The total budget of the College of Agriculture for 1929–30, exclusive of the above items, is $2,394,871.32, an increase of about $155,000 over the present year. Among the special allotments provided is $25,000 for an insectary at the Citrus Experiment Station.

THE University of Alabama School of Medicine announces the following appointments of new teachers for the coming year: Professor and head of the department of anatomy, Dr. Edward A. Boyden, formerly assistant professor of anatomy at Harvard University and professor at the University of Illinois; instructor in histology and embryology, Dr. Thomas E. Hunt, of the University of Chicago; instructor in gross and applied anatomy, Franklin S. DuBois, of the University of Illinois; research associate in anatomy, Dr. Eleanor L. Abrams, of the University of Chicago; instructor in pathology and bacteriology, Allan W. Blair, of the Pathological Institute of the Royal Victoria Hospital, McGill University, Montreal.

DR. PERCY WELLS COBB, of the Nela Park Research Laboratory, Cleveland, Ohio, has accepted an appointment as associate professor of biophysics in the department of ophthalmology at Washington University, Saint Louis. Dr. Cobb is now in Europe attending the International Congress of Ophthalmology in Amsterdam, as is also Dr. Charles Weiss, associate professor of experimental bacteriology in the same department.

DR. FRANCIS BAYARD CARTER, assistant in medicine, Yale University School of Medicine, New Haven, has been appointed head of the department of obstetrics and gynecology at the University of Virginia with rank as associate professor.

DR. JOHN WENDELL BAILEY, head of the department of biology at Mississippi College, has accepted a similar position at the University of Richmond, Virginia. Robert F. Smart has been appointed assistant professor of botany.

AT the University of Cambridge, Mr. F. H. Garner has been appointed university lecturer in agriculture, and Dr. A. S. Watt has been appointed university lecturer (Gurney lecturer) in forestry, both for three years.

M. ROMAN has been appointed professor of geology in the University of Lyons to succeed the late M. Depéret.

DISCUSSION

THE ORIGIN OF CHLOROPHYLL AND ITS RELATIONSHIP TO THE BLOOD PIGMENTS

NOACK has published another interesting paper on the origin of chlorophyll.[1] It is known that the formation of chlorophyll takes place, in most cases, only in the light, while in leaves that are grown and extracted in the dark a chlorophyll-like substance, protochlorophyll,[2] may be obtained. This is present only in very small amounts and exhibits a red fluorescence similar to that of chlorophyll.

Noack has been investigating the formation of chlorophyll from protochlorophyll, which he has obtained pure enough for many experimental purposes. Acid splits off magnesium from protochlorophyll, the same as it does from chlorophyll, to form another pigment which he calls protopheophytin, in analogy to pheophytin. By the introduction of magnesium, protopheophytin can be reconverted into protochlorophyll. Protopheophytin has a beautiful red color and Noack was quite certain that this compound belonged to a class of pigments that were already known. Investigation showed it to be quite similar to the pigment that is found in small amounts in the galls of animals that have been fed on green fodder. This pigment has been called phylloerythrin or bilipurpurin. It has been prepared in crystalline form from the galls of cattle. Preliminary investigations showed this pigment and protopheophytin to have essentially the same chemical constitution, although phylloerythrin produces no ester and has its acid group present in the form of an anhydride. By exercising special care the free acid could be split off by the use of weak alkalies. This acid showed a typical blood porphyrin spectrum and could be transformed into other anhydrous compounds. These compounds were spectroscopically identical with the compounds that have been obtained from protopheophytin. Also, by introducing magnesium into the phylloerythrin a green substance was obtained which had a spectrum almost identical with that of protochlorophyll. Thus, the chlorophyll that is contained in green fodder, when introduced into the animal body, can be transformed into a pigment which conversely may be considered as the first step in the formation of chlorophyll of plants. Having established this fact Noack then endeavored to ascertain the manner in which this transformation takes place. He sought to do this by starting out with chlorophyll, a compound whose identity has been established chemically. By mild reduction in acid solution, he succeeded in converting pure

[1] Kurt Noack, *Forschungen und Fortschriftte*, 5: 100–101, 1929.

[2] See SCIENCE, 68: 569, 1928.

preparations of chlorophyll and its separate modifications, a and b, into protopheophytin, pheophytin being formed as an intermediate step. Subsequent removal of the ester groups gave the same free acid that had been obtained from the phylloerythrin of galls. This acid gave the same spectrum as blood porphyrin. Anhydro-compounds were also obtainable from the free acid and these were identical in spectra and other properties with those formed from natural protopheophytin and phylloerythrin.

The chemical relation of chlorophyll to protochlorophyll thus has been cleared up by establishing that chlorophyll is an oxidation product of protochlorophyll. In addition the gap between the leaf and blood pigments has been bridged.

In the green plant this means that the photo-oxidation of protochlorophyll is the final step in the formation of chlorophyll.

An explanation can also be made of the rôle which iron plays in the formation of the green pigments, since it is well known that absence of iron is a cause of the chlorosis of leaves and since Noack had previously shown that the fluorescent organic pigments, including chlorophyll, possess a strong photo-oxidative action which is decidedly hastened by the presence of small amounts of iron.

Furthermore, this shows a noteworthy relationship between the chemical activity involved in the formation of chlorophyll and the function of chlorophyll, since Noack had in an earlier paper shown that the photo-oxidative action of chlorophyll is linked up somehow with the assimilation of carbon dioxide. This indicates that in the physiology of animals the formation of phylloerythrin from chlorophyll involves a reduction process. In addition, the spectroscopic agreement of cleaved phylloerythrin with the blood porphyrins lends definite support to the often disputed formation of blood pigment from chlorophyll. Hans Fischer has already pointed out the importance of phylloerythrin as a product formed biologically from chlorophyll.

This paper by Noack shows very clearly a relation between the green pigment found in leaves and the red pigment found in blood. It does not show just how the blood pigment is formed from chlorophyll. The paper is concerned with two problems very important in biochemistry. The first problem concerns the origin of chlorophyll. Showing that chlorophyll comes from protochlorophyll does not solve the problem. It will be solved only when we know how protochlorophyll is produced.

The other problem concerns the manner in which blood pigment is produced from chlorophyll. Is the relation a direct one or is chlorophyll broken down and then resynthesized as blood? These two important problems must sooner or later be solved by biochemists, as they are most fundamental in all plant and animal life.

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SIGNIFICANCE OF POST-ILLINOIAN, PRE-IOWAN LOESS

IN the May 24, 1929, issue of SCIENCE, Mr. Frank Leverett questioned the writer's correlation of the Loveland loess of western Iowa with post-Illinoian, pre-Iowan loess on Illinoian till in western Illinois and southeastern Iowa. Leverett stated that the probable correlation of the Loveland loess of western Iowa is with pre-Illinoian loess rather than with post-Illinoian loess; he considers the Loveland loess to be pre-Illinoian, pre-Iowan in age and not post-Illinoian, pre-Iowan in age as the Loveland has been interpreted to be by the writer. Leverett and the writer agree that the Loveland loess of western Iowa is post-Kansan gumbotil erosion, pre-Iowan in age; we differ as to whether it is the loess which underlies the Illinoian till or the loess which overlies the Illinoian till that is of the same age as the Loveland of western Iowa. Since the Loveland loess of western Iowa was deposited within the interval of time during which both the pre-Illinoian and post-Illinoian loesses were laid down in the Illinoian drift area, it may well be that although the Loveland loess appears to be a single formation, in reality its lower part may be pre-Illinoian in age and only its upper part post-Illinoian in age; and it may be that a part of the Loveland of western Iowa was deposited during the Illinoian glacial stage.

The purpose of this brief paper is to make clear that the post-Illinoian loess which the writer correlated with the Loveland loess of western Iowa would lose none of its significance as evidence in establishing the relative ages of the Iowan and Illinoian tills even if further investigations were to demonstrate that all or a part of the Loveland loess of western Iowa is pre-Illinoian rather than post-Illinoian in age.

There are two loesses on the Illinoian till, only the younger of which, the Peorian loess, is also on the Iowan till. The older loess is by no means a "nondescript deposit" found only in "a few places" as stated by Leverett. It has been mapped widely by members of the Illinois and Iowa Geological Surveys.

On the Iowan till the Peorian loess only is present. This loess has been shown by Calvin, Alden and Leighton, the writer and others to be genetically related to the Iowan till and to have been deposited very soon after the retreat of the Iowan ice-sheet. There is beneath the Iowan till in places a loess which resembles the older loess on the Illinoian till