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The mechanical destruction of pepsin.

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At various times since 1884, one of us (M.) has studied the effects of shaking upon living cells, such as red blood corpuscles, bacteria, and arbacia eggs. Those experiments led to the general conclusion that shaking, by virtue of the mechanical factor, exerts a profound influence upon living organisms. In the present series of experiments we intend to investigate the changes which shaking may produce in the action of ferments. We began with the study of pepsin, the determination of which is greatly facilitated by several recently described reactions.

Solutions of pepsin, partly filling long bottles, were shaken at room temperature and at a temperature of 33° C. for periods of different lengths, by means of shaking machines. Our results which we state here very briefly are unmistakable. Shaking under these conditions destroys pepsin. Even short periods greatly diminish its strength. If shaken long enough it is completely destroyed. The temperature has a marked influence upon the rate of destruction. Higher temperatures hasten the destruction.

That the effect is not due to oxidation was proved by substituting for the air in the bottles, hydrogen, carbon dioxide or oxygen. There was no appreciable difference in the results.

It was also shown experimentally that the destruction was not brought about by any rise of temperature caused by the shaking. Maximum thermometers were fixed in the bottles perpendicular to their long axes, that is, perpendicular to the direction of shaking: in no case did the thermometer inside register as much as a degree higher than the thermometer outside.

We have also found that the degree of shaking which occurs in the animal body is sufficient to reduce the activity of pepsin. This was determined by introducing a small bottle containing a solution of pepsin into a dog's stomach through an esophageal fistula and permitting it to remain there for 24 hours or longer. The pepsin strength was diminished as much as 40 per cent. com-

pared with that of the pepsin in a similar bottle kept in the thermostat at a temperature of 39° C.

The reported results were demonstrated by the reactions for pepsin of Jacoby and Solms, of Fuld, and of Gross.

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A demonstration of the effects of CO_2 upon the frog's pupil.

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Frogs placed in an atmosphere of CO_2 gas show within thirty seconds, before any symptoms of excitement, a good constriction of the pupil. This constriction becomes almost maximal within five minutes; there is no dilatation.

The same effect is exerted by CO_2 gas upon excised frog's bulbi.

When the frog's iris, in the excised bulbus or in the living animal, is under the influence of CO_2 gas, the powerful mydriatic effect of adrenalin is strongly reduced.

Since CO_2 produces this myotic action upon excised bulbi, its effect must be exerted, largely at least, upon the sphincter pupillæ, that is, its action is peripheral. These experiments, however, do not exclude a possible central action.

This myotic effect of asphyxia in frogs is interesting, as asphyxia in mammals produces chiefly dilatation.

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On the specific acquired resistance of red blood cells.

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It is a well known fact that the serum plays a preponderating rôle in the immune reactions of animals. On the other hand, it has been amply shown that the immune characters of the serum