

to the hostility of the Marabout Mahmadu Lamine, two expeditions were formed last December to proceed against him (*Proc. roy. geogr. soc.*, April, 1887). The country to be traversed is little known, and topographical surveys will be carried on during the expedition. Besides this, Dr. Tautain and Lieutenant Quiquandon will explore the country adjoining the north-eastern boundary of Senegambia, which includes the country called Bakunu, between the desert and the upper course of the Niger. It was traversed by Mungo Park in 1796. A third party will survey the unknown part of the Niger, as far as it forms the boundary of Senegambia, and ascend the Tankiso, which has its source in Futa-Jalon, and has never been visited.

Asia.

H. E. M. James, F. E. Younghusband, and H. Fulford have made an interesting journey in a part of Manchuria which had hitherto not been visited by Europeans. They left Mukden, the capital of South Manchuria, on May 29, 1886, intending to ascend the Yalu River and to reach the point where the Chinese, Korean, and Russian frontiers meet. They were prevented from carrying out their intention by the impracticability of the upper valley of the Yalu. Therefore they turned due north, up one of the tributaries of the Yalu, crossed the main chain of mountains by a low pass 2,700 feet high, and came down the Tang-ho, an affluent of the main or western branch of the Sungari. They then visited the Chang Pei-shan ('ever white mountain'). It was found to be a recently extinct volcano, with a lovely blue pellucid lake filling the bottom of the crater, and surmounted by a serrated circle of peaks rising about 650 feet above the surface of the water. The loftiest of these was found to be 7,525 feet high, while formerly its height was estimated at 10,000 to 12,000 feet. The sides of the mountain are composed of disintegrated pumice, to which its conspicuously white aspect is due. There are no glaciers, but snow lies in the clefts all the year round. The Pei-shan forms the centre of the river-system of Manchuria; the Yalu, which forms the southern part of the Korean frontier, the Tumen, which forms its northern part, and the western Sungari, having their sources here. From here the party went to Kirin, descending the Sungari. While the rest of Manchuria is infested with robbers, the colonists and hunters of this district have managed to suppress them, and travelling is comparatively safe. Considerable difficulties were experienced owing to incessant rains, which made the rivers impassable. Numerous gold-diggings were met with, the most extensive being but a few marches from Kirin. Here

they staid for three weeks, and started on Sept. 3 for Tsitsihar, the capital of northern Manchuria, on the Nonni, a tributary of the Sungari. From Tsitsihar they turned south-east, and crossed a high, undulating, and perfectly uncultivated steppe, with numerous brackish lakes. At the shores of these lakes, earth containing soda and salt is gathered, from which soda and salt are made. Thus they reached Hulan, on the Hulan River, a few miles from the Sungari. The country all around here is very fertile, and is being rapidly settled, some of the towns having upward of 25,000 inhabitants. They visited the south-east corner of Manchuria, where the Russian, Korean, and Chinese frontiers meet, and returned to Kirin and Mukden. A great part of the country they traversed was never visited by Europeans, and the compass survey of their route will be very valuable (*Proc. roy. geogr. soc.*, Dec., 1886; April, 1887).

America.

La gazette géographique (April 21) says that Chaffanjon's explorations on the upper Orinoco have been successful, and that he has returned to Ciudad Bolivar.

Thouar's expedition, which was sent out to explore the Pilcomayo, is detained at Lagunillas, on account of the outbreak of cholera in Paraguay.

NOTES AND NEWS.

THE second annual meeting of the American economic association will be held in Boston and Cambridge, May 21-25, 1887. The meetings will, for the most part, be held in the buildings of the Massachusetts institute of technology; but one session will be held at Harvard university in Cambridge. The following is the programme, subject to revision: May 21 (evening), joint session of the American economic association and the American historical association, with addresses by the presidents of the two associations (Gen. Francis A. Walker and Prof. Justin Winsor), reception of both associations in the Museum of fine arts; May 23, report of the standing committee on transportation, 'Agitation for federal regulation of the railways' (by Prof. E. J. James), 'Long and short haul clauses of the federal railway law' (by Dr. Edwin R. A. Seligman), 'Some curious phases of the railway question in Europe' (by Simon Sterne, Esq.), 'Sociological character of political economy' (by F. H. Giddings, Esq.), and 'Mine labor in the Hocking valley' (by Dr. Edward W. Bemis); May 24 (forenoon), economic association, report of committee on trade on 'Condition and organization of retail trade,' report of standing com-

mittee on public finance on 'Municipal public works,' paper by Frank J. Goodnow on the 'Administrative aspect of municipal franchises and finance in Europe and America;' (afternoon), joint session of both associations (Saunders's theatre, Cambridge), papers by Hon. Carroll D. Wright on 'The study of statistics in colleges,' by Prof. E. J. James on 'Our legal tender decisions,' and by Dr. A. B. Hart on 'Finances of the American revolution;' (evening), meeting in Boston, paper by Professor Folwell on 'Economic theory,' paper by Prof. Richmond Smith on 'Wage statistics,' report on the Connecticut valley branch of the American economic association by Dr. E. W. Bemis (secretary), report of the secretary on the 'Condition and prospects of the American economic association;' May 25, both associations will go to Plymouth, and dine together at the Samoset House.

— A letter from Mr. Tebbutt in the April number of the *Observatory* states that the 'great southern comet,' to which we have already referred in *Science*, was first seen at Windsor, New South Wales, on the evening of the 28th of January. The tail was many degrees in length, and extended as far as the star Achernar in the constellation Eridanus, but no nucleus could be detected on that evening or on the evening of Jan. 30. On Feb. 1, although the sky was pretty free from cloud, not the slightest trace of the tail could be seen, owing to the brilliancy of the moon. No accurate observations were obtained, and the comet was not seen again. The *Revista do observatorio* for February, published by Dr. Cruls at Rio Janeiro, gives a sketch of the comet made on Jan. 24, 1887. The nucleus was then somewhere beyond the bright star α Gruis, invisible in the haze of the horizon; and the tail stretched up beyond β Hydrae, a narrow ribbon fifty-two degrees in length and about half a degree in width. At Cordoba no accurate observations could be made on account of the lack of a definite nucleus. Dr. Thome has expressed the opinion — though, as he says, the evidence is not such as would be accepted by astronomers as conclusive — that the comet is identical with the great comet of 1880, to which it bears a strong resemblance in its physical characteristics. The great comets of 1843, 1880, and 1882, and the comet discovered during the total eclipse of the sun of May, 1882, all seem to be moving in similar orbits, and doubtless belong to the same family, having formed at some earlier stage parts of a single body. The Melbourne comet is now, without doubt, to be added to the family, and there may be many other large comets in this stream, which pass by the sun unobserved. Dr. Meyer's

recent investigations show, that, if any one of these brilliant comets had passed perihelion in May, its position with respect to the sun would have insured its escape. Dr. Meyer is not inclined to admit the identity of the comets of 1843, 1880, and 1882.

— Commander F. E. Chadwick, of the navy, contributes to the May number of *Scribner's magazine* an important article, entitled 'The development of the steamship,' in which he describes the first experiments in steam-navigation, the early lack of faith in its possibilities, the obstacles that were overcome, the rapid improvements in steamships, the growth of ocean transportation, and the establishment of the great transatlantic lines. An especially interesting feature of the article is the description of the most famous of modern steamships.

— The publication of *The journal of education for New Brunswick* has met with such encouragement that it has been determined to enlarge it to a twenty-four page paper, to be published monthly, in the interest of teachers and students of the maritime provinces of Canada. The first number of this periodical will be published about the first of June next.

— Within three months of the appearance of the first part of the new series of his 'Butterflies of North America' (see *Science*, ix. 122), Mr. W. H. Edwards issues another, which is even more interesting than that, for two of the three quarto plates furnish abundant details of the early stages of butterflies, heretofore unknown, and including many not usually given by naturalists. The first of these is *Colias harfordi* of southern California, which the author has been able to raise in the east from eggs sent by Mr. Wright of San Bernardino, — a collector who has done much to develop our knowledge of the butterflies of that region. The other is *Neonympha gemma*, a southern insect, not uncommon in West Virginia. This last plate contains also *N. henshawi* of New Mexico, of which the egg also is given; and the whole plate, in delicacy of drawing and faithfulness of coloring, is matchless, and reflects the greatest credit upon all concerned. *Argynnis* comes in again for its share, one species, *A. coronis*, being figured, and another, *A. calippe*, having a page of its history recorded from the notes of Mr. Wright, from which it appears, that, in contrast to our eastern species, it flies in spring, and in spring only. It is much to be hoped that the Boston publishers (Houghton, Mifflin, & Co.) will be able to assure the author in a substantial manner of the growing appreciation of the public for such excellent work and costly outlay.

—The well-known Woburn rotation experiments, undertaken by Voelcker for the Royal agricultural society of England, have been frequently quoted as casting discredit upon the conclusions of the chemist regarding the manurial value of different articles of cattle-food (see article in *Science*, ix. No. 206, for an account of these experiments). The manure from animals fed with cottonseed-meal, in particular, showed no superiority over that from animals fed with corn-meal, although the former must have been much the richer in plant-food. Those, however, who interpreted the experiments unfavorably to the conclusion of the chemist, forgot that the soil is as important a factor as the manure in the production of a crop, and that upon an already fertile soil the direct fertilizing effects of manures may have no opportunity to show themselves; some other factor being present in relative minimum, and thus controlling production. In the last number of the *Journal of the Royal agricultural society*, Voelcker reports briefly upon the beginning of a similar experiment upon *poor soil*. Few details are given; but the general result was that the manure from cottonseed-meal greatly surpassed that from corn-meal, thus indicating strongly that the soil of the Woburn experimental field was too rich for the proper conduct of experiments with fertilizers, and giving a very plausible explanation of the abnormal results reached.

—A system of indicating the time at night throughout a district lighted by electricity from a central station has been patented by Patrick B. Delany, an electrician of this city. The system consists in causing all the electric lights in the district to fluctuate in intensity, in a predetermined manner, at proper intervals, and in such a way as to indicate the hour.

—Mr. E. C. Sanford of the Johns Hopkins university has republished, with an introductory note by Prof. Stanley Hall, his study of the manuscripts of Laura Bridgman, the famous blind deaf-mute now living, at the age of fifty-seven, at South Boston. The author has had access to almost all of the diaries and other writings which Laura Bridgman has from time to time written, and has given a valuable as well as interesting analysis of their contents. Her autobiography is given almost entire, and abounds in quaint errors, such as normally constituted persons would seldom if ever commit. These are sifted out and presented with much tact, and the whole study is an important contribution to the history of one of the most remarkable educations through which a human being ever passed.

—About two years ago, Mr. de Nicéville of the

Indian museum, Calcutta, sent for exhibition to the entomological society of London several series of Indian butterflies, which were universally regarded as distinct species, but which closely resembled one another, excepting that the conspicuous ocellated spots of the under surface of the wings of certain kinds found in the rainy season were replaced in other kinds which fly only in the dry season by more uniform, paler, and leaf-like markings, in which the ocelli are obsolete. He regarded these as probable instances of seasonal dimorphism, — a view which was vigorously combated by some of the members present at the exhibition. He has now proved his right to the belief in the case of four pairs, having raised one series of forms from eggs of the other (*Journ. Asiatic soc. Bengal*, 1886). These were species of *Ypthima*, *Mycalesis*, and *Melanitis*, and it is the first time this phenomenon of seasonal dimorphism has been shown in tropical butterflies; it was supposed to be altogether related to the winter of temperate regions. Mr. de Nicéville believes that the obliteration of the ocelli is “an advantage to the insects during the cold and hot seasons, as at those times the vegetation is much more scanty and dried up, the insects live chiefly among the grass, and would consequently be easily seen were they not inconspicuously colored and marked; while in the rains, the vegetation being then very dense, they can hide themselves, and their conspicuous livery is no bar to their safety.” De Nicéville adds at the end of his paper (in which the early stages of *Ypthima* and *Mycalesis* are for the first time figured) that he could indicate “many dozens of Indian species” in which he believes seasonal dimorphism occurs, “including nearly every family into which butterflies have been divided,” but he “might again be accused of ‘guessing.’” Here is certainly an interesting and open field for the Indian entomologists, which even the tyro may till.

—Excavations for the foundations of the 1000-foot iron tower to be erected in the Champ de Mars, Paris, are being made. Each of the four members of the tower framework will rest upon a pyramid of masonry 26.24 feet high, to which it will be secured by anchor-bolts six inches in diameter. Four immense masses of beton, resting on a stratum of clay nearly fifty feet below the surface, will serve as foundations for each of the masonry pyramids; and the enormous weight of the whole will act as a counterpoise to insure the stability of the tower against the great wind-pressure to which it will be subjected.

—Messrs. Ticknor & Co., Boston, have recently published, under the title ‘American literature

and other papers,' a volume of essays by Edwin P. Whipple, in the introduction to which John G. Whittier says of the author that he was the ablest critical essayist of his time, and the place he has left will not be readily filled. Scarcely inferior to Macaulay in brilliance of diction and graphic portraiture, he was freer from prejudice and passion, and more loyal to the truth of fact and history. He was a thoroughly honest man. He wrote with conscience always at his elbow, and never sacrificed his real convictions for the sake of epigram and antithesis. He instinctively took the right side of the questions that came before him for decision, even when by so doing he ranked himself with the unpopular minority. He had the manliest hatred of hypocrisy and meanness; but if his language had at times the severity of justice, it was never merciless. He 'set down naught in malice.'

— The well-known researches of Warington have done much to elucidate the process of nitrification as it takes place in the soil. His latest paper (*Journ. chem. soc.*, Feb. 1887, p. 118) deals with the distribution of the nitrifying organism in the soil. Evidences of its presence were found to the depth of six feet, but it was neither abundant nor vigorous. The author concludes that nitrification is practically confined to the surface soil.

— The lactocrite, a new apparatus for testing milk, particularly with regard to its value for butter, is the invention of de Laval, also the inventor of the well-known centrifugal separator, which bears his name, and is designed to be used with the latter. The milk is first heated with its own bulk of strong acetic acid to which five per cent of strong sulphuric acid has been added. This treatment, continued for seven or eight minutes, suffices to set free the fat of the milk from its emulsified state. A glass tube with a narrow neck, properly graduated, is then filled with the milk, placed in a suitable holder in a disk which is attached to the centrifugal separator, and the latter set in operation. A complete separation of the fat is then effected in the narrow neck of the tube, where the amount is read off. The instrument is designed to enable creameries using the centrifugal to test the quality of each patron's milk; and it appears to be well adapted to this purpose. Several tests of its accuracy have been made of late. Sexhlet, in the *Milch Zeitung* (xvi. 14), reports that he obtained by it results agreeing within 0.1 per cent with those of his aerometric method. Sebelien (*Landw. Vers. Stat.*, xxxiii. 405) finds, that, if all the directions are strictly observed, the results do not vary at most more

than 0.1 per cent, and usually not over 0.05 per cent, from those of gravimetric analysis, but notes that these directions must be carefully followed. Faber (*Analyst*, xii. 6) obtained about the same results. Blythe (*Ibid.*, xii. 34) found in eleven trials a maximum error of 0.14 per cent, and an average error of 0.05 per cent.

— Ginn & Co. have ready this week 'Little flower people,' by Gertrude Elizabeth Hale, an interesting elementary work on flowers, designed to awaken an interest in plant-life among the youngest readers; also 'Outlines of logic,' by Herman Lotze, translated and edited by Prof. George T. Ladd of Yale college.

— Mr. William Cushing has been obliged to give up the publication of his proposed 'Anonyms' as a companion to his 'Pseudonyms.' This is to be regretted as a loss to American bibliography. There ought to be enough public-spirited institutions and individuals — booksellers and librarians — to whom such a work is an almost daily necessity, to offer Mr. Cushing and his publishers a guaranty against loss in completing a work so admirably begun.

— With the publication of the third volume of the history of Central America, now about ready to place in the hands of subscribers, but fourteen of the thirty-nine volumes of Hubert Howe Bancroft's works remain unpublished. The History company are gratified with the success that has attended the enterprise thus far; the growing favor in which each successive volume is held by the public, and the especially kind notices and reviews of the press, generally prove a very great encouragement.

— G. P. Putnam's Sons announce that when they have completed the publication of their edition of Franklin's works, of which the third volume is about to be delivered to subscribers, they will follow this with an edition of the 'Writings of Washington,' printed in similar style. The set, which will probably be comprised in twelve volumes, will contain the diaries, the addresses, and the correspondence, and will include a number of papers not before printed. Arrangements for the editing have been in train for some months, and the name of the editor will be announced shortly. The limited edition printed of the 'Franklin's works' is now all subscribed for, and the price of sets has already appreciated, as was the case with the 'Hamilton.'

— Messrs. Macmillan are going to issue this month the second volume of the 'Course of practical physics,' by Prof. Balfour Stewart and Mr. W. Haldane Gee, dealing with electricity and magnetism.

— Two years ago Professor Baird conceived the idea of procuring one of the prehistoric Easter Island idols to be added to the collection at the national museum. After much labor and patience, his efforts, aided by the government, have been successful, and the idol arrived in Washington on Monday last, together with a number of other valuable antiquities. The curiosities have been brought over without injury and without expense, naval vessels conveying them for the entire ocean-voyage. There are hundreds of these images on the island concerning which there is no knowledge whatever. One of them was taken from the island by the German government recently, and is now in the national museum at Berlin.

— The forthcoming report of the department of agriculture on the English sparrow will be a very interesting document. It will contain about four hundred printed pages, in which will appear the experiences of about thirty-two hundred people with this destructive biped. Dr. Merriam, the ornithologist of the department, who has charge of the preparation of the report, says that the indictment against the sparrow is a terrible one; and it has scarcely a friend in the whole country. Farmers who devote their time to the cultivation of grain, report that the sparrows, wherever they are thick, do frightful damage to cereals. Market-gardeners and the raisers of small-fruit, in the vicinity of cities, say, that, since sparrows began to multiply, the profits of market-gardening have almost vanished. The only known use for the sparrow is as a substitute for reed-birds. One man in Albany, N.Y., reports that he sells hundreds of dozens of sparrows every month to the restaurants in that city for reed-birds. They make excellent table-birds.

— The Smithsonian institution has just received a large collection of birds collected by Mr. Robert Henderson in the West India islands. Mr. Henderson, who has just returned from his trip, has been engaged in this work since last December, and has covered all of the islands except Ruatan, Turneff, and Cosomel in the lower part of the Caribbean Sea. He will make a second trip this summer to the above islands.

— The *West American scientist*, a monthly issued at San Diego, Cal., has enlarged to a twenty-four-page magazine with its third volume.

— The New York mineralogical club has recently been organized in this city. The objects of the club are, to create and stimulate an interest in mineralogy, and to collect, describe, and preserve all suitable material available in New York City and vicinity; such collection to be deposited in some public institution, so as to preserve a miner-

alogical record of places soon to be covered with buildings. It has been decided that all meetings of the club, if possible, shall be held at the residences of the members, for the purpose of examining collections as well as promoting sociability. Meetings will be held on the last Tuesday of every month, the chairman of each meeting to be the host of the occasion. The officers of the club are, George F. Kunz, secretary; B. B. Chamberlain, treasurer; Prof. D. S. Martin, Rev. J. Seldon Spencer, and Edgar A. Hutchins, executive committee; L. P. Gratacap and A. Woodward, curators. There are already over forty members on the roll.

— Mr. Stephen Salisbury of Worcester, Mass., has just given to the Technical institute of that city one hundred thousand dollars, to be used in the erection and equipment of a building for laboratories for mechanical, physical, and chemical science, as a memorial to his father, the late Stephen Salisbury, who for a great many years was president and chief patron of the institute.

— A remarkable illustration of the puzzling migratory habits of the herring has just been observed, says *Nature*, on the south-west coast of Norway, at the so-called Jaederen, between the towns of Stavanger and Egersund. This district used to be one of the richest herring-fishing grounds in Norway during the spring, but about twenty-five years ago the fish suddenly and completely disappeared from the coast. In March enormous shoals once more came under shore, first 'striking land' at the same spot as in former times. The quality of the herring is exactly the same as it was twenty-five years ago, and the shoals were accompanied by numerous 'herring' whales.

— According to *Engineering* for April 22, Russia proposes to press forward vigorously with the construction of the Samarcand railway from the Caspian Sea to the Amu Daria. It is stated that when the line is finished it will be possible to make a journey from Paris to Samarcand in seven days. The line will commence at Ouzoun-Ada, a small port on the Caspian, the distance from that point to the Amu Daria being in round figures 625 miles. Of this distance, 543½ miles of line are now entirely completed, and open for the conveyance of passengers and goods. The present terminus of the line is Tchardghoni, to which place it was completed Nov. 30, 1886. The construction of the line was commenced by General Arrenkoff in May, 1885, and 418½ miles were completed in eighteen months. The number of persons engaged in the construction was about 2,200. Not only was the permanent way laid through to

Tehardghoni in the course of the eighteen months, but houses and cottages for employees, a line of telegraph, and sand-sheds, were also established. The object of the sand-sheds is, of course, to protect the line against sand-storms, which constitute one of the difficulties with which it has to deal. Active preparations have been made for the construction of the remaining section to the Amu Daria: the necessary workmen have been collected, a large mass of materials has been brought together, and General Arrenkoff expects to complete the whole line through to Amu Daria by Nov. 15.

LETTERS TO THE EDITOR.

*.*The attention of scientific men is called to the advantages of the correspondence columns of SCIENCE for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

Comparative psychology.

PRESS of work has prevented me from replying before to a certain form of presentation, in *Science* for April 1, of my paper published in the *Popular science monthly* for March, on comparative psychology, and which really amounts very largely to a misrepresentation not only of what I think, but of what I actually expressed in the address referred to above.

It is assumed throughout by *Science* that I have ignored Professor Morgan's view of the case as to the study of animal intelligence, for it is stated that "he [the writer] has not faced this argument," etc., and "These limitations and considerations carry with them many consequences, but we can find in Dr. Mills's address no evidence that he has ever given them any consideration."

A few extracts from my own paper, followed by others from Professor Morgan's (in *Mind* for April, 1886), will test this matter. I am quoted in *Science* as saying, "Animals are the 'poor relations' of man; the latter is one of them, not only in body, but in mind. In not a few respects they are not only equal, but superior, to man." Professor Morgan says, "I am, moreover, fully persuaded that my four-footed friends have feelings and emotions distinctly akin to and dimly foreshadowing my own;" "I by no means deny the existence of animal mind;" etc.

Again he says, "A material difference in the ratio of the senses must, we may suppose, make a material difference in the mental product." He then alludes, as I do myself after the very passage *Science* quotes from my paper, to the superiority of the senses in the animals below man; for though *Science*, referring to my use of the expression 'lower' animals, says ironically, "We presume he uses the adjective 'lower' merely in deference to a custom of some antiquity," I have explicitly stated that it must be conceded that man as a totality stands at the head of the animal world, as the following extract will show: "The assumption that man is only accidentally the

superior of the brute would but lead to confusion, for it must be admitted that there is a scale, and that man ranks first. We are simply desirous of doing the lower creation that justice which we feel assured has not yet been allowed them, and of seeing the human family interested in those that we think scientific investigation is proving constantly are much more our fellow-creatures than has generally been supposed." "We are not contending for the equality of man and the rest of the animal kingdom," etc.

Again, *Science* represents me as saying that "man has only developed a superiority to the brute because of his social tendencies, resulting in the division of labour," etc.

Now, what I did actually write was as follows: "Man's present superiority over the lower animals is traceable in large part to his eminently social tendencies," etc., which is a very different thing; and I have elsewhere in the paper called attention to many other agencies which have tended to make man the supreme animal.

Professor Morgan holds, that, strictly, the only mind one can know is his own mind; that at best human psychology is a "psychology of sages, but not of savages; that all our knowledge of human minds other than our own is necessarily ejective; that our systems of human psychology hold good only for the philosophers who frame them; that our ejective inferences concerning our neighbours' minds, motives, and characters, are liable to error."

Now compare with this the following from my own paper: "And at this point allow me to indicate a danger that should make us cautious and modest in attempting to explain the behavior of animals. We infer from our fellow-man's behavior similarity of motive and mental processes to our own under like circumstances. We find, the more experience we have, that we are often at fault as to both. And when we are more free from the thralldom of so-called systems and methods in education, we may learn that the activities of the human mind cannot be reduced in all persons to precisely the one plan, like so much clock-work. This may mar somewhat the completeness and beauty of our philosophy of education, but it may also in the end conduce to human progress by providing the greater freedom, and end in insuring an individuality of character which seems to be now rapidly disappearing. Now, if individual men so differ in psychic behavior, how much more is it likely that still greater differences hold for the lower animals! An objection may be based, however, on this to the whole study of comparative psychology. The objection holds to some extent even for human psychology; but, as we infer similarity of behavior in men to denote similarity of inner processes, so are we justified in the same as regards the lower animals, though it must be conceded somewhat less so. We must always be prepared to admit that there may be psychic paths unknown and possibly unknowable to us in the realm of their inner life. But if we regard man as the outcome of development through lower forms, according to variation with natural selection—in a word, if man is the final link in a long chain binding the whole animal creation together, we have the greater reason for inferring that comparative psychology and human psychology have common roots. We must, in fact, believe in a mental or psychic evolution as well as in a physical (morphological) one."