

series of salts may be given. In each case 1.5 gm. of *S. cymbifolium* was shaken with 100 cc. of N/10 salt. The acid was titrated with sodium hydroxide, and is expressed as a fraction of normality. The borate was titrated after addition of manitol. The hydrion concentration was determined colorimetrically.

Acidity produced in salt solutions by *Sphagnum cymbifolium*:

Salt (N/10).	Titration Value.	P <sub>H</sub> Value.
Sodium chloride . . .	0.00026	4.6
Sodium sulphate . . .	0.0005	4.6
Sodium acetate . . .	0.0065	5.5
Sodium citrate . . .	0.0085	5.9
Sodium borate . . .	0.015	9.4

The fact that high titration value goes with low hydrion concentration is very suggestive. A solution of sodium chloride and hydrochloric acid having the titration value shown was prepared and corresponding salt-acid mixtures of the other salts employed. The hydrion concentrations of these were determined, and were found to be 4.6; 4.6; 5.5; 5.9; 9.5, respectively. The agreement is very satisfactory, and seems to give definite proof that the acid present in the salt solution after shaking with *Sphagnum* is, in fact, the acid of the salt employed. The explanation of Rice, that a similar phenomenon in soils is due to the formation of acid aluminium salts, does not appear to be applicable here. The further implications of these results will be dealt with in a later communication.

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### Three Cases of Abnormal Anterior Abdominal Veins in the Frog.

THE abnormalities here described were discovered during class dissection in this College. Of fifteen specimens dissected three showed abnormality in the anterior abdominal vein. All three specimens were females.

Specimen A. The anterior abdominal vein had no connexion with the liver, but emptied itself into the *left* subclavian vein.

Specimen B. Similar to A. In addition there was a transverse anastomosis between the external jugular veins.

Specimen C. The anterior abdominal vein sent a small vessel to the liver, but most of the blood passed into the *right* subclavian vein.

The abnormal specimens showed no other peculiarities.

Communications between the anterior abdominal vein and the right or left subclavian veins have been recorded by four observers, of whom three found one specimen each. Buller (*Journ. Anat. and Phys.*, vol. 30, 1896) found in a female specimen a condition similar to C, but opening nearer the heart, namely, into the superior vena cava at the entrance of the subclavian into it. Woodland (*Zool. Anz.*, Bd. 35, 1910) described the first abnormality (A) in a male frog, and O'Donoghue (*Zool. Anz.*, Bd. 37, 1911) the same condition in a male specimen, coupled, however, with an abnormal heart. Lastly, Collinge (*Journ. Anat. and Phys.*, vol. 50, 1915) reported one case in which the anterior abdominal vein gave off a large branch to the hepatic portal system and then sent a

fine vessel into the right anterior vena cava, and another case where both right and left venæ cavae received contributions, no blood going to the liver from the anterior abdominal vein. The abnormalities here in question are probably of rare occurrence, and it is surprising to find them in 20 per cent. of a batch of frogs (3 out of 15).

The interest of the abnormality, as was pointed out by the above writers, lies in the fact that it represents a persistent embryonic feature. The anterior abdominal vein of the adult frog originates by the fusion of a pair of larval veins carrying blood from the hind limb to the sinus venosus. Posteriorly the fusion is complete, anteriorly the right vein usually disappears, the left loses its connexion with the sinus venosus, and a new connexion is acquired, namely, with the hepatic portal system. The specimens A and B, therefore, show a loss of the right anterior portion of the ventral vein, have retained the connexion with the sinus venosus through the subclavian vein of the left side, but have not acquired the communication between the fused posterior veins (anterior abdominal) and the hepatic portal system. In specimen C the *left* vein of the pair has disappeared, the communication with the sinus venosus remains, and the hepatic portal connexion has been acquired. Specimen A has been placed in the Museum of the Zoology Department of the College.

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February 27.

### The Life-History of *Amœba*.

SINCE the full details of some experiments on *Amœba proteus* carried out upon numerous strains of *Amœba*, each strain descended from one single individual, will not be forthcoming for some time, it seems advisable to make a preliminary announcement of the following results obtained by my assistant, Miss Isabelle P. M'Guire.

On November 23, 1923, five glass dishes, ranging from 3 to 6 inches diameter, and height 3 inches, were provided with 50 c.c. of Glasgow tap-water, and 2 to 5 wheat grains, according to the capacity of the dish. These were left in a warm room over-night. On November 24 *one* adult amœba from Culture 11 (*Q.J.M.S.*, Vol. 69, Part I., Dec. 1924), plus about 25 c.c. of the culture water plus some food organisms upon which *A. proteus* feeds (these latter being carefully scrutinised and identified before being used), was inoculated into each of the prepared aquaria, care being taken to see that no minute amœbæ were included. Each dish was then covered with a glass plate and put into a warm (temp. 60° F.) shady place. Tap-water was added gradually until each aquarium became full of liquid. One wheat grain was added to each on the following dates: March 23 and June 10. Two wheat grains were added to each on July 4 and September 9.

In February and March 1925 the aquaria were examined. None of them contained adult amœbæ. In two of them, however, a population of small amœbæ were seen—recognisable under a  $\frac{1}{4}$ -inch objective. In two others encysted young amœbæ were visible amongst the debris. A few of these were transferred to a slide, and were kept in a damp chamber from March 12 last until March 16, on which date young amœbæ hatched out of the cysts. The fifth aquarium was a blank: no amœbæ or encysted young amœbæ were found.

Since Miss M'Guire is working in Notre Dame Laboratory, where cultures are constantly set up, it