That the department of chemistry will assign a "fellow," who shall have received his bachelor's degree, to the problem; this fellow to devote from half to full time to the problem and the balance to assistant work in the department of chemistry.

That the fellow shall be paid (about) $800 per year to be drawn from the "fellowship" fund and the college funds in proportion to the amount of time he shall spend on each.

That the work of the fellowship shall be considered as legitimate material upon recommendation of the department staff for a thesis for the degree of Master of Science, and in special cases for the degree of Doctor of Philosophy, the fellow having completed the other requisite requirements as of credits, languages, residence, etc.

That (about) 10 per cent. of the fellowship fund shall be set aside for equipment, chemicals, traveling expenses, etc.

That the several problems presented shall be under the immediate direction of the department member who represents that branch of the science, or of a director of industrial research and head of the division of industrial chemistry.

That the regular salary of each department member who has fellowships under his supervision shall be augmented by a specified sum to be drawn from the fellowship fund.

That fellows engaged upon industrial problems shall not be charged laboratory fees, or breakage fees, nor shall there be any charges relative to their procurement of any advanced degree.

That department members will not accept any personal propositions which might legitimately become a department fellowship.

The scheme as developed should relieve much of the aforementioned difficulties and "diseases."

The higher salary paid assistants would create a demand and a competition among men for the positions. High-class men may be selected. These men, being holders of at least the bachelor's degree, will be available for assistant work of a high order, such as will relieve the professors of a vast amount of responsibility and time spent in the laboratory and in preparation. This alone would often cut half of the time from the professor's schedule, thus enabling him to improve his courses by giving them the proper amount of reflection and applying with deliberation the principles of pedagogy.

It will provide a suitable source of outlet for the research needs of the professor, inasmuch as he is to be the director of several fellowships. The responsibility for their success will rest primarily upon his shoulders, although the major portion of the laboratory work connected with them will be performed by others. He will thus have incentive to keep "alive," and the spirit of competition and production and contact with the outside world of industry will make him more keenly appreciative of his function as a teacher of a coming generation of chemists.

The college will be granting advanced degrees yearly to its fellows, and these are bound to create a reputation for the college in their respective fields of investigation which will make for its recognition and success.

The increase in the department personnel due to many assistants will decrease the work and responsibility of each professor, thus providing the time in which he may study and work upon his fellowship problems, and his salary will be justly augmented by inspiring work performed in working hours rather than by depressing analytical procedures performed at night or at the expense of college courses. He will not then feel the need of an apology for the profession of his choice. In brief, the college and its teaching staff in chemistry will have much to gain and nothing to lose by the adoption of a system of cooperation with industry in chemical research.

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THE DIGESTIBILITY OF THE BRANNY COATS OF WHEAT

THERE is one phase of the recurrent subject of the digestibility of flours containing more or less of the branny portion of wheat that has not been brought out in the dis-

cussion of recent digestion experiments on bran either by Holmes[1] or Snyder.[2]

It is a matter of regret that Holmes did not make, or at least did not publish, the proximate analysis of the bran used in his digestion experiments. The bran is merely described as "an ordinary commercial wheat bran secured in the open market."

For the purpose of this study then we may divide the wheat berry into three portions: The germ or embryo, the branny covering and the flour cells. The branny covering includes several outer and middle layers and the inner layer termed the aleurone layer. The aleurone layer or so-called gluten cells contains proteins apparently in higher amount than the outer layers, but the gluten cells do not possess the properties of, nor take part in the formation of gluten. Hence, although functionally the aleurone layer is a part of the endosperm and serves as a covering for the flour cells or so-called starch cells or floury portion, actually the physical property it possesses of close adherence to the outer coatings during the milling process, obliges us to consider it as simply one of the bran layers. Neither the bran coats nor the germ contains starch grains or those protein bodies which possess the same characteristics as the crude gluten obtained from the flour cells by the customary mechanical method of washing away the starch from a flour dough. Nevertheless commercial bran as obtained from all processes of milling at present employed contains considerable amounts of starch and gluten. The germ is, for the most part, recovered in the shorts or sometimes as a separate fairly pure product sold as "germ middlings." Bran manufactured by large well-equipped mills making use of the most improved bran dusting machinery is less "rich" than bran made by the average mill of smaller capacity. In other words, when the bran is closely "skinned" it contains less flour than "rich" bran. The flour present in bran exists both as loosely adhering but separate particles and unseparated masses of flour cells. No system of milling, however perfect, is at the present time capable of removing all the floury portions from the bran. Bran contains easily visible specks of flour, both free and adherent. Sometimes millers test the clean-up of their bran by rubbing it upon the coat sleeve or other piece of dark colored cloth. Commercial shorts contains still larger amounts of flour particles. White middlings, "red dog" and other "rich" feeds contain still more.

One of the tests which the cereal testing laboratory is frequently called upon to perform is the determination of the amount of flour present in bran, shorts and other by-products of flour milling. The method which we have generally used for this purpose is to determine the percentage of starch. On account of the presence in bran of considerable amounts of pentosans and other carbohydrates, the usual Sacchse method for starch determination is not applicable. The diastase method[3] is usually used for this purpose. Since wheat flour contains on the average about 70 per cent. of starch, the amount of floury material or potential flour present in a wheat by-product may be determined with a fair degree of accuracy by determining the amount of starch and multiplying by one hundred seventieths. Very few samples of bran have as low as 12 per cent. of flour. The average of some recent analyses of commercial brans gave 18.93 per cent. floury material. These may possibly not be representative, but the average amount of floury material in commercial bran will not be far from 15 per cent. and 30 per cent. floury material in commercial shorts is perhaps an average amount.

Consideration of the amounts of flour in average commercial bran will throw a little further light upon the subject of the digestibility of the branny coatings in the human stomach. Bearing in mind then the percentages of digestibility found by Holmes

[1] "Experiments on the Digestibility of Wheat Bran in a Diet without Wheat Flour," U. S. Department of Agriculture. Bulletin No. 751.

[2] Science, N. S., 50, August 8, 1919, pp. 130–132.

[3] U. S. Dept. of Agriculture, Bureau of Chemistry, Bulletin 107, p. 53.

with ordinary unground wheat bran, viz., for protein 28.0 per cent. and for carbohydrates 55.5 per cent. and the other quoted experiments on graham, whole wheat flours and straight flours where greater or less amounts of the branny coatings were present, it seems perfectly safe to assert that the digestibility of the combined branny coatings of the wheat berry is even lower than the figures quoted. If we may assume, for example, that average commercial bran contains 14 per cent. protein and consists of 15 per cent. flour cells and 85 per cent. branny coats and that average straight flour has 11.5 per cent. protein, 2.1 per cent. of the bran is flour protein and 11.9 per cent. bran protein. If it is fair to apply to the flour protein, the average coefficient of protein digestibility—90.9 per cent. found in white flour digestion experiments,[4] 1.91 per cent. of the bran is digested from the flour protein and since but 3.92 per cent. of the total protein is digested, the balance or 2.01 per cent. represents the digestible protein derived from the bran coats only. The digestibility of the protein of the branny covering of the wheat grain is therefore about 16.8 per cent.

In the absence of data on the digestibility of ground husks and pulverized nut shells, it is perhaps no exaggeration to assert that as far as the digestibility in the human stomach of the branny portion of the wheat grain is concerned, bran must be considered as not much more nutritious or desirable than pulverized nut shells would be.

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[4] Page 6, U. S. Dept. of Agriculture, Bulletin No. 751.

THE INTRODUCTORY COURSE IN ZOOLOGY

IT has been of especial interest to those of us in the University of Missouri who have taken part in the presentation of the introductory course in zoology to read the recent discussion in SCIENCE by Professor Bradley M. Davis[1] and Professor A. Franklin Shull,[2] because the type of course advocated by both is exactly the kind of elementary course that has been given here for nearly twenty years. It is, therefore, extremely gratifying to us to note the tendency that is beginning to manifest itself, as a result of the readjustment from war conditions, in respect to the introductory teaching of botany and zoology in our colleges and universities, and it is our earnest hope that it will not be long before the old type course will have been abandoned everywhere and its place taken by the more significant course based upon fundamental principles.

We have been attempting to do for a long time exactly what Professor Davis expresses as his hope for the future—"nothing more than the grounding of fundamental principles and a selection of information with rather definite reference to its general and practical interests, or its broad philosophical bearing," and Professor Shull's description of the first course in zoology, as it has been given in the University of Michigan for several years, applies in all essential respects to ours.

In no sense has our introductory course been one based upon the study of types, and never has it been dominated by anatomy. It has been our strong conviction that such a course fails utterly, from an educational point of view, in affording an adequate introduction to the study of zoological science. A thorough study of a single animal and studies in comparative morphology and in taxonomy belong, we have always held, to the more advanced and specialized courses designed for students who have an interest in the further pursuit of zoological knowledge, and not to the introductory course.

Long ago we recognized the obvious fact that the great majority of students who take our course in general zoology will receive no further biological training, and, therefore, our efforts have been directed toward giving it

[1] SCIENCE, N. S., Vol. 48, November 22, 1918, pp. 514–515.

[2] SCIENCE, N. S., Vol. 48, December 27, 1918, pp. 648–649.