for twenty-five successive years, sustaining members have the additional privilege of requesting transfer to the life membership class without further payment of dues.

LORD NUFFIELD has given £25,000 towards a fund to enable the British Institution of Production Engineers, of which he is the president, to proceed at once with the creation of its proposed Production Engineering Research Department, under the charge of Professor Georg Schlesinger.

THE University of Oregon Medical School at Portland, one unit of the Oregon State System of Higher Education, is the recipient of three substantial gifts for instructional and research facilities. The Julius L. Meier family has given $50,000 as a memorial to former Governor Julius L. Meier to be used in supplementing a state appropriation of $110,000 and a PWA grant of $130,909 in the erection of a tuberculosis hospital on the campus of the Medical School and as a part of the university hospitals and clinics. Margaret M. Widmer and Gertrude D. Widmer, graduates of the university, have given the Medical School a farm valued at $30,000, the income to be used in research on heart disease and cancer, the endowment to be known as the "Widmer Memorial Research Fund of the University of Oregon Medical School." Dr. John E. Weeks, of Portland, recently gave $100,000 toward the construction of a medical library, auditorium and laboratory building. This gift was matched by the Rockefeller Foundation, and a grant was secured from the Public Works Administration for an additional $163,350, thereby making it possible to erect a building costing $363,350. The structure will provide the most modern facilities for a large medical library, an auditorium seating six hundred for student and professional gatherings, and a laboratory unit for medical research. Construction on the new tuberculosis hospital and the library, auditorium and laboratory building is now under way.

THE Hall of Pharmacy at the New York World's Fair of 1939, constructed at the cost of $1,000,000, was dedicated on the afternoon of Sunday, November 13. The hall occupies 45,000 square feet of space, sufficient to accommodate several score exhibitors.

THE Kansas State Herbarium has now been transferred to a large fireproof vault on the grounds of Kansas State College, at Manhattan. This herbarium was started in the 1870's by W. A. Kellerman, greatly augmented by A. S. Hitchcock up to 1901, and further enlarged under its present curator, F. C. Gates, during the past twenty years. The collection contains about 90,000 sheets and is particularly full from each of the various counties of Kansas.

AT the U. S. Geological Survey, plans have been made for starting immediately the construction, repair and improvement of river measurement stations, for which $590,000 of Public Works funds have been allocated. Such work will be performed in practically every state in accordance with the approved allotments by states and handled through the district offices of the Geological Survey. Similar arrangements have been made for commencing immediately the Public Works program relating to the surveys of floods and droughts for which $100,000 has been appropriated. Field work has been started on the following PWA projects of the Geologic Branch: Investigations of manganese deposits in the Olympic Mountains, Washington; of phosphate deposits in Wyoming; and of mineral deposits in Strawberry Valley, Utah, and in the Henry Mountains, Utah; and classifications of coal lands in Wyoming and Montana. These projects are in charge of C. F. Park, W. W. Rubey, A. A. Baker and Charles Hunt, respectively.

THE *Journal* of the American Medical Association reports that committees representing Cornell University Medical College and the University of Havana Faculty of Medicine have arranged for exchange students and teaching staff for periods of study. Four undergraduate students and/or members of the teaching staff of Cornell will study parasitology, tropical diseases or any other subject of special interest for six weeks in the summer in Havana under the auspices of the university. Three undergraduates in medicine and/or members of the teaching staff of the University of Havana will have the opportunity of studying at Cornell for a period of eight weeks, one each in the fall, winter and spring. Each university agreed to grant to each visitor on satisfactory completion of the work a certificate covering the studies pursued and the time employed thereon. The studies at the respective schools will be supervised by special committees. Dr. Wilson G. Smillie is chairman of the committee at Cornell and Dr. Alberto Inclán of the one in Havana. The agreement is in effect for one year.

DISCUSSION

WHY WE SELDOM SEE A LUNAR RAINBOW

THE fact that we see the lunar rainbow only once to the hundred times, more or less, that we see the sun-caused, or solar, bow, we instinctively attribute to the great difference between the brightness of the sun and that of the moon. The brighter the light the brighter the bow, of course, other things being equal, and the brighter the bow the more likely we

are to see it. Q.E.D., as Euclid used to say when he had clinched the argument. In this case, however, the argument isn't yet clinched. If the relative frequencies of the solar and lunar rainbows were merely a question of the comparative brightnesses of the two luminaries, we then should expect to see halos, kindred phenomena, about the sun far more frequently than around the moon, but that does not appear to be their ratio. Many people insist that though the sun is up all of every day and the moon below the horizon half, on the average, of every night, still they see the lunar halo more frequently than the solar and claim at the same time that they are awake all day long and asleep through most of the night. This contrast—the fact that the lunar halo is (or seems to be) more frequently seen than the solar halo—is owing, largely at least, to the fact that at night there is no blinding glare from the light of the sky, while in the daytime it often is so intense as to discourage close observation, and to render relatively inconspicuous local intensifications, such as constitute the halo. This is evidenced by the fact that solar halos, and solar coronas, especially, are much more conspicuous when seen in a black mirror, or even in a quiet puddle of dirty water, than when viewed directly in the sky.

But our concern here is with the rainbow, not the halo, which got into the argument surreptitiously. Obviously a lunar rainbow would be faint beyond detection if produced under the same conditions by which the solar bow could just be seen; but on the other hand if the two bows were intrinsically equally bright the night bow might still be clearly seen while the daytime one was lost in the ever-present glare. However, the glare from the region about a rainbow generally is far less than that caused by the thin clouds in the neighborhood of a solar halo. Hence it would seem that if the brightness of the parent luminary and the glare of the sky were the only things that affected the visibility of a rainbow the advantage then would be decidedly with the solar bow. And there are other conditions that intensify this disparity, as will appear from a consideration of the fact that a bow can be seen in only that portion of the rain which is directly illuminated by the sun or moon. This means that the rain cloud is of quite limited extent, at least on the side facing the luminary—not extensive enough to shade the falling rain in which the bow appears. Hence a local convectional shower is more likely than any other to give a rainbow display. Now, over land, where people live anyway, the large majority of such showers occur in the summer afternoon, a time when the sun has every chance to produce a bow and the moon no chance at all.

Furthermore, the most likely time for the appearance of a lunar bow is when the moon is nearly full, and as early as possible after dark, that is, before a local or heat thunderstorm has fully rained out. That particular time, then, is from 8 to 10 o'clock P.M. This means that in mid latitudes, at least, the moon bow is most likely to be seen to the west of the observer. But normally, owing to the fact that the winds are prevailingly from the west and grow stronger with increase of height, the sky is too much covered with blown cloud to the east of the storm to allow direct light from sun or moon to reach the falling rain.

Finally, the moon is in the right phase during the right hours only 3 days, or so, each month, while the sun, always in full glow, is in the proper position every day.

In short, therefore, over land solar bows are far more frequent than lunar bows because:

1. The sun is many times brighter than the moon.
2. The local, or rainbow, shower occurs most frequently in the afternoon and far less often at night.
3. Sunshine often can reach the west or (commonly) windward side of a local shower, the side of least canopy, whereas the light from a nearly full moon, coming from the east, is likely to be intercepted by a layer of cloud.
4. Finally, the sun is in condition and position suitable for the production of a bow every day, and the moon one tenth of the days.

The moon then has such a poor chance to produce a conspicuous bow that it is a wonder that anybody ever sees one, and most people never do. What that chance is can be computed a little closer, perhaps, than one can just guess it. Consider the central portion of the United States. Here about 50 thunderstorms are recorded per year from any given point, but of these only 15, at most, bring rain to the place of observation. Furthermore, it would be liberal, perhaps, to assume that 5 of these occur at night. Again, the moon is in the proper phase and position to produce a rainbow on only one tenth of the nights. Thus far, then, the chance of a lunar bow has been reduced to one in two years. But that is not all, probably only once in 5 times is the sky clear enough in front of a night thunderstorm to permit full illumination of the oncoming sheet of rain; and, finally, from the fact that most of the solar bows are faint it would seem that only one third, at most, of the lunar bows can be visible. Hence once in 30 years is about as often as a close observer in the central portion of the United States may expect to see a lunar rainbow, and as most of us are likely to miss at least three out of four such bows that might be seen, the average inland dweller is lucky if he ever sees one.

However, along certain coasts, and over particular oceanic regions, the chance of seeing a lunar rainbow, and solar bow too, for that matter, is better than it is far inland, because there the passage of cold air starts

at any time a convection shower with a rather limited cloud canopy.

Nevertheless, conditions 1 and 4, above, are the same there as on land; hence even over the ocean the lunar bow is a comparatively rare phenomenon.

W. J. HUMPHREYS

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OBSERVATION OF A LUNAR RAINBOW BY FRANKLIN

WHILE reading Carl Van Doren's biography of Benjamin Franklin I was reminded of Professor A. K. Lobeck's report (SCIENCE, August 26, 1938) on his observation of a rainbow at night. In 1726, at the age of twenty Franklin kept a journal of his return trip from England to America. The *Berkshire* sailed into the Channel on August 5. Under the date of Tuesday, August 30, young Franklin recorded that "the moon being near full as she rose after eight o'clock, there appeared a rainbow in a western cloud, to windward of us." He also had the experience on this trip of witnessing an eclipse of the sun and an eclipse of the moon just fifteen days apart.

RAYMOND L. HIGHTOWER

KALAMAZOO, MICH.

FREQUENCY OF LUNAR RAINBOWS

A RECENT note by Lobeck recognizes the fact that to most continental residents a lunar rainbow is a distinct novelty.[1] Lobeck also infers greater frequency of lunar rainbows in the trade wind belt, due to thunder squalls. However this may be, it is the purpose of this note to point out that both solar and lunar rainbows are relatively frequent in occurrence in the Hawaiian Islands, where most of the geographically variable rainfall is of orographic origin, *i.e.*, due to cooling of trade winds in passing over rugged island topography. Here, where local showers and mists occur sporadically on days and nights which are generally clear, are ideal conditions for rainbows, and persons in certain localities probably see rainbows almost daily at certain seasons. Any one who has occasion to travel about in upland districts ordinarily sees two or more rainbows a week. Near the full moon, lunar rainbows are often seen and certainly the matters of common knowledge to young and old in this part of the United States. In the solar rainbow, the secondary spectrum is visible more often than not, and the writer has a persistent impression of having seen the secondary spectrum in a lunar rainbow, but can not offer date or systematic observations.

CHESTER K. WENTWORTH

BOARD OF WATER SUPPLY,
HONOLULU

[1] A. K. Lobeck, SCIENCE, 88: 2278, 187, 1938.

MASTODON DISCOVERED IN OHIO

EARLY in September, 1938, a part of the skeleton of a mastodon (Americanus) was unearthed in a field by an Amish farmer, J. J. Miller, who was digging a drainage ditch. The remains consist of a thigh bone and eight teeth, the largest of which weighs a little more than 6 pounds. The remainder of the skeleton was so badly decomposed that it could not be recovered. About ten years ago, during the excavation of a drainage ditch on the same site, the skeleton was partially destroyed by dynamite. It interfered with the digging, and the farmer, not aware of the nature of the obstruction, used the explosive to remove it.

The plot of ground on which the bones were found is located on the extreme western end of the area known as "The Plains" in Berlin Township in Holmes County, Ohio, about two miles southwest of Benton and three miles northwest of Berlin. "The Plains" is already noted for the discovery of the skeleton of a giant sloth, Megalonyx (Jeffersoni), in 1890, on the farm of Abraham Druschell. This specimen, an excellent one, is mounted and stands in the Geological Museum in Orton Hall at Ohio State University.

The remains of the giant sloth were found embedded in shell marl, beneath six feet of black earth. The bones of the mastodon were found lying on top of the shell marl and three feet below the surface beneath black earth, high in humus content. Evidently, the area known as "The Plains" was at one time a glacial lake, which was destroyed by natural processes such as the lowering of the outlet and gradual filling-in by wash and plant and animal accumulations. When finally reduced to a bog, the sloth and mastodon were probably mired in and the skeletons preserved in the bog waters.

KARL VER STEEG

COLLEGE OF WOOSTER

FRESH-WATER MEDUSAE IN TENNESSEE

ON July 15 about a half dozen live *Craspedacusta ryderi* were brought into my office. These had been collected by Miss Sara Betty Fowler from Andrew Jackson Lake, privately owned, at the suggestion of Mr. Harry McCann, custodian.

The lake, about twelve miles west of Knoxville, has an area of from 50 to 65 acres with the greatest depth of from 20 to 30 feet. When we visited the lake on the afternoon of July 15 thousands of the medusae were found at and near the surface of the water. Something like 300 were collected in a short time over a small area. These were placed in an unaerated aquarium. By July 18 most of the specimens remained on the bottom of the aquarium or had disintegrated. Only a few swam irregularly about. Eleven of the more active specimens were preserved. It was found