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Variations in the Anteriomesenteric Axis of the Arterial Blood Supply of the Frog

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VARIATIONS IN THE ANTERIOMESENTERIC AXIS OF THE ARTERIAL BLOOD SUPPLY OF THE FROG

This paper is submitted to the faculty of
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VARIATIONS IN THE ANTERIOMESENTERIC AXIS OF THE ARTERIAL BLOOD SUPPLY OF THE FROG.

This work was undertaken in ofder to determine if phylogenetically any comparison was possible between variations in the blood supply of this area in the frog and in man. One hundred and thirty nine specimens were dissected and drawn, and upon them are based the percentages in this article. All information on the coeliac axis of man was gained from the extensive research of Dr. Nicholas A. Michels, Professor of Anatomy of Jefferson Medical College, Philadelphia.

In all cases, the coeliaco - mesenteric artery of the frog arose as a common trunk from the dorsal aorta. This artery bifurcates to form the coeliac and anterior mesenteric arteries. The coeliac always gives off the left gastric as its first branch. Contrast this constant pattern with the types of coeliac axis that occur in man.

TYPE I - Hepatolienogastric trunk - 89%

A. In 64.5% of these cases the left gastric is given off first, and the trunk then bifurcates into splenic and common hepatic.

B. 13% have a supernumerary branch - usually the dorsal pancreatic or colic branch.

C. 11.5% have an additional hepato - mesenteric trunk.

D. 22.5% have the Tripod of Haller pattern in which the three arteries come off together forming a common trunk. 5% of these have a fourth artery coming off at the same point forming a tetrapod. This artery is usually the dorsal pancreatic.

TYPE II - Hepatolienal trunk - 3.5%

A. The left gastric now comes from the aorta, splenic or hapatic.

B. A hepatomesenteric or hepatogastric trunk may be present.

TYPE III - Hepatolienomesenteric trunk - 0.5%

A. The left gastric now arises from the aorta as the sole component of the coeliac.

TYPE IV - Hepatogastric trunk - 1.5%

A. This trunk is accompanied by a lieno - mesenteric trunk or hepato - lieno mesenteric trunk.

TYPE V - Lienogastric trunk - 5.5%

A. The hepatic now arises from the aorta or superior mesenteric.

TYPE VI - Coeliacomesenteric trunk - rare

A. The hepatic, left gastric, splenic, and superior mesenteric arteries compose this trunk.

TYPE VII - Coeliacocolic trunk - rare

A. The hepatic, left gastric, splenic, and middle or left colic are fused in this type.

B. The colics in this case are really enlarged dorsal pancreatics which supply the pancreas and large intestine.

In tracing the anterior mesenterics in the frog, it was found that the splenic arose in three ways:

1. As the first branch of the anterior mesenteric which thereafter bifurcates into one artery supplying the duodenum and small intestine and another artery supplying the large intestine.
2. As a third generation branch of the anterior mesenteric.
3. As one branch in a tripod branching of the anterior mesenteric.

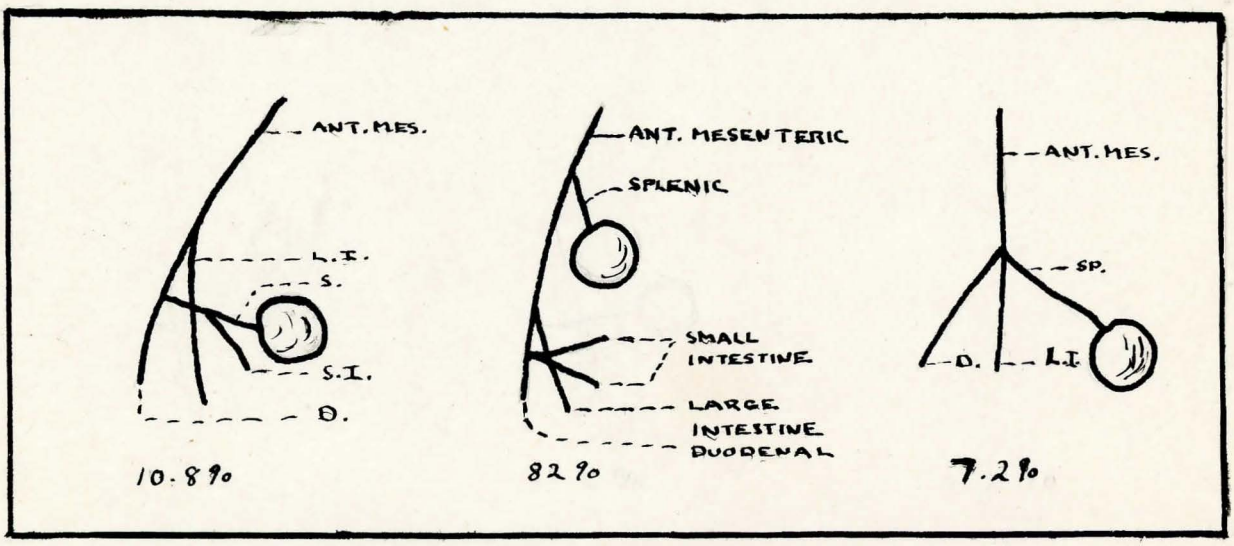


FIGURE 1; VARIATIONS IN ANT. MESENTERIC ARTERY OF FROG.

The splenic never arises from the coeliac in the frog, whereas in man in 1.5% of all cases does the splenic ever arise from any artery other than the coeliac. In this 1.5% of human cases the splenic arises with the superior mesenteric (anterior) as the lieno - mesenteric trunk or as a hepato-lienal - mesenteric trunk. The superior mesenteric (anterior) of man usually arises alone from the aorta at a point below the coeliac.

The left gastric artery of the frog was always the first branch off the coeliac. This artery supplies the left stomach wall and the pancreas. From three to eleven branches are sent to the stomach wall with six to seven branches being the usual number. These branches were very often paired, and the pairs were usually evenly spaced. Branches (none to six) were sent to the pancreas with one or two occuring most commonly.

The left gastric of the frog compares favorably with that of man in arising as the first branch of the coeliac. In only 3.5% of the cases in man did the left gastric ever arise from any artery except the coeliac. The left gastric was then derived directly from the aorta, splenic, or hepatic. In 22.5% of the normal axis types, hepatolienogastric trunks, in man the left gastric, however, arose at the Tripod of Haller instead of being the first branch of the coeliac.

The coeliac artery of the frog, after giving off the left gastric, continues ventrally where it usually bifurcates into the hepatic and right gastric arteries. Branches from the coeliac before reaching the hepatic were found as tabulated.

	No, of branches	No. of specimens	Percentage
1.	1	46	33.1%
2.	2	56	40.3%
3.	3	26	18.7%
4.	4	10	7.2%
5.	7	1	0.7%

One branch of this part of the coeliac, at least, always supplied the pancreas and coursed along the pancreatic duct to the duodenum where it anastomosed with duodenal arteries. If two branches were present off the coeliac, one was the transverse pancreatic while the second supplied the pancreas or common bile duct. Distribution is shown in following chart:

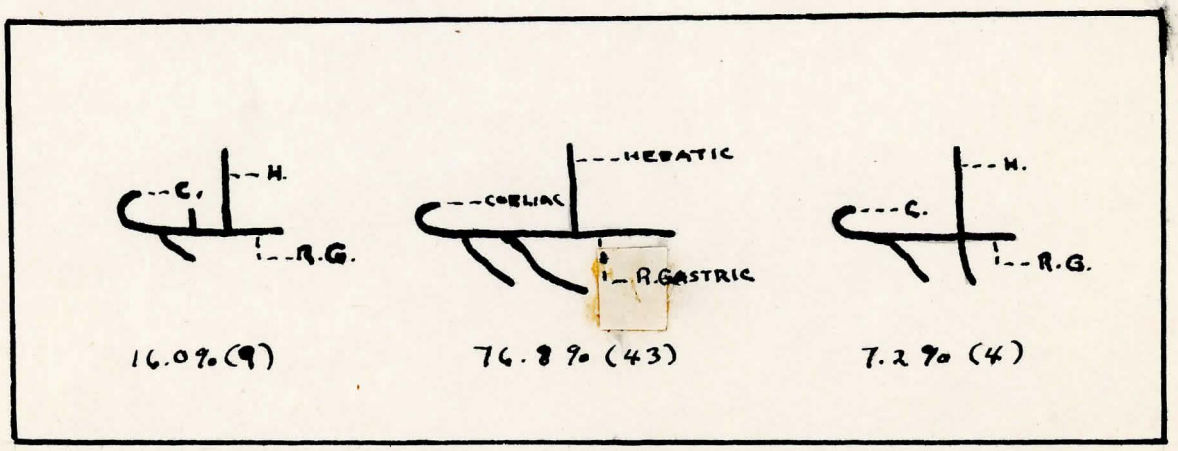
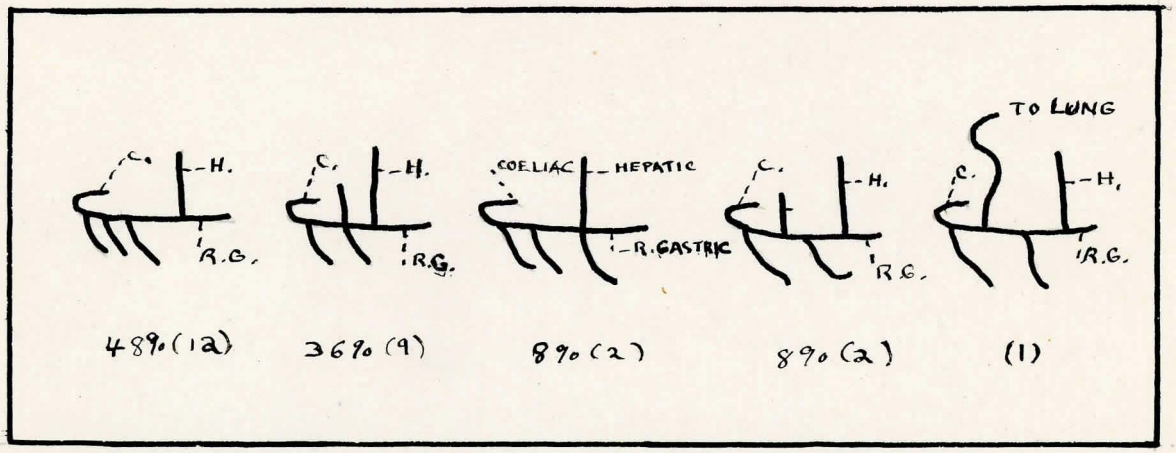


FIGURE 2: DISTRIBUTION OF BRANCHES OF COELIAC ARTERY OF FROG

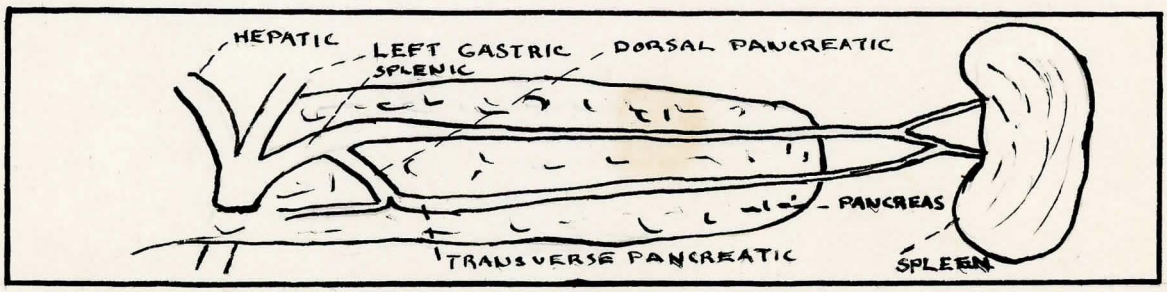
Three branches showed the following distribution:



FIQURE 3: DISTRIBUTION OF BRANCHES OF COELIAC ARTERY OF FROG

One case was found in which a branch of the coeliac traveled to the apex of the lung. The closest correlation to this finding in man is the left inferior phrenic which comes off the coeliac to supply the left side of the diaphragm and passes under the esophagus giving a recurrent branch to the cardioesophageal end of the stomach.

The main pancreatic branch of this part of the coeliac artery in the frog corresponds to the transverse pancreatic in man. This artery in man is a branch of the dorsal pancreatic which usually comes from the splenic but may otherwise be a branch of the hepatic, coeliac, or superior mesenteric.



FIQURE 4: ARTERIAL SUPPLY TO PANCREAS AND SPLEEN OF MAN

The hepatic artery in the frog showed great variation. Commonly, there was a single hepatic which ran up the common bile duct into the liver substance, giving off a cystic artery to the gall bladder at some point along its course. Some hepatics were bifurcated at or near the base into cystic and hepatic arteries. In these cases the cystic was to the right of the hepatic from a ventral veiw. Cases were found in which the hepatic came off a branch of the right gastric or from a tripod branching with the right gastric.

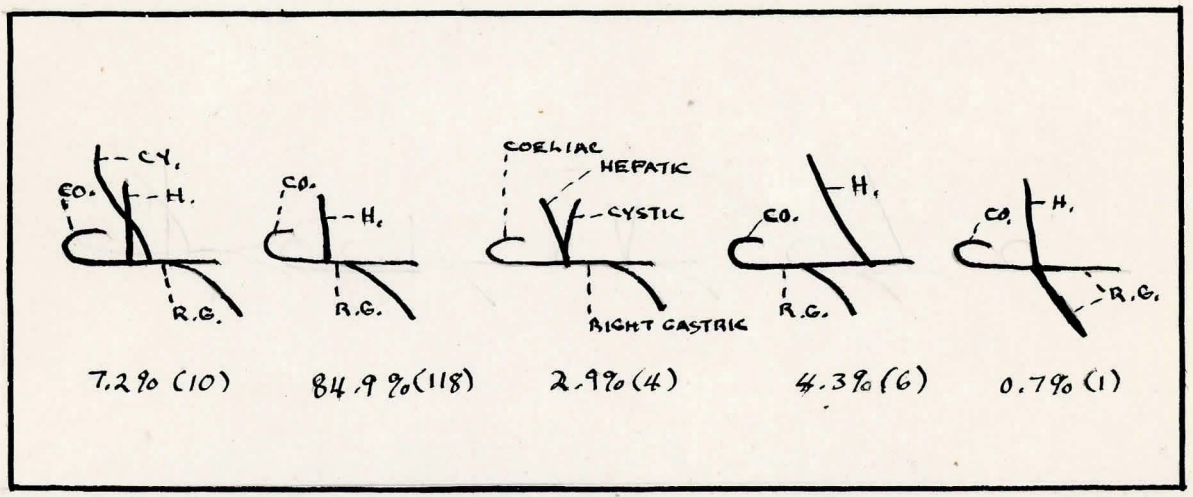


FIGURE 5: VARIATIONS IN HEPATIC ARTERY OF FROG

In man the hepatic is varied even more so than in the frog. Cases of accessory hepatics or branches of the common hepatic arising from different trunks are numerous. In only 5.5% of the cases does no part of the hepatic arise from the coeliac axis. The hepatic then arises directly from the aorta or from the superior mesenteric. Accessory hepatomesenteric and hepatogastric trunks are often found. The cystic artery of man is usually a branch of the right hepatic artery.

The right gastric as the other bifurcated end branch of the coeliac has variations due to the unsettled hepatic. Cystic arteries often arise from it.

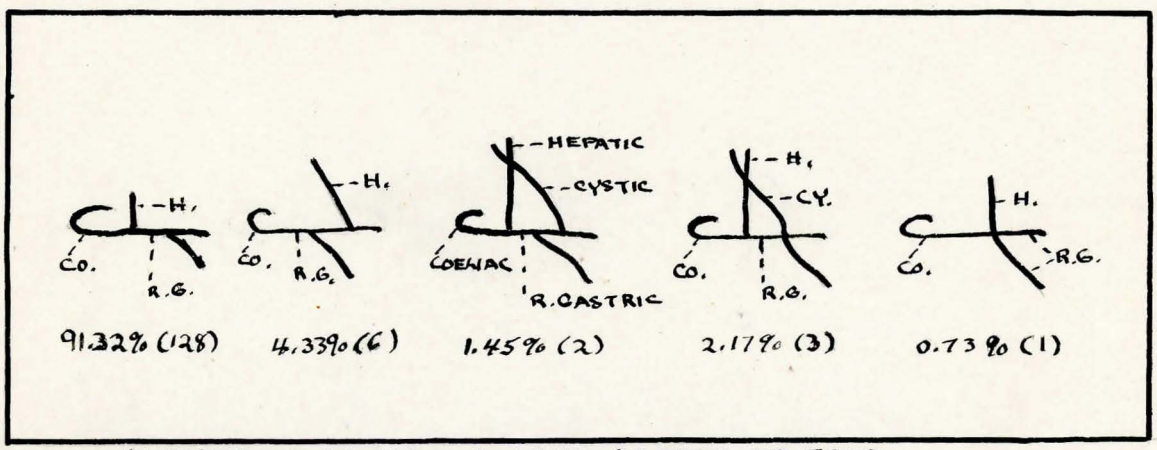


FIGURE 6: VARIATIONS IN RIGHT GASTRIC ARTERY OF FROG

Before the right gastric bifurcates and goes to supply the right side of the stomach it occasionally gives off branches. The branches occur in the following frequencies:

	No. of branches	No. of specimens	Percentage
1.	0	111	80.2%
2.	1	20	14.5%
3.	2	7	5.2%
4.	4	1	0.1%

If one branch only was given off by the right gastric it supplied either the common bile duct or pancreas.

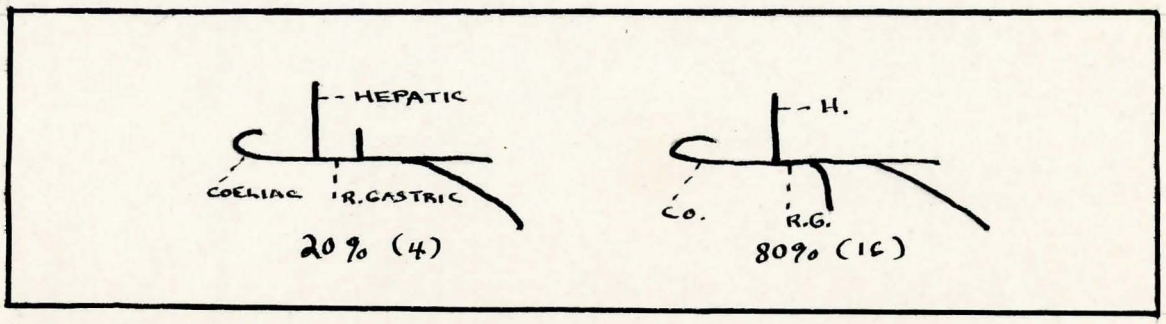
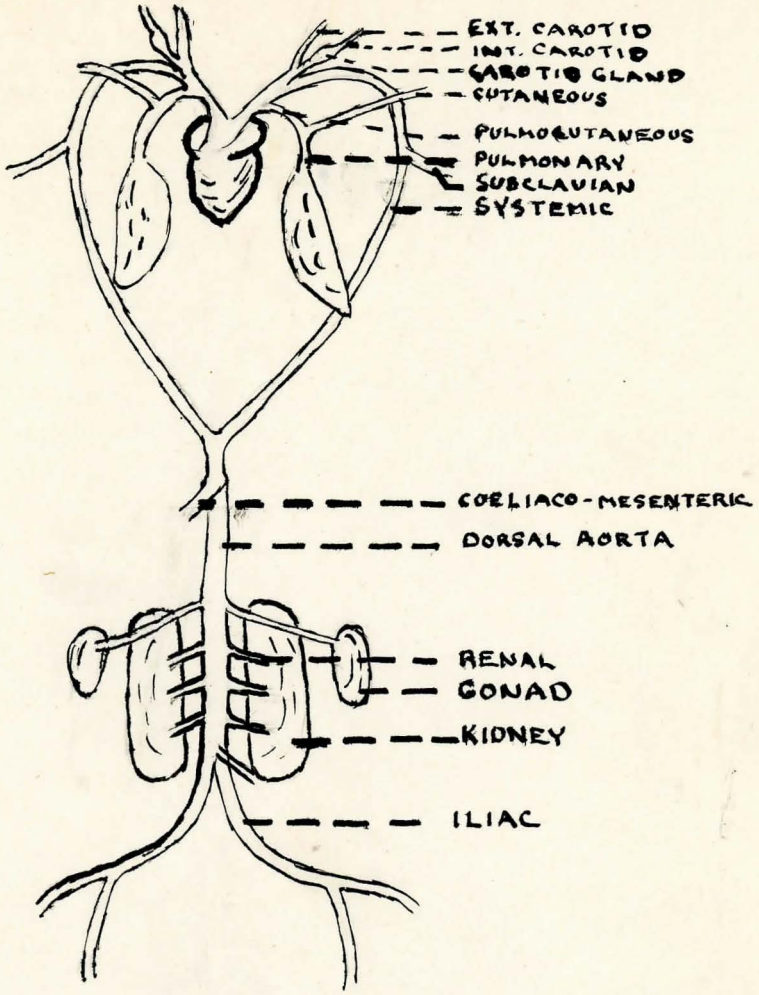


FIGURE 7: VARIATIONS IN BRANCHING OF R.GASTRIC ARTERY OF FROG

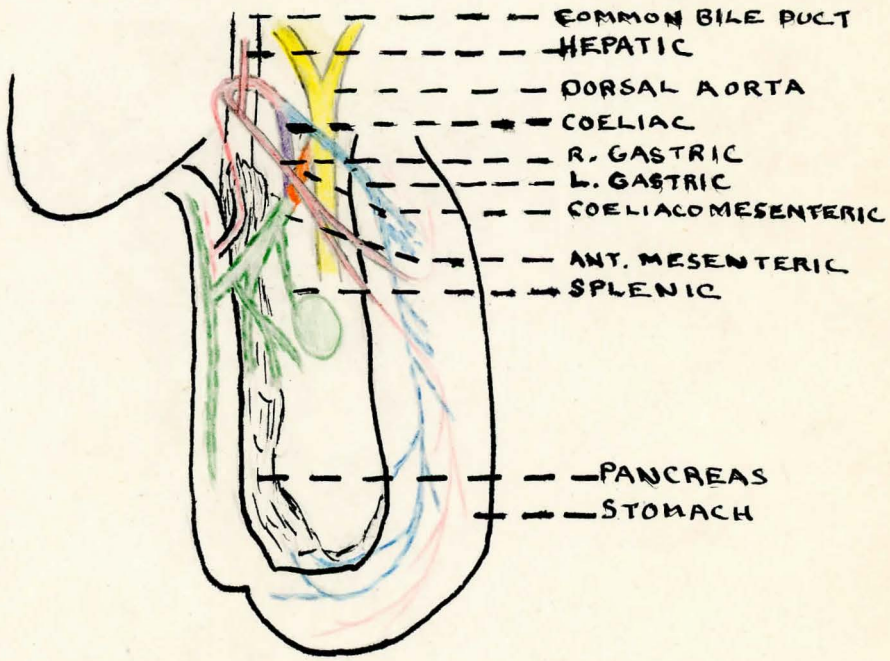
The right gastric of man never exists as a branch of the coeliac but is usually a branch of some part of the hepatic.

1. 40% from the common hepatic
2. 40% from the left hepatic
3. 5.5% from the right hepatic
4. 5.5% from the middle hepatic
5. 8.0% from the gastro - duodenal

In summary it may be concluded that some arteries of the frog and man compared favorably. The origin of the left gastric, the existence of a transverse pancreatic, and the numerous variations of the hepatic artery in the frog anticipate these conditions in man. The relationship of the splenic and right gastric arteries in the two animals is not as clear. However, in any case, the complexity of the coeliac axis of man with its surgical implications and resectional difficulties is definitely forshadowed as far down the scale of evolution as the simple frog.



ARTERIAL BLOOD SUPPLY OF FROG



ANTERIOMESENTERIC AXIS OF FROG