numerous exhibits under the microscopes. Subsequently, this body was represented at a meeting of the Botanical Society at the Hartley Laboratories, when Mr. Wheldon read Part II of his paper.

At the last meeting, in December, Mr. R. A. Sloan lectured on the determination of the focal length and magnifying power of microscope objectives. He gave a masterly account of the principles involved, and, with the aid of several diagrams drawn to scale, simplified many difficulties.

The year closed with interest in the Society maintained to the full, and with the prospect of continued increase in its membership and usefulness.

CURATORS' REPORT.

During the year 114 slides were issued to 10 members, as against 239 slides and 18 members for the previous year, and 205 slides and 19 members for the year 1921.

We are indebted to Mr. F. W. Hutton for the gift of the following two slides :—Marine Polyzoa : Idmonia serpens. Entomology :—(Symphyta) : Ovipositor of Rhadinoceraea micans. The total number of slides in the cabinets is now 1,311.

LIBRARIAN'S REPORT.

During the past year 45 books were issued on loan to members, these being distributed among approximately 25 readers. These figures, as compared with 1922, show a decrease in the number of books issued, viz., 45 as against 83 in 1922.

The following books and periodicals have been added to the Library since the last report was read before the Society :—Quarterly Journals of the Royal Microscopical Society, Quekett Club, Lancashire and Cheshire Naturalists' Club, and the Queensland Naturalist. Six volumes from the Ray Society, viz., " British Freshwater Rhizopoda and Heliozoa " (Vols. IV and V) by Cash and Wailes ; " British Charophyta," by Graves and Bullock Webster ; " British Orthoptera," by Lucas ; " British Marine Annelids " (Vol. IV, Parts 1 and 2) by McIntosh ; and " Elements of Insect Anatomy," by Comstock and Kellog. Presented by Dr. C. Hay Murray: "Monograph on the Bed-bug"; "English Mechanic" 11 vols. ; " Chart on Object-mounting " ; " Transactions of the Linnean Society," Vol. VI (Part 10) ; " Transactions of the Royal Society of Edinburgh," Vol. XLVI (Part 1). Presented by Mr. James Gauld : " Handbook of British Hepaticae," by Cooke ; " Mosses and Liverworts," by Russell. Presented by Mr. F. N. Pierce, F.E.S. : " The Genitalia of the Tortricidae," by Pierce and Metcalf. Presented by Mr. R. A. Sloan : " Charts on Optics." Thus there is a total of 414 volumes and pamphlets in the Library.

THE LIVERPOOL MICROSCOPICAL SOCIETY.

FINANCIAL STATEMENT, YEAR 1921

Dr.

	£	s.	d.
To Lantern Expenses	2	11	3
,, Printing and Stationery*	35	12	6
,, Subscriptions to other Societies	1	1	0
,, Electrical Repairs etc.	10	5	7
,, Secretary's Postages & Expenses	6	9	5
,, Treasurer's .... do		10	1
,, Fire Insurance		15	0
,, Lecturer's Expenses	1	5	3
,, Cheque Book	0	2	0
,, Rent of Rooms and Bookcase, and attendance	14	17	0
,, Balance to 1922	11	15	3
	£85	4	4

Cr.

	£	s.	d.	£	s.	d.
By Balance from 1920				16	16	6
,, Subscriptions—						
1918-19-20—24				12	12	0
1921—78 Whole						
8 Half	43	1	0			
1922—17 Whole						
2 Half	9	9	0	65	2	0
,, Sale of 4 Medals				3	0	0
,, Bank Interest				0	5	10
				85	4	4

*Including Cost of Report.

13*th*. *January*, 1922.

THE LIVERPOOL MICROSCOPICAL SOCIETY.

FINANCIAL STATEMENT, YEAR 1922.

Dr.

	£	s.	d.
To Lantern Expenses*	7	16	10
,, Printing & Stationery	9	16	0
,, Subscriptions to other Societies	1	8	0
,, Elec. Alterations & Repairs**	7	18	11
,, Secretary's Postages & Expenses	5	17	6
,, Treasurer's do		7	11
,, Fire Insurance		8	6
,, Expenses—Special Pathé Exhibition	1	5	0
,, Rent of Rooms & Bookcases and Attendance	14	17	0
,, Balance to 1922	11	6	7
	61	2	3

*New electrical outfit
**Including re-wiring for tables.

Cr.

	£	s.	d.	£	s.	d.
By Balance from 1921				11	15	3
,, Subscriptions—						
1920-21—6	3	3	0			
1922—65 whole						
4 halves	35	3	6			
1923—18	9	9	0			
1924-26—1	1	11	6	49	7	0
				£61	2	3

12*th*. *January*, 1923.

THE LIVERPOOL MICROSCOPICAL SOCIETY.

FINANCIAL STATEMENT, YEAR 1923.

Dr. | *Cr.*

Dr.	£	s.	d.
To Lantern Expenses	2	8	0
,, Printing and Stationery	10	12	0
,, Subscriptions to other Societies	1	8	0
,, Electrical Repairs	0	6	6
,, Secty's Postages and Expenses	7	3	11
,, Treasurer's Do.	0	3	1
,, Fire Insurance	0	8	6
,, Advertising Lecture	0	19	6
,, Rent of Rooms and Bookcases and Attendance	14	17	0
,, Balance to 1924	18	14	5
	£57	0	11

Cr.				£	s.	d.
By Balance from 1922				11	6	7
,, Cash received for Lamps, donated to defray cost of new Electric Fittings January, 1922				6	4	0
,, Donation				1	1	0
,, Subscriptions :						
1922 .... 4	2	2	0			
1923 ....69	36	4	6	38	6	6
,, Bank Interest				0	2	10
				£57	0	11

11*th*. *January*, 1924.

LIVERPOOL MICROSCOPICAL SOCIETY.

LIST OF MEMBERS,

JANUARY, 1924.

HONORARY MEMBERS.

R. Croston, 69, Marlborough Road, Tuebrook

G. F. Healey, 13, Charlesville, Claughton

Thompson Muskett, 101, Gwladys Street, Walton.

William Narramore, F.L.S., M.R.S., 33, Milton Road, Waterloo.

R. Newstead, M.Sc., F.R.S., A.L.S., F.E.S., School of Tropical Medicine, Pembroke Place, Liverpool.

F. N. Pierce, F.E.S., The Old Rectory, Warmington, Oundle North Hants.

CORRESPONDING MEMBERS.

Seabury Edwards, F.R.M.S., Supt. of Excise, Prome, Burmah

W. H. Harrison, Imperial Agricultural Research Institute, Pusa (Behar), North India.

Albert Mann, Bureau of Plant Industry, Washington, U.S.A.

J. L. K. Pedder, Heywood's, St. Peter, Barbadoes.

Miss Jane Weightman, M.A., Principal, "Mary Vaughan" High School, Hang Chow, Chekiang, China.

ORDINARY MEMBERS.

Elected ** Members of Council.*

1917 Ahlborn, Miss Jane, 23, Ramilies Road, Sefton Park.

1881 Abraham, Miss Emma C., Grassendale Park.

1900 Aman, F. T., A.M.Inst.C.E., City Engineer's Office, Municipal Buildings, Dale Street.

1905 Armstrong, Frank, 112, Bold Street.

1922 Ashby Thomas, C., Westmount, Cornwallis Road, Maidstone Kent.

1915 Atkinson, Thomas, 70, Bold Street.

1922 Banks, John H. L., 15, Victoria Road, Tuebrook.

1920 Beadle, Miss Margaret, 54, The Grove, Thorne Road, Doncaster.

1923 Best, John J., The Ferns, Little Neston.

*1919 Beaumont, G. M., Bannisdale, Hunt's Cross.

1924 Bowyer, Geo., 3, Quarry Bank Terrace, Weston, near Runcorn.

*1921 Brislee, Francis J., D.Sc., F.I.C., F.R.M.S., Holmfield Church Road, Roby.

1922 Brislee, Miss Frances Winifred, Holmfield, Church Road, Roby.

1917 Brown, James, 7, Eltham Street, Fairfield.

1923 Bryant, Edward Arthur, 8, Groes Road, Grassendale.

1903 Burne, Chas. F., Buena Vista, East Alexandra Road, New Brighton.

1920 Campbell, J. H., 20, Tatton Road, Orrell Park, Liverpool.

1923 Coffey, T. A., 24, Carrington Street, Liverpool.

*1918 Collie, C. Holmes, Braywood Villa, Moreton, nr. Birkenhead.

*1917 Cook, Arthur, 16, Clarendon Road, Blackburn.

1922 Cook, A. Slater, Carpenter's Lane, West Kirby.

*1918 Coombs, G. N., 95, Romer Road, Liverpool.

1918 Cunliffe, R. Foster, 28, Prince's Avenue, Liverpool.

1913 Cunningham, W. J., Norman Road, Runcorn.

1922 Dance, Miss Margaret, D.Sc., The Parsonage, Leamington, Spa.

1891 Davies, Herbert E., M.A., B.Sc., F.I.C., Chapel Chambers, Chapel Street, Liverpool.

1905 Dearsley, A. H., 112, Bold Street, Liverpool.

1923 Doig, H., 16, Croxteth Avenue, Liscard.

1913 Driver, W. R., 3, Mulgrave Street, Liverpool.

1918 Drury, Jas. D., 2, Park Grove, Bootle.

*1919 Eccles, F. H., 16, Abergele Road, Stanley.

1919 Ellison, George, 52, Serpentine Road, Liscard.

1921 Evans, Miss Alwen M., School of Tropical Medicine, L'pool

1918 Evans, John, 5, Parkbridge Road, Birkenhead.

1892 Forshaw, F. H., Riverside, Halebank, nr. Widnes.

*1913 Fry, Edward, 89, Penny Lane, Sefton Park, Liverpool.

*1912 Garnett, Theodore, M.A., South Bank Road, Grassendale.

*1920 Gauld, James, 1, Thackeray Street, Liverpool.

1918 Gibson, F. A., 1, Sandon Road, Egremont.

1916 Gladstone, Ernest S., 5, Mossley Hill Drive, Liverpool.

1918 Gleave, Miss E. L., 19, Meadowcroft Road, Wallasey.

*1917 Gould, Joseph, 73, Littledale Road, Egremont.

1921 Gudgeon, Thomas W., 4, Briardale Road, Rock Ferry.

1916 Guest, Cecil F., 272, Westminster Road, Liverpool.

1923 Gunning, Edward H., 39, Stamford Street, Holt Rd., L'pool.

1921 Halsall, Cyril H., Belvidere Road, Princes Park, Liverpool.

1918 Harley, George K., 25, Park View, Waterloo.

*1912 Harper, William E., 35, Ivanhoe Road, Liverpool.

1922 Harris, Miss Dorothy, 40, Yew Tree Road, Walton.

1923 Harris, Charles, 3, Edenhurst, Atherton Street, N. Brighton.

1900 Haydon, James R., Highbury, Ranelagh Drive, Grassendale.

1892 Haydon, W. T., F.L.S., 55, Grey Road, Walton.

1919 Hayes, James, 109, Botanic Road, Liverpool.

1915 Henderson, James A., 18, Elm Hall Drive, Mossley Hill, Liverpool.

1917 Hilton, Miss Irene, " Montrose," Thingwall Road, W'tree.

1923 Horsburgh, D., 27, Princes Avenue, Liverpool.

1920 Hutchison, H. A., 139, Priory Road, Anfield.

1911 Hutton, F. W., 53, Greenway Road, Runcorn.

1921 Hutton, J. T. D'Arcy, 1, Hayman's Green, West Derby.

1921 Johnstone, C. H., Southesk, Dowhill Road, Crosby.

1923 Jones, Trevor Hughes, 108, Liverpool Road, Crosby.

1923 Kefalas, Andrew, 21, Berkley Street, Liverpool.

1910 Kenworthy, A. B., 38, Egerton Road, Wavertree.

1920 Kerr, C. H., Hayfield, Thingwall Road, Wavertree.

1918 Lamb, J. Mundle, Avondale, Moor Park, Fazakerley.

1912 Larkin, William, Rushmere, Bigglescombe Park, Ilfracombe

1907 Leonard, Edward, 93, Shrewsbury Road, N., Birkenhead.

1924 Lipkin, R., M.P.S., 28, Lark Lane, Liverpool.

1922 Logan, Dr. J. R., 81, Hartington Road, Liverpool.

1898 Macphail, James D., 40, Moss Lane, Walton.

1921 Macphail, Mrs. G. M., 40, Moss Lane, Walton.

1920 Manson, S. J. D., 18, Great George Road, Waterloo.

1923 Mansbridge, W., Church Road, Wavertree.

1919 Mapplebeck, W., L.D.S., 50, Rodney Street, Liverpool.

1919 Mossman, E. H., 46, Stanley Street, Fairfield.

1922 Moore, P. A., 63, Milton Road, Waterloo.

*1923 Morch, O. A., 522, Old Chester Road, Rock Ferry.

*1921 Murray, Dr. C. Hay, 38, Grosvenor Road, Birkenhead.

1917 Newall, Alfred V., 28, Nook Rise, Wavertree.

1893 Nuttall, F. R. Dixon, F.R.M.S., "Ingleholme," Eccleston Park, near Prescot.

1916 Pallis, Alexander, "Tatoi," Aigburth Drive, Liverpool.

1921 Paton, George A., 31, Trevor Road, Orrell Park, Liverpool

1923 Pearson, Harold S., Dental Hospital, Pembroke Place, Liverpool.

1921 Peel, Albert, 6, Ronald Road, Waterloo Park.

1919 Perry, Hanson, 16, Frogmore Road, Market Drayton, Shropshire.

1924 Pilgram, Stanley S., 1, Cowley Street, Runcorn.

1923 Polson, Sidney, 83, Manor Road, Wallasey.

1919 Potts, Donald, J.P., Borrowdale, Warren Road, Blundellsands.

1917 Pritchard, E. O., 1, Dexter Street, Park Place, Liverpool.

1909 Pryce, George, B.A., 19, Fairview Road, Oxton.

1923 Purkiss, R. E., 209, Warbreck Moor, Aintree.

1922 Pye, Henry E., 6, Elm Terrace, Beech Street.

1913 Rimmer, C. Percy, 5, Devonshire Road, Liverpool.

1924 Roberts, Herbert Harper, 24, Falkner Street, Liverpool.

1916 Roberts, R. W. Boothman, Waverley, Kinross Road, Waterloo.

1924 Robertson, Mrs. M. E. C., 42, Rosslyn Street, St. Michael's.

*1916 Sloan, Robert A., 40, Village Road, Oxton.

1924 Smith, H. W., 13, Blenheim Road, Sefton Park.

1923 Smith, F., 71, Bold Street (Lizars, Ltd.).

*1911 Smith, Frank J., B.Sc., A.I.C., 36, Brelade Road, Liverpool.

1918 Smith, T. J. Forrester, Dublin Street, Liverpool.

1923 Spencer, George, 539, West Derby Road, Liverpool.

1923 Stephenson, Miss Elsie, 106, Grant Avenue, Liverpool.

1919 Tharratt, G. R., 17, Sydenham Avenue, Liverpool.

1907 Tinne, Philip F., M.A., M.B., Clayton Lodge, Aigburth Road, Liverpool.

1913 Tinne, Mrs. E., M., Clayton Lodge, Aigburth Road, L'pool.

1921 Travis, Ernest, 15, Alexander Road, West Derby.

1922 Turner, Charles F., 27, Elsmere Avenue, Aigburth.

1922 Turner, P., 50, Clarendon Road, Wallasey.

*1913 Walker, C. H. Hesketh, 41, South Castle Street, Liverpool.

1920 Watkin, Harold G., 95, Durning Road, Liverpool.

1918 Weightman, H. H., 13, Alexandra Road, Waterloo.

1911 White, Henry T., 2, Reedville, Oxton.

1918 White, W. H., 1, Anfield Road, Stanley Park, Liverpool.

*1922 Wilkinson, A. V., 31, Leominster Road, Liscard, Wallasey.

1919 Wilkinson, C. H., 58, Tunstall Street, Wavertree.

1919 Williams, E. Gardner, Fairmead, Formby.

1871 Williams, J. Michael, 31, Grove Park, Liverpool.

*1897 Williams, W. Collingwood, B.Sc., F.I.C., Lynter, Eaton Road, Cressington Park.

*1921 Wright, Harold G. S., 174, Stamfordham Drive, Springwood Estate, Allerton.

1922 Young, Gerald J. F., 3, Pengwern Terrace, Wallasey.

THE

LIVERPOOL MICROSCOPICAL SOCIETY

was founded in the year 1868, having for its object the cultivation and advancement of Microscopy.

The ordinary meetings are held at the *Royal Institution, Colquitt Street,* at 7-30 o'clock on the first Friday evening in every month, except January, June, July and August.

The Annual General Meeting is held on the third Friday in January.

During the summer a number of Field Meetings are arranged, to which members are invited to bring their friends.

Candidates for membership must be proposed by three or more members, one of the proposers from personal knowledge of the candidate.

The Society possesses a useful Library, and a large collection of Microscopical preparations.

Subscription 10/6 per annum.

Further information may be had from the Hon. Secretary.