resulted in a preparation which had lost practically all of its power.

On testing the freshly cut surface with guaiacum solution no blue color was developed excepting rather faintly around the core.

While it is appreciated that the work as it now stands is incomplete and requires further confirmation and study, the termination of the fruit season has brought it to a close for the present and it was thought that the results obtained thus far would justify a preliminary report. It is proposed to continue the study during the coming season, when it is believed much more striking results will be obtained from the immature fruit. The present work has been done on fruit that was practically mature but there are indications that the enzyme is much more active in green fruit.

From the results now at hand we believe that the following conclusions can be drawn at least tentatively:

1. That there is present in fruits, in general, an oxidizing enzyme capable of producing a tannin-like substance having the power to precipitate protein nitrogen.

2. That this enzyme is active only in slightly acid solutions and when the concentration is above a certain minimum.

3. That this tannin-like substance or substances does not exist in the normal fruit on the tree but is rapidly formed on injury or removal of the fruit from the tree.

4. That the function of this substance or substances is to inhibit fungus and bacterial growths on injury of the fruits, in part, probably, by the conversion of the protein into an insoluble form and in part by the germicidal action of the substance itself.

It should also be stated that there are indications of another enzyme in the calcium carbonate precipitate, which is very active in liberating oxygen from hydrogen peroxide and is believed to be of the nature of a catalase. However, there has not yet been opportunity for the thorough study of this phase of the question.

We desire to express our thanks to Dr. C. F. Dawson, of this Station, who kindly prepared the cultures and offered valuable suggestions during the progress of the work.

DELAWARE COLLEGE AGRICULTURAL EXPERIMENT STATION.

[FROM THE STORRS AGRICULTURAL EXPERIMENT STATION.]

THE OCCURRENCE OF TYROSINE CRYSTALS IN ROQUEFORT CHEESE.

BY ARTHUR W. DOX.

Received January 10, 1911.

While engaged in some coöperative investigations looking toward the introduction of foreign methods of cheese manufacture into this

country, the writer had occasion to examin many specimens of Roquefort. This variety of cheese belongs to the same general class as the Stilton and Gorgonzola types, but differs from these in the fact that it is made entirely of sheep's milk. It is characterized by its open, porous texture which permits the growth of a green mold, *Penicillium roqueforti*, through the entire mass, and the development of a peculiar pungent flavor so much admired by the connoisseur.

In the numerous cracks and crevices of this cheese, small white specks were almost invariably observed. These were especially noticeable where the air space was lined with mold, thus forming a green background. They varied in size from minute specks hardly visible to the eye to spherules the sized of a pinhead. Three possible explanations of their origin suggested themselves. It was first thought that they might consist of free fatty acids, since mold is known to possess considerable lipolytic power. Then again they might be insoluble soaps formed from the union of higher fatty acids with calcium, and lastly they might be some insoluble product of proteolysis, such as tyrosine.

With the view of determining the nature and origin of these white concretions, a number of them were laboriously picked out from a cheese in which they were particularly large and abundant, and carefully freed from the matrix of cheese. Heated on a platinum foil, they charred without melting and finally burned leaving no residue. They could therefore be neither fatty acids nor calcium soaps. They dissolved quite readily in dilute alkalies. The solution gave no biuret test but a strong Millon reaction and also Piria's test. These tests indicate a substance having a phenol group. On recrystallizing the substance from dilute ammonia water, a crystallin mass was obtained, which under the microscope was easily identified as tyrosine, from the characteristic wavy appearance of the crystals and their arrangement in bundles constricted in the middle. After purification in this way the reaction with Millon's reagent was stronger than before. Owing to the difficulty of separating these concretions from the cheese only a few centigrams were obtained—not enough for purification and analysis. Tyrosine, however, is so characteristic a substance that the above tests are sufficient for its identification. The crystals occurring in the cheese probably contain a considerable admixture of leucine.

Although white specks of this description are abundant in Roquefort, they are seldom encountered in other varieties of cheese. Van Slyke and Publow[1] note the occurrence of white specks in certain specimens of Cheddar cheese that had been ripened below the freezing point of water. They did not positively identify the material, but are inclined

[1] *Science and Practice of Cheese Making*, 1909, 332.

toward the belief that the substance is a calcium soap, formed from fatty acids derived from the fat and the calcium salts of the cheese.

The occurrence of tyrosine in cheese is not a new observation. In Cheddar cheese it has been found by Van Slyke and Hart;[1] in Roquefort cheese by Sieber;[2] in Emmenthal cheese by Weidmann,[3] by Benecke and Schulze,[4] by Röse and Schulze,[5] by Winterstein and Thöny,[6] and in Camembert cheese by the writer.[7] In no case, however, has it been observed in the form of crystals. The peculiarity of Roquefort in this regard may be accounted for by the greater abundance of tyrosine formed and the more favorable opportunity presented for its crystallization along crevices where there is more or less circulation of air. In Swiss and Cheddar cheese tyrosine is less abundant and sometimes occurs only in traces. In both of these varieties, a decomposition product of tyrosine, *p*-hydroxyphenylethylamine, has been found. This substance results from a simple loss of carbon dioxide from the carboxyl group, a type of reaction brought about by many species of bacteria. Although *p*-hydroxyphenylethylamine has not yet been sought for in Roquefort cheese, we know that the high salt content of this variety (4 per cent. or more) very materially reduces the growth of this type of bacteria, and the tyrosine liberated by the proteolytic enzyme of the mold would be left to accumulate in the substratum until crystallization ensued.

[From the Laboratory of Physiological Chemistry of the University of Illinois.]

FASTING STUDIES: II. ON THE CATALASE CONTENT OF TISSUES AND ORGANS AFTER PROLONGED FASTING.

By P. B. Hawk.

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The catalytic power of pathological tissues has been studied by several investigators. For example, Jolles and Oppenheim[8] found that the blood of patients suffering from carcinoma, nephritis or tuberculosis possessed decreased catalytic power. Later it was shown by Blumenthal and Brahn[9] that secondary cancer nodules of the liver showed far less catalytic activity than normal liver tissue and, furthermore, that the liver tissue between the nodules was less active than normal liver tissue

[1] New York Agric. Expt. Sta. *Bull.* 231, 26.
[2] *J. prakt. Chem. N. F.*, 31, 203.
[3] *Landw. Jahrb.*, 11, 592.
[4] *Ibid.*, 16, 321.
[5] *Landw. Vers. Sta.*, 31, 119.
[6] *Z. physiol. Chem.*, 36, 29.
[7] Bureau of Animal Industry, *Bull.* 109, 20.
[8] *Münch. med. Wochschr.*, 1904, 47.
[9] *Z. Krebsforschung*, 8, 436.