sand seedlings, which range from two to three years in age, have been acclimatized at the State Forest Nursery near Clayton. They will be planted almost exclusively on publicly owned lands that their growth and condition may be checked closely. Settings will be made in orchard formation to assure a future supply of nuts if the trees thrive in their new environment.

DISCUSSION

CONSIDERATIONS LEADING TO THE VIEW THAT PELLAGRA IS AN IRON-DEFICIENCY DISEASE

THERE are so many facts recorded in the literature which tend to support the idea that iron deficiency occurs in pellagra that it seems curious that no one has suggested that the etiology of pellagra is in some way related to iron deficiency. At least the writer has not found such a reference.

Pellagra is practically unknown in very young infants (first year or two). In this connection it is interesting to note that children, puppies, kittens and rabbits are born with an iron concentration of about three times that found in adults. It is worthy of note that the young just mentioned get their first nourishment from milk which has a low iron content, while guinea-pigs, which feed like adults as soon as born, have no higher iron concentration than full-grown animals.

It is recorded that in the investigations of the Thompson-McFadden Pellagra Commission the disease was found to be more prevalent in women than in men—and particularly within the age limits of 19 to 44 years. Between these ages the menstrual cycle in woman causes her to lose 250 cc or more of blood each 28 days. Calculating the hemoglobin content of blood as 10 per cent. and iron as 0.335 per cent. of hemoglobin, the daily loss of iron by this route alone is 3.00 mg. Sherman estimates that such daily loss may average 3.0 mg. Unless the food eaten contains abundant iron this loss, in women certainly, operates to cause a depletion of the amount of iron in the body. Pellagra, in the United States, occurs almost wholly among the rural population of the Southern states, and is found chiefly among those whose economic status forces them to subsist upon a diet made up largely of corn bread and syrup—a diet low in iron. The low iron content of the diet of the women in the rural districts in the South, coupled with the regular losses of iron during menstruation, therefore, are in harmony with the view that the higher incidence of pellagra in women between the ages of 19 and 44 years is related to an iron deficiency. In connection with the foregoing it is also interesting to note that the symptoms of pellagra are usually ameliorated during pregnancy.

Largely as the result of the work of Goldberger and his associates it is generally believed that the heat-stable portion of vitamin B (called the P-P factor or vitamin G—after Goldberger) protects against pellagra. This work of Goldberger has made less of an impression upon clinicians and laboratory workers in the South who are in actual contact with the disease than might be inferred from its ready acceptance in standard texts to-day. Assuming, however, that there is such a "vitamin," its exceptional stability towards heat and its concentration by absorption on kaolin lend themselves suggestively to the idea that the active agent may, indeed, be iron.

Goldberger and his associates adopted the working hypothesis that black-tongue of dogs is the analogue of pellagra in man, and they found that diets which are effective in preventing pellagra in man are also effective in preventing black-tongue of dogs—and the same is said of the curative effects of those diets. Examination of the protocols published by Goldberger reveals the fact that those diets which prevented or cured black-tongue in dogs are just those to which had been added "syrup iodid of iron U.S.P.," and those diets which when fed to dogs produced black-tongue or failed to cure the disease are those to which no iron had been added. Apparently the iron was not added to or withheld from those diets with any intent to affect the balance of the element, because the footnote explains that it was added to "improve the mineral composition of the diet." They make no further mention of iron.

Further, it may be said that the foods which are supposed to contain liberal quantities of vitamin G (beef, liver, egg yolk, yeast) are all iron-containing foods (some of them being among those containing more iron than any other known biological product), while the pellagra-producing diet of poor farmers of the South (molasses and corn bread) is extremely poor in iron.

The anemia which is a very frequent concomitant of pellagra may be yet another finger pointing to an iron deficiency in pellagra.

The achlorhydria of pellagra would certainly promote a greater than normal alkalinity in the region of the duodenum, and the lessened solubility of iron salts in an alkaline medium would hinder their absorption—for it is known that it is there that iron is almost wholly absorbed.[1]

[1] A. B. Macallum, "On the Absorption of Iron in the Animal Body," *Journal of Physiology*, 16: 268, 1894.

Kollath,[2] working with rats, found that the administration of alkaline hematin served to prevent the symptoms which ordinarily supervene when the P–P factor or "vitamin G" is withheld from the diet. The above reasoning leads one to question whether or not it was the iron, so given, that conferred the benefit.

While none of the considerations here outlined prove that pellagra is an iron-deficiency disease, there is much plausibility to the view, and the writer has adopted the working hypothesis that pellagra is an iron-deficiency disease, and has set out to prove or disprove the thesis.

During the past summer the results of iron therapy have been studied in 51 cases of human pellagra. In severe cases, the iron was administered intravenously, and in milder cases it was given orally.

Although the clinical course of this disease is so variable that it is difficult to make a reliable prognosis in any single case, the results obtained are of a very encouraging nature. A more detailed report of these clinical studies will be published elsewhere.

Our studies included one series of dogs with black-tongue—believed by some to be the canine analogue of human pellagra. The animals were maintained on the Chittenden-Underhill diet of peas, cracker meal and cotton-seed oil. The dietary deficiency disease first described by the above-mentioned authors was produced in all its severity, and when the dogs in this condition received iron by the intravenous route, without any other alteration in the régime, they were restored to a normal appearance as judged by the disappearance of characteristic symptoms, return of appetite and an increase in body weight. These experiments are being repeated, extended and amplified, and will be reported in due course.

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SUPPLEMENTAL NOTE REGARDING MOSQUITO VECTORS OF EXPERIMENTAL YELLOW FEVER

IN a recent issue of this journal, the writer[1] summarized, in brief, attempts of several investigators to transmit experimental yellow fever through mosquitoes of various species. Shortly afterward abstracts of the work of Dr. Shüffner and his coworkers with *Aedes* (*Stegomyia*) *albopictus*[2] and of de Vogel with *"Stegomyia scutellaris"*[3] came to hand. As these mosquitoes are important semidomestic insects in the Far East, it seems of importance to call attention to these additional data. In biting experiments, the former authors report one fatal infection in ten rhesus monkeys tested, and de Vogel obtained only non-fatal infections in six monkeys, although a blood subinoculation from one of the latter produced death in another animal.

A point in taxonomy is raised in connection with the above two mosquitoes. On the basis of misidentified specimens, Theobald sank *A. scutellaris* into synonymy with *A. albopictus*. Both Edwards and Barraud have since corrected this mistake, placing *A. scutellaris* Walk. nec Theo. as a synonym of *A. variegatus* Bigot. Walker's type came from the Dutch East Indies, and the present distribution of *A. variegatus* is given as "Christmas Island, South of Java and many Pacific islands." *A. albopictus* occurs throughout the oriental region.

One would be inclined to conclude on the basis of the abstracts that two distinct species of mosquitoes were used by the above investigators, but I am informed that in his original article de Vogel treats the *"Stegomyia scutellaris"* with which he was working as synonymous with *A. albopictus*.

While the results of transmission experiments with *A. albopictus* do not indicate this species to be as favorable to the virus as the Javanese *A. aegypti*, which were also tested, or the West African *stegomyiae*, in our experience, yet incrimination of this ubiquitous oriental mosquito constitutes information of high potential value in prophylactic measures.

Taeniorhynchus (*Mansonioides*) *africanus* and *Aedes vittatus* are two important species incriminated by the writer in experimental yellow fever transmission which also occur in the Far East. With *A. aegypti*, the common host of that disease, and *T. uniformis*, an untested but very close relative to *T. africanus* which should be equally capable of acting as a host, also widely distributed in that region, one dreads to contemplate the appalling situation that would develop should the virus of yellow fever ever become established in East Africa and thence be spread into the vast, densely populated Orient.[4]

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[2] W. Kollath, "Water-soluble Vitamins and Their Relation to Each Other" (abstract), *Chemical Abstracts*, 24: 1887, 1930.

[1] C. B. Philip, SCIENCE, 71: 614–615, June 13, 1930.

[2] J. E. Dinger, W. A. P. Schüffner, E. P. Snidjers and N. H. Swellengrebel, *Nederl. Tijdschr. v. Geneesk.*, December, 1929, No. 51, pp. 5982–91.

[3] W. de Vogel, *Bull. Office Internat. d'Hyg. Publique*, February, 1930, 22: 282–286. Abstracts in *Trop. Dis. Bull.*, 27: 486–487, June, 1930.

[4] The writer is indebted to Dr. C. E. Mickel and Mr. W. B. Owen, of the University of Minnesota, and to Dr. H. W. Kumm, of the Rockefeller Foundation, for references in connection with the systematic points referred to above.