ticle of matter to insure that the chamber contains black body radiation. Further suppose that an alternating electric field is applied to the chamber so that the electron moves to and fro, but without touching the walls. If the electron is perfectly reflecting it will perform work upon the radiation, and the temperature will accordingly continually increase till the radiant energy per cc is infinite. But such a concentration of energy, we may take it, is impossible. The electron can not therefore be perfectly reflecting, or it absorbs besides reflects radiant energy. Now a continual increase in its internal energy through absorption of radiation on account of its motion is not permissible, since in that case its internal energy would ultimately become infinitely large, and hence it is periodically converted into some other form. This can not be radiation produced by acceleration, since the energy required for this is derived from the kinetic energy of the electron, or the energy of the applied field. The internal energy must therefore be converted directly into radiation, and hence the electron may radiate in two entirely different ways.

But even under these circumstances the applied field will perform work upon the electron, for the energy converted into radiation through acceleration may be varied through the applied field, and this work ultimately appears as radiation. Thus the density of the radiation may be made infinitely large, which we have seen is impossible. It follows, therefore, that ultimately the applied field should have no effect on the electron, or that its field decreases till zero. Since the temperature under these conditions will be very large, causing a large absorption of radiant energy by the electron, its average amount of internal energy will in consequence be very large. Thus in a general way the external field of an electron decreases with increase of its internal energy.

We might also in the beginning have supposed that the force on the electron decreases with increase of density of radiation. Since the density would nevertheless become infinite, we must suppose that the force becomes zero for a finite density. This is possible only if the electron undergoes a change, which naturally involves a change in internal energy, and so on.

R. D. KLEEMAN

SCHENECTADY, NEW YORK

NOTE ON HAEMOGLOBIN

DURING the course of a spectrographic examination of horse and fowl haemoglobin we have noted that the absorption band, whose peak appears at AU4100 for oxyhaemoglobin and AU4300 for haemoglobin in solutions of the above compounds, does not appear when washed corpuscle suspensions containing haemoglobin and oxyhaemoglobin in similar concentrations are examined. Furthermore the absorption which begins at AU2500 in solutions of horse haemoglobin also is absent when haemoglobin or oxyhaemoglobin is observed in washed cell suspensions. The specific bands in the visible regions of solutions of the above pigments are observed in the washed cell suspensions in their usual location.

Apparently there is, in the case of haemoglobin in the cell, a possibility that it is in combination with some constituent of the corpuscle. This problem is one of several concerning the blood pigment for which we are attempting to find a solution.

A. BRUCE MACALLUM
R. C. BRADLEY

BIOCHEMICAL DEPARTMENT,
UNIVERSITY OF WESTERN ONTARIO,
MEDICAL SCHOOL,
LONDON, CANADA

A FOSSIL MAMMAL WITH UNBORN TWINS

THE South Dakota State School of Mines has recently mounted and placed on exhibition in its geological museum a most unusual fossil vertebrate specimen from the Oligocene of South Dakota. This is a superbly preserved skeleton of a mother *Oreodon* (*Merycoidodon*) *culbertsoni* with unborn twins. It is the only known occurrence of a fossil mammal accompanied by unborn young.

The specimen was found by the School of Mines collecting party of 1928, Mr. James Bump, Mr. Robert Hernon and Mr. Harold Martin, in the Lower Oreodon beds of Cain Creek, about two miles north of Imlay in the heart of the Big Badlands. Only a small portion of the skull of the mother was exposed to the weather. Excavation disclosed the complete skeleton except that the ribs on the right side were mostly missing. Upon turning over the block in the field for final shellacking and other protection, the skulls of two unborn individuals, lying within the pelvic region, were discovered. A photograph of the rough block made in the preparing room before work was begun upon it shows in good way much of the skeleton of the mother and the positions occupied by the twins.

The mother skeleton, the right side showing, is mounted in relief on a nicely tooled slab. The skeletons of the twins are only partially preserved. Some of this loss is due doubtless to the cartilaginous, nonpetrifying nature of the material. The better portions are the skulls and some of the larger leg bones. The skull of one is well preserved and nearly perfect. The other may be easily discerned but is much crushed and the parts displaced. Both skulls show well-developed teeth. The cranial bones are very thin and delicate and much care was necessary to prevent injury to them. In the mounting of the specimen

it was thought advisable not to attempt extracting the fetal forms completely from their matrix. They were mounted with the mother skeleton pretty much as found without attempting, however, to place them in theoretically exact position.

The School of Mines has had a collecting party in the White River Badlands during the last six field seasons. The results of this work have been most gratifying in that the institution now has a large collection, representative of this important life period, much of which has been prepared, mounted and placed on exhibition. The collection contains an especially good representation from the Protoceras channel beds.

CLEOPHAS C. O'HARRA
SOUTH DAKOTA SCHOOL OF MINES

BABYLONIAN MATHEMATICS

IN my address on "Mathematics before the Greeks" recently published in SCIENCE[1] I quoted a statement from Smith's "History of Mathematics"[2] to the effect that "in a tablet from Sennacherib's palace (about 700 B. C.), now in the British Museum, a circle is divided into 480 equal parts." Professor Smith does not give any authority for this statement but informed me privately that he probably learned of the fact during a visit to the museum. On appealing to Mr. C. J. Gadd, of the Department of Egyptian and Assyrian Antiquities, I learned recently that the tablet in question was almost certainly the one numbered K90, discussed by Hincks, and Bosanquet and Sayce, and referred to by more than one historian of mathematics. Mr. Gadd drew my attention also to an important discussion of this tablet by F. X. Kugler, in his "Sternkunde und Sterndienst in Babel," 2. Buch, 1. Teil, 1909, pp. 45–50. The views of Hincks rather than those of Bosanquet and Sayce are here upheld. In this connection Kugler refers to an article by Schiaparelli in *Scientia,* vol. 3, 1908; this is also in Schiaparelli "Scritti sulla Storia della Astronomia Antica," vol. 1, 1925, see especially page 23.

In the paragraph just before the last of my address I summarized, in about a dozen lines, some of the astronomical knowledge of the Babylonians. My friend Professor Cajori inquired if I intentionally omitted any reference to the Babylonian discovery of the precession of the equinoxes. This was a discovery of about 350 B. C. and hence should hardly be included in a survey of "Mathematics before the Greeks." It is, of course, a matter of great interest, and in my recently published "Bibliography of Egyptian and Babylonian Mathematics" I refer to Schnabel's important paper on the subject (1927) as well as to Professor Cajori's review of it in SCIENCE.[3] Schnabel's article seems to have been developed from a part of Kugler's work, mentioned above, published in 1924.

R. C. ARCHIBALD
BROWN UNIVERSITY

USEFUL GREAT TOES

A NUMBER of years ago, in the Louvre Galleries, in Paris, an artist who was born without any arms was a familiar sight. He was painting copies in oil of the principal masterpieces in the gallery and made thereby a comfortable living. That fact shows that the copies were of good quality.

But every one would ask at once how *could* he copy these paintings in oil without any hands? It was done entirely by means of the, to us, useless great toes and their next neighbor, the second toes. He held the brushes between these toes.

One morning when I happened to be in the gallery at the usual hour for the *déjeuner à la fourchette,* I saw him just finishing his meal. He seized a pint bottle with the left toes and grasping the cork with the corresponding toes on the right foot uncorked the bottle, lifted it to his mouth and after drinking all that he wished replaced the cork with the right toes and then with the sole of the right foot gave it a smart tap to replace it firmly.

W. W. KEEN

SCIENTIFIC BOOKS

Revision of the American Chipmunks. By ARTHUR H. HOWELL. North American Fauna, No. 52. U. S. Department of Agriculture, Bureau of Biological Survey. November, 1929. 157 pp.

THE appearance of the "Revision of the American Chipmunks," long known to be in course of preparation, is a zoological event of importance. These animals, so attractive to every lover of nature, are of more than ordinary interest to students of evolution on account of the great number of local forms. Modern methods have made it possible to deal with the subject very thoroughly, no less than 14,554 specimens having been examined. Sixty-five species and subspecies are recognized in North America, including Mexico. There are chipmunks also in northern and northeastern Asia, and it is found that the whole series falls into three main groups, the Asiatic *Eutamias,* the western American *Neotamias* (defined

[1] SCIENCE, 71: 109, January 31, 1930.
[2] Vol. 2, p. 230.
[3] SCIENCE, 65: 184, February 18, 1927.