which pure cysteine undergoes. The fact that small amounts of iron or copper salts accelerate the oxidation of cysteine by air does not at all prove that a slow oxidation can not take place in their absence. Nor is there reason to suppose that copper and iron and possibly manganese are the only elements having the power of combining spontaneously with oxygen when in a pure state; but on the contrary the evidence is that carbon, sulfur, silicon and a great number of other elements have these same powers. The fact, if it be such, that pyrophosphate fails to check cysteine oxidation and also fails to prevent the catalytic action of copper on the oxidation does not at all prove that therefore the oxidation of cysteine is due to traces of copper. Such a conclusion is a *non-sequitur*. All that it shows is that pyrophosphate is inert in effecting the oxidation, whether catalyzed by copper or not.

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THE IRON-DEFICIENCY HYPOTHESIS IN PELLAGRA

IT is not desired to further the controversy between Bliss[1] and Halliday[2] regarding the soundness of the hypothesis presented by Bliss that pellagra is an iron-deficiency disease, nor to enter into a discussion of the nature of the specific food factor concerned in pellagra. However, since Bliss' position is largely based upon an erroneous interpretation of the more recent literature, a correct presentation of the facts may, at least, serve to forestall misplaced confidence in iron therapy in the treatment of pellagra.

In presenting his hypothesis, Bliss[3] fails to make available sufficient working details of his own observations, depending upon his appraisal of the literature, chiefly the work of Goldberger and his associates, for its support. The following is presented as the keynote of his argument:

> "Goldberger and his associates adopted the working hypothesis that blacktongue 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 blacktongue 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 blacktongue 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 blacktongue 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."

The least that can be said of the above is that it is erroneous and misleading, and may be dismissed once and for all by the statement that at no time was syrup iodid of iron used by Goldberger and his associates in their studies in dogs, and no mention is made of it in any of their reports on blacktongue. It is, however, fair to state that the experimental basal diet used in the human studies at Milledgeville, Georgia, contained this substance, but it was a constant basic factor in all diets used, regardless of whether pellagra was or was not prevented.

Bliss also cites the fact that while beef, liver and yeast have been found to rate high as blacktongue and pellagra preventives, they are also rich in iron. However, he makes the mistake of including egg yolk in this group. Although very rich in iron, this substance made such a poor showing as a blacktongue preventive[4] that its test in human pellagra was not considered worth while. Milk[5] and tomato juice,[6] which, though poor in iron, were found to be pellagra preventive, are left out of consideration; and wheat and cowpeas,[7] which, like egg yolk, are high in iron but low in the pellagra preventive factor, are not mentioned. He also overlooked the fact that while yeast itself was found to be a rich source of this protective factor, its dried watery extract[8] was even better, and its charred form,[9] which retains all the iron, was entirely devoid of it. It would therefore seem that in formulating his iron deficiency theory, Dr. Bliss either overlooked the nullifying nature of the very facts by which he attempts to support it or failed to grasp their significance.

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[1] S. Bliss, "The Iron-Deficiency Hypothesis in Pellagra," SCIENCE, 75: 266, March 4, 1932.
[2] N. Halliday, "The Lack of Correlation between Anemia and the Pellagra-like Symptoms in Rats," SCIENCE, 74: 312, September 25, 1931.
[3] S. Bliss, "Considerations Leading to the View that Pellagra is an Iron-Deficiency Disease," SCIENCE, 72: 577, December 5, 1930.
[4] Goldberger and others, U. S. Pub. Health Rep., Vol. 43, No. 23, Wash., D. C., June 8, 1928 (Reprint 1231).
[5] Goldberger and others, U. S. Pub. Health Rep., Vol. 39, No. 3, Wash., D. C., January 18, 1924 (Reprint 895).
[6] Goldberger and others, U. S. Pub. Health Rep., Vol. 42, No. 19, Wash., D. C., May 13, 1927 (Reprint 1157).
[7] Goldberger and others, U. S. Pub. Health Rep., Vol. 43, No. 23, Wash., D. C., June 8, 1928 (Reprint 1231).
[8] Goldberger and others, U. S. Pub. Health Rep., Vol. 41, No. 8, Wash., D. C., February 19, 1926 (Reprint 1062).
[9] Goldberger and others, U. S. Pub. Health Rep., Vol. 43, No. 12, Wash., D. C., March 23, 1928 (Reprint 1216).