I strongly suspect that in this he was influenced by his contacts with Dr. Conklin. I know that he would have derived great satisfaction in this award to his friend.

FRANK B. JEWETT

PRESENTATION OF THE HENRY DRAPER MEDAL FOR 1942 TO IRA SPRAGUE BOWEN[3]

MORE than three quarters of a century ago, Huggins, a former Draper medalist, found that the spectra of certain nebulae were composed of sharp isolated bright lines, thus proving that their luminous material is a glowing rarefied gas. Some of the lines were recognized as those of hydrogen, and later others were identified as due to helium and ionized carbon, oxygen and nitrogen, but nearly half of the nebular radiations, including the two strong green lines, could not be matched in any terrestrial source. These mysterious radiations were believed to indicate the presence in the gaseous nebulae of an unknown element "nebulium" and for more than sixty years the nature of "nebulium" remained one of the outstanding problems of physical astronomy with which the ablest spectroscopist had struggled and had failed. It was solved not by an astronomer but by a physicist, Professor Ira Sprague Bowen, of the California Institute of Technology.

Dr. Bowen's dramatic discovery of the nature of "nebulium" was the result of his brilliant analysis based as modern atomic theory, in which two factors contributed to his success. The first of these was the recognition by him that under the condition of extremely low density obtaining in the gaseous nebulae, radiation of energy could take place through transitions between metastable states. For these the mean life of the excited state is so long that even in the most rarefied laboratory sources, the energy is transferred to another atom by collision and no radiation occurs. The second contributing factor was that his laboratory investigations in spectroscopy carried on in collaboration with Millikan furnished the data which enabled him to determine the energy states for certain of the lighter elements known to be present in the nebulae. He found that the two strong green radiations and one in the blue could be accounted for by transitions between metastable states in doubly ionized oxygen. The familiar pair in the ultraviolet and a line in the red had a like origin in ionized oxygen while the strong red pair was due to similar transitions in ionized nitrogen. Thus "nebulium," the mystery of half a century, turned out to be the two elements forming the chief constituents of the air we breathe.

This initial success with the origin of the chief nebular lines was followed immediately by his identification of a number of fainter ones which had been recorded in the spectra of these objects. Later when opportunity offered, Dr. Bowen went to the Lick Observatory as Morrison research associate where he undertook a search for still fainter radiations emitted by the nebulae. Largely as the results of ingenious methods introduced by him in the observing technique, he was able to record the faintest lines obtainable with the very efficient equipment selected for this problem. The investigation was signally successful and not only revealed the presence in the nebulae of several elements, in particular iron, magnesium, potassium and calcium, which had not been known to exist in them, but indicated that the chemical composition of the gaseous nebulae does not differ greatly from that of the sun and the stars, a result of great cosmological importance.

The researches of Professor Bowen have not only greatly enriched our knowledge of the chemical constitution of the nebulae, but they have provided the answers to many enigmas concerning the physical processes involved in the emission of their light. He has given us most conclusive explanations of the presence or absence of certain radiations in their spectra and in particular the behavior of different lines emitted in the gaseous envelopes of very high temperature stars, bringing to these problems that brilliant and logical analysis characteristic of all his work. His spectroscopic investigations in the laboratory, moreover, have furnished the data not alone for his own researches on the nebulae but have been utilized by others in the solution of the many spectroscopic problems in the broader field of astrophysics. We are, therefore, indebted to him for some of the most important contributions to astronomical physics in recent times.

In recognition of these remarkable achievements your committee has unanimously recommended the award of the Draper Medal for 1942 to Professor Ira Sprague Bowen. The academy may justly be proud to count him among its members and to honor him by the bestowal of this award.

J. H. MOORE

[3] Read by Dr. S. A. Mitchell, in the absence of Dr. Moore.

PRESENTATION OF THE AGASSIZ MEDAL FOR THE YEAR 1942, WITH ACCOMPANYING HONORARIUM OF $300, TO COLUMBUS O'DONNELL ISELIN, II.

I AM going to be a bit reminiscent this evening and recall that over forty years ago when I went up the steps of the Agassiz Museum for the first time, a tall stooped figure had just preceded me, the smart brougham from which he had emerged was in the act of driving off. I followed that figure up the stairway and saw it enter a door marked "A. Agassiz" in bold

letters. As he went in he turned a little sign from "out" to "in." I turn that same sign when I remember to do so, but I often forget; he never did. I naturally wondered what manner of man this was. I soon found out that the graduate students at that time packed into the museum building held him in mortal dread. Rumor had it that some one once carrying a leaky pail of water with living Necturi for experimental purposes from the cellar to the research laboratory on the fifth floor had gone up the stairs just ahead of him. Being the soul of precision and neatness he began to follow the streak of dirty water and he followed it to the desk of the unfortunate student, to whom he administered a most terrific lecture on the evils of untidiness. The details of this persisted and no doubt grew as the tale was told over and over again. In those days long ago there was no love lost between the museum staff and the professors and instructors in the laboratory belonging to the faculty of arts and sciences. All these were then crowded together in the same building. They have all learned better sense now and realize how the work of each one interdigitates with that of all the others. So at the time of which I speak Mr. Agassiz was a mysterious figure, held in what we should think of to-day as rather ridiculous awe.

A few among us who were interested in the museum soon learned of the wonderful work which he had done in his younger years in invertebrate embryology; his masterly handling of the taxonomy of that most difficult group, the Echini; his pioneer work in the exploration of the deep sea; three careers, each of which would have won him lasting fame, to say nothing of his management of the Calumet and Hekla Mining Company, which provided the funds so generously spent by him in many ways and especially on the unequaled series of illustrated Memoirs, the like of which no institution in America has ever produced.

Unfortunately during the latter years of his life he spent, wasted as we know now, years on the study of coral reefs, years which he might far better have devoted to subjects which he was more competent to work upon. While he describes reefs beyond number, he was unable to draw any generalizations and the data which he gathered have not been very useful to the geologists, although Dr. Stanley Gardiner has made some important deductions from the bottom samples which he gathered.

I early determined to know this man and found him simple, kind and friendly. He was much interested in the boyish trip which some friends of mine and I hatched up for the summer of our sophomore year in the Bahamas, using a sponging schooner to dredge from. He was obviously sincerely interested in what we found, and I remember one sponge over which he was really excited.

I found that regularly at ten o'clock each evening that he was in Cambridge, he would go to the Holly Tree at Harvard Square, famous for its beautifully poached eggs. He would eat two of these, drink a glass of beer and then walk back to his house on Quincy Street. I made bold to meet him there quite casually and after a while often walked home with him. This same habit of taking walks at night led to an amusing incident in Berlin, where Mr. Agassiz had been called to be knighted by the German Emperor with the Order pour le Merite, a distinction rarely accorded to foreigners. One evening just after the great event, it was foggy and he was crossing the river which flows through Berlin, walking along the narrow footpath of the bridge. He fetched up in front of a towering figure in the familiar Feldtgrau uniform. Naturally the officer made no move; neither by the same token did Mr. Agassiz, who was nothing if not hot-tempered and impetuous. After some slight hesitation he reached forward and drew the German officer's sword from its scabbard and dropped it into the river. The effect was exactly the opposite to what he had expected. The officer, who had sworn to defend his sword with his life-blood if necessary, was not as infuriated as he was terror-stricken and dismayed, and before long quite characteristically Mr. Agassiz's heart softened and he promised that as soon as daylight came every possible means should be taken to recover the sword. This naturally was done to the officer's everlasting gratitude.

But I can not ramble on this way forever. I simply wanted to point out, as one of a number of those who remember him, but who are inevitably growing fewer, the sort of man whom Sir John Murray wished to commemorate when this award was established. I also wish to put on record the fact that I can think of no one who could stand as recipient and be more utterly satisfactory to Mr. Agassiz as him whom we honor now. Columbus Iselin began as a young man to explore the deep sea from his own *Atlantis,* and I remember the joy and delight with which Henry Bigelow and I gloated over his first catches of beautifully preserved deep-sea fishes and invertebrates. From those days forward Columbus has proved himself to be a competent investigator. Oh no! more than that, an inspired investigator and an excellent teacher, a painstaking and effective executive, and one whose researches into the dynamics and the circulation of the waters of the ocean and especially of the Gulf Stream, have put him in the forefront of oceanographers of the day. Moreover, he has administered the activities of the Woods Hole Oceanographical Institute with singular distinction, both during peace and during war; this also considering that he followed a predecessor who set a mighty high standard for any one who came after him.

It is therefore a rare distinction for me as a member of the committee which has made this award to ask the president in the name of the academy to hand the Agassiz Medal to Columbus O'Donnell Iselin. I only wish that Mr. Agassiz had lived to know him.

THOMAS BARBOUR

PRESENTATION OF THE DANIEL GIRAUD ELLIOT MEDAL FOR 1935, WITH ACCOMPANYING HONORARIUM OF $200, TO EDWIN H. COLBERT

THE award to Edwin H. Colbert for his "Siwalik Mammals in the American Museum of Natural History" (*Transactions* of the American Philosophical Society, 1935, quarto, x + 401 pp., 198 figures in text, 1 folding map) seems especially timely and appropriate, because just a century earlier Cautley and Falconer published the first of their important contributions on the fossil mammals of India. Since then the field has been ably developed by their successors, especially Lydekker, Pilgrim, Matthew and now Colbert. The latter, after giving an excellent summary and analysis of his predecessors' results, has brought in a wealth of new and significant observations of his own.

Although this work is written in English, the technical portions, albeit through no fault of the author, would be hardly more intelligible to the English-speaking world than Chinese, except for the handful of students who have mastered the technical language of paleontology. This branch of science has inherited a double load of technical words, first from geology, and second from anatomy, besides contributing an enormous and rapidly growing vocabulary of its own. But however technical the author was compelled to be in the descriptive portions of his text, he has succeeded in achieving great clarity in the statement of his more general results, which are of wide interest to students both of mammalian evolution and of intercontinental exchange of faunal elements.

In summarizing the work of his predecessors, the author notes that: "Lithologically the origin of the (Siwalik) series is probably simple, representing increasingly coarse river detritus brought down from a rapidly rising mountain mass. Moreover, there are no great secondary changes to be found in the Siwalik rocks, evidences of automorphism and glaciation being absent. The factor of predominant importance is that of erosion and deposition by rapidly flowing rivers." He sets forth fully the accurate records as to locality and stratigraphic levels which were kept by Barnum Brown when the latter made his collection of fossil mammals for the American Museum in 1922. Brown's work in this field was amazingly extensive and productive, especially in view of the great difficulties of collecting in this super-torrid region.

The main part of Colbert's memoir deals with the description of the fossil mammals, the classification and phylogeny of many of the mammalian families, the migrations of certain mammals to and from India during late Tertiary and Quaternary times.

Among the most remarkable mammals dealt with was *Dissopsalis,* a somewhat wolflike placental carnivore with a remarkably small brain—the last survivor of the Eocene and Oligocene creodonts.

In the section on the horses Colbert's measurements and graphs confirm Matthew's conclusion that the two Siwalik "species" of *Hipparion* grade into each other. He further shows that with regard to their molar patterns these forms were definitely more advanced than the American *Hipparion mohavense* Merriam and *H. gratum* Osborn. From this fact and from the complete absence in the known record in Europe of ancestral *Hipparions* of earlier date, Colbert favors the view that these forms originated in North America and spread to India during the lower Pliocene.

The ten species of Siwalik rhinoceroses are distributed under five genera, of which *Gaindatherium* Colbert is more primitive in many features than the existing *Rhinoceros indicus.* It is also intermediate between the latter and the very primitive and older *Caenopus.* Colbert applies and extends D'Arcy Thompson's method by projecting the drawings of several rhinoceros skulls against a grid of coordinates; in a sequence of four rhinoceros skulls the coordinates become progressively distorted in several directions, indicating differential emphasis of certain features.

One of the most notable parts of the memoir deals with the fossil pigs of India, which branched into fifteen genera and numerous species. Colbert divides them into six groups and traces several phyletic lines through the lower, middle and upper Siwaliks. In one of them, *Conohyus,* the posterior premolars developed great conical crowns for smashing and cutting the food. In another, *Listriodon,* each molar bore two cross-crests and thus convergently resembled a tapir's molars. In still another, *Sus falconeri,* the skull is already highly peculiar and needs only the final stage to complete its transformation into that of the African wart hog (*Phacochoerus africanus*).

In describing the fossil Indian hippopotami Colbert quotes the remarkable suggestion of C. W. Andrews that the hippopotami, usually supposed to be related to the pigs, may have been derived from some of the anthracotheres, especially the Siwalik *Merycopotamus.* Colbert gives a thorough analysis and comes to a conservative conclusion but leaves a strong case for the reality of Andrews's interpretation of the evidence.

The descriptive section ends with an excellent analysis of the twenty genera and numerous species of fossil giraffes centering in the Siwaliks. Colbert divides them into three main series: The first and