threatened with dire punishment if they refused to attend rehearsals) actually begging for, nay, angrily demanding, at least one rehearsal, and not getting it!

There are, to be sure, two sides to this operatic question. In Germany they have plenty of rehearsals, but no singers; here we have the singers and no rehearsals. Which is the better, or the worse? The great Felix Mottl refused to come back to America because he was in despair over the rehearsal question; but now that he has become Generalmusikdirector in Munich, it is reported on good authority that he is in despair over the singer question. The American situation, after all, seems more hopeful than the German. When an opera is repeated several times we generally get excellent results. Lengthening the season and crowding less into each week would be a way of mending matters. Mr. Conried seems to have had the intention of adding a month to next year's season. In this he was confirmed by his disastrous week in "unmusical Boston." But in the cities of the West he had such a brilliant success that he may, after all, change his mind again about confining himself to New York hereafter.

THE NATIONAL ACADEMY OF SCIENCES.

WASHINGTON, April 24, 1905.

Never before, we believe, since the National Academy of Sciences was created, in 1863, has a spring session brought so meagre a crop of papers as did that of last week. Meeting in Holy Week has not hitherto had such an effect, but this year there were only eight papers. The consolation was that those few were not hurried over as Academy papers usually are, but could be understood and enjoyed in full.

Dr. William Morris Davis, Professor of Geology in Harvard, opened the readings with a deductive sketch of the distinctive effects upon the conformation of the surface of any land-region of several modes of erosion. No other than erosive agencies were considered; and indeed the title of the paper, "The Geographical Cycle in an Arid Clime," would limit the subject still further. But, unfortunately, no lantern had been provided, and the paper probably had to be modified in its presentation. It was very interesting, however, as it was given. In an ordinary climate, the surface of the land would in the ultimate result get washed down to one lowest possible level, technically called the base-level. It usually coincides with the sea-level. Powell showed the importance of recognizing this tendency, since, under normal conditions, there is no other cause that can produce a terrestrial level surface. In arid regions there is no other erosive agency than that of the wind to mould the surface; and wind is far more efficient in such regions than where vegetation arrests it and makes a relative calm close to the ground. Air, of course, does not seek any particular level for itself and its freight, as water does. But its action, as figured by Professor Davis on the blackboard, reminds one of the process of grading a railway-bed by cutting and filling, the depressions being raised with the matter removed from the elevations; so that, like that operation, it does at last leave a level surface—interrupted, it may be, by bare crags of rock. This level surface may perfectly well be below the sea-level, none other than which can usually be the last surface washing. Nevertheless, the wind may strike upon the base of an obstruction in such a manner as to dig holes. It was a matter of regret that a second paper by Professor Davis, which was announced on the printed list, did not get read.

Professor E. L. Nichols of Cornell gave a paper entitled "The Mechanical Equivalent of Light." Since ordinary text-books do not use this phrase, the reader may naturally ask what meaning can be attached to it. The photometric intensity of any one bright line or narrow band in a spectrum will vary in strict proportion to its heat-energy, and the value of the inverse ratio (the energy per brightness) will be the mechanical equivalent of the light of the wave-length of that band. But, for different parts of the visible spectrum, this inverse ratio will vary immeasurably, becoming infinite at the limits of the visible spectrum. We may add that the curve of variation will be appreciably different for different eyes, though they be normal eyes, and not a little for the same eye at different times of day, conditions of health, etc. Perhaps our many expressions about "everything looking blue" to a man in one mood, "bearing a roseate hue" in another mood, and so forth, though they are all now understood as purely metaphorical, may, some of them, have had their origin, before poetry was recognized as such, in nice observations of positive fact. At any rate, the mechanical equivalent of ordinary light capable of dispersion by a prism will have a different value for each illuminant, for each pattern of lamp or burner in which that illuminant is used, for each state of cleanliness of that lamp, for each eye, and for each state of the eye. But the usage of physicists restricts the phrase to the light of a little lamp introduced by Von Hefner-Alteneck burning "pear oil" (often insufficiently designated as "amyl-acetate") and having a flame of a certain fixed height. The photometric intensity of such a flame is called a hefner. It is about eight-ninths of a standard sperm candle-power. An ardent admirer of the marvellous precision of modern physical measurements was all ears and eyes when Prof. Nichols proposed to set down upon the blackboard the three principal determinations of the mechanical equivalent of light by Thomson, Tumlirz, and Ångström, and was evidently preparing himself to be astounded. When he learned that the three values of this important unit which the three eminent physicists had obtained were in the ratios of 19, 13, and 7, respectively, his surprise was of an unexpected kind. Prof. Nichols gave a number of conclusive reasons for holding Ångström's value to be the only trustworthy determination. What had to be done was to remove all the invisible rays from the Hefner flame and measure the heat of the remaining visible rays. If a young student under examination were unexpectedly required to give an instant answer to the question how this should be done, never having heard of the problem, he would infallibly propose to disperse the light into a spectrum, screen off the invisible parts, and concentrate the rest into a calorimeter. But, easy as this would be to say, the difficulties of doing it, with the consequent probable errors, caused Thomson and Tumlirz to prefer to cut off the dark heat by simply passing the light through water. Now it is true that the water would permit the passage of but a very small proportion of the dark heat; but this small proportion might amount to as much as all the heat of the visible part, or more. Ångström therefore chose the difficult method. Some of the visible rays would be absorbed in the spectroscope, no doubt; but, by a photometric comparison with the bare flame, or otherwise, he could readily correct for that; and his value is alone capable of reconciliation with Langley's bolometer results and various other observations.

Prof. Nichols gave the amounts of energy per unit of photometric intensity in the light of a kerosene lamp, of an ordinary gaslight, and of an acetylene light. Such vague descriptions of course preclude precision, but the three amounts of heat were nearly in the ratios of 9, 8, and 7. He compared the different illuminants from other points of view. If we take the "economy" of a mode of illumination to consist in the proportion of the energy that is visible, then the Welsbach burner is a more economical source of light than the electric arc or than the sun itself. If, however, we define the economy as consisting in the ratio of the watts of light-emission to the consumption of fuel-weight, the Welsbach burner stands very low—hardly above a tallow candle—while acetylene distances every artificial competitor. Professor Nichols remarked that the place in the spectrum to the light of which the human eye is most sensitive is also the point of maximum energy in the solar spectrum, and that the curve of sensitiveness of the eye for light of different wave-lengths and the curve of energy in sunlight are substantially identical; which he thought gave logical support to the idea that our faculty of vision, including its seeing the particular texture of light as colorless which it does so see, has been developed in conformity to the character of sunlight. Fortunately the idea is in no desperate need of logical support.

The well-known therapeutist, Dr. Horatio C. Wood, spoke upon the effect of alcohol on the circulation. The University of Pennsylvania has always taught that alcohol is an active stimulant to the heart. The Johns Hopkins University teaches that it is a sedative to the heart. In order to settle the question, Dr. Wood had instituted a thorough experimental research. The mammalian heart is so susceptible to a thousand influences that no decisive results can be obtained with it. The numerous experiments that have been made upon it are conflicting in the extreme. A heart of more poise is needed—one of those hearts which can be taken out and hung on a peg, and which will still go calmly on for days undisturbed. Cold-blooded reptilian and batrachian hearts were chiefly employed. The first question submitted to experiment was, What is the effect of alcohol upon the arterial pressure? The apparatus employed was described. It was ingeniously contrived to avoid subjecting the blood-vessels to unnatural strains. The experiments so con-

ducted showed that ordinarily the pressure is not affected at all by alcohol. But arterial pressure, like all pressure, is a reaction between two opposing forces, the strength of the heart's action on the one hand, and the friction in the arteries on the other. Alcohol might increase one of these while correspondingly diminishing the other. In fact, this was found to be the case; for if the constrictive reaction of the arteries was paralyzed by severing their connection with the vasomotor centres, it was found that the heart dilated so much more fully under the influence of alcohol that the increase in the flow through the carotid would amount to from 50 to 75 per cent., although the frequency of the heart-beat was unaffected. The apparatus was so arranged that every five minutes there was an alternation between supplying the heart with blood mixed with alcohol and with pure blood, while the blood that passed through the carotid in each five-minute half-period was collected. The result was invariably as stated. It follows, therefore, that alcohol has a double effect on the circulation, at once stimulating the heart and paralyzing the vasomotor centres. But if this be the case, the flow of blood must be greatly increased, and consequently there should be a dilatation of the smaller vessels which would be shown by that instrument which detects changes in the volume of a limb. Dr. Wood's communication was set forth in so interesting a way, and his delivery was so admirable, that the audience was vivaciously responsive.

Professor Brooks, of the Johns Hopkins University, explained how he had discovered that the principal axis of symmetry of the mature oyster is already marked in the ovarian egg—in the egg before it is yet an egg, and while it is still attached. In that stage of development it has a kind of stem, in reference to which the nucleus of segmentation is symmetrically situated. It also has a shell at that time, but as soon as it is expelled the sea water enters the shell, and the egg slips out; whereupon, in ninety-nine cases out of a hundred, the egg assumes a spherical form, so that the axis which its stem had marked now appears to be obliterated. However, in one egg out of every hundred a sort of neck remains, which is identifiable, by its peculiar shape and by the situation of the nucleus, with what was at first the stem. The segmentary spindle and all the segmentations are placed symmetrically to the axis of this neck, and the identity of the axis can be traced throughout the animal's life. It is perhaps the only case in which a principal feature of a mature, individual, and unattached animal is so indubitably determinate from the very first.

Mr. Agassiz, the President of the Academy, gave a fascinatingly interesting account of his last *Albatross* expedition. It was intended to explore a part of the Pacific Ocean that had been quite unknown. We will not undertake to state all the lines run over, but the following will show some of the principal passages, though not always in chronological order. From Panama to the Gallapagos (on the equator due south of New Orleans); thence to Callao (12 degrees south); thence to Easter Island, and to Mango Rava Islands (on the tropic of Capricorn westward of Pitcairn, due south of Sitka); back to Acapulco (south by west of the city of Mexico). In this quadrilateral particularly in its southern part, was found a large district of the ocean characterized by a bottom of manganese nodules, with scarcely anything else. Each haul would fetch up two or three bushels of what looked like potatoes, running up to the size of cannon balls. Such a bottom is found nowhere else, although manganese nodules have been brought up sporadically. Elsewhere the bottom is covered with an ooze largely of decaying animal matter, affording plenty of food, but in this district there is very little food. It is a sea-bottom desert. It lies upon a plateau some 2,000 fathoms deep, between which and the coast is a series of deeps where the soundings were most irregular, some of them reaching 4,000 fathoms. It is curious that the explorers took with them a chart from Kiel, where they found laid down, on the evidence of a few soundings, the "Albatross Plateau," a sort of chairvoyance of what was to be. Mr. Agassiz called it a guess. Over this plateau there are no currents. No food is drifted there, and consequently there is no animal life at the surface. There being no life at the surface, no food can drop to the bottom; and that explains its being a desert. In the Humboldt Current, animal life reaches a depth of 300 fathoms. Where there were currents, plenty of food and animal life was everywhere found. The amount of animal life on the surface of the Humboldt Current is immense, but it diminishes very rapidly as the depth increases, because the temperature falls very rapidly. It would be 72 degrees Fahrenheit at the surface, 52 degrees at 30 fathoms, and at 100 fathoms not much above 40 degrees. Many of the so-called deep-sea animals really do not live below 150 fathoms; but they are brought up in the hauls, and, being much damaged, are supposed to have come from great depths. Mr. Agassiz remarked that this relation between the distribution of animals and the currents throws a certain light upon former geological conditions. It was the eastward currents that stocked and peopled the islands of the Pacific; and there were greater currents in geological ages.

Easter Island was visited, and it was most satisfactory to have an account of that enigmatical place from such an observer. The whole periphery of the island is land-walled 12 to 15 feet high, with numerous platforms for the gigantic images. In the entire absence of wood, these were roughly cut from stone with obsidian tools. The stone must have been soft when first taken from the quarry. They are idols with enormous heads and small bodies, not apparently intended to imitate humanity, and infinitely below the work found in Central America. Hieroglyphics abound which the natives can still read. Originally there must have been a population of four or five thousand inhabitants; at present the natives number fifty or sixty. Every indication is that the work ceased most suddenly, as if in consequence of some unexpected physical or psychical catastrophe. The audience was charmed with the lecture. It recalled Louis Agassiz to those who had heard that famous naturalist and lecturer.

On Wednesday the Academy visited the new Bureau of Standards with the Washington Academy of Sciences. It is as yet impossible to form any critical opinion of this institution; but it has certainly been planned upon a generous scale, with the intention of covering every kind of standardization that there is any important wish in the country to have the Government undertake. The appearance of everything—buildings, instruments, and men—is highly creditable; and there are enough accomplished physicists in the country to make its work an object of national pride.

On Wednesday evening the Academy dined with Mr. Agassiz at the New Willard.

DR. EVANS'S SIXTH YEAR'S CRETAN CAMPAIGN.

KNOSSOS, March 29, 1905.

Had I not already made similar prophecies, I should say, after this week spent in the Museum at Heraclion and on the site of the House of the Double Axe at Knossos, that discoveries are likely to end with the present year's work. But an incident of two days ago gives me pause. While our party was paying its last visit to the excavations, the foreman brought the curved segment of a vase-handle, instantly identified by Dr. Evans as belonging to one of the familiar Knossian funnel-shaped vases made of micaceous schist. The Italians have found the like at and near Phæstos. This handle was decorated with alternating nautiluses and sprays wrought in an extremely clear-cut fashion, suggesting the best palace-style of vase painting. But the newly found fragment came fresh from a trial pit just experimentally sunk at a considerable distance west of the palace. Indeed, it lay on the upward slope of the long hill running parallel to that on which the Knossian palace stands. If followed by others, this small find must indicate the presence of important remains upon that hill. The trial pit was sunk in the line of the deep-level Mycenæan causeway discovered last year below a Roman road built along the same line about 2,000 years afterwards. These two roads run, one under the other, from the theatre building 100 yards northwest of the palace due westward. The problem in hand is to remove the upper Roman road and lay bare the lower Mycenæan one. This will probably have been done by April 14, when a visit is expected from members of the forthcoming Archæological Congress at Athens.

Incidentally there is also in progress the excavation of certain magazines lying deep down and by the side of this Mycenæan causeway. Whether there are older magazines beneath the ones now in hand remains to be seen. Fewer magazines belonging to the oldest Knossian palace have come to light so far than might have been hoped. The Italians at Phæstos have found several such, and it is equally clear on both sides that at least two distinct epochs are distinguishable in buildings and in pottery and the like. Of course, the older and the later palace both antedate 1500 B. C.; and remains both earlier and later than either have been forthcoming, not only from Knossos, Phæstros, and Hagia Triada, but also notably from Gournia, where our countrywoman, Miss Harriet Boyd, has found so much of vital importance for the history of earlier Cretan handicraftsmanship, and for the understanding of the mysterious worship of the Cretan snake-goddess.

As the years pass by since Dr. Evans's final campaign at Knossos, it becomes more