FINLAY'S COMET (1886 VII.).—The following ephemeris for this comet is continued from *Astronomischen Nachrichten*, No. 3164:—

12*h*. *M.T. Paris.*

1893.	R.A. app. h. m. s.	Decl. app. ° ′
June 22	2 19 1	+11 14·5
23	23 47	11 40·6
24	28 33	12 6·3
25	33 19	12 31·6
26	38 4	12 56·5
27	42 50	13 21·0
28	47 35	13 45·1
29	52 20	14 8·7

The comet during this week lies towards the southern part of the constellation of Aries, passing near Aries 38 on the 26th.

A BRIGHT COMET?—A telegram which we have received from Kiel contains the following data obtained on June 5 and 12 with regard to a probable comet:—

1893.	R.A. h. m.	Decl. ° ′
June 5	9 57·1	+14 21
12	10 4·3	+20 56

This object lies somewhere in the region of η Leonis.

OBSERVATIONS OF NEBULÆ.—In *Astronomischen Nachrichten*, No. 3167-68, Dr. Rudolf Spitaler communicates the observations of nebulæ that he has recently made with the 27-inch Grubb refractor of the Observatory in Vienna. He also compares the brightnesses obtained by him with those in Dreyer's new General Catalogue of Nebulæ and Clusters. In addition to the mean places of these objects and of the comparison stars employed for the years 1891 and 1892, he gives several notes and a plate illustrating many of the nebulæ.

THE YERKES TELESCOPE.—*Astronomy and Astrophysics* for June gives some particulars about the Yerkes telescope, from which we make the following few notes. The great tube pier and clockwork are being built by Messrs. Warner and Swasey, the makers of the Lick 36-inch. The column will be made in five sections, each section except the base one (which will weigh about 18 tons), weighing about 5½ tons each. The column rises 31 feet 4 inches from the base. The pier head weighs 5½ tons; thus the total weight of the column and head reaches about 45 tons. The polar axis, which is of steel, is 15 inches in diameter, 13 feet long, and weighs about 3½ tons, the declination axis measuring 12 inches in diameter and weighs 1¾ tons. The length of the sheet steel tube (exclusive of eye end) measures 62½ feet, its greatest diameter reaching 52 inches, and weighs 6 tons. The focal length of the objective is about 64 feet. All quick and slow motions and clamps can be operated either from the balcony, eye end, or floor, by hand or by electricity as may be required. The floor will be an elevating one like that at the Lick. The telescope weighs in all 75 tons, and an idea of its size may be gathered from the fact that "when the telescope is pointed to the zenith, the object glass will be 72 feet in the air, or about as high as a seven-story house."

THE SMITHSONIAN REPORT FOR YEAR ENDING 1892.—Among the many interesting points to which Mr. S. P. Langley, the secretary of the Smithsonian Institution, refers to in this report, we note the following: The Smithsonian Astrophysical Observatory still occupies the "temporary wooden shelter on the grounds." Although the money for the permanent building is in hand, the Institution is only waiting for the action of Congress to provide a site. With respect to the work that is being done and is proposed for the future, Mr. Langley makes a special reference. The branch of astronomy to which the resources of the Observatory will be devoted will be that of exploring the great unknown region in the infra-red end of the spectrum by the method recently improved by Mr.. Langley himself. The secretary refers also at some length to the recent gift of 200,000 dollars to the Institution by Mr. Thomas George Hodgkins, of Setauket, N.Y., the interest on 100,000 dollars of which is to be used for the general purposes of the Institution on the "increase and diffusion of knowledge among men," provided that the interest on the remainder be used in the investigation of the properties of atmospheric air considered in its very widest relationship to all branches of that science. The report contains the result of several communications on the subject. At some length are treated also reports on the National Zoological Park, which, by the way, seems to be in a not very flourishing condition, on the financial aid given to Research, the National Museum, Bureau of Ethnology, &c., which we must pass over, as they do not appertain directly to the subject of this column. One point we must refer to is the proposed plan of publishing a work on the moon which shall represent the present knowledge of her physical features. The Institution is already in communication with some of the leading observatories of the world, and it is hoped that "a series of photographic representations of hitherto unequalled size and definition, which shall represent the moon's surface as far as possible on a definite scale, and *entirely* without the intervention of the draughtsman." We heartily wish the co-workers in this scheme success, for have we not now, with the present state of photography and fine instruments, a good basis to work upon.

THE MORPHOLOGY OF THE VERTEBRATE EAR.[1]

I. THIS elaborate and important monograph monopolizes the first two parts of the sixth volume of the *Journal of Morphology*. It is the second of a projected series on "Vertebrate Cephalogenesis." Its predecessor was published in the same journal two years ago, and the instalment now under consideration has been anticipated by three shorter communications (Nos. 5, 7, and 8 of the literature cited) of a distinctly sensational character. The 320 pages of contents are illustrated by 26 simple woodcuts; and by 12 magnificent folding plates, printed in colour, and bearing the charmed names of Werner and Winter.

The monograph is subdivided into six sections, with a recapitulatory one, and is based upon the morphological study of the ears of adequate representatives of leading classes and orders of vertebrates, and upon experimental observations chiefly involving the pig and cat. The author's work bears every trace of extreme caution in manipulation, and he lays much stress upon deceptive effects produced by the action of reagents—for example, the knobbing and apparent collar-formation met with in the hair-cells of the avian basilar organ. In seeking to correct certain kindred errors which have arisen during the work of his predecessors, the author concludes (i.) that Retzius' "nerve plates" of the avian labyrinth are "products of the maceration process"; (ii.) that the "horseshoe figure," which the same investigator attributed to the mammalian hair-cell, is an "optical effect"; (iii.) that the continuity between the pillar-fibres and basilar membrane described by Noel "does not exist"; and (iv.) that the basilar membrane itself—defined as "a modified portion of the skin of the head which forms first and last the floor upon which the sense organs rest"—is not elastic enough "to serve for the transmission of the delicate undulations which it has been supposed to transmit." While denying the presence of "spiral nerves" in the cochlea, he concludes that they "exist in the living condition as delicate walled but relatively large lymph channels"; and concerning the very involved question of relationship between the nerve fibres and hair-cells, he asserts that the ultimate filaments are "continuations of the nerve into the hair processes." The "membrana tectoria" of the mammal is said to be but a "cupula terminalis-like structure produced by the gluing together of the hairs of the sensory cells of the organ of Corti, and the breaking away of the whole from the cells which bear them"; and it is incidentally remarked that as found in ordinary preparations it is but "an artifact produced by the use of reagents." However much disposed to accept this very revolutionary deduction, we await confirmation of certain of the author's detailed observations, before fully acquiescing in the belief that "the membrana tectoria, the membrana reticularis, Loewenberg's net, and the three or four main trunks of the system of spiral nerves of the cochlea" so-called, are one and all pure artifacts.

In the course of his inquiry the author has been led into a re-examination of the detailed relationships of the auditory nerves; and in this department he has done a lasting service by sufficiently emphasizing Breschet's long-recorded discovery that the auditory nerve of man is "divided into two branches, each of which supplies semicircular canal organs" (*i.e.* that

[1] "A Contribution to the Morphology of the Vertebrate Ear, with a Reconsideration of its Functions." By Howard Ayers, Director of the Lake Laboratory, Milwaukee, Wis., U.S.A.

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the posterior ampulla is innervated from the cochlear nerve), the unfortunate bearings of which upon certain much more recent physiological speculations he is not slow to point out (p. 148). The thanks of all teachers are similarly due to the author, for having introduced the peculiarly appropriate term "ama" for that second and non-sensiferous enlargement of the canals met with in the lower and the highest classes of vertebrates, and for the substitution of "external" for the misleading "horizontal" canal.

One very remarkable discovery, which the author deals with only too casually, is that "in many forms of Elasmobranchs the ear contains scarcely any crystals, and not unfrequently sand grains." The interest of this, by analogy to Hensen's well-known experimental observations upon the Decapod Crustacea, will sufficiently appeal to all zoologists; and we sincerely hope the author will early furnish us with particulars concerning it.

II. Revolutionary as may be some of the author's conclusions above cited, the refrain of the major part of his morphological inquiry is, on the whole, no less so. It runs as follows:—"There can be no doubt that the internal ear develops from superficial canal organs"; that it is primarily subdivided into anterior and posterior portions; and that a "fateful distortion," under which the great development of the cochlea drags the posterior half downwards, has "perhaps more than anything else" deceived us and "retarded our progress in the knowledge of the significance" of its parts. Thus it is that the author gives definiteness to a view which, although it unconsciously dawned with Leydig's recognition of structural similarity between the auditory and tegumental-canal sense-organs of the Ichthyopsida, was first definitely formulated by Beard. He takes his stand upon Beard's brilliant generalization, as modified by the acceptance of Froriep's interesting correction (p. 314), and by certain considerations arising out of his own inquiry. In the performance of this task the author has been shoulder to shoulder with Mr. Allis, co-editor and joint founder of the *Journal of Morphology*, and author of one of the most remarkable papers which its pages have yet borne, viz. that upon "The Anatomy and Development of the Lateral Line System in Amia Calva," duly noted in these pages (NATURE, Aug. 29, 1889), and nothing is more apparent than that he has sought to extend the laws of growth which Allis discovered for the lateral line organs to the internal auditory one. His leading deduction that the last named structure consists of "a symmetrical group" of the organs in question chiefly rests upon the following discoveries and allegations, apart from any question of general structural resemblance between the two, viz. (i.) the lineally recurring (antero-posterior) symmetry of the parts of the labyrinth; (ii.) the duplication of the endolymphatic ducts in Cyclostomes and some Elasmobranchs; (iii.) the double and repetitional nature of the auditory nerve—that being regarded as a derivative of "two distinct cranial nerves," consisting of an anterior (utricular) fasciculus in anastomosis with the facial, and a posterior (cochlear) one, either in astomosis with the glossopharyngeal, or totally independent; and (iv.) an attempt to show that the *macula acoustica neglecta* is an "abortive second horizontal canal organ." Although inclined to accept the general tenor of the author's broader morphological conclusions, we cannot concur in the last cited one. He formulates it almost entirely upon the study of nerve distribution; and, by his own showing (pp. 28, 29) the sensiferous area in question might well have had an independent origin. The conclusion does not, however, materially affect the author's dictum, and in respect to it he seems to have been carried away by a bias in favour of Allis, which elsewhere reappears (pp. 275, 277, and 283), and culminates in the unwarrantable assertion (p. 308) that "the semicircular canals of the ear are simply remnants of the canal system of the surface" (p. 318) "not known to have any other function than the one inherited from their ancestors, viz. that of serving as mechanical protectors of the sense organs," and that they are to be classed with such structures as valves in the horizontal veins . . . the vermiform appendix . . . and atavistic muscles" (*sic*). Having sought to show that the "canal organ has been gradually losing ground" during the progress of descent with modification, the author argues (p. 235) that the future human ear "will not retain much else than the cochlea"! What of the adherents to the bagpipe? We would recommend a periodical examination of their ears to the author's notice. Statements of the order here commented upon are indicative of haste and over-enthusiasm, while others, to the effect that (p. 47) "the cells involuted with the sensory structures "merely" serve as a lining of the auditory canal chambers," and that the otoliths, which they secrete (p. 309) "are to be considered as essentially foreign bodies . . . tolerated because of the impossibility of getting rid of them . . . and the result of the secretive action of the ectoderm cells, which in ancestral forms produced the surface scales," are little short of nonsensical.

With Fritsch, the author regards the Savi's vesicles of the *Batoidei* as derivatives of "the widespread open canal type" of organ; and by no means the least striking portions of his treatise are those in which he attempts to prove (i.) that the semicircular arch of *Myxine* is "composed of the anterior and posterior vertical canals of the Gnathostome vertebrate ear"—deducing an argument in favour of the non-degeneracy of the *Marsipobranchii*, and (ii.) "that a comparison of the ears of Myxine, Petronnyzon, Dasyatis, Torpedo, and Man clearly shows the connection of the [endolymphatic] duct with the utricular and sacular chambers to be a fundamental condition, and not a secondary acquirement."

III. That the physiological aspects of the author's inquiry might be expected to be no less sensational than the morphological ones, is sufficiently clear from his earlier surmise (pamphlet No. 7 of literature cited) that (p. 8) "when one considers the truly wonderful auditory powers" of the mocking bird, "it becomes evident that we must seek for some explanation which does not involve the piano-string hypothesis," and that (p. 9) "it is perfectly obvious that we do not need an internal ear in the vertebrate organization for the perfect exercise of the function of equilibration, since in Amphioxus the organ is absent, and in higher forms the auditory nerves may be destroyed without destroying this function." Little wonder, then, that the author should denounce both the "statical" theory of Goltz, and the more recent "dynamical" one of Cyon, Crum-Brown, and later experimentalists. His attitude towards the majority of his predecessors is best expressed in his remark that "all the phenomena following canal section in mammals and in birds are nothing more than the results of brain lesions such as are entirely inadequate to explain" them.

Availing himself of the observations of Munk, that, whereas in the dog, destruction of the ear, which may lead up to fatty degeneration of its inner constituent, is "always followed by dizziness and equilibrative disturbances, such disturbances do not appear when the cochlea is preserved," and of others akin to them he concludes that, provided the semi-circular canals "have a function, it is not either statically or dynamically equilibrative." Reference is made to Steiner's important observation that whether (in the shark) "the semicircular canals were removed or not," disturbance of the otoliths covering the utricular sense organ, invariably instituted rolling movements, usually towards the side disturbed; but the author is silent concerning Engelmann's attempt to assign distinct functions to the cristæ and maculæ with their associated otolithic masses. Indeed, his opening statement (p. 237) that "we have very slender foundation for forming final judgments of the functional relations of any parts of the internal ear, and that at present what we imperatively need is not speculation, but *experimentation*," well defines our position to-day, when the sum of the author's own experimental observations are taken into account. The physiological section of his work is much weaker and less extensive than its morphological ally.

IV. The author is to be congratulated upon an unusually speculative treatise, embodying a substratum of solid work. As a "paper" it is, in its bulkiness, a sort of awful example fit to rank with that of his countryman Mark on the egg of *Limax campestris* (*Bull. Mus. Comp. Zoöl.*, vol. vi., 445 pages in all). The publication of such voluminous treatises in any but book form, provided with an analytical index, is unjust to both author and reader. It is a gross mistake, and the author has but himself to thank if he escapes proper recognition in consequence. Much of the said bulkiness of the present treatise is due to the incorporation of needlessly lengthy citations from foreign writers, which, permissible in a book, are out of place in a "paper" intended for specialists possessing a full knowledge of current literature. We could have wished, instead of these, a recognition and an explanation of topics untouched; for example, of the circular condition of the posterior canal among the depressed Batoidei, which the author's remarks on pp. 13, 16, 222, and 223 by no means sufficiently express, and which is inexplicable on his belief that "the mechanical forms active in the modelling of the ear are

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for the most part the inherited tendencies of cell growth acquired as legacy from the canal organs of the surface." Among important topics which the author ignores, and upon which we could have wished his opinion, are Chatin's alleged discovery of all intermediate stages between the rod-bearing and ciliated cells of the Batrachian auditory epithelium, and the views of Engelmann, Chun, and Yves Delage, arising from the experimental study of the otoliths in Ctenophora, Mollusca, and Crustacea. The latter are by no means reconcilable with the author's bold assertion that "the functions of the otoliths are entirely unknown." In dealing with the "chalk-sacs" of the amphibia, the author remarks (p. 21) that their "morphological as well as physiological significance" is still unknown. He ignores the fact that Lenhossek has shown them to be tubular glands and named them; and this is very remarkable, as, while he makes no mention of that author's paper, he acknowledges one by Coggi, in which it receives ample recognition. G. B. H.

PERSPECTIVE AND COLOUR.

IN *Brain*, Parts LXI. and LXII., which have just been published, occurs an interesting article by Prof. Einthoven (of Leyden) on the production of shadow and perspective effects by difference of colour. The following is an account of the phenomena:—

Difference of colour may, under certain circumstances, be the cause of an apparent difference in distance.[1] To observe the phenomenon, it is only necessary to glue different coloured figures, such as letters of blue and of red paper, to a screen of black velvet and to look at them from a suitable distance. In the experiment about to be described, Roman capital letters of about eight by four centimeters were used, the screen being placed at about three meters distance from the observer.[2]

Under these conditions it appeared, both to Prof. Einthoven and to others who he interrogated, that the red letters were nearer than the blue. Obviously, the phenomenon might be explained by difference in accommodation. In order to see the red letters distinctly, a greater amount of accommodation is necessary than in focussing the blue ones, and the greater sense of effort might account for the notion of the red letters being nearer. This accommodation hypothesis, plausible as it seems, cannot however be accepted as a satisfactory explanation of the phenomenon. Several observations tell against it, notably this: that there are about as many persons who see the blue letters before the red, as there are those who see red before blue. In the second place, the apparent difference in distance—so distinct to binocular vision—disappears almost wholly with the closure of one eye. Looked at with one eye only, and for some length of time, the letters appeared to be lying in the same plane, but each time that the other eye was opened the difference in distance obtruded itself irresistibly.

The amount of difference remains constant, and can be estimated with considerable accuracy, in the same way as in making a stereoscopical observation. The question therefore suggested itself, whether we had not here to deal with real stereoscopy? The answer to this question is an affirmative. Brücke[3] has shown by means of a simple experiment that the retinal images of differently coloured points are shifted with respect to one another. Looking with one eye at a narrow vertical strip on a black background, the upper and lower thirds of the strip being red and the middle third blue, Brücke observed that the blue part deviated to one side, the two red parts to the other side. By covering either eye alternately, a deviation of the blue and red parts in opposite directions will be observed; and, on both eyes being used, the notion of a difference in distance is proved by the combination of the two images in such a way that the parts that deviate to the nasal side constitute the nearer image; the parts that deviate to the temporal side, the further image. The stereoscopical effect is, however, more distinct and convincing with the coloured letters than with the strip used by Brücke.

The cause of the relative removal of the differently coloured images lies in the eccentricity of the pupil, as may be demonstrated experimentally. The pupils may be made highly eccentric by covering them partially. Partial covering on the nasal side is equivalent to a removal of the pupil to the temporal side, and conversely, covering the temporal side is equivalent to removal to the nasal side. With a nasal eccentric pupil a shifting of the differently coloured images in one direction will be observed; with a temporal eccentric pupil the shifting will be in the other direction.

The effect of an artificial eccentricity of the pupil is surprising when both eyes are used. Anyone who sees the red letters before the blue has only to cover his pupils symmetrically on the temporal side, when he will observe the red letters retreat and soon appear to be behind the blue. On covering his pupils symmetrically on the nasal side, the red letters come forward more and more, and seem at last (experimenting at a distance of four or five meters) to remain several decimeters in front of the blue. A person who sees the blue letters before the red, has only to cover his pupils on the nasal side, when he will observe that the distances change, the red coming forward and the blue shrinking back.

Lately, however, Dr. A. D. Waller has found that on repeating the experiment with a seemingly slight modification, he obtained the same effects with one eye alone. He used as a test object rings of blue paper on a red ground, or of red paper on a blue ground, and found that the nasal pupil of the left eye gives the same appearance of circular trenches or hillocks as does the temporal pupil of the right eye.

This observation has been the motive to a more thorough study of the phenomenon.

On looking with the right eye and a temporal pupil at red rings on a blue paper, the rings appear as circular hillocks when the paper is held to the left, and also sloping in that direction. One seems to be looking against the dark edges of a thick red ring fixed upon the blue paper. With a nasal pupil the red rings appear as circular trenches.

The phenomenon is the more striking in proportion to the purity of the colours used. The pupil must be made sufficiently eccentric and in a suitable direction by means of a black screen that covers it from one side, or better still, by means of a stenopæic apparatus. The pupil must not be too narrow, and the whole eye should be wide open and well-directed, so as to avoid any partial covering by the nose, eyelid, or lashes. Lastly, it is not desirable to keep the eccentricity of the pupil constant for more than a brief period. For if one stares at the rings a long time with unmoved pupils, all appreciation of distance is lost, as in so many cases where only one eye is used, and the rings may even seem to lie in a plane that intersects the plane of the blue paper perpendicularly. If, on the contrary, one shifts the screen or the stenopæic apparatus now and then the rings appear to rise and sink, and, under the above-mentioned conditions the rising will be with temporal pupil, the sinking with nasal pupil, and in a way almost as striking as if they were seen stereoscopically.

Prof. Einthoven proves mathematically that the explanation of the phenomenon is found in the appearance of shadows.

[1] Donders. *Wetensch. bijbladen. Med. Gasth. v. Ooglijders*, 1868.
[2] W. Einthoven, "Stéreoscopie dépendant d'une différence de couleur." *Archives Néerlandaises*. t. 20.
[3] Vorlesungen über Physiologie Wien, 1884, 3 Aufl. B. 2, S. 95.

THE FLORA OF GREENLAND.

IN 1891 Dr. William H. Burk accompanied, as botanist, the party which escorted Lieut. Peary to his winter quarters in McCormick Bay. A number of plants were collected and taken to America, but they had barely been determined before an expedition was organised to search for Lieut. Peary, and Mr. William G. Meehan was appointed botanist to it. This was just a year ago. Mr. Meehan was also fortunate enough to obtain specimens, and a catalogue of the plants collected in both cases was communicated to the Academy of Natural Sciences of Philadelphia on April 11. Some idea as to the character of the catalogue will be obtained from the following introduction to it:—

The range of territory covered by Dr. Burk and Mr. Meehan was between about latitude 63° and above 78° or between Godthaab and Littleton Island.

As nearly the whole collection was repeated by each collector, it may be taken as a fairly complete flora of that portion of the territory of Greenland.

Before starting in their respective journeys, both Dr. Burk and Mr. Meehan were instructed to examine as far as possible

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