is produced a disc-like coagulation; their number rapidly increases, and this particular condensation becomes the embryo strictly so called, while the remainder of the blastoderm serves only for its nourishment. The embryo soon begins to broaden into the form of a biscuit. Three leaves or layers of cellules can be distinguished, superposed like envelopes upon each other, and each having its particular place in the construction of the living being; from the exterior leaf is formed the epidermis and the central parts of the nervous system, the spinal marrow and the brain; from the central layer is formed the interior membrane which lines the digestive canal from the mouth to the anus, with all the glands that are attached to it (the lungs, the liver, the salivary glands, &c.); the intermediate layer is the source of all the other organs.

The processes by which the three layers of cellules give birth to the most complicated organs can all be reduced—(1) To new segmentations, and consequently to an increase in the number of the cells; (2) To the division of labour or the differentiation of these cellules; (3) To the combination of these cellules, differently developed. The cellules which comprise a living organism may thus be compared to the citizens of a state, some of whom have one set of functions to perform, others another; the division of labour, and the organic perfection which results from it, enables the state to accomplish certain undertakings which would be impossible to isolated individuals. Every living organism composed of many cellules resembles a sort of republic capable of accomplishing certain organic functions, which could not be discharged by a single cell, an *amœba*, or a monocellular plant. No rational mind would seek to explain by superhuman intervention the public weal which accrues to political society, from the harmony of particular actions; so also in the organism, all the adaptations to ends ought to be regarded as the natural and necessary consequence of co-operation, of the differentiation and the perfection of the cellules, and not as the intentional work of a supernatural will.

Until the brain begins to show itself distinctly, it is scarcely possible to recognise any difference between the embryos of the different vertebrata, or at least of the three superior classes—reptiles, birds, and mammals. Why, then, should any one now refuse to admit the most important consequence of the theory of evolution, according to which men have descended from simious or even inferior mammals? Are the phenomena of the development of the individual man, the earliest characteristics of which are given above, less marvellous? Is it not in the highest degree astonishing that all the vertebrate animals, belonging to the most diverse classes—fishes, amphibia, reptiles, birds, and mammals—cannot, in the earliest stages of their embryonic development, be distinguished from each other, and that even at a much later stage, when reptiles and birds are distinctly separated from mammalia, man and the dog are still almost identical? The development of the individual (*ontogenesis*) is as difficult to explain as that of the species (*Phylogenesis*). It may be even said that it is still more so, seeing that it has an infinitely shorter time in which to be accomplished. The former is nothing more than a compact reproduction of the latter, and Haeckel rightly finds in this parallelism the most incontestible proof in favour of the theory of evolution. Man and the superior vertebrata reproduce in the earlier phases of their development conditions which last through the life of the lower orders of fishes; they then pass into forms which are characteristic of the amphibia; the marks of the mammalia appear only at a later stage, and even here are discovered a succession of degrees which correspond to the characters of different species or families. It is the same order in which the palæontological history of the earth shows us the successive production of the different animal forms—first the fishes, then the amphibia, next the inferior mammals, and last the superior mammals.

Side by side with these two orders of evolution there is a third parallel with them: it is that which is found particularly expounded in the works of Cuvier, Goethe, Meckel, Johannes Müller, Gegenbaur, Huxley, and forms the subject of comparative anatomy. This science seeks to determine what is common to the forms of different species, and studies living beings from the point of view of the scale of perfection. In this respect also we find that fishes, amphibia, and the inferior mammals stand in the same relation to man as from the standpoint of embryonic evolution and of palæontology. Now, this triple parallelism of individual development, of palæontological development, and of systematic development, is completely explained by the theory of transformation, by the laws of heredity and adaptation, while no opponent of the theory of evolution has ever been able to account for it in a natural and philosophic manner. Haeckel concludes from this that we shall be compelled to admit Lamarck's theory of evolution, if we are not led to accept Darwin's theory of selection.

SOCIETIES AND ACADEMIES

London

Royal Society, Feb. 20.—"On the Anatomy of the Land Planarians of Ceylon." By H. N. Moseley, M.A., Exeter College, Oxford.

Two new species of Land Planarians from Ceylon are described as belonging to the genus *Bipalium* (Stimpson), *B. Ceres*, the other to that of *Rynchodemus*, *R. Thwaitesii*.

With regard to the habits of *Bipalium*, the most interesting facts noted are that these animals use a thread of their body-slime for suspension in air, as aquatic Planarians were observed to do for their suspension in water by Sir J. Dalyell, and the cellar-slug does for its suspension in air. The anatomy of the Planarians was studied by means of vertical and longitudinal sections from hardened specimens. The skin in *Bipalium* and *Rynchodemus* closely conforms to the Planarian type, but is more perfectly differentiated histologically than in aquatic species, and approaches that of the leech in the distribution, colour, and structure of its pigment, and especially in the arrangement of the glandular system. The superficial and deep glandular systems of the leech are both here represented. In *B. Ceres* peculiar glandular structures exist, which may foreshadow the segmental organs of Annelids, it being remembered that these segmental organs are solid in an early stage of development. Rod-like bodies are present in abundance, though, singularly enough, Max Schultze failed to find any in *Geoplana*. These rod-like bodies are probably homologous with the nail-like bodies of Nemertines; and it is possible that the setæ of Annelids are modifications of them.

The muscular arrangement in *Bipalium*, which is very complex, throws great light on the homologies between the muscular layers of *Turbellaria* and those of other Vermes. In *Bipalium* there is an external circular muscular coat, which even presents the same imbricated structure which is found in it in leeches and other worms. In *Dendrocœlum lacteum* there is also an external circular coat. In cases where a distinct external circular muscular coat is absent, it is represented by a thick membrane, which is very probably contractile. All Turbellarians are built on the same essential type, as regards muscular arrangement, as are other worms. The general muscular arrangements in the bodies of the *Bipalium* and *Rynchodemus* have become much modified from those of flat Planarians by the pinching together and condensation of the body, but they are nevertheless referable to the same type.

The digestive tract consists of three tubes, one anterior, two posterior, as in other Planarians, and as in the embryo leech before the formation of the anus. Characteristic of land Planarians, and consequent on the condensation of the body, is the absence of all diverticulæ from the inner aspects of the two posterior digestive tubes. The close approximation of the intestinal diverticula in *Bipalium* and *Rhynchodemus*, and the reduction of the intervening tissue to a mere membranous septum, is very striking, and seems to foreshadow the condition of things in Annelids. The great difference in the form of the mouth in *Rhynchodemus* and *Bipalium* is also remarkable, considering the many points in which these forms are closely allied.

A pair of large water-vascular trunks, or, as they are here termed, primitive vascular trunks, are conspicuous objects in transverse sections of the bodies of *Bipalium* and *Rhynchodemus*. A peculiar network of connective tissue is characteristic of these vascular canals on section, and is shown to present exactly similar features in *Leptoplana tremellaris*, *Dendrocœlum lacteum*, and *Bothriocephalus latus*. The close agreement in the relative position of the oviducts to the vascular canals in *Dendrocœlum* and our land Planarians is very remarkable. The nerves and ganglia of Planarians lie within the primitive vascular system, as do the corresponding structures within the primitive body-cavity of the leech.

A small marine Planarian was found to contain hæmoglobin. In *Bipalium* there are a series of separate testes disposed in pairs, as in the leech. In *Rhynchodemus* the testicular cavities are more closely packed, and follow no such definite arrangement. The ovaries are simple sacs in both *Bipalium* and *Rhynchodemus*, and are placed very far forwards in the head, a long distance from the uterus. In *Bipalium*, short branches given off from the posterior positions of the oviduct are the rudiments of a ramified ovary, such as exists in *Dendrocœlum lacteum*. The organs described as nervous ganglia by Blanchard in *Polycladus* are almost certainly its testes and ovaries, and therefore the arrangement of these bodies in *Polycladus* is the same as that in *Bipalium*.

The nervous system is ill defined, but appears to consist of a network of fibres without ganglion cells, which lies within the primitive vascular canals.

Numerous eye-spots are presented in *Bipalium*, most of them being grouped in certain regions in the head, but some few being found all over the upper surface of the body, even down to the tail. In *Rhynchodemus* two eyes only are present. All gradations would appear to exist between the simple unicellular eye-spot of *Bipalium* and the more complex eye of *Leptoplana* or *Geodesmus*, where the lens is split up into a series of rod-like bodies, forming apparently a stage towards the compound eyes of Articulata.

In considering the general anatomy of *Bipalium*, it is impossible to help being struck by the many points of resemblance between this animal and a leech. Mr. Herbert Spencer has, in his "Principles of Biology," placed a gulf between Planarians and leeches by denoting the former as secondary, the latter as tertiary aggregates, so called because consisting of a series of secondary aggregates formed one behind the other by a process of budding. It is obvious, however, that a single leech is directly comparable to a single *Bipalium*. The successive pairs of testes, the position of the intromittent generative organs, the septa of the digestive tract, and most of all, the pair of posterior cæca, are evidently homologous in the two animals. Further, were leeches really tertiary aggregates, the fact would surely come out in their development, or at least some indication of the mode of their genesis would survive in the development of some annelid. Such, however, is not the case. The young worm or leech is at first unsegmented, like a Planarian, and the traces of segmentation appear subsequently in it, just as do the protovertebræ in vertebrates which Mr. Spencer calls secondary aggregates. If Mr. Spencer's hypothesis was correct, we should expect to find at least some Annelid developing its segments in the egg as a series of buds. It is not, of course, here meant to be concluded that Annelids are not sometimes in a condition of tertiary aggregation, as *Nais* certainly is when in a budding condition, but that ordinarily they are secondary and not tertiary aggregates, and if so, then so also are Arthropoda.

"On a new Locality of Amblygonite, and on Montebrasite, a new hydrated Aluminium and Lithium Phosphate." By M. Des Cloizeaux.

Geological Society, Feb. 5, Warington W. Smyth, F.R.S., vice-president, in the chair. The following communication was read:—"On the Oolites of Northamptonshire.—Part II." By Samuel Sharp, F.G.S. In the first part of this memoir the succession of beds in the neighbourhood of Northampton was shown to be as follows:—

	Clay	Great Oolite.
	White Limestone	
	Clay with Ferruginous Band... ("Upper Estuarine")	
	Line of Unconformity.	
Northampton Sand	Sand with Plant Bed... ("Lower Estuarine")	Inferior Oolite.
	Variable Beds	
	Ironstone Beds	
	Upper Lias Clay.	

The Great Oolite limestone of this section has been confounded, even up to the present time, with a limestone (frequently Oolitic) which occurs between Kettering and Stamford, is prevalent about the latter town, extends through Rutland and Lincolnshire (where it attains a thickness exceeding 200 feet) and into Yorkshire, which limestone has been distinguished by Mr. Judd as the "Lincolnshire limestone." The object of the author was to show that these two limestones were distinct, and that while the former was of the Great Oolite period, the latter as certainly belonged to the Inferior Oolite; and in citing evidence in proof of this position upon stratigraphical and palæontological grounds, he gave a general account of the geology of the northern division of Northamptonshire, illustrating his description by the exhibition of numerous fossils gathered from the various beds and localities referred to. Between Northampton and Kettering, the Great Oolite limestone is the surface rock; and intersecting valleys upon that line, and the escarpment of the Ise valley, a mile east of Kettering, exhibit this sequence of beds:—

Great Oolite	Limestone.	
,, ,, ...	Upper Estuarine Clays.	
Inferior Oolite ...	Lower Estuarine Beds	Northampton Sand.
,, ,, ...	Ferruginous Beds	
Upper Lias.........	Clay.	

And this section, with the successive superaddition of Great Oolite, Clay, Cornbrash, Kelloway Rock, and Oxford Clay, is continued due east across the country to the Valley of the Nene, and on into Huntingdonshire. Upon the same Ise escarpment, about a mile north-east of Kettering, the thin end of the wedge of the Lincolnshire limestone is seen to come in; and this sequence, for the first time, is presented:—

Great Oolite	Limestone.	
,, ,, ...	Upper Estuarine Clays.	
Inferior Oolite ...	LINCOLNSHIRE LIMESTONE (very thin).	
,, ,, ...	Lower Estuarine Beds	Northampton Sand.
,, ,, ...	Ferruginous Beds	
Upper Lias.........	Clay.	

The same sequence, with the occasional superaddition of the Great Oolite Clay, was shown to be repeated upon the western escarpment of the Ise, at Glendon, Barford Bridge, near Rockingham at Weekly, and at Geddington (the Lincolnshire limestone increasing in thickness at every advance), and to occur over and over again upon innumerable escarpments in the counties of Northampton, Rutland, Lincoln, and York, offering unmistakeable and incontrovertible evidence of the true stratigraphical position of the Lincolnshire limestone.

February 21.—Annual General Meeting. His Grace the Duke of Argyll, K.T., F.R.S., president, in the chair. The Secretary read the Reports of the Council, and of the Library and Museum Committee. The general position of the Society was described as satisfactory, and the number of Fellows is said to have essentially increased.

In presenting the Wollaston Gold Medal to Sir Philip de Malpas Grey-Egerton, Bart, F.R.S., F.G.S., the president spoke as follows:—"Sir Philip Egerton,—I consider myself fortunate in being the organ of the Geological Society in presenting you with the Wollaston Medal, which has been awarded to you by the Council for the present year. The eminent services which you have rendered to geology during a period now extending over forty years have long been familiar to scientific men, and have given you more than a European reputation. These services have been so great and so universally recognised, that the only difficulty I now have is not in assigning grounds for the vote which I have the pleasure of announcing, but in explaining why it has been so long delayed. That delay has been occasioned, I believe, solely by the fact that you have yourself been so long an honoured member of the Council whose duty it is to consider the claims of geologists for the honours of this Society; and whatever influence you have had in that body has doubtless been exerted in favour of others to the exclusion of yourself. It is at least some compensation for the loss which the Council sustains in your absence that it is now able to accord a recognition which has long been due. The many papers which you have contributed to this Society from 1833 down to the present time are a sufficient indication of the wide range of your observations. But the special attention you have bestowed, and the light you have thrown on the structure and affinities of fossil fishes and reptiles, have been of the highest value, and have formed in the aggregate a most important contribution to our knowledge of the history of organic life. I have the highest pleasure in now handing to you the Wollaston Medal."

Sir Philip Egerton, in reply, said:—"My Lord President, I know not whether it is owing to the poverty of the English language or to my unskilfulness in use of it, but I am quite at a loss for words adequate to express my appreciation of the great and unexpected honour conferred upon me by the award of the Wollaston Medal, and for appropriate terms to convey to your Grace my acknowledgments of the kind, but too flattering terms you have used in communicating the decision of the Council; and my embarrassment is increased by the consciousness that, in comparison with those illustrious names which already adorn the Wollaston roll, I am quite unworthy that of the Morse telegraph instrument as worked in America. The tape is drawn by a clock at the uniform rate of 6 inches per hour. As it passes over a grooved brass roller, holes are punched in it by a sharp steel point, drawn down by an electro-magnet whenever the electric circuit is completed, and drawn back by a spiral spring when the contact is broken. There are two grooves in the roller and two electro-magnets, one of which is worked by the anemometer, and the other by the rain-gauge. Thus, when both magnets are in operation, two parallel rows of holes are punched in the tape.—"On the Madras Cyclone of May 2, 1871," by Captain H. Toynbee, F.R.A.S. After giving extracts from several logs containing data taken during the time of the hurricane, and observations taken at the Madras Observatory; the author says it seems fair to conclude that the centre of this cyclone passed to the W. and probably to the N.W. between the parallels of 10° and 13° N.; that its route was probably much interfered with by the high land to the W. and S.W. of Madras; but that it caused very disturbed weather on the west coast of India. The paper concludes with some practical suggestions as to how ships might more safely ride out a gale.—"On the character of the storm of August 21 and 23, 1868, over the British Isles," by Captain T. O. Watson.

PARIS

Academy of Sciences, Feb. 17.—M. de Quatrefages, president, in the chair. A decree of the President of the Republic authorising the election of M. Janssen to the Academy was read, and M. Janssen admitted. M. Faye read the termination of his answer to Fathers Secchi and Tacchini; it was devoted to the refutation of Secchi's statement that spots were solar eruptions and the proof that they were down-rushes caused by cyclones.—M. A. Trecul read a paper on the carpellary theory as regards *Martynia fragrans*.—M. A. de Caligny contributed a further paper on hydraulic engineering, &c.—Colonel H. Levret sent a note on the determination of geographical position on any elipsoid, and M. Boutin a note on the presence of nitre in *Amarantus Blitum;* the dried plant contains 11·68 parts per cent. by weight of potassic nitrate.—M. T. Tissandier presented a description of some meteorological observations made in a balloon.—M. L. Hugo sent a note on two antique dodecahedra in the Louvre, and M. Brachet two microscope lenses made of spinelle ruby; he believes that these will act better than the portion of the object-glass which is usually made of crown glass. A letter from P. Tacchini with a drawing of the remarkable appearance of Jupiter during January was received.—M. J. Bourget sent a paper on the mathematical theory of Pinaud's experiments on the sounds produced by heated tubes.—M. Wurtz presented a note from Dr. L. C. de Coppet on the recent communications of MM. Gernez and Vander Mensbrugghe on super-saturated solutions.—M. Bussy communicated a note from M. Lefranc on atractylic acid; this acid occurs in *Atractylis gummifera* L.—MM. Schützenberger and Risler sent a paper on the oxidising power of blood.—The eighth note of M. P. Bert on experimental researches on the effect of changes of barometric pressure on life, was received.—M. Laboulbène communicated a note on the cause of the elevation of central temperature in cases of acute pleurisy, &c.—M. E. Rivière sent a note on the pre-historic station of Cape Roux.—From M. Champouillon a note on certain imperfections in the official report on recruiting in France was received.—M. Guerin sent a note on silkworm disease; he finds that both healthy and unhealthy moths lay sound eggs.

Feb. 24.—M. de Quatrefages, president, in the chair.—M. Pasteur read a note on M. Cornalia's report on silkworm cultivation. M. Pasteur believes that his system of preserving the healthy eggs will produce good results.—M. Dumas reported on Mr. Fayrer's book on Indian poison snakes.—M. J. Raulin presented a paper on the silkworm disease, and M. Hugo a note on a necklace of polyhedric beads in the Louvre. M. Ed. Weyer a note on left-handed curves of the sixth order. M. de Rebaucour on the cyclic systems, MM. Troost and Hautefeuille on the "solution" of gases in cast and wrought iron and in steel. The authors believe that the gases given off in the "boiling" of iron are due to decompositions in the iron itself.—M. Ch. Violette sent a note on the compound of sugar with potassic chloride, and M. Grimaux one on the solidifying points of solutions of acetic anhydride in water.—M. Bidaud sent a note on the flame reaction of boric anhydride. He finds it to be excessively delicate, with a coal-gas bunsen flame.—M. L. Ranvier sent a paper on the regeneration of cut nerves.—MM. D. Tommasi and G. Quesneville on the action of zinc on acetylic chloride; M. G. Perry, notes on the third ray in triple refracting crystals and on the variability of the co-efficient of elasticity and dispersion.

DIARY

THURSDAY, MARCH 6.

ROYAL SOCIETY, at 8.30.—On the Vapour Density of Potassium: J. Dewar and W. Dittmarr.—On New Sources of Ethyl and Methyl Aniline: J. Spiller.

SOCIETY OF ANTIQUARIES, at 8.30.—On the Troad: Sir John Lubbock.

LINNEAN SOCIETY, at 8.—On the Perigynium of Carex: G. Bentham.

CHEMICAL SOCIETY, at 8.—On the Action of Hydrochloric Acid on Codeine: Dr. C. R. A. Wright.—New Process of Mercury Estimation, with some Observations on Mercury Salts: P. Hannay.—On a Method of Estimating Nitric Acid: T. E. Thorpe.—Note on the Action of Acetates upon Solutions of Plumbic Salts, with Remarks on the Solubility of Plumbic Chloride: F. Field.

ROYAL INSTITUTION, at 3.—Forces and Motions of the Body: Prof. Rutherford.

FRIDAY, MARCH 7.

ROYAL INSTITUTION, at 3.—On the Temperature of the Sun and the Work of Sunlight: James Dewar.

GEOLOGISTS' ASSOCIATION, at 8.—On the Geology of Brighton: James Howell.—On some Fossils from the Margate Chalk: W. Wetherell.

ROYAL COLLEGE OF SURGEONS, at 4.—Extinct Mammals: Prof. Flower.

SATURDAY, MARCH 8.

ROYAL INSTITUTION, at 3.—On the Philosophy of the Pure Sciences: Prof. W. K. Clifford.

SUNDAY, MARCH 9.

SUNDAY LECTURE SOCIETY, at 4.—The Education of Women: Mrs. Fawcett.

MONDAY, MARCH 10.

ROYAL COLLEGE OF SURGEONS, at 4.—Extinct Mammals: Prof. Flower.

LONDON INSTITUTION, at 4.—Physical Geography: Prof. Duncan.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Notes of a Journey in Southern Formosa: J. Thomson.

CANTOR LECTURES, at 8.—On the Energy of Light, with especial reference to the Measurement and Utilisation of it: Rev. Arthur Rigg.

TUESDAY, MARCH 11.

PHOTOGRAPHIC SOCIETY, at 8.—On the Development of Negatives and Transparencies: Col. Stuart Wortley.—On the Photographic Operations for observing the coming Transit of Venus: Lord Lindsay.

ROYAL INSTITUTION, at 3.—Forces and Motions of the Body: Prof. Rutherford.

WEDNESDAY, MARCH 12.

SOCIETY OF ARTS, at 8.—On Signalling at Sea, with special reference to Signals of Distress: Capt. Colomb.

GEOLOGICAL SOCIETY, at 8.—On the Solfatara and some Sulphur-deposits at Kalamaki, near Corinth: Prof. Ansted.—On the Origin of Clay-ironstone: J. Lucas.—Note in vindication of Leptophlæum rhombicum and Lepidodendron gaspianum: Principal Dawson.—Synopsis of the younger formations of New Zealand: Captain F. W. Hutton.

ARCHÆOLOGICAL ASSOCIATION, at 8.

LONDON INSTITUTION, at 7.—Fresco and Siliceous Painting: Prof. Barff.

ROYAL COLLEGE OF SURGEONS, at 4.—Extinct Mammals: Prof. Flower.

BOOKS RECEIVED

ENGLISH.—The Student's Manual of Comparative Anatomy and Guide to Dissection, Part 1, Mammalia: G. H. Morrell, M.A.—The Romance of Astronomy: R. K. Miller (Macmillan).—Colymbia (Trübner).—A Course of Qualitative Chemical Analysis: W. G. Valentin (Churchill).—Exalted States of the Nervous System. 3rd Edition: R. H. Collyer (Renshaw).—The Story of the Earth and Man: J. W. Dawson (Hodder and Stoughton).

FOREIGN.—Einleitung in die Theoretische Physik: V. Von Lang (Williams and Norgate).

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