against the contemplated cooperation in research in the universities. Botanical gardens and arboreta are also deemed better suited to investigative work of the descriptive character than to research in the basic sciences.

The authors emphasize that the foregoing conclusions apply particularly to the problems underlying forest production. The situation is somewhat different in the field of forest utilization, where the problems are more closely analogous to those of the engineering industries. Existing agencies are already conducting researches of basic character in the properties of cellulose, lignin and oleoresins, in wood preservation and in the physical qualities of wood.

The final chapter of the book deals with the need of creating a new agency to develop the research required as a foundation of silviculture. The authors make clear at the beginning that they do not propose a great institution for the centralization of basic forest research. It is the purpose rather to provide a special administrative agency, analogous to the Kaiser Wilhelm Gesellschaft of Berlin, which would be authorized to receive and administer funds for research and would build up centers of scientific work at universities which are deemed to be qualified to carry forward carefully planned projects of a basic character. The plan would not divorce forest research from the universities and other competent agencies, nor would the outstanding scientific workers be drawn off from their university associations. As expressed by the authors:

> These activities [of the central institute] should not involve the creation of a large, isolated research institute, but rather the development ultimately of several smaller research units which should be located in university centers and affiliated informally with existing scientific departments. Research thrives best and is most productive in compact semiindependent units of moderate size where the investigators are closely and informally associated, but where they are able to maintain contacts with general scientific and intellectual interests.

The first task of the new agency would be to study the status of the different basic sciences in relation to forestry. In this study the view-points of the different sciences would be brought into correlation and, in its subsequent activities, the central agency would render an important service in coordinating individual efforts in solving basic forestry problems.

The authors do not endeavor to suggest the specific lines of endeavor of the central agency. They emphasize, however, the study of the life processes of trees and forests, as fundamental to the successful practice of silviculture. "A new science of forest physiology, involving both physiology of the tree and of the forest, must be developed."

In the space of a brief article it is impossible to do justice to the many interesting features of the report of Messrs. Bailey and Spoehr. It merits careful study not only by foresters but by scientific men generally.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

NEW FORMS OF DRY AND WET BULB THERMOMETERS

DRY and wet bulb thermometers are used mainly to obtain relative humidity. There are several well-known forms of hygrodeiks which by simple manipulation of index hands enable one to read on an adjacent chart the relative humidity and the dew-point; but in general, meteorological stations use a sling or whirled psychrometer, and have recourse to tables for the values mentioned above. For approximate values of the relative humidity at places where tables are not always at hand, there has been proposed lately a short-cut method.[1]

This method meets the approval of the Royal Meteorological Society but to us seems less satisfactory and convenient than a method which has been in use at Blue Hill Observatory for some years.

The Poulter formulas are:

$$(1)\quad \text{R. H.} = 100 - 350\, d/_T$$
$$(2)\quad \text{R. H.} = 100 - dd/_2$$

in which d is the difference between the dry and wet readings of the thermometers. For example, if the dry read 69° F. and the wet 59° F. the relative humidity would be 49 per cent. by (1) and 50 per cent. by (2). These values, however, are in error about 5 per cent. if we use the generally accepted formula

$$(3)\quad e = e^1 - .00367\ P\ (t - t_1)\ \left(1 + \frac{Z-32}{1571}\right)$$

in which the units are inches of mercury and Fahrenheit degrees. For the values given above (69° F. and 59° F.) this reduces to .387 inch divided by .707 inch (the respective wet and dry saturation pressures, or 55 per cent. relative humidity).

The process becomes much simplified if units of force for pressure and kilograds for temperature are employed. Thus for a megabar pressure, *i.e.*, megadyne per square centimeter, or the new standard atmosphere, the relation is

$$(4)\quad p_s = p_e - .20\ d$$

[1] *Quart. Journ. Roy. Meteor. Soc.*, October, 1928, method of R. M. Poulter.

in which p_s is the vapor pressure at saturation, p_e at evaporation and d the difference between dry and wet temperatures. These values can be read directly from the new type instruments. Example: M 76 dry, and M 56 wet. The value of the right-hand part of (4) is 17.4 − 4.0 (kilodynes per square centimeter). We have then directly the ratio of the vapor pressures, 13.4/24.5, or 55 per cent., as the relative humidity.

On these new instruments one can read also the saturation *weights* as well as pressures, hence it is an easy matter to compute the absolute humidity; thus, for above values,

$$18.1 \times .55 = 9.6 \text{ grams per cubic meter of space.}$$

We now have values conforming to the C. G. S. system of units. In order to bring the mb (millibar of meteorologists) into step with the bar of physicists and chemists, in use long before meteorologists woke up to the need of scientific units, we simply read kilobar for millibar. The bar like the dyne is a basic unit, the force which would give an acceleration of one centimeter per second per second to one gram.

It is interesting to note the increasing use of the prefix *kilo,* for we now meet in common usage not only kilogram, kilometer, kilocycle and kilowatt but also kilovolt, kilojoule (10^{10} ergs), kilocal and kilobar.

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SPECIAL ARTICLES

IS OSSIFICATION INFLUENCED SOLELY BY ULTRA-VIOLET LIGHT?

OWING to the increasing interest in the physiological properties of ultra-violet light in the prevention and cure of rickets, legweakness in poultry and nutritional paralysis in swine, the following data, obtained in 1926, may be of interest to workers in the field of light therapy.

At that time we were conducting routine determinations of the ossifying potency of different sources of light, by means of the bone-ash method.[1] The question arose relative to the effect of diffused laboratory light and ordinary electric illumination on the ossification process. This question was raised because of rather constant variations in the bone ash of rats which were reared in different parts of the laboratory. Rats whose cages were continuously shaded or darkened invariably manifested a lower rate of calcification as compared with their own litter mates on the same ration, but whose cages were less shaded during the ordinary working hours.

The animal laboratory is situated in a half-story attic on the third floor, and the building is almost entirely surrounded by tall trees. As a result, the windows, which are small, are partly shaded. Practically no direct sunlight can reach the windows and little of this can penetrate into the laboratory, and the windows are usually closed during the cooler months. Consequently, it is necessary to work by electric light most of the year. These lights consisted of 75-watt Mazda bulbs hung at a distance of about twelve feet above the floor. The cages, which consisted of wood frame and wire mesh, were of the apartment type, consequently, most of the animals were shaded most of the time.

To determine, if possible, the effect of laboratory light on the calcification rate, litter mates twenty-one days of age and weighing approximately forty grams were divided into four experimental groups, all of which received the Wisconsin rachitogenic ration.[2] Group I was placed in a cylindrical wire-mesh cage covered with loosely woven black muslin cloth in which an opening was made through which was introduced a 100-watt Mazda bulb which was allowed to burn eight hours per day. Group II was placed in a similar cage which was covered completely with the black muslin cloth. Group III was placed in a similar cage without cover of any kind and exposed to the ordinary laboratory light. Group IV was treated the same as Group II except that the covering material consisted of cardboard arranged in such a manner that light was excluded completely but with facilities for air circulation. The following results were obtained when the femur bones were dried, extracted and ashed at the end of a twenty-one-day feeding period, the percentage of ash being calculated on the dry, fat-free basis.

Group	Treatment	Bone ash per cent.
I	Mazda bulb 8 hours per day	31.82
II	Dark cage—muslin cloth	22.44
III	Laboratory light	25.33
IV	Dark cage—cardboard cover	16.65

An additional experiment was conducted in which the feeding period was lengthened to thirty-five days, the results of which were as follows:

Group	Treatment	Bone ash per cent.
V	Mazda bulb 24 hours per day	50.59
VI	Dark cage	18.46
VII	Laboratory light	26.48
VIII	Two drops cod-liver oil daily	38.95

[1] R. A. Dutcher, M. Creighton and H. Rothrock, *J. Biol. Chem.*, 1925, 66: 401.

[2] H. Steenbock and A. Black, *J. Biol. Chem.*, 1925, 64: 263.