(2) in which a qualitative change takes place. In degeneration there may be "rudimentation" when the structure is not of use to the embryo and starts to disappear at the beginning of ontogeny, and "aphanisis," in which the structure develops normally in the embryo and disappears in the adult. Interesting examples of these categories are given, one being the dorsal vertebral musculature of the turtles, which develops to a certain period in the embryo and is later carried completely away, apparently by phagocytosis.

Again it is said that coordinations between organs or groups of organs which are changing in the course of phylogeny may be placed into two groups: (1) Morpho-physiological coordinations, in which each member of a network of parts is functionally necessary to the other, and (2) topographic coordinations, in which the organs are not united functionally. To the first group belong, for example, the central nervous system, the motor system and the skeletal muscles; to the second the brain, the roofing bones of the skull and the chondrocranium, all of which may change together owing to proximity.

Differing rates of development of various coordinated parts in the embryo lead to profound results in phylogeny. This brings the author to his theory of phylembryogenesis, which seeks to explain how and in what periods of embryonic life the changes come about that lead up to alterations in the organism. "It is usually considered that the phyletic changes begin with small, heritable variations (mutations). Our investigations bring us to the viewpoint of Fritz Muller that the phylogenetic changes in the developed organs are led up to through an alteration of the course of embryonic development of these organs.

The various modes of alteration of the ontogeny are: (1) new characters appearing at the end of ontogenesis (anaboly), in which case a true recapitulation or repetition is preserved, (2) a deviation at some intermediate stage in ontogeny resulting in recapitulation only of the earlier stages of the history, and (3) changes in the first period of ontology (archallaxis), where no traces of recapitulation can remain. A change in the tempo or rate of development of various parts gives acceleration or retardation. Such an effect can not be gained by "deviation" or "archallaxis."

Finally, it is noted that archallaxis is a method of development of entirely new structures, of rapid replacement of old organs and of rapid adaptation to new or rapidly changing environments. Anaboly is a method of accumulating small heritable variations, resulting perhaps in many diverse adaptations or in adaptations to slow changes of environment. Deviation is a process intermediate between these two extremes.

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SCIENTIFIC MEETINGS

THE COPENHAGEN MEETING OF THE SECOND INTERNATIONAL CONGRESS ON LIGHT

MODERN phototherapy had its beginning in Copenhagen in 1895 when Dr. Niels R. Finsen (1866–1904) demonstrated the curative effects of the ultra-violet rays from the carbon arc in healing a tuberculous skin disease called lupus. In the meantime the treatment of certain diseases by means of light rays has become world-wide.

It was therefore singularly fitting that after a lapse of almost four decades a recently established organization (Congrès International de la Lumière—biologique, physique, therapeutique) should hold its meeting in the city of the father of phototherapy and that this meeting was officered by members of the Finsen Institute; among others, including Doctors Axel Reyn, chief physician (president of the congress), Svend Lomholt, director of the laboratory, H. M. Hansen, professor of biophysics at the university, and A. Kissmeyer, the genial secretary of the second congress, through whose forethought and methodical arrangements everything pertaining to this congress functioned without a single interruption.

The purpose of the Second International Congress on Light, which met in Copenhagen on August 15 to 18, 1932, was for the presentation of reports and new data on all questions relating to biological and biophysical researches made in connection with light and the therapeutic uses of light. There was an attendance of some 300, representing 26 different countries.

The scope and the total amount of work presented at this meeting represent a long step in advance of the humble beginnings of the First International Congress (on "Actinology"), which met in Paris in July, 1929.

The Third International Congress on Light is scheduled to meet in Wiesbaden, Germany, in 1936. In view of the wide field of activities now laid out, it would appear that the next meeting of this congress may be expected to be distinguished from its predecessors by a broad general outlook upon the future, thus expanding its usefulness, and making it more truly international in scope.

The high point in the deliberations of the Copenhagen meeting of the International Congress on Light is the recommendation to evaluate ultra-violet radiation stimuli upon a physical (radiometric) basis, in absolute units.

For this purpose the ultra-violet radiation from the source is to be separated into three components by means of a non-selective radiometer (thermopile) and a series of three standard filters. Owing to the complexity of the problem the correlation of the physical measurements with the biological and physiological (*e.g.*, erythemal) reaction is left for future settlement.

The subjects for discussion at the Copenhagen meeting were presented under four general themes: I. How can the effect of light baths on tuberculosis be explained? II. The basis and organization of helioclimatic researches in relation to public hygiene. III. The rôle of pigmentation in the biologic action of light, and the therapeutic effect of light baths. IV. The choice of a unit and a method of measuring ultra-violet radiation used in medicine.

For each of the above-mentioned themes there were one or two "rapporteurs" and 5 to 6 "co-rapporteurs"; also a leader of the "discussion." As is to be expected, these reports summarize data and information in particular fields of activity. The opinions expressed are those of the individual presenting the subject.

In addition to these papers on general subjects that had been selected in advance of the meeting of this congress, there were a large number of special communications on investigations in progress, as follows: Physics, 18; biology, 24; therapy, 11; and biochemistry, 8 papers.

One day was devoted to visiting the Finsen Institute and to the Minkerup Sanatorium. At the former institute members of the staff gave lectures on the use of phototherapy in the treatment of cutaneous, oto-laryngologic and surgical tuberculosis. In the latter institution there was a lecture on the results of seacoast sanatorium treatment of 1,400 scrofulous children.

At the conclusion of the meeting of this congress there were visits to other sanatoria in Denmark, notably the Julemaerke Sanatorium (on Kolding Fjord) and the Vejle-fjord Sanatorium.

The reports and abstracts of the communications presented at the Copenhagen meeting of the "IIe Congrès International de la Lumière" will be published in book form by Engelsen and Schroder (Copenhagen, Denmark). Readers interested in procuring a copy should address the publishers, or the Secretary General, Dr. A. Kissmeyer, Finsen Institute, Copenhagen. This publication contains over 400 pages of material which is entirely too long to even attempt to summarize in this communication.

It must suffice to record the results of the deliberations of the committee on measurement and standardization of ultra-violet radiation used in medicine. These results are summarized in the following statement (translation from French), which was presented at the concluding meeting of the congress:

In the meeting of Aug. 17th in the Castle of Christiansborg the committee after a discussion and exchange of different points of view, decided unanimously:

1. To recommend the standardization of sources used in medicine, dividing the ultra-violet spectrum in three spectral parts, defined provisionally by the following filters:

Noviol-A—Barium-flint (U. V. of long wave-length, or U. V.—*A.* giving approximately the spectral band from 4000 to 3150A).

Barium-flint—Pyrex (U. V. of medium wave-length, or U. V.—*B.* giving approximately the spectral band from 3150 to 2800A).

Pyrex (U. V. of short wave-length, or U. V.—*C.* giving approximately the rays shorter than 2800A).

These filters, made from a special melt will be given to the following national institutes:

Bureau of Standards, Washington.
Comitade Nazionale della Ricerche de Rome.
Institut d'Actinologie, Paris.
Institut Finsen, Copenhagen.
Institut für Strahlenforschung, Berlin.
National Physical Laboratory, Teddington, London.

If possible these institutes will standardize these filters for manufacturers, physicians and meteorologists.

For each part of the spectrum as defined by these filters, the measurement of the radiation is to be made radiometrically by means of a non-selective method (*e.g.*, by a thermopile) and preferably (for medical and meteorological measurements) expressed in milligram calories per cm^2 per minute.

The lamp manufacturers are advised to give energy data for these parts of the spectrum for all their lamp types, stating all conditions of measurement.

The distance from the lamp to the receiving instrument should be the one used during medical treatment, and in case the distance to the patient can be varied a distance of 1 meter is recommended.

(2) The committee recommends to physicians the use of simple physical, biological, photochemical or photoelectrical methods of measuring in order to check the constancy of each lamp used. The committee emphasizes that at the present time a comparison of intensities by such methods is only possible for lamps of the same type and not for lamps of different types.

(3) The definite adoption of a unit of measurement

for the intensity of the ultra-violet used in medicine can not be recommended at the present Congress. In view of the complexity of the biological problems which must be solved before a unit can be fixed, the International Committee proposes to undertake a program of cooperation between the different institutes to serve as a basis of discussion at the meeting of the next Congress, when this question will be considered.

(4) The committee has decided to prepare an actinometric bibliography of the papers interesting to biologists and physicians. This will be published by the secretary general of the committee on measurement and standardization, Dr. J. Saidman, in the "Annales d'Actinometrie."

(5) The present members of the International Committee of Measurement will make these recommendations known to the different medical societies and scientific journals of their respective countries. To the non-represented countries the recommendations will be sent by the secretary general of the committee.

The production of such filters as recommended will probably never be a commercial proposition. If so, the various countries will probably eventually manufacture them for their citizens. In the meantime (the experimental stage) I have been assigned the task of procuring the prompt delivery of standard samples of these filters to the national laboratories. To expedite matters, Dr. H. P. Gage, of the Research Laboratory of the Corning Glass Works, Corning, New York, has kindly undertaken to promptly supply samples from large melts of each kind of filter glass recommended for measuring the ultra-violet in the spectral bands, *A, B,* and *C*. The original recommendation mentioned Corex-D glass to obtain the spectral band, "C." However, since this would require a thickness of almost 4 mm, another kind of glass, Electric Pyrex (which has a sharper ultra-violet cut-off than Corex-D) will be used.

It is to be noted that the barium-flint filter gives the radiation in the spectral range of wave-lengths less than 313 millimicrons, which is of importance in erythemal and antirachitic tests. This use of a physical specification of the radiation in the bands of wave-lengths *A, B* and *C* avoids reference to biological effects, such as for example, erythema. This places the evaluation of the radiation stimulus upon a physical basis, hoping eventually to obtain the biological correlations when better understood.

While these recommendations specify the use of merely the filters (which will be sufficiently accurate for some work, and will be a step in advance in systematic work) nevertheless, owing to small variations in the spectral transmissions of different samples of the same kind of filter, for more precise work it will be desirable to know the relative spectral energy distribution of the source, in order to evaluate more exactly the energy in a given spectral band.

In all cases a cell of water, 1 centimeter in thickness, within thin windows of crystalline quartz, should be used in front of the thermopile to eliminate the difference in the infra-red absorption by these filters.

In order to obtain the radiation intensity of any spectral band, in absolute value, the thermopile is calibrated by exposure to a standard of radiation, such as is issued by the Bureau of Standards.

The complete accomplishments of such a congress can not be summarized in print. Naturally in an international group (some 300 in all) of biophysicists, biochemists, physiologists, biologists and phototherapists, there is bound to be a diversity of opinions and personal interests. It is to be hoped that by the next meeting the fundamental problems will be sufficiently clarified so that personal preferences can be given up and action can be taken to meet future needs.

Evidently the time was not ripe for sacrificing personal preferences and looking forward to the formulation of a definite general procedure that will be the best for the future. For example, one experimenter, using gram calories, wanted to continue to do so, partly because he is equipped for making such measurements, and partly because the gram-calory is used in metabolism—the latter a novel idea which, if adopted, may lead to much confusion. Another experimenter, equipped with a total radiation pyrheliometer for measuring the dosage intensity of solar radiation, instead of the ultra-violet component in which he was principally interested, wanted to continue to use his instrument in spite of its shortcomings. Still another worker, apparently unfamiliar with the functioning of a thermopile, was opposed to its use for measuring ultra-violet radiation because it was non-selective to wave-length: thus overlooking an important principle that permits direct standardization in fundamental units, which is not possible with selective photochemical, photoelectrical and photographic devices

The question whether the specification of the dosage should be on a physical or a correlated biological (erythemal) basis was discussed in the first congress in 1929, and again in the present meeting. But the subject is so new that the physiologists and the phototherapists, who use the erythemal test to gauge the initial dose, could not come to agreement.

In this country, the evaluation of radiation stimuli, used in physical, biological and physiological work, in energy units (microwatts per cm^2) was begun about 18 years ago. The method is now in common use, not only in recording the intensity of radiation stimuli, but also in specifying the ultra-violet output of lamps. Hence, as far as this country is concerned, experimental procedure will continue practically as it has in the past.

As already stated the International Congress on Light is to meet again in 1936. The present indications are that, in the meantime, there will be greater international cooperation and good-will than ever before; and when the international committee on measurement and standardization again meets, those present should have ample information and data available upon the pressing questions awaiting action.

W. W. COBLENTZ,
United States member, International Committee on Measurement and Standardization; representative, Council on Physical Therapy, American Medical Association.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

DETERMINATION OF THE EASILY SOLUBLE PHOSPHORUS IN SOILS

DURING the past few years several different chemical and biological methods have been proposed for the determination of the easily soluble phosphorus content of soils. Methods in which it is necessary to grow bacteria or plants in order to secure information in regard to the availability of plant food in soils are objectionable in routine analysis because of the length of time required to complete the determinations. Also it is difficult to secure the same results when these methods are used on samples of soil taken from the same area at different times of the year.

Chemical methods do not imitate the plant as far as the extraction of the phosphorus from the soil is concerned. The solvent added to the soil comes in contact with the surface of all exposed mineral phosphates; whereas the plant roots secure their phosphorus through the root hairs which come in contact with only a few phosphate particles as compared with the total number which are present in the soil. Also there is the possibility of the absorption of the dissolved phosphorus in some soils when certain extraction methods are used, which occurs to a less extent in case of the plant roots which secure the major portion of their phosphorus directly from the water film surrounding the phosphate particles.

The value of any method will depend upon the correlation which occurs between the amount of phosphorus extracted from the soil and the response secured from phosphorus fertilizers applied to crops grown on that soil under field conditions. In order to secure accurate correlations a large number of different soils must be studied and comparisons made with each crop which is grown.

As a result of an extensive investigation of different chemical methods which have been proposed for the determination of the easily soluble phosphorus content of soils, the best correlation between the response from phosphorus fertilizers applied to crops grown on different soils and the easily soluble phosphorus removed from soil was secured with the method which is described in the following paragraph. This method separates quite accurately those soils which respond and do not respond to phosphorus fertilization. A complete report of this investigation will be published elsewhere.

METHOD OF SOIL ANALYSIS

Place a heavy filter paper over one end of a glass tube which is one inch in diameter and four inches long and fasten the filter paper to the end of the tube with a rubber band. Satisfactory tubes can be made by breaking the closed end of a test-tube one inch in diameter and six inches long and smoothing the broken end of the tube with the aid of a nichrome wire gauze and a good burner. Add 10 grams of 60 mesh phosphorus-free glass sand or alundum to the tube and tap gently to obtain a level surface. Place 5 grams of pulverized soil in an even layer on top of the sand or alundum and then cover the soil with 5 or 10 grams of sand so that it will not be disturbed when the solvent is added. Place the tube in a clamp so that it is held in vertical position. Add 200 cc of tenth normal acetic acid to an Erlenmeyer flask. Place a rubber stopper containing a glass tube 8 or 9 millimeters in diameter and 2 inches long in the mouth of the flask and pour enough solution into the percolation tube to cover the sand one inch deep. Immediately invert the flask over the tube and allow the solution to percolate through the soil.

Catch the filtrate in a beaker or a flask and when the percolation is complete determine the phosphorus in a 25 cc aliquot which is placed in a 1 by 6 inch test-tube and treated as follows: Add .5 cc of seven normal sulphuric acid containing 2.5 per cent. of ammonium molybdate; mix the solution in the test-tube thoroughly; allow it to stand about one minute, and then add two or three drops of stannous chloride solution which develops a blue color if phosphorus is present. The stannous chloride solution is made by dissolving one half gram of tin in 10 cc of arsenic-free hydrochloric acid, after which it is diluted to 50 cc with distilled water.

Comparisons can be made with tubes containing known amounts of standard phosphate solution which have been diluted to a volume of 25 cc. When soils contain less than .008 milligrams of phosphorus in 25