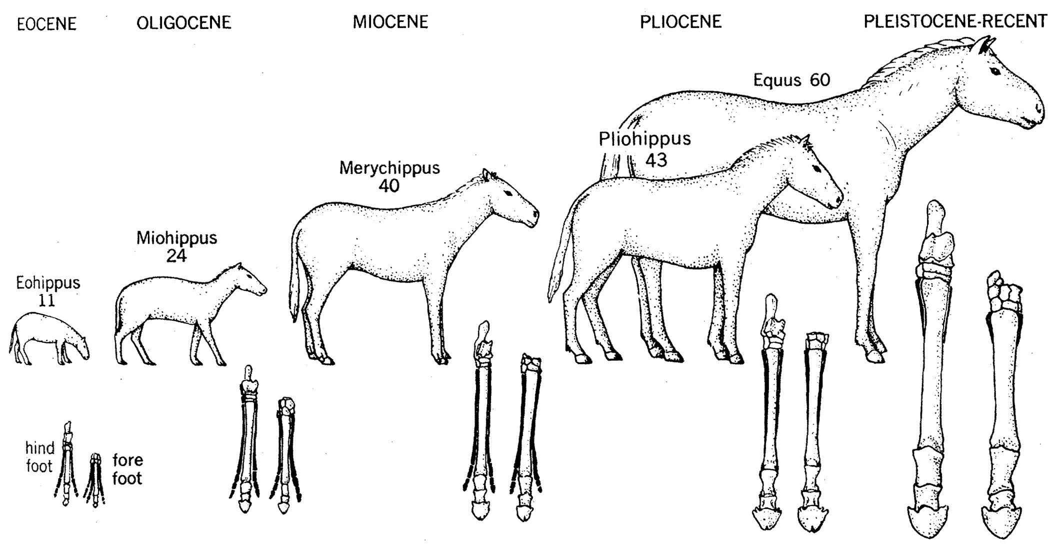
PROFESSOR HUXLEY ON EVOLUTION

At a recent meeting [1880] of the Zoological Society, among the papers read was one by Professor [Thomas H.] Huxley on the application of the laws of evolution to the arrangement of the vertebrata, and more particularly mammalia. The illustrations adduced were those of the history of the horse, principally, so far as is known, from the work of Professor Marsh on the Eocenes of North America. The announcement of the paper had drawn together an unusually large attendance, as it was expected that the marshalling of the facts in Professor Huxley's hands would have great interest in practically substantiating the theory of evolution, which, though foreshadowed by others, took practical shape in the work of Darwin twenty-one years ago.

Professor Huxley began by saying:—There is evidence, the value of which has not been disputed, and which, in my judgment, amounts to proof, that between the commencement of the tertiary epoch and the present time the group of the equidae has been represented by a series of forms, of which the oldest is that which departs least from the general type of structure of the higher mammalia, while the latest is that which most widely differs from that type. In fact, the earliest known equine animal possesses four complete sub-equal digits on the fore foot, three on the hind foot; the ulna is complete and distinct from the radius; the fibula is complete and distinct from the tibia; there are 44 teeth, the full number of canines being present, and the cheek-teeth having short crowns with simple patterns and early-formed roots. The latest, on the other hand, has only one complete digit on each foot, the rest being represented by rudiments; the ulna is reduced and partially anchylosed with the radius; the fibula is still more reduced and partially anchylosed with the tibia; the canine teeth are partially or completely suppressed in the females; the first cheek-teeth usually remain undeveloped, and when they appear are very small; the other cheek-teeth have long crowns, with highly complicated patterns and late-formed roots. The equidae of the intermediate ages exhibit intermediate characters. With respect to the interpretations of these facts two hypotheses and only two, appear to be imaginable. The one assumes that these successive forms of equine animals have come into existence independently of one another. The other assumes that they are the result of the gradual modification undergone by the successive members of a continuous line of ancestry. As I am not aware that any zoologist maintains the first hypothesis, I do not feel called upon to discuss it. The adoption of the second, however, is equivalent to the acceptance of the doctrine of evolution so far as horses are concerned, and in the absence of evidence to the contrary, I shall suppose that it is accepted. Since the commencement of the eocene epoch, the animals which constitute the family of the equidae have undergone processes of modification of three kinds:—1, there has been an excess of development of one part of the oldest form over another; 2, certain parts have undergone complete or partial suppression; 3, parts originally distinct have coalesced. Employing the term "law" simply in the sense of a general statement of facts ascertained by observation, I shall speak of these three processes by which the eohippus form has passed into equus as the expression of a three-fold law of evolution. It is of profound interest to remark that this law or generalized statement of the nature of the ancestral evolution of the horse, is precisely the same as that which formulates the process of individual development in animals generally, from the period at which the broad characters of the group to which an animal belongs are discernible onwards. After a mammalian embryo, for example, has taken on its general mammalian characters, its further progress towards its special form is affected by the excessive growth of one part or relation to another, by the arrest or suppression of parts already formed, and by the coalescence of parts primarily distinct. This coincidence of the laws of ancestral and individual development creates a strong confidence in the general validity of the former, and a belief that we may safely employ it in reasoning deductively from the known to the unknown. . . .



From *General Zoology*, Storer *et al.*, McGraw-Hill Book Co., New York, 1975; adapted from R. S. Lull, *Fossils*, courtesy of the University Society, New York, 1931

Excerpted from *SCIENCE*, vol. 2 (first series), January-December 1881, January 22, 1881, pp. 33-35

The utilization of the sun's rays for warming and ventilating apartments.

BY E. S. MORSE OF SALEM, MASS.

Mr. Morse drew attention to this device a year ago, before the National academy of sciences. At that time he was able to offer only crude computations as to the operations of the heater, derived from its use at the museum of Salem, Mass.

The device consists mainly of a slaty surface painted black, standing vertically upon a wall, outside the building, with flues to conduct warmed air to the inside. The slates are inserted in a groove, much as one might place glass in a frame. One made within the last year was three feet wide and eight long. It was placed where it received the sun's rays as directly as practicable. Its service was to warm a room used for a library. During an entire winter the room was thus made comfortable, except on a few of the coldest days. The current of air passing through it, when the sun's rays impinged directly upon it, was raised about 30°; it discharged 3,206 feet of warmed air in an hour. This was in the morning. At 11.45 the air of the apartment was raised 29°, with 3,326 cubic feet of air discharged; at 12.45, 29° and 4,119 feet; at 1.55, 24° and 3,062 feet; at 2.45, 20° and 1,299 feet. The room measured 20 × 14, and was ten feet high.

The apparatus works to most advantage in a room that is ventilated by an open chimney. But some very good results have been obtained in closed rooms. One was cited, where the air in a public building was raised by such means to nearly 40° above the outside temperature. In general, a difference of 30° to 35° can thus be secured during four or five working hours of the day. . . .

Excerpted from *SCIENCE*, vol. 2 (old series), July–December 1883, August 31, 1883, Proceedings of Section B.—Physics, p. 283

PROGRESS IN UTILIZATION OF SOLAR HEAT.—Since May, last year, M. Mouchot has been carrying on experiments near Algiers with his solar receivers. The smaller mirrors (0.80 m. diameter) have been used successfully for various operations in glass, not requiring more than 400° to 500°. Among these are the fusion and calcination of alum, preparations of benzoic acid, purification of linseed of oil, concentration of syrups, sublimation of sulphur, distillation of sulphuric acid, and carbonization of wood in closed vessels. The large solar receiver (with mirror of 3.80 m.) has been improved by addition of a sufficient vapor chamber and of an interior arrangement which keeps the liquid to be vaporized constantly in contact with the whole heating surface. This apparatus on November 18, last year, raised 35 litres of cold water to the boiling point in 80 minutes, and an hour and a half later showed a pressure of eight atmospheres. On December 24, M. Mouchot with it distilled directly 25 litres of wine in 80 minutes, producing four litres of brandy. Steam distillation was also successfully done, but perhaps the most interesting results are those relating to mechanical utilization of solar heat. Since March the receiver has been working a horizontal engine (without expansion or condensation) at a rate of 120 revolutions a minute, under a constant pressure of 3.5 atmospheres. The disposable work has been utilized in driving a pump which yields six litres a minute at 3.50 m. or 1,200 litres an hour at 1 m., and in throwing a water-jet 12 m. This result, which M. Mouchot says could be easily improved, is obtained in a constant manner from 8 A.M. to 4 P.M., neither strong winds nor passing clouds sensibly affecting it.

From *SCIENCE*, vol. 1 (first series), July–December 1880, August 7, 1880, p. 69

A PLEA FOR PURE SCIENCE

Address of H. A. Rowland of Baltimore, Md., Vice-President of Section B, August 15, 1883

. . . To a civilized nation of the present day, the applications of science are a necessity; and our country has hitherto succeeded in this line, only for the reason that there are certain countries in the world where pure science has been and is cultivated, and where the study of nature is considered a noble pursuit. . . .

. . . How shall we, then, honor the few, the very few, who, in spite of all difficulties, have kept their eyes fixed on the goal, and have steadily worked for pure science, giving to the world a most precious donation, which has borne fruit in our greater knowledge of the universe and in the applications to our physical life which have enriched thousands and benefited each one of us? . . .

Jenny Lind, with her beautiful voice, would have cultivated it to some extent in her native village; yet who would expect her to travel over the world, and give concerts for nothing? and how would she have been able to do so if she had wished? And so the scientific man, whatever his natural talents, must have instruments and a library, and a suitable and respectable salary to live upon, before he is able to exert himself to his full capacity. This is true of advance in all the higher departments of human learning, and yet something more is necessary. It is not those in this country who receive the largest salary, and have positions in the richest colleges, who have advanced their subject the most: men receiving the highest salaries, and occupying the professor's chair, are to-day doing absolutely nothing in pure science, but are striving by the commercial applications of their science to increase their already large salary. . . . [T]he duty of a professor is to advance his science, and to set an example of pure and true devotion to it which shall demonstrate to his students and the world that there is something high and noble worth living for. Money changers are often respectable men, and yet they were once severely rebuked for carrying on their trade in the court of the temple. . . .

. . . [The student] goes forth into the world, and the height to which he rises has been influenced by the ideals which he has consciously or unconsciously inbibed in his university. If the professors under whom he has studied have been high in their profession, and have themselves had high ideals; if they have considered the advance of their particular subject their highest work in life, and are themselves honored for their intellect throughout the world,—the student is drawn toward that which is highest, and ever after in life has high ideals. But if the student is taught by what are sometimes called good teachers, and teachers only, who know little more than the student, . . . no one can doubt the lowered tone of his mind. He finds that by his feeble efforts he can surpass one to whom a university has given its highest honor; and he begins to think that he himself is a born genius, and the incentive to work is gone. He is great by the side of the molehill, and does not know any mountain to compare himself with. . . .

Excerpted from *SCIENCE*, vol. 2 (old series), July–December 1883, August 24, 1883, Proceedings of Section B—Physics, pp. 242–250