antigen was given by mouth. This was repeated each morning for 3 consecutive doses in each series.

Blood was taken from subjects before experiments were started. All showing the presence of agglutinins against typhoid antigen were eliminated. Three weeks after the oral ingestion of the antigen, blood was again drawn and the agglutination tests performed upon the serum. The accompanying table gives the results.

TABLE I.

Typhoid Vaccine		Bacteriophage Dissolved *B. typhosus*	
Number of Cases	Dilution	Number of Cases	Dilution
4	negative	15	1:40
2	1:20	27	1:80
8	1:40	15	1:160
10	1:80	4	1:320

Bile was given before the oral administration. Arnold[1] explained the influence of bile upon permeability of the intestinal tract in the light of his experimental work. The results reported here seem to show that dissolved *B. typhosus* proteins are more efficient than standard typhoid vaccine for oral immunization.

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Susceptibility of Rodents to Gastro-Intestinal Infections.

IRVING KAUFMAN. (Introduced by Lloyd Arnold.)

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Kisskalt[1] found that the susceptibility of mice to enteritides infections was increased after the administration of saponin. He concluded that this was due to the lowering of surface tension and increasing the spaces between the cells lining the mucosa. We have investigated this problem from the viewpoint advocated by Arnold.[2]

Half-grown mice were given 0.1 cc. of a 20% aqueous solution of saponin by stomach tube. The animals were killed at various time intervals and the bacterial flora and hydrogen-ion concentration of the contents of the stomach, duodenum and jejunum were

[1] Arnold, L., *J. Hygiene*, 1929, **29**, 82.

[1] Kisskalt, K., *Arch. F. Hyg.*, 1929, **101**, 205.

[2] Arnold, L., *J. Hyg.*, 1929, **29**, 82.

determined. The time intervals varied from 15 minutes to 12 hours. There were 180 mice used in the experiment recorded in the accompanying graph. The graph illustrates the changes produced within a 6-hour period of time after the introduction of saponin. There was little variation found in the 20 mice used for each time interval experiment. There is a sudden change in the hydrogen-ion concentration and the bacterial flora following intragastric application of saponin.

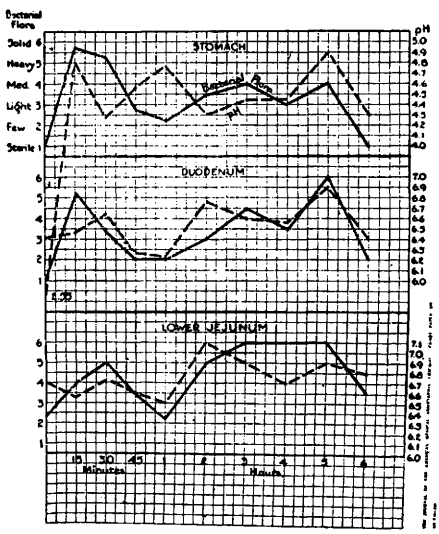

FIG. 1.

Hydrogen-ion concentration and relative density of bacterial flora in stomach, duodenum and lower jejunum of mice after oral administration of saponin.

Ordinate represents time at indicated intervals after ingestion of saponin.

Abscissa on left margin represents relative density of bacterial flora. Solid line illustrates the bacterial flora within the various segments in relation to time as indicated in ordinate.

Abscissa on right margin represents H-ion concentration of the contents of segments of alimentary tract after saponin ingestion.

Organ cultures after the introduction of saponin in the stomach accompanied by a dose of *B. enteritides* show a widespread distribution of this organism within the body of the animal. When the same dose of bacteria is introduced without saponin the organs were found to be sterile after the same period of time. The increased susceptibility observed by Kisskalt,[1] seems to be intimately associated with certain demonstrable changes in the bacterial flora and acid-base equilibrium of the stomach and small intestine. The changes within the intragastric and intestinal contents have been shown to take place as a result of certain alterations in environment of the animal (Arnold[2]). Saponin causes a sudden alteration in

the acid-base equilibrium and in the bacterial flora of the contents of the stomach and small intestine.

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Changes in Respirations Produced by Surgical Operations.

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Reduction of vital capacity and elevation and decreased excursions of the diaphragm are significant alterations of the respiratory function known to follow certain surgical operations, notably those on the abdomen. The hypoventilation[1] resulting from the postoperative embarrassment of respiration has been regarded as a factor leading to the development of atelectasis and pneumonia.

To obtain data regarding changes of the separate components of respiration, pneumograph tracings were made before and after operation on a series of hospital patients. The method employed was a modification of that described by Greisheimer[2] in which rubber bags (from sphygmomanometers) were fitted into covers of sufficient length to encircle the body of the patient. One tube was attached to a bulb for the inflation of the bag; the other tube was connected by pressure tubing to a water manometer. One bag was placed about the thorax as high as possible, another around the abdomen below the costal margins. In this manner thoracic (intercostal) and abdominal (diaphragmatic) respirations were recorded synchronously on a smoked surface. In order to make conditions of the experiment uniform, all tracings were taken with the patient in the supine position and with such a pressure in the inflated bag that at expiration the pointer was 2 cm. above the base line. Observations were made on 58 patients, having operations in various anatomical regions as follows: upper abdomen, 19; lower abdomen, 21; thyroid, 9; thorax 5 (4 thoracoplasties); perineum or extremities, 4. The observations reported here are based on more than 200 tracings.

Results. In the following tables, the maximum, minimum, mean and median changes in rate of respiration and depth of thoracic and

[1] Müller, G. P., Overholt, R. H., Pendergrass, E. P., *Arch. Surg.*, 1929, **19**, 1322.

[2] Greisheimer, E., *Minn. Med.*, 1925, **8**, 387.