sudden accidental death are interesting. His analyses showed ratios of 10 and 40 respectively and the total bile acids were 8.2% and 8.7%, approximately 16 times as high as the average of our operative cases.

It is further very interesting to note that in several of our specimens the bile contained a large amount of cholesterol crystals and those cases had little or no bile acid in the bile. This was true not only in 2 cases with little or no pigment in the bile as a result of long cystic duct obstruction, but in another bile which appeared absolutely normal grossly except for the presence of cholesterol crystals and on chemical examination proved to contain but 42 mg.% of bile salts.

These figures are offered as further proof of the above annunciated theory that cholesterol stones are due to a faulty differential absorption of bile acids and cholesterol by the abnormal gall bladder mucosa.

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Intestinal Absorption of Viable Yeast.

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The fate of yeast ingested by mouth has been investigated in this laboratory for the past 2 years. The relative destruction within the lumen of the stomach, small intestine and large intestine has been reported (Montgomery, Boor, Bergeim and Arnold).[1] We wish to report upon the passage of yeast through the wall of the intestinal tract into the body. The procedures carried out by Nedzel[2] for absorption of bacteria have been followed in these investigations.

Fasting dogs were given one cake of compressed yeast (Fleischmann) in 100 cc. saline by a stomach tube and animals were killed at periods indicated in Table I. One gram masses of certain organs were removed and cultured in maltose acid broth. Subcultures

[1] Montgomery, Boor, Arnold and Bergeim, PROC. SOC. EXP. BIOL. AND MED., 1931, **28**, 589.

[2] Nedzel and Arnold, PROC. SOC. EXP. BIOL. AND MED., 1931, **28**, 358, 360, 361, 364, 366.

were made on maltose acid agar after 24 hours and the presence or absence of yeast was determined as indicated in Table I. In 6%

TABLE I.
Distribution of viable yeast in organs of dogs after oral administration. Positive cultures in percent of animals used are indicated.

Organ	½ hr. (5 dogs)	1 hr. (6 dogs)	2 hrs. (7 dogs)	4 hrs. (4 dogs)
	%	%	%	%
Liver	40	33	29	25
Lymph	20	33	29	25
Lung	—	—	—	—
Spleen	—	—	—	—
Kidney	—	16	29	25

TABLE II.
Viable yeast in portal blood and bile. Dogs fed yeast by mouth.

Time min.	Specimen	Dog No.					
		I	II	III	IV	V	VI
10	Blood	0	0	0	—	—	—
	Bile	0	0	0	—	—	—
20	Blood	0	0	0	+	—	+
	Bile	0	0	0	—	+	+
30	Blood	0	0	0	—	—	+
	Bile	0	0	0	—	—	+
40	Blood	0	0	0	—	—	—
	Bile	0	0	0	—	—	—
50	Blood	0	0	0	—	—	—
	Bile	0	0	0	—	—	—
60	Blood	—	—	—	—	—	—
	Bile	+	—	—	—	—	—

+ indicates presence of yeast. — indicates absence of yeast.
0 indicates no material cultures.

TABLE III.
Viable yeast in portal blood and bile after duodenal injection.

Time min.	Specimen	Dog No.			
		I	II	III	IV
10	Blood	—	—	—	—
	Bile	—	—	—	—
20	Blood	—	—	++	—
	Bile	—	—	—	—
30	Blood	++++	—	—	—
	Bile	+	—	+	—
40	Blood	—	—	—	—
	Bile	++	—	—	—
50	Blood	++	—	—	—
	Bile	++	—	—	—
60	Blood	—	—	—	—
	Bile	++	—	—	—

+ represents 1-25 colonies. ++++ represents 150 colonies or more.
— indicates no yeast growth.

of the cases, 2 cc. specimens of portal blood and bile were taken every 10 minutes for an hour and placed in maltose broth. After 24 hours these were subcultured as above. (Table II).

Fasting dogs were anesthetized, the abdomen opened, and one cake of yeast dissolved in about 25 cc. saline injected into the duodenum. Animals were killed at the time intervals shown in the accompanying graph, and one gram specimens of the organs removed and treated as in Part I. Two cubic centimeter specimens of portal blood and bile were taken on the dogs every 10 minutes for an hour after injection and cultured as in Part I. Results are shown in Table III.

Dogs, fasted for 24 hours, were anesthetized, the abdomens opened, and amounts of yeast in saline suspension, varying from 10 billion to 300 million cells, injected into the portal vein. The dogs were killed at one half and one hour, as indicated in Tables IV and V, and one gram specimens of the organs shown in these tables cultured in maltose acid broth. Subcultures were made after 24 hours, on maltose agar, and the number of viable yeast determined as indicated in Tables IV and V.

TABLE IV.
Distribution of viable yeast in dogs injected into portal vein.
Dogs killed ½ hour after injection.

Dose, cells in millions	Date	Liver	Lymph	Lung	Spleen	Kidney
10,000	11/20	++++	++	+++	+	++
10,000	11/21	+++	++	+	+	++
4,000	11/24	++	—	—	—	—
3,200	11/25	++	—	—	—	—
2,400	12/19	++	—	—	—	—
720	11/28	+	—	—	—	—

+ represents 1-25 colonies. ++++ represents 150 colonies or more.
— indicates no yeast in organ culture.

TABLE V.
Distribution of viable yeast in dogs, injected into portal vein. Dogs killed 1 hour after injection.

Dose, cells in millions	Date	Liver	Lymph	Lung	Spleen	Kidney
4,200	12/8	1800	90	—	—	—
4,800	12/10	3000	60	3000	40	375
4,800	12/11	65	72	21	—	130
400	12/15	69	—	—	—	—
300	12/17	40	—	—	—	—

When a large dose—5 to 10 billion cells—is injected into the portal vein, the yeast cells are showered throughout all the organs,

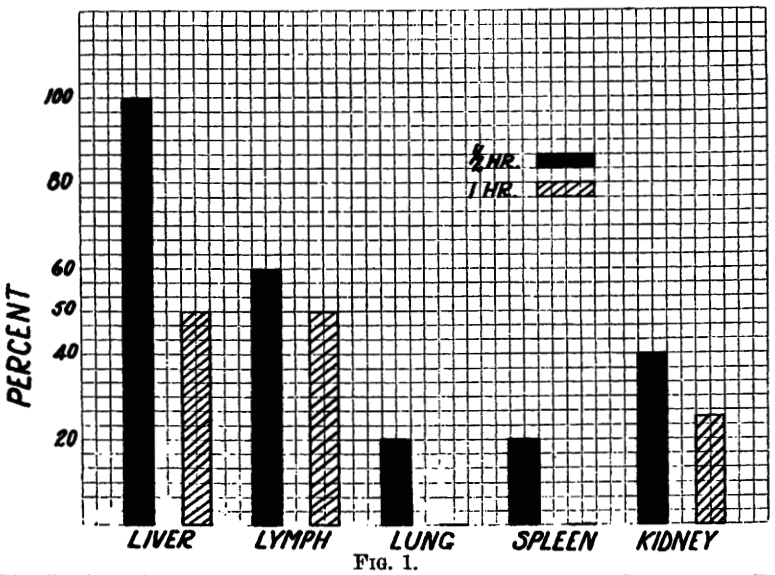

FIG. 1.

Distribution of viable yeast in organs of dogs injected intraduodenally. Positive cultures in percent of animals used are indicated.

but decreasing the dose lowers the incidence of appearance, most of the cells being caught by the liver. Increasing the time interval produces a wider distribution with a smaller dose—1 to 4 billion cells. One accidental finding is of interest; a bitch about 4 weeks pregnant was injected intraportally with 300 million cells and killed within one half hour. Although the dose was much smaller than in previous experiments, yeast was found in appreciable quantities throughout all the organs, indicating that the liver-filtering function was markedly impaired.

Results of human feeding experiments corroborating these results will be published at a later date.

Conclusions. 1. Yeast fed by mouth is absorbed like bacteria into the portal circulation from the lumen of the intestinal tract. 2. Intraduodenal injections did not show increased absorption of yeast over that fed by mouth. 3. Intraportal injections demonstrate that the amount of yeast recovered from the organs, and the relative distribution, varies directly with the amount of yeast injected.