atmosphere is not developed and maintained.

4. Finally, a medical school, both by precept and example, must seek to inoculate a sustaining philosophy in the souls of its graduates. The philosophy of medicine implies a cheerful acquiescence to the burdens of the day. It inspires the unfortunate and cheers the depressed. It teaches how to encourage the hopeless as well as to relieve the suffering. It provides courage and fortitude with which to meet sorrow and disappointment. Lived up to, it insures a geniality of soul and tolerance for the opinions of others. Dishonesty is its most hated foe. Such a philosophy is needed by every successful clinician: it is practical even though idealistic. It does not develop best in the materialistic atmosphere of a pure science not learned and pursued in love.

CONCLUSION.—Brief reference has been made to a few of the dangers inherent in some of the very factors that have made contemporary medicine so brilliant. To infer anything short of an attempt to be constructively critical is to misconstrue. It is hoped that every clinical practitioner and teacher will ponder deeply on these and kindred topics, for clinical medicine is destined to come into its own in the near future. This will be hastened if the entire profession takes a more active share in the direction of education and the enforcement of needed reforms.

Progress and optimism are the natural progeny of health; they wither in the face of disease. Preventive medicine, through domination of the forces of nature and their utilization in promoting the welfare of mankind, is the ultimate goal of medical science. Through science the facts are discovered, through clinical practitioners their application is effected. The prevention and cure of many diseases to which mankind is heir depends neither upon the acquisition of knowledge through scientific research alone, nor its proper application to patients in the limited domain of each practitioner. Medicine must have behind it the tremendous power of a concordant public opinion. To win this, scientists, teachers and practitioners must miss no opportunity to become active agents in the proper transmission of all useful knowledge to the public at large. In no other way can humanity be freed from the pernicious influence of quack remedies, cults of false pretenses, and a host of kindred delusions which drain the physical and financial and psychic resources of thousands every year. When fads and personal whims are kept constantly subservient to the weight of judiciously proved opinion, and if devotion to truth characterizes the daily life of student and physician—a grateful public will generously support all forms of needed medical investigation.

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PHOTOPERIODISM, THE RESPONSE OF THE PLANT TO RELATIVE LENGTH OF DAY AND NIGHT[1]

IN an article published in 1920[2] data were presented tending to show that the length of day may exercise a remarkable regulatory action in initiating or inhibiting sexual reproduction in plants. In a number of species studied it was found that ordinarily the plant can attain the flowering and fruiting stage only when the length of day falls within certain limits so that in such cases flowering and fruiting occur only at certain seasons of the year. In this respect some species and varieties respond to long days while others respond to short days. Moreover, some plants are much more sensitive to change in length of day than are others. Since the publication of this paper the investigations have been extended to cover various other features of plant activity as affected by the prevailing length of day, including increase in stature, aerial and subterranean branching, formation of tubers and bulbs, root-growth, leaf-fall, dormancy and rejuvenescence. In collaboration with C. W. Bacon of this office fairly extensive biochemical studies of the subject have been carried out to ascertain the nature of the internal chemical changes involved and their relationship to the observed responses

[1] The writers are indebted to Mr. O. F. Cook, of the Bureau of Plant Industry, for suggestion of the term *photoperiodism* to designate the phenomena in question.

[2] "Effect of the Relative Length of Day and Night and Other Factors of the Environment on Growth and Reproduction in Plants," in *Journal of Agricultural Research*, Vol. XVIII, No. 11, March 1, 1920, pp. 553-606.

of the plant. Inasmuch as publication of the details of these investigations has been considerably delayed it seems desirable at this time to briefly indicate the principal conclusions reached. The duration of the daily illumination period not only influences the quantity of photosynthetic material formed but also may determine the use which the plant can make of this material. In general, there is an optimal light period for maximum upward or apogeotropic elongation of the stem which for some species corresponds to the long summer days of higher latitudes, while for other species the intermediate length of day of spring and fall (or the equatorial day length) is optimal. Changes in the light period to sub-optimum conditions for stem-elongation, resulting from appropriate increase or decrease in length of day, as the case may be, may initiate a series of characteristic responses which are definitely associated with periodicity in plant behavior. Reference has already been made to flowering and fruiting. There seems to be an optimal light period for sexual reproduction which tends to direct the energies of the plant more or less quantitatively toward flowering and fruiting. Again, departure in day length from the optimal for increase in stature causes loss of dominance of the apical bud, thus promoting various types of branching. Leaf-fall and entrance upon the rest period, also, result from exposure to a certain length of day which is unfavorable for stem-growth. It has been found that there may be an intermediate length of day especially favorable to dormancy or death while under both longer and shorter days activity of the plant may continue. Further changes of the light period by a sufficient increment or decrement away from the optimal for increase in stature and beyond the optimal for sexual reproduction tend to induce intense tuberization, a feature marking the final stages in reduction of stem-elongation. Formation of bulbs is induced by excessively long days while formation of tubers commonly results from excessively short days. This deposition of carbohydrate in relatively condensed or dehydrated forms as a result of an unfavorable light period indicates marked loss of power to utilize the products of photosynthesis in elongating the stem or in developing flower and fruit, a condition well exemplified in the stemless or leaf-rosette form of foliage development. The opposite change toward the optimal day length for stem-elongation may rescue typical annual plants from impending death and effect more or less complete rejuvenescence. The evidence indicates that the degree of hydration of the living cell content is brought under delicate control by the ratio of the number of hours of sunlight to the number of hours of darkness in the 24-hour period. Well defined correlation has been established between the hydrogen-ion concentration of the cell sap and the observed responses of the plant to change in the length of the day. Thus, change from the purely vegetative to the flowering and fruiting stage may involve marked change in hydrogen-ion concentration in the apical bud and even a reversal of acidity relations between the apex and the base of the stem. Correlation also has been found between the content of "available" carbohydrate (the simpler sugars) and the responses of the plant to differences in length of day. Causal relationships, however, have not been definitely established. It seems probable that the annual cycle of length of day, affording as it does a consistently rhythmic feature of the external environment, is a dominant causal factor in phenomena of plant periodicity, subject, of course, to the modifying influences of temperature and other environmental factors.

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FISH PARASITISM IN ITS RELATION TO BIOLOGICAL PROBLEMS OF THE NORTHWEST[1]

IN this great Northwest of ours fish afford a natural resource of importance to the welfare of a good many citizens. Not only do the commercial interests utilize fish for market purposes, but the sportsmen derive infinite

[1] One of the papers in a *Symposium* on "Biology in Its Relation to the Development of the Northwest," presented at the meetings of the Western Society of Naturalists at Corvallis.