heating milk and the presence of pathogenic bacteria in butter and cheese.

Foreign sources have been drawn upon exhaustively, and complete bibliographies are listed at the end of each chapter.

Of special interest are the chapters dealing with the nutritive value of raw, boiled and dried milk in infant feeding. A strong case is made in favor of boiled milk, which will be a matter of gratification and confirmation to pediatricians who are championing this cause in America. The evidence for dried milk is not convincing, but in general is favorable.

The chapters on the production of milk and "Methods Commonly Used in Heating Milk" are disappointing. In the former we are surprised to learn that in England "there are no means for keeping milk cool during transit" and the author does not insist upon the need for this. So important a matter as the grading of milk is relegated to the appendix! Pasteurization is inadequately treated. The practise is exceptional in England, but this seems no excuse for not presenting a fuller discussion.

The text includes 348 pages and 8 plates. Non-technical summaries of each chapter precede the more detailed discussion, which is a great convenience to the reader. The book is a most valuable contribution to our literature on milk.

C. M. HILLIARD
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Fungoid and Insect Pests. By F. R. PETHERBRIDGE. Edited by MESSRS. T. B. WOOD and E. J. RUSSELL, under the Farm Institute Series, 1916. Pp. 174. Cambridge University Press.

This little book is well printed and well illustrated but is not extensive enough as to the number of diseases and pests discussed to justify the title. It can hardly serve as a very general reference for farmers and market gardeners as the authors have hoped. The life histories and remedial measures for some fungus and insect pests are taken up. As a short reading text or bulletin to familiarize the public with mycological methods and to indicate possible remedial measures for control of a few pests, it contains interesting matter.

In their introductory parts—1 and 2—the authors have not drawn as close distinctions as to what constitutes diseases as might be wished. It is now hardly allowable to teach that plant diseases may be caused by "unsuitable surroundings such as unfavorable conditions of soil or weather," nor have they made very clear the distinction between infectious diseases and the ravages of animal or insect pests. Note for example: "We have dealt with some of the plant diseases caused by fungi and will now turn our attention to those caused by members of the animal kingdom. By far the greater number of these diseases are due to the ravages of insects."

Insects are effective carriers of disease, but it is safe to say that there are few farmers who would think of the work of the cabbage-leaf butterfly, the wire worm, the army worm, the May beetle or of grain weevils as diseases.

The strongest feature, perhaps, consists in the suggestive statement of remedial measures associated with each disease or insect under consideration. The facts are, generally, well grouped, though in some cases the subjects of chapters and the text overlap, as in Chapters 2 and 3. On page 46 there is a particularly good photograph of common potato scab over the legend: "Figure 15. Potato Scab—the cause of which is not known." No other discussion is given upon this disease and thus the facts are not properly conveyed. Bearing further on the limited scope of the text, no mention is made of any diseases of small fruits or of orchard and shade trees and but slight attention is given to the commonest garden crops.

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SPECIAL ARTICLES

IS SPECIES-SPECIFICITY A MENDELIAN CHARACTER?

IN a recent book[1] the writer raised the question whether or not the phenomena described

[1] "The Organism as a Whole," G. P. Putnam's Sons, New York, 1916.

under the name of genus- or species-specificity are Mendelian in character. It is obvious that a definite answer to this question would be of fundamental importance for the problem of evolution. If species-specificity is not a Mendelian character, we are confronted with the possibility that Mendelian mutations may not have been the only essential factor in evolution.

The phenomena of species-specificity are, as far as we know at present, exclusively determined by the proteins. Phenomena of cytolysis by foreign blood or extracts of foreign tissues, the precipitin and the anaphylaxis reactions can apparently not be produced by any other constituent of an organism than the proteins; and the two or three exceptions reported to this general rule may have been due to impurities in the substances used for the experiments.

A decision of the question of heredity mentioned might be possible by comparing the species-specificity of a hybrid with that of the two parent forms. If it could be shown that the species-specificity of a F_1 hybrid is identical with that of only one of the two parents, no matter whether this parent is the paternal or maternal species, we might consider this an indication that species-specificity is Mendelian; if the species-specificity of a F_1 hybrid, however, is always identical with that of the maternal form, no matter from which of the two parent forms the mother is selected, it might indicate that the cytoplasm of the egg determines the inheritance of the species-specificity.

Experiments of this kind meet with the difficulty that only closely related species can be crossed successfully and in closely related species the differences in species-specificity are generally too uncertain to permit a definite conclusion. In the splendid work of Reichert and Brown on the "Differentiation and Specificity of Corresponding Proteins and other Vital Substances in Relation to Biological Classification and Organic Evolution,"[2] it has been shown that the corresponding hemoglobins of different species are not identical, and "that their peculiarities are of positive generic specificity and even much more sensitive in their differentiation than the precipitin test." In their book they describe the hemoglobin crystals of the horse and the mule, but not those of the donkey. It seemed of interest to make the series complete in order to find out whether or not the hemoglobins of the mule resemble more closely the maternal or paternal form. A decisive result in favor of a Mendelian origin of the specificity could only be had if the hemoglobin crystals of the F_1 hybrid were identical with those of only one of the two parent forms, otherwise the result would decide neither for nor against a Mendelian inheritance of species-specificity.

The writer obtained donkey blood, the hemoglobin crystals of which were prepared and analyzed by Professor A. P. Brown, of the department of mineralogy at the University of Pennsylvania, who was kind enough to communicate his results to me in a letter which with his permission I take the liberty of publishing here.

May 4, 1916

Dear Dr. Loeb: I suppose you have come to the conclusion that I have forgotten all about your samples of the donkey blood, containing no oxalate, which you so kindly sent me; but I have been working upon them as my time permitted and I think that I can now venture to state that in the orthorhombic [or what I have called the "α-oxyhemoglobin"] constant differences may be observed; and these indicate that in this substance the blood of the donkey more closely resembles the blood of the horse than it does that of the mule. I place more weight upon the results obtained from the *orthorhombic* crystals than upon those deduced from the *monoclinic* crystals for the reason that the monoclinic crystals obtained from all three bloods show a strong tendency to twin and these twins are what we call "mimetic twins." The name "mimetic" is applied to them because they mimic or imitate a higher grade of symmetry than they really possess. For instance, these monoclinic crystals approach in their angles those of the hexagonal system and are indeed what we call pseudo-hexagonal. For these somewhat plastic crystals, by the way they twin, average their asymmetries (*i. e.*, their departures from pseudo-hexagonal symmetry) until they become, in their angles,

[2] Carnegie Institution Publication, No. 116.

really hexagonal. The outline of the crystal plate then comes to be bounded by curved (not straight) lines which show the hexagonal angles at the place where this average adjustment is most perfect. This curving of the bounding outlines renders the measurements variable and these measurements I regard as untrustworthy. The true hexagonal angle is 60° or 120° and the pseudo-hexagonal (but really monoclinic) angle may be 123° or 124° or its supplement and the influence of this produces its curving. Examples of such curving outlines to these crystals produced by this sort of twinning may be seen in Reichert and Brown "Crystallography of Hemoglobin, etc.," on Plate 3, Figs. 14 and 18, and Plate 4, Fig. 19, and the "regular growth" of the methemoglobin (hexagonal) over the oxyhemoglobin crystals (monoclinic but pseudo-hexagonal) which sufficiently approaches the true hexagonal angles of the methemoglobin to enter into regular growth with this substance is illustrated on Plate 4 in Figs. 20–23 in the case of shad blood. It is this pseudo-symmetry which renders the measurements of such twinned crystals uncertain and inconstant. Fortunately this difficulty does not apply in the case of the orthorhombic crystals of the bloods under consideration, nor indeed in the case of the majority of orthorhombic crystals, although this tendency to mimetic twinning must always be borne in mind. I do not think it need be considered in the case of the orthorhombic crystals of either the donkey, horse or mule, which are the animals under consideration. But the measurements of the *monoclinic* crystals from the blood of these three animals are rendered uncertain and are made variable by this tendency to mimetic twinning. Therefore it is to the orthorhombic crystals that I must turn to formulate any conclusions as to the likenesses or the differences in these bloods. Fortunately in the unoxalated blood that you sent me the production of crystals is easy, and, while their measurement is not easy, I think that you may rely upon the results obtained; at least they are as reliable as I can make them with my present methods. The results from these orthorhombic crystals as compared with those of horse and mule are given below.

	Axial Ratio $a:b:c$	Prism Angle (Normals)	Macrodome Angle (Normals)
Horse.....	0.7467 : 1 : 0.4097	73° 30′	57° 30′
Donkey.....	0.7522 : 1 : 0.4144	73° 54′	57° 42′
Mule[3].....	0.7813 : 1 : 0.4198	76° 00′	56° 30′

[3] Donkey ♂ and horse ♀.

These measurements appear to indicate, as I said at first in this letter, that the crystals of "α-oxyhemoglobin" of the donkey approach more nearly those of the horse than they do those of the mule.

Very sincerely yours,

(Signed) AMOS P. BROWN

It is impossible to utilize these results for or against the idea that species-specificity is a Mendelian character. In view of the bearing on the problem of the inheritance of species-specificity the writer thought that even these negative results might be of some interest.

A further difficulty which besets the solution of this problem is that the terms species and genus are selected on a morphological basis and not according to the protein reactions involved in the phenomena of species-specificity.

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NEW YORK

THE AMERICAN PHYSICAL SOCIETY

THE eighty-sixth meeting of the American Physical Society was held at Columbia University, December 26–29, 1916. Sessions on Tuesday afternoon, Thursday forenoon and afternoon, and Friday forenoon and afternoon were joint sessions with Section B, American Association for the Advancement of Science, and were held at the School of Journalism. The two sessions on Wednesday were joint sessions with Sections B and C and were held in Havemeyer Hall. The following program of papers was presented:

A Proposed New Form of Seismograph. Herbert Bell.

The Velocity of Sound in Gases in Metal Tubes, as a Function of Density. Karl K. Darrow.

Measurements in Frictional Electricity. L. E. Woodman and N. R. French.

The Preparation of Metallic Mirrors, Transparent Metallic Prisms and Films by Distillation. Otto Stuhlman, Jr.

Our Part in the Advancement of World Physical Science. L. A. Bauer.

Some Experiments Concerning Magnet-Photography. L. A. Bauer and W. F. G. Swann.