lectures on experimental and practical medicine, classified the results of most of these previous authors, and tested them by a new series of direct observations. His table of mean results showed that vegetable feeders have a high temperature. The sheep gave a temperature of 104°, the goat of 104°, the pigeon of 108°, and the common fowl 108°. The rabbit showed 103°, while the dog and the cat, animal or mixed feeders, showed 102°. But some herbivora were comparatively low, the ox, for example, 101°, and the horse 100°. The differences here stated were supposed by the last-named observer to depend on the cutaneous covering of the animal more than on any other cause. In the case of the pigeon, on which this author made ninety-four observations, the high temperature was attributed to the non-conducting character of the feathers, a marvellous protection to a swift-flying animal in a cold atmosphere. In man, from 100 observations, he came to the conclusion that in a strictly natural state 98° F. was the truest standard. These researches are useful as comparative studies; still, it is an open question whether in man, or in any species of animal that can live on a mixed diet, there is a variation of temperature according to the mode of diet; and it would be a good work to inquire on a large scale if, under a purely vegetable form of dietary, the temperature in man is reduced. Our correspondent informs us that in him (a healthy man) and in his wife (a healthy woman), both in the prime of life, the temperature now ranges from 96° to to 97.4° F. He for three years and a half, and she for two years and a half, have been total abstainers from alcohol, and have subsisted on fruit and vegetables, with addition of "butter, cheese, milk, eggs, and a little fish." Previously to adopting this system his temperature had never fallen under 98° "in so far as he remembers," and he therefore is inclined to the view that under his new regime he lives as healthily as before, at a lower expenditure of energy. If such prove to be correct, and if it should be demonstrated that a minimum animal diet (for our correspondent, be it observed, is not strictly a vegetarian) will support life efficiently under reduced combustion and reduced waste of material, a valuable as well as curious fact will be added to our practical knowledge. Evidently there is here open a fine field for a patient, perfectly unbiased, and truthful investigator.

EVOLUTION.[1]

IN the course of that theory of natural science best known to the outer world as that of evolution or development (whereof Darwin was the principal expounder), it becomes necessary for the theorist to endeavor to bridge over the gaps which are very easily to be discerned betwixt existing classes of animals. No doubt geology has supplied not a few of those "missing links," and has undoubtedly proved, for example, how the modern one-toed horse has descended from a four or five toed ancestor; and how birds and reptiles, which every zoologist knows are near kindred, can be linked by at least one fossil bird, which is neither bird nor reptile, but a very decided mixture of both groups. Still, the geological record is an imperfect one, and always will be. If every living thing which had ever existed had been preserved in a fossil state, and had been placed at the disposal of the geologist and anatomist for investigation, there might have been few or no difficulties in the way of piecing together the bits of the puzzle of life. As, however, fossil animals and plants constitute the mere chance preservations of the life that was, we have perforce to be content with a very meagre knowledge of existence in the past ages.

There remains, however, another method of arriving at the relationship which science seeks to show exists between apparently diverse groups of animals and plants. In plain language, when we study the development of an animal or a plant, and see how it works its way from the germ to become the adult form, we are brought face to face with a series of changes and scenes which are significant enough to the thinking mind. Suppose we discover that a frog begins life as a fish, a fact every schoolboy knows, what is the meaning of this strange becoming on the part of that tailless animal? Natural history replies that the frog's development we see to-day is really a recapitulation of its past descent. Witnessing how a tadpole becomes a frog, we are really looking at a moving panorama of the rise and progress of the whole frog-race, whereby that race must have sprung from a fish-like stock, and must have gradually grown into the lung-possessing, air-breathing creatures of the present time. This seems to be the only reasonable interpretation to be placed upon the marvellous changes which we see represented in the development of animals and plants; and this, at least, is the meaning which science attaches to the unfoldings of form and structure discernible in the course of the living being's progress from its beginning, in the egg, to its assumption of its adult character.

In the course of studies in the development of animals, we meet with some very curious discoveries and theories relative to the origin of the various zoological groups; and certain ideas of the origin of backboned animals at large, lately promulgated, seem to be worthy of mention here, as tending to keep us *au courant* with the progress of thought in biology. The puzzle of naturalists has been that of accounting for the origin of the vertebrated animals aforesaid, because these backboned tribes (which range from the fishes to quadrupeds) seem really to stand out very distinctly and by themselves as a specially defined sub-kingdom. The backboned branch of the animal tree, in other words, has presented great difficulties in its being traced to its connection with the parent stem. There is a certain fish, the lowest of its class, called the lancelet, which is found to present, both in its development and in its adult structure, certain close affinities to a lowly tribe of creatures known as tunicates, or sea-squirts. A sea-squirt is simply a kind of animated bag with two openings, somewhat like an ancient "leather bottel," which remains attached to a rock or stone. Hence, from the likeness between the sea-squirt's development and that of the lowest fish, many zoologists are given to regard the former as the putative parent of the vertebrate animals. The sea-squirt, in this view, is the very far-back ancestor (or representative of the ancestor) of the backboned tribes.

More recently, however, certain adventurous spirits in biology have ventilated new ideas of the origin of the backboned forms, and these ideas, I fancy, are more startling even to biological minds (given to feel surprised at nothing whatever) than any previous theories which have been advanced. Seeking for the ancestors of backboned animals among the annelids or worms has not been a process attended by success, in so far as evidence of probability is concerned; but higher in the series of jointed or articulate animals we find the insects, spiders, and crustaceans, of which class the lobster is a fair representative. One scientist declared that for choice he finds the most likely origin of the backboned tribes in the spider-class. What induces this belief is the tendency to head development, among other signs of advance, which the spiders, scorpions, and their allies exhibit. What we call a scorpion's head is really its head and chest united, and a close examination of this region shows that in the arrangement of its nerve-masses, its nerves, sense-organs, and so forth, there is to be traced a very exact resemblance to the similar arrangements in the vertebrate head. Again, it is held that in the development of the scorpion and spider, essentially similar features to those seen in backboned development are to be traced. So that the far-back ancestor of the highest animals, on this belief, are to be sought for in some primitive scorpion, which, getting on in the world, gave origin to the higher group. There might be a difficulty regarding the transition from air to water, from scorpion to fish, no doubt; but I presume it is maintained that out of a common type of primitive breathing organ the modification in question could easily have occurred.

The other theory of vertebrate origin also sees the ancestor of backboned animals in some primitive jointed animal or other. Tracing the development of the backboned brain and spinal cord, an observer regards these important structures as having been formed by the elaboration of jointed nerve-masses placed on the outside of a tube. There is such a tube in the middle of the spinal cord, and this tube extends onwards into the brain. The bold idea has therefore been formulated that the central nervous canal of the backboned tribes represents the digestive tube of the vertebrate ancestor; certain dilatations of the tube in the brain corresponding to the stomach of that ancestor, whose own nervous system (lying

[1] Dr. Andrew Wilson, in the Illustrated News of the World.

below its digestive tract) has become transformed into the backboned nervous belongings. There is, however, the big liver of the ancestor to be reckoned with. Where has it gone to in the course of the transformation? In the young lamprey it is shown that a kind of temporary liver may be regarded as existing in the brain, and this is looked upon as the rudiment or remnant of the liver which was once the possession of the vertebrate's ancester. On the whole, it may be said, we are getting on very nicely in biological theory; and, whether we accept the views thus set forth or not, we may at least feel some curiosity in knowing how modern speculation is deriving the vertebrates from lower forms, and how the modern backboned animal is thought actually to carry in its spinal cord the remnant of the ancestral digestive system.

NOTES AND NEWS.

THE Hon. C. B. Farwell of Chicago received a telegram on Aug. 11 from Professor Dyhrenfurth, in charge of the rain-producing experiments provided for by the last Congress, now being conducted on the ranch of Nelson Morris, in Texas. The professor says that the first experiment was made on the 10th, powder being exploded high in the air; and that it rained heavily there on the 11th.

— Mr. F. Howard Collins, the author of a useful epitome of Mr. Herbert Spencer's system of philosophy, has written a pamphlet in which he discusses the causes of the diminution of the jaw in the civilized races. In opposition to the views of Weismann, says *Nature*, he contends that the phenomenon is due to disuse.

— A recent issue of *Nature*, quoting from *Das Wetter* for July, reports a curious case of globular lightning which occurred at Berga, near Schlieben, in Germany, between 3 and 4 o'clock on the morning of July 1. The lightning entered the chimney and split into two parts, one portion running along the rafters of the roof, and the other entering a bed-room occupied by a man and his wife and three children. The man, who was up, on account of the violence of the storm, saw the ball jump on to the bedstead, which it broke, and from there it slowly travelled to the opposite side of the room, and disappeared, with a loud crash, through the wall. None of the occupants were injured, further than being deafened for a short time.

— The Vienna correspondent of the London *News*, recalling that paper's description of the Roman remains at Hainburg, about twenty-four miles from Vienna, on the site of the ancient Roman frontier town of Carnuntum, on their discovery a year or two ago, says that new excavations are now taking place in the immediate neighborhood of the Castle of Petronell, the residence of the Counts of Abendsberg Traun, which is about two miles distant from Hainburg, and have resulted in the discovery of many interesting architectural remains and much sculpture. These discoveries lead to the conclusion that Carnuntum must have been a much larger town than was thought, for it seems that it must have contained several hundred thousand inhabitants.

— It is the fashion to write articles on theories of rest and how to obtain it, says the *Illustrated American*. Anna Brackett contributes an admirable paper, entitled "The Technique of Rest," wherein she sets forth the possibilities of absolute rest, both mental and physical, under difficult circumstances. The celebrated Dr. Hammond has also given some very erudite and practical views of the same theme. It would be well for the rushing, hurrying, scurrying, never-resting crowd of workers to stop a moment and listen to such notes of solemn warning; and, at least in the choice of "recreations," to select such diversions as will tend to create exhausted vitality, and not add fresh fuel to a consuming fire. Dr. Hammond lays some stress on the trite truth that rest is often but a change of work. The athlete may rest over a game of chess or whist. The brain-worker of sedentary habit who concentrates a weary mind upon an intricate game which demands unremitting alertness of attention is diverting from his chosen calling just so much mental vigor, — exactly, to an atom, so much vital power. Let those men and women who are thinking for a living stop thinking, as a conscious effort, when they would rest. If she who would plan her life wisely will make a careful estimate of the comparative values of those things which enter into it only by her own consent, offsetting them in the inventory by those demands which are essential, she will draw a pencil through every diversion which is akin to her life-work. If she is a wise journalist or literary woman, she will eschew whist as a wary thief of her powers, whose dangers are even enhanced by her mental habit of self-surrender and concentration.

— Professor Tito Martini of Venice contributes to the issue of the *Rivista Scientifico-Industriale* for the end of June, the results of some experiments on the crystallization of thin liquid films. He finds, according to *Nature*, that a strong solution of sodium sulphate, when cooled to near its saturation point, possesses a viscous character which enables it to form a thin film on a metallic ring, as in Mr. Boys's experiments with soap-bubbles. On rapid evaporation such a film crystallizes to an extremely beautiful open lattice-work of minute crystals, which preserve their transparency for some time, and then effloresce and crumble to powder. The experiments succeeded with rings up to thirty-six millimetres diameter. Similar experiments with ammonium chloride and sodium hyposulphite have hitherto proved unsuccessful. With a transparent film of liquid sulphur, however, even more beautiful results have been obtained. The author regards such experiments, besides being eminently suitable for lecture demonstration, as likely to throw light on the nature of molecular arrangement in relation to crystallization.

— During the last two centuries, says the *Scottish Geographical Magazine*, the Lapps of Norway have been moving gradually southwards, preserving their uncivilized and nomadic mode of life in their new environment. Dr. Yngar Nielsen of Christiania has recently studied this interesting ethnological question (Le Tour du Monde, Nouvelles Géog., p. 137). According to him the southern limit of this people is now marked by the railway from Trondhjem to Östersund, nearly along the 63d parallel of north latitude. To the north of this line are found ancient tombs, places of worship, and names of Lappish origin. Here the Lapps of the present day, though nominally converted to Christianity, retain in secret some of their pagan customs, whereas further south they are good Christians, and have changed even in type. About the year 1600 the southern limit of the Lapps was on the parallel of the northern extremity of the fiord of Trondheim; since then they have made several excursions southward, and have been repeatedly checked by the Norwegian Government. In 1890 they advanced as far as the plateaus of the Hardanger Fjeld. The Norwegians do not resert to violence, but defend their property by legal processes. The question of the Lapp invasion is, however, one that demands the serious attention of the Government.

— In a paper on "Some aspects of Acclimatization in New Zealand," read before the Australasian Association at its Christchurch meeting by Mr. G. M. Thomson, the following remarkable case of hereditary transmission of an apparently defective characteristic was described (New Zealand *Journal of Science*, July). In the district of Strath Taieri, in Otago, some years ago, certain sheep on one of the runs, probably the progeny of a single ram, were found to be evidently short-winded. Apparently the action of the heart was defective, for when these sheep were driven, they would run with the rest of the flock for a short distance and then lie down panting. The result of this peculiar affection was that at nearly every mustering these short-winded sheep used to be left behind, being unable to be driven with the rest. Sometimes they were brought on more slowly afterwards, but if it happened to be shearing time they were simply caught and shorn where they lay. As a result of this peculiar condition a form of artificial selection was set up, the vigorous sheep being constantly drafted away for sale, etc., while this defective strain increased with great rapidity throughout the district, for whenever the mobs were mustered for the market, shearing, or drafting, these "cranky" sheep (as they came to be called) were left behind This defective character appeared in every succeeding generation, and seemed to increase in force, reminding one of the Ancon sheep referred to by Darwin. At first, of course, the character was not recognized as "hereditary," but as the members of this cranky breed increased to a very