

tablishing of relations, not in the cataloguing of facts.

N. E. DORSEY

404 MARYLAND BUILDING,
WASHINGTON, D. C.

QUOTATIONS

THE EARNING POWER OF RESEARCH

A FEW years ago the X-ray tube was an erratic apparatus not in any very general use. The research laboratory of the General Electric Company realized that there was a possibility of utilizing pure electronic emission from a hot filament to produce controllable X-rays in a perfect vacuum. They conducted extensive research upon such devices as then existed, and as a result the tungsten target took the place of platinum in the standard gas tube of that day. Research had also to be applied before the laboratory learned positively that available electrons already existed and that there was a possibility of controlling them, as, for example, focusing them on a target. The research has been continued, until today practically all the X-ray tubes of the country are made by the company in accordance with the discoveries of the man whose name the tubes bear. The Coolidge tube is also used abroad almost to the exclusion of other types. These remarkable results have been achieved through very careful, accurate, and often discouraging studies of electric phenomena in high vacua, with very pure materials. The perfection of the tube is the nucleus of an annual business, including accessories and generating apparatus used in X-ray work, of from five to ten million dollars a year. The benefit cannot be measured wholly in monetary return, for everyone is familiar with the humanitarian benefits.

Our oldest industries have been the most reluctant in establishing research laboratories. But the experience of a leader may guide the entire industry. Some years ago the Ward Baking Company established a fellowship at the Mellon Institute. The research soon brought results and the application of a more balanced yeast nutrient to the dough gave better fermentation and better bread. It was discovered that the baker can grow yeast in the dough and control fermentation wastes. This

conservation amounts to 2 per cent of the flour, 15 per cent of the sugar, and sufficient yeast to make the total saving 45 cents net per barrel of flour used. It is estimated that this process saves American, Canadian, and British bakers not less than \$40,000 per day, without detriment to the quality of the bread.

In 1915 a control laboratory was installed with one chemist. Today there are a variety of control laboratories with twenty-five technical workers. A chemist has frequently saved two months' salary for his employer with a report on samples from a single carload of butter. The control which has been established as a result of research upon the raw materials makes possible uniformity in the finished product. Time, temperature, and other factors which influence fermentation have been established, and since no two carloads of flour are alike the data are vital in determining how fermentation must be varied to secure uniformity. The study of enzymes, proteins, colloids, yeasts, bacteria, and nutrient value is pointing the way to still better bread, higher nutritive values, economy in production, and the elevation of the entire industry. It is no wonder that during these days of industrial depression this pioneer in research as applied to baking has increased the number of its scientific workers. Results continue to justify the increase.—*The Journal of Industrial and Engineering Chemistry*.

SCIENTIFIC BOOKS

A Monograph of the Existing Crinoids. Volume

1. The Comatulids. Part 2. By AUSTIN HOBART CLARK, Curator, Division of Echinoderms, United States National Museum. Bulletin 82. Washington, 1921. 4 to Pp. xxvi + 795; with 949 text-figures and 57 plates.

The first part of Clark's monograph appeared in 1915.¹ The present brochure, fully twice the size of its predecessor, constitutes the concluding part of the general introduction to The Comatulids. The systematic description of the group will follow. The major part of this work has already been completed and much of it has appeared in a series of monographs and

¹ Reviewed in SCIENCE, N. S., Vol. XLII, No. 1080, p. 342, Sept. 10, 1915, by Frank Springer.

shorter papers which have supplied the first adequate account of the free crinoids. It has been no mean task, for when Mr. Clark tackled the problem, the classification of the comatulids was in a state of hopeless confusion. The resolution of this chaos into a system was a brilliant piece of analysis and construction, and constitutes a notable achievement in the field of animal taxonomy. The present volume contains an enormous amount of detail, and maintains the high standard of Part 1. It has a wealth of illustration—no less than 1,364 figures, the greater part drawn by the author, as there are few photographs. Such figures as have been taken from previous authors have in almost all cases been retouched by Mr. Clark to bring out points previously overlooked or misinterpreted. Nine hundred forty-nine drawings appear in the text.

What might be termed the background of the work has been stated by Mr. Frank Springer in his review of Part 1, and need not therefore be recounted here. The present volume contains a very large amount of entirely new and original matter. It begins by taking up the description of the radials of the comatulids at the point at which it was left at the end of Part 1. The articular faces of the radials of 52 species are described in detail from dissections preserved in the collection of the National Museum and reference is made to the 20 described more or less satisfactorily by previous authors. The whole subject of the structure, relationships, physiology and homologies of the so-called post-radial structures (arms and pinnules) is exhaustively treated. All of this matter is original and is based upon specimens in the National Museum. The perisomic plates, or those developed within and entirely confined to the ventral surface, come in for detailed description for the first time, the subject being handled in an entirely new way; and the side-plates and covering-plates of the pinnules of 203 species in the National Museum collection are also treated.

A complete and detailed account of the anatomy, embryology, and regeneration of the comatulids is given. There is at present no single source from which this information can

be derived, as it is widely scattered through a great number of usually short papers in various languages.

The spawning season of 24 species is given; previously that of only 4 species was known.

The pentacrinoid young of 28 species are described and the first comparative account of the pentacrinoids is given.

A considerable amount of information is assembled concerning the habits, reactions to various stimuli and food, concerning which up to the present there has been no adequate source of information.

All of the numerous parasites and commensals on the crinoids are listed and when necessary for comparative purposes, many of those occurring on other echinoderms. Parasitism and commensalism among marine invertebrates has been greatly neglected and this section therefore forms an important contribution to the subject. Incidentally, a detailed account of the myzostomes, almost exclusively parasitic on the crinoids, is given, together with a complete list of all the known species. No other list exists at present.

The coloring of the comatulids, remarkable for its brilliancy and diversity, is treated in detail for the first time, the color of 160 species, in many cases from the author's own notes taken at sea, being given. The pigment is described and the chemical composition of the skeleton is discussed.

Such, in bare outline, are the contents of an extraordinarily well conceived and thoroughly executed treatise, upon the publication of which the author as well as the authorities of the National Museum are to be congratulated, for the work will always remain a point of departure for future investigation.

The press-work of this volume is excellent and an improvement over that of Part 1. The half-rag paper is also a decided advance, although really too thin to carry the larger text figures, since the printing on the reverse shows through. A few copies of such fundamental memoirs as the present should be printed upon heavy, full-rag paper, or better still upon linen, and deposited in, say, half a dozen "strategic" libraries of the world. Too many of our basic

monographs are printed upon paper which will be relatively short-lived.

W. K. FISHER.

SPECIAL ARTICLES

A NEW VARIETY OF BARLEY WITH STRIKING CHARACTERISTICS

THE new variety of barley, which the writer has provisionally called Mack's Branched barley, has never been recorded in literature heretofore. It was discovered by Mr. J. M. Mack, of Fallbrook, California, in a wheat field mixed with much barley. Specimens of the new form were sent to the University of California in 1921 for further investigation; and the writer has been much interested in it in connection with his genetic studies in barley. It is a six row barley possessing the following characteristics:

1. An Increase in the Number of Nodes accompanied by an irregular Shortening of Internodes. The number of nodes in ordinary varieties of barley varies from three to seven, the uppermost internode below the spike being always the longest; while Mack's Branched barley has from 10 to 30 nodes on each tiller without elongation of the uppermost internode. The shortening of the internodes and the increase in the number of nodes make the straw much stiffer; and indeed the variety would be most resistant to lodging if not for the fact that too heavy a weight is carried at the upper portion as a result of branching.

2. The capacity to Branch at Any Node. Tillers arise from the first node at the bottom in ordinary cultivated barleys. Wessling barley has a branched spike, but the branching is confined to the head. No form has been recorded heretofore as branching freely at any node and also capable of secondary and tertiary branching, which is a characteristic of Mack's Branched barley.

3. The capacity to Produce Roots at any Node. Although it is possible to induce some of the common varieties of barley to produce roots at nodes near the base, the setting of

roots at the upper nodes when covered with soil is quite a unique character possessed by this form alone.

4. The Capability of Vegetative Propagation. The fact that this variety of barley is capable of branching and rooting at every node suggested to the writer the possibility of vegetative propagation. Abundant roots were secured by the layerage method in a period of 2 weeks in the open field in January. Cutting off a tiller and transplanting it in a pot in the greenhouse has resulted in slower recovery than in the case of mount layerage; but nevertheless a main root has arisen from a node near the place of cutting and hence it is reasonably sure that the cutting will succeed as a separate plant.

The possibility of vegetative propagation of this cereal is of considerable scientific interest, if it is not yet of practical agricultural interest. This new form is of appreciable value especially to those interested in genetic studies of barley, because it makes possible the continuous propagation of the heterozygote. This will make backcrossing in barley as a means of genetic investigation more practical, although it is still doubtful whether backcrossing can be extensively employed in this cereal, the process of artificial fertilization being so tedious in contrast with the ease of growing self-fertilizing hybrid generations.

Although the new form is apparently of no agricultural value by itself, yet the branching and cold resistant characters may be utilized to advantage by hybridization with some of the commoner types of cultivated barley.

Nothing is yet known concerning the origin of this interesting form, as it was discovered in a mixed field. All that we know is that its striking characteristics are constant and breed true under the different environmental conditions to which it has been subjected. The writer plans to make a number of crosses between this form and several of the cultivated varieties in the coming spring, as this interesting barley certainly deserves an intensive genetic study.

KWEN S. HOR

UNIVERSITY OF CALIFORNIA

¹ *Phil. Mag.*, s. 5, Vol. 24, p. 87.

² *Phil. Mag.*, s. 5, Vol. 24, p. 423.