amounts, but it is likely that the proteid directly connected with glycocoll will be found to be highly melassigenic.

We have been in the habit of associating the so-called gums or viscous bodies in cane juice with the cellulose or non-nitrogenous constituents of the plant, but we may have to modify this view in the presence of a gelatin-yielding proteid peculiar to sugar-cane and allied plants.

LABORATORY OF KOHALA SUGAR CO.,
KOHALA, HAWAII, H. I.

[CONTRIBUTIONS FROM THE CHEMICAL LABORATORY OF THE CASE SCHOOL OF APPLIED SCIENCE.]

XXIX.—THE INFLUENCE OF ANTISEPTICS ON THE DIGESTION OF BLOOD FIBRIN BY PEPSIN IN A HYDROCHLORIC ACID SOLUTION.[1]

BY CHARLES F. MABERY AND LEO GOLDSMITH.

Received September 27, 1897.

WHILE it may be difficult to perform experiments on artificial digestion under conditions that approximate those of natural digestion in the body, it is possible to determine the influence of substances that exert a retarding influence on the normal chemical reactions which involve the solution of fibrin or albumin by pepsin in an acid solution. The retardation by certain artificial colors, oroline yellow, saffoline, and magenta, was studied by Weber,[2] and the influence of alcohol in different proportions, and other bodies by Chittenden and Mendel.

In a recent number of this Journal,[3] Frank D. Simons gave an account of results which he had obtained in studying the action on the digestive ferments of salicylic acid, formol, several dyestuffs and essential oils.

In view of the stringent food laws that are everywhere recognized as necessary for the protection of the health and pecuniary interest of the consumer, the influence of adulterations commonly found in foodstuffs and in prepared foods should be well understood.

[1] The experiments described in this paper were made at my suggestion by Mr. Goldsmith, and they formed the subject of his thesis for the degree of Bachelor of Science. The paper was read at the meeting of the Cleveland Chemical Society, June, 1897. C. F. M.

[2] This Journal, 18, 1092.

[3] *Ibid*, 19, 744.

The results presented in this paper were obtained with alum, salicylic acid, boric acid, and formaline. The material used for digestion was blood fibrin separated by agitation in the ordinary way from fresh blood as soon as it was drawn from the steers. It was carefully separated into shreds as nearly as possible of uniform size and preserved in alcohol. For use it was thoroughly washed with water, spread out in thin layers on a glass plate, and dried at 100°. The digestive ferment was a scale pepsin, marked 1 : 3000, prepared by Armour & Co., of Chicago. In each of the following experiments twenty millimeters of pepsin was allowed to act in 100 cc. of a solution containing two-tenths of one per cent. of hydrochloric acid, on one gram of fibrin prepared as described above. The action was allowed to proceed for a definite time in a water-bath at 38°–40°, and the fibrin remaining after the experiment was stopped was removed by filtration, washed, dried at 100°, and weighed either on a Gooch filter or on a weighed paper filter. In every series of experiments the results were controlled by duplicate trials under the same conditions without the antiseptic.

EXPERIMENTS WITH ALUM.

First Series. Time 4 Hours.

Weight alum. Grams.	Weight undigested fibrin. Grams.	Per cent. digested fibrin.
0.00	0.0	100.00
0.00	0.0	100.00
0.01	0.0	100.00
0.01	0.0013	99.87
0.05	0.0132	98.68
0.05	0.0143	98.57
0.10	0.0150	98.50
0.10	0.0103	98.37
0.50	0.0979	90.21
0.50	0.0964	91.36
1.00	0.1196	89.04
1.00	0.1538	84.62
5.00	0.7017	29.83
5.00	0.7185	28.15

Second Series. Time 6 Hours.

0.00	0.00	100.00
0.00	0.0062	99.38
0.01	0.0102	98.98
0.01	0.0117	98.93
0.05	0.0155	98.45
0.05	0.0205	97.95
0.10	0.0162	98.38
0.10	0.0288	97.12
0.50	0.0600	94.00
0.50	0.0619	93.81
1.00	0.0813	91.87
1.00	0.0876	91.44

Third Series. Time 4 Hours.

0.00	0.0060	99.31
0.00	0.0070	99.30
0.00	0.0037	99.63
0.01	0.0103	98.97
0.01	0.0980	99.02
0.05	0.0235	97.65
0.05	0.0203	97.97
0.10	0.0349	96.51
0.10	0.0355	96.45
0.50	0.0798	92.02
0.50	0.0800	92.00
1.00	0.1780	82.40
1.00	0.1785	82.15
2.50	0.3472	65.28
2.50	0.3642	63.58

Fourth Series. Time 3 4-5 Hours.

0.00	0.0016	99.84
0.00	0.0025	99.75
0.00	0.0025	99.75
0.01	0.0031	99.69
0.01	0.0037	99.62
0.05	0.0070	99.30
0.05	0.0088	99.12
0.10	0.0247	99.53
0.10	0.0236	99.64
0.5	0.0810	97.90
0.5	0.0795	97.05
1.0	0.1797	91.03
1.0	0.1805	92.95
5.0	0.6094	82.06
5.0	0.6087	39.13

Fifth Series. Time 3 Hours.

0.0	0.0054	99.46
0.0	0.0063	99.37
0.02	0.0205	97.95
0.02	0.0192	98.02
0.10	0.0308	96.92
0.10	0.0345	96.55
0.20	0.0864	91.38
0.20	0.0755	92.45
1.00	0.7657	23.43
1.00	0.7540	24.60

In this last experiment equal weights of alum and sodium bicarbonate were used, and the weights are the weights of the mixtures.

The influence of the alum in retarding the digestive action of pepsin is clearly demonstrated by these results. Even with such small amounts as 0.01 gram, the influence is apparent, and it increases regularly and rapidly with larger proportions of alum. The duration of the experiment evidently affects the proportion of fibrin dissolved. In the fifth series the mixture of alum and sodium bicarbonate should reduce the acidity of the solution, thereby interfering with the normal condition of the digestive action.

For the purpose of testing the influence of alum under conditions of actual practice, two loaves of bread were prepared with the same weight of flour in each, one with alum baking powder containing alum, one part, sodium bicarbonate, one part, starch, one part; the other with a cream of tartar baking powder, composed of cream of tartar, two parts, sodium bicarbonate, one part, starch, one part. From the loaf after baking, the weight of alum was calculated. In each experiment sixty grams of bread were used, containing 0.75 gram of alum, or 1.5 grams cream of tartar, and in each trial the digestion was continued fifteen hours.

Kind of bread.	Weight bread undigested. Grams.	Weight bread digested. Per cent.
Alum	30.78	48.70
Alum	29.85	50.25
Cream of tartar	22.34	62.76
Cream of tartar	23.28	60.12

From these results it is evident that alum has an appreciable effect upon the proportion of bread digested.

A series of experiments was made to ascertain the effect of salicylic acid on the function of digestion. But on account of the small solubility of the acid, the action could not be tried with larger quantities than two-tenths gram of the acid. With this quantity an appreciable retardation is indicated. The proportions and conditions of the experiments were the same as those of the preceding experiments with alum.

Weight salicylic acid. Gram.	Weight undigested fibrin. Gram.	Digested fibrin. Per cent.
0.0	0.0276	97.23
0.0	0.0384	96.16
0.05	0.0484	95.16
0.05	0.0317	96.83
0.20	0.0671	92.29
0.20	0.0635	92.65

EXPERIMENTS WITH BORIC ACID.

Boric acid seems to exert an influence on the rate of change, but the proportion of acid does not seem to be essential. In the following series of experiments the times of filtration were somewhat irregular, and the first three tests which were intended as a means of control, were not altogether satisfactory :

Weight boric acid. Gram.	Weight undigested fibrin. Gram.	Digested fibrin. Per cent.
0.0	0.0393	96.07
0.0	0.0290	97.10
0.0	0.0155	98.45
0.05	0.0718	92.82
0.05	0.0754	92.46
0.10	0.0447	95.53
0.10	0.0504	94.46
0.30	0.0620	93.80
0.30	0.0380	96.20

EXPERIMENTS WITH FORMALINE.

The influence of formaline seems to be more marked than that of boric acid. In general the action is greater with the increase in weight of the antiseptic :

Weight formaline. Gram.	Weight undigested fibrin. Gram.	Digested fibrin. Per cent.
0.00	0.0393	96.07
0.00	0.0290	97.10
0.00	0.0155	98.45
0.05	0.0585	94.15
0.05	0.0413	95.87
0.10	0.0905	90.95
0.10	0.0752	92.48
0.30	0.1101	80.99
0.30	0.1045	89.55

While all the substances tested in these experiments show some influence on the digestive action of pepsin, only alum exhibits a marked effect. Although it is not possible, on account of the complex conditions existing in the stomach, to draw any conclusions from these results on what should take place in natural digestion, it would seem possible to conduct series of experiments on digestion within the stomach, introducing into the food suitable proportions of the antiseptics, and to determine the effects on the blood, and in other directions within the system. But such experiments are within the domain of physiological chemistry.

REVIEW.

SOME RECORDS OF RECENT PROGRESS IN INDUSTRIAL CHEMISTRY.

During very recent years, progress in industrial chemistry, as in practically every field of human activity, has been peculiarly marked. Competition between manufacturers, depression in trade and commerce from various causes, the opening of new channels of consumption, have all done their share to establish that necessity, which from all time, has been such a vigorous stimulant to investigation and invention, and the results, as a rule, have been proportional to the needs presented. It is apparent in the advances being made that there is an increasing recognition of the value of rational over empirical work and of the effort of carefully educated men over that of men who, ignorant of the cardinal and fundamental principles of the processes they control, grope darkly after the ends they would attain. And so for us here, and at the present time one of the most important signs of progress is to be found in the increasing and exacting interest being manifested in all the leading manufacturing countries of the world in the education of technologists, and the im-