change further. Probably the most important change which has and is taking place and which should be welcomed is that evolution theories are being removed from the realm of abstract speculations and placed on experimental and quantitative basis.

Among the concluding chapters of Lukin's book, that devoted to a consideration of the parallelism between the phenotypic and the genotypic variability is most interesting. It is well known that organisms frequently respond to environmental changes by adaptive phenotypic modifications; yet the same adaptive characters may be genotypically fixed in races normally living in the corresponding environments (see the above quoted example of the changes in the composition of the blood in low altitude and high altitude mammals). Adaptation may be attained either by development of a norm of reaction which responds favorably to the variety of external conditions in which the species usually occurs or else by development of a variety of genotypes with specialized norms of reaction fitting the different ecological niches. Lukin points out that the history of the species and its biology determine which one of these two methods of adaptation is more efficient. Genotypic specialization is preferable to phenotypic plasticity where an early appearance of an adaptive character in the ontogeny is desirable. For example, skin callosities may develop either as a response of the skin to pressure or as a genetically fixed character arising already in embryos without the stimulus of pressure. The former method exposes the animal to risks during the process of formation of callosities, while the latter protects it from the birth on. Phyletic advances are usually accompanied by genotypic specialization. According to Mashkovcev, the lung development in lower amphibians (axolotl) depends on the functional stimulus of respiration by air; in higher ones the lung development is partly (in frogs) or completely (toad) independent of functional stimuli.

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THE STUDY OF POLLEN IN PEAT

An Introduction to Pollen Analysis (*with a foreword by Roger P. Wodehouse*). By G. ERDTMAN. 239 pp., 28 plates, 3 portrait plates, 15 text figs., some multiple; new series Plant Science Books, vol. 12; Waltham, Mass.: Chronica Botanica Company; New York: G. E. Stechert and Company. 1943. $5.00.

THE well-known and much-admired Swedish botanist, G. Erdtman, here gives to the world a partial harvest of the many years that he has devoted to the study of pollen analysis. This branch of botanical-geological science stems from the resistance to decay of the cuticle of pollen grains, entrapped in the peaty deposits of swamps, or, to a large extent, in fine-grained muds, silts and sands deposited by various agencies. As peat bogs afford an almost perfect trap for pollen, the preserved pollen represents the pollen rains throughout the period of growth of the bog. Pollen analysis is the process of study of the stratigraphic distribution of pollen, its separation from decayed vegetable matter and mineral grains, its identification and the interpretation of results in terms of the environment of the bog throughout its history. The pollen of plants growing on or near the borders of the bog records the local conditions, whereas pollen of upland plants reflects the ecology of the general neighborhood and hence the climate of the time. In practice 150 grains of tree pollen are counted from each sample in a vertical peat section. Percentages of the tree pollen, omitting corylloid pollen, are calculated and plotted in a graph. Increase or decrease is considered much more significant than absolute percentage of any tree species. Opposite trends, as of spruce and of mixed hardwoods, are considered of the highest importance as indicating a pronounced change in the forest association and hence in climate.

The discovery of these relationships is a noble scientific accomplishment in which Swedish scientists have taken a leading part. Erdtman's historical account somewhat overemphasizes the accomplishments of his countrymen. Nevertheless, it is perhaps fair enough to say that the systematic attack on paleoclimatological problems by means of pollen analysis of bogs dates from von Post's paper of 1916 and is based largely on Lagerheim's techniques. Since 1916, activity in the field has been astonishing. Erdtman's useful biennial bibliographies record an average of 150 papers a year in Europe alone, with contributions from all over the world. The study of the Postglacial and Interglacial peats absorbs most of the workers, but the pollen of the Tropics and of Tertiary and Cretaceous coals, as well as the spores of Cretaceous and Carboniferous coals afford opportunities for researches of great botanical interest.

Erdtman's book is primarily a manual for botanists and contains chapters on the chemistry of peat by E. Erdtman, on field and laboratory methods for the collection and preservation of fresh and fossil pollen, on the identification of pollen and on methods of presenting an analysis. Important to botanists are six chapters devoted to the morphology and identification of pollen with elaborate references to the literature.

The discussion of the output and dissemination of pollen, the composition of pollen rains, the distance of transport and loss of pollen by decay is presented with ample references to the literature. Here is the heart of the subject, the area in which the greatest possible errors lie. Unfortunately the author is not so critical, dispassionate or comprehensive as might be desired. To one acquainted with the subject, his remarks are perhaps adequate, but proof of the assumption that the pollen analysis represents with sufficient accuracy the pollen rain is not clear-cut and convincing. The errors of sampling and treatment of samples are not sufficiently differentiated from errors arising from the imperfections of the pollen record. Perhaps these matters are reserved for a later book on the stratigraphy and paleoclimatology of bogs. Indeed, it may not be possible to discuss all these matters in so brief a space. The absence of a truly critical discussion will leave those whose interest is paleoclimatological and chronological disappointed.

As a manual for the practicing pollen analyst or as a text-book for the aspiring student, the book will find its greatest usefulness. We can be grateful to the editor and his volunteer assistants for successful solution of the problems involved in publishing a text with the author isolated by the war. Errors seem to be at a minimum, but redrawing of some of the illustrations would have been helpful.

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SPECIAL ARTICLES

CORN GERM: A VALUABLE PROTEIN FOOD

IN times of food stringency, such as are with us now and will stay with us until the havoc of war has subsided, the most economical use of available food supplies is imperative, and the introduction of new food materials should be welcome. Cowgill[1] has recently emphasized the importance of supplementing available foods by new or little-used foods, the nutritive value of which has been demonstrated by research precipitated by the war. This note calls attention to the value of corn germ as a potentially valuable protein food in human nutrition. The potential output of defatted corn germ, based on the crop yield of 1942, assuming a processing of 16 per cent. of the crop by dry milling and distilling,[2] and a yield of 7 per cent. of germ, has been estimated[3] at 1,000 million pounds per year.

The nutritive value of the proteins of the corn germ has not been studied by any method, in so far as the authors are aware. The potential availability of this food product in human nutrition warrants a better understanding of its nutritive properties. We therefore undertook a study of the digestibility and biological value of corn germ proteins, using the nitrogen balance method that has been developed in this laboratory.[4,5]

The sample of defatted corn germ tested[6] was solvent-extracted at low temperatures (less than 75° C.) and analyzed as follows: 93.06 per cent. dry matter, 2.94 per cent. ether extract, 4.18 per cent. crude fiber, 21.19 per cent. protein ($N \times 6.25$), and 25.6 micrograms of thiamine per gram. The biological value of the protein in this product was measured with a group of 10 young albino rats with initial weights of about 70 grams, and was compared, by a reversal system of feeding, with that of the proteins of beef round, dried and defatted at a low temperature. Both test foods were incorporated in an otherwise complete diet in such amounts as to provide approximately 10 per cent. of protein ($N \times 6.25$), of which nutrient the test foods

TABLE 1
THE UTILIZATION OF NITROGEN (PROTEIN) IN DEFATTED CORN GERM AND IN AUTOCLAVED SOYBEANS, IN COMPARISON WITH THAT OF THE NITROGEN OF BEEF ROUND

Utilization of corn germ nitrogen				
Rat No.	Coefficients of true digestibility		Biological value	
	Beef round	Defatted corn germ	Beef round	Defatted corn germ
229	100	87	77	84
231	100	84	77	78
233	100	82	74	83
235	100	87	72	80
237	99	79	73	66
230	100	90	77	80
232	100	77	86	79
234	99	87	79	79
236	99	89	77	72
238	100	88	77	75
Averages:	*99.7*	*85.0*	*76.9*	*77.6*

Utilization of soybean nitrogen				
Rat No.	Coefficients of true digestibility		Biological value	
	Beef round	Autoclaved soybeans	Beef round	Autoclaved soybeans
239	100	85	77	73
241	100	83	70	66
243	99	86	75	73
245	98	81	72	70
247	99	86	71	70
240	100	84	76	66
242	98	83	77	67
244	99	84	75	60
246	100	87	77	68
248	100	85	72	62
Averages:	*99.3*	*84.4*	*74.2*	*67.5*

[1] G. R. Cowgill, *American Scientist*, 31: 142, 1943.

[2] Corn germ made by the wet-milling process, due to leaching with water and contact with sulfurous acid, may not be highly valuable, either as a source of protein or of vitamins.

[3] This estimate was made by Ezra Levin, president of the VioBin Corporation, of Monticello, Ill., in a private communication.

[4] H. H. Mitchell, *Jour. Biol. Chem.*, 58: 873, 1924.

[5] H. H. Mitchell and G. G. Carman, *Jour. Biol. Chem.*, 68: 183, 1926.

[6] Obtained from the VioBin Corporation of Monticello, Ill., through the courtesy of Ezra Levin.