as it should have been. It, of course, was impossible, or rather impracticable, to extend a precise level net into areas through which railroads had not been run, for the expense would have been prohibitive. It may be that the Survey did not fully realize the necessity for having all engineering and surveying work on the same datum, but in recent years it has become fully alive to the necessity of having a single datum for the entire country, and it is consequently extending its precise leveling net as rapidly as funds available will permit.

While it is of value to the nation for various organizations and individuals to adopt and use mean sea-level datum for their elevations, the country will benefit still more if each organization doing extensive leveling will publish in pamphlet form the elevations and descriptions of the bench marks they may establish in order that other organizations and individuals may properly coordinate their levels. Engineers are urged also to use substantial bench marks in order that future work may be benefited by their preservation.

The amount of precise leveling which should be done by the federal government can not be foretold. It must depend upon the needs of the various organizations and individuals using the results. After a certain development of the precise level net which appears now to be absolutely necessary, the rapidity with which further extensions are made should depend upon the development of the country. But such further extensions should precede rather than follow such development, as is proved by the unfortunate condition of affairs in much of our engineering and surveying work, due to lack of precise elevations in the past, when such work was inaugurated.

This paper on mean sea level should, and no doubt will, do much good in furthering the universal adoption of mean sea level as the reference surface for all elevations.

The publication of such pamphlets by government organizations is to be commended, for they present facts to the public in an effective way which may otherwise be buried for years in valuable but more cumbersome government reports with which all of us are more or less familiar. William Bowie

## PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES

The sixth number of volume 3 of the *Proceedings of the National Academy of Sciences* contains the following articles:

*The stark effect in helium and neon*: Harry Nyquist, Sloane Laboratory, Yale University. An improvement of Lo Surdo's method is applied.

*New analyses of echinoderms:* F. W. Clarke and R. M. Kamm, United States Geological Survey, Washington. A progressive enrichment in magnesia, following increase of temperature, is unmistakable.

*On utilizing the facts of juvenile promise and family history in awarding naval commissions to untried men*: C. B. Davenport, Station for Experimental Evolution, Carnegie Institution of Washington. A study with family charts of a number of naval officers.

*The triplet series of radium:* Gladys A. Anslow and Janet T. Howell, Department of Physics, Smith College.

*The measurement of small angles by displacement interferometry:* Carl Barus, Department of Physics, Brown University.

*Mechanisms that defend the body from poliomyelitic infection, (a) external or extranervous, (b) internal or nervous:* Simon Flexner, Rockefeller Institute for Medical Research. A report upon the results of recent experiments.

*The occurrence of harmonics in the infrared absorption spectra of diatomic gases:* James B. Brinsmade and Edwin C. Kemble, Jefferson Physical Laboratory, Harvard University. The discontinuities in the structure of these bands force the conclusion that the angular velocities are distributed among the molecules in the discontinuous manner predicted by the older form of the quantum theory, and the proved existence of harmonics is almost equally good evidence that the vibrational energy of the molecules is distributed in the same manner.

*The loss in energy of Wehnelt cathodes by electron emission:* W. Wilson, Research Laboratories of the American Telephone and Telegraph Company and of the Western Electric Company. The emission of the elec-

trons from Wehnelt cathodes is due to a similar mechanism to that causing the emission from heated pure metals.

*Daily variations of water and dry matter in the leaves of corn and the sorghums:* EDWIN C. MILLER, Kansas Agricultural Experiment Station. Under the conditions of these experiments the sorghums, and more particularly milo, absorb water from the soil and transport it to the leaves more rapidly in proportion to the loss of water from the plant than does corn; and thus the sorghums can produce more dry matter for each unit of leaf area under severe climatic conditions than can the corn plant.

*Note on complementary fresnellian fringes:* CARL BARUS, Department of Physics, Brown University.

*The displacement interferometry of long distances*: CARL BARUS, Department of Physics, Brown University. In preceding notes two methods for measuring small angles have been suggested. Application is here made to the determination of distances and is shown that an object at about a mile should be located to about thirty feet.

*National Research Council:* Meetings of the Executive Committeee and the Joint Meeting of the Executive, Military, and Engineering Committees. Report of the Astronomy Committee.

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## SPECIAL ARTICLES

### INTRA-VITAM COLOR REACTIONS

WE have slowly come to have great confidence in the specificity of certain physiological actions. We introduce into an organism certain substances, and definite results follow; but about the only thing we know in the matter is that the results follow with certainty. In such cases, if only we could see what it is that happens while it is happening, it seems certain that important advances would be made in our knowledge of nutrition, growth and decay—of physiology, pathology and medicine.

If substances giving color reactions in living tissues could be applied to small, transparent, varied and highly complex living organisms, under circumstances that would permit microscopic examination while the reactions are in progress, we might hope for more light on this exceedingly important subject. Experiments I have made lead to the belief that many of the conditions requisite for success in this line of investigation can be much more fully realized than hitherto by feeding colored substances, notably coal-tar dyes, to free-living nematodes.

These minute, transparent animals are comparatively highly organized; not only this, but also extremely varied in their mode of life. Some are exclusively vegetarian, others exclusively carnivorous, and others omnivorous. They constitute a group composed probably of hundreds of thousands of species, embodying an almost inconceivable number of kinds of physiological action. Their organs are enclosed in a thin transparent cuticle, and are strung out so as to make them unusually suitable for *intra-vitam* examination. Under slight pressure the nema flattens out more or less without losing its vitality sufficiently to preclude satisfactory *intra-vitam* examination under the highest powers of the microscope.

Observing certain precautions, I find that a great variety of coal-tar compounds and other colored compounds can be fed to nemas, apparently without interfering materially with their normal metabolism. I have had the best results by cumulative action, using small quantities of color dissolved in the medium in which the nema lived, and allowing the dye to act for days or weeks.

Not infrequently the dyes prove to be highly specific in their action. Only certain cells, or only definite parts of certain cells, exhibit visible reactions in the form of colorations. The results obtained by the use of any given dye may be quite varied. It is evident in many cases that the dye is digested and assimilated, thereby undergoing molecular changes by which it is converted into new compounds in a manner analogous to the processes exemplified in chemical laboratories devoted to the production of aniline dyes. Thus, a dye may give rise to several different colors, none of them like that of the dye itself, and all of them very