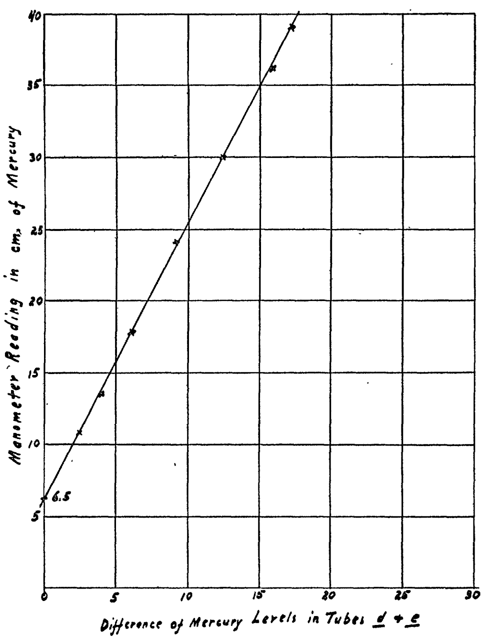

FIG. 2

which the curve crosses the ordinate represents the pressure to operate the spring. The stiffer the spring the greater this pressure will be and *vice versa*. The slope of the curve is equal to the ratio of the difference in levels of the mercury in the open manometer and in tubes *d* and *e*. In Fig. 2 it may be seen that if the difference of the mercury levels in tubes *d* and *e* is changed .55 cm that in the manometer is changed 1 cm. Therefore, if a scale is constructed with divisions equal to the slope of the curve (in this case .55 cm) but marked 1, 2, 3, etc. cm the scale will read the pressure in the system directly in centimeters of mercury. The scale is fastened behind tube *e* so that the level of the mercury in tube *d* (at equilibrium pressure in the syringe) is opposite to the pressure reading equal to that at which the curve crosses the ordinate axis, in this case 6.5 cm.

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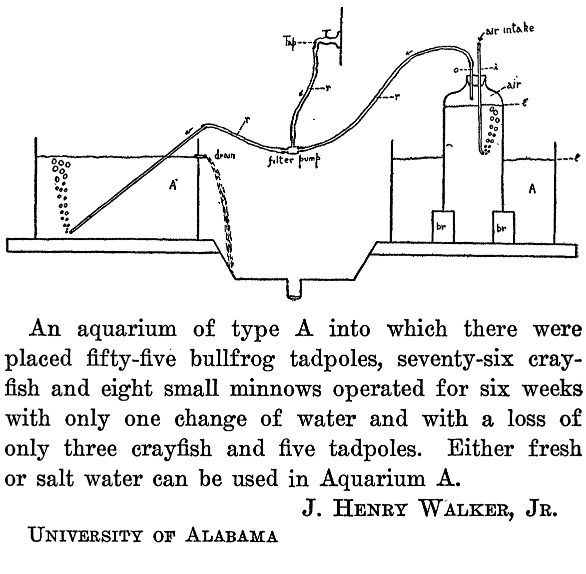
INEXPENSIVE AERATED AQUARIA

FOR several years the writer has been using an economical method of aerating aquaria suitable for high schools and institutions which can not afford the more expensive pressure systems used in the larger research laboratories.

The system of two aquaria (A and A′), as set up in the text figure, can be aerated efficiently at a low cost. The apparatus includes two aquaria, one bell jar (open top high form), one suction filter-pump, three pieces of glass tubing, three sections of rubber hose, one two-hole rubber stopper, and two half bricks.

It is necessary in aquarium A to place the bell jar on two pieces of brick in order to facilitate circulation of water currents. The glass tube (i) can be adjusted so that air will bubble continuously into the jar. In starting the apparatus it is necessary to have the lower end of tube (i) below the water surface (1). When the water level (1′) within the jar almost reaches the lower end of the tube (o), the tube (i) should be raised above the water level (1). The suction from the outlet (o) creates a partial vacuum in the top of the jar. This causes the water in the bell jar to approximate a level which will tend to equalize the atmospheric pressure on the water inside and outside the jar. When these two pressures are equalized the water in the jar maintains a constant level and air will bubble intermittently in the water. This causes aeration and circulation of water sufficient for the whole aquarium.

The second aquarium A′ can be used in cities where the water is not acid nor chlorinated, since the water passing into aquarium A′ is tap water. This second system was devised and used by one of the Hertwig brothers in his German laboratory.



An aquarium of type A into which there were placed fifty-five bullfrog tadpoles, seventy-six crayfish and eight small minnows operated for six weeks with only one change of water and with a loss of only three crayfish and five tadpoles. Either fresh or salt water can be used in Aquarium A.

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DIFFERENTIAL FILTRATION AS A MEANS OF ISOLATING BACTERIUM GRANULOSIS

IT is often difficult to separate very small slowly growing from larger more rapidly growing bacteria. This is especially true in the attempts to obtain *Bacterium granulosis* in a pure growth from cultures of conjunctival suspensions.

Bacterium granulosis usually requires four or five days for a growth sufficient for ordinary transfer. By this time, contaminating organisms such as staphylococci and diphtheroids have been multiplying rapidly, making it difficult, and frequently impossible, to recover *Bacterium granulosis* in pure culture by the usual methods of diluting and plating.

In order to overcome this difficulty we have attempted to separate the smaller from the larger organisms by means of differential filtration.

Berkefeld "V" filters, new or used, are selected and tested for permeability for *B. prodigiosus* and staphylococci. The filters which allow the passage of *B. prodigiosus* but not of staphylococci are chosen. A suspension of the contaminated material is diluted in normal saline solution and passed through the filter. The filtrate is either spread on plates or inoculated into leptospira medium. Occasionally other small bacteria may be found in the cultures of the filtrate along with *Bacterium granulosis*. These other organisms have not offered the same technical difficulty of separation from *Bacterium granulosis* as have staphylococci, diphtheroids and other large bacteria which rapidly overgrow and suppress it.

This method, therefore, has been satisfactory in separating *Bacterium granulosis* from contaminated cultures in which it has been difficult or impossible to recover the organism in the usual manner.

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SPECIAL ARTICLES

A RATION FOR THE PRODUCTION OF RICKETS IN CHICKS

UP to the present time we have used a ration consisting of 97 parts of ground yellow corn, 2 parts of calcium carbonate, 1 part of common salt, and skimmed milk *ad libitum* for the production of rickets in growing chicks. The ration is extremely low in vitamin D, and when day-old chicks are placed on the ration severe rickets is produced in 5 to 6 weeks. The ash content of the extracted tibia removed from these chicks is about 30 to 33 per cent., while the ash content of similarly treated tibia from normal White Leghorn chicks of the same age is about 40 to 45 per cent. or often somewhat higher. The addition of various sources of vitamin D to this ration, together with a study of the ash content of the bone, furnishes an excellent method for the determination of the vitamin D potency of these materials. However in the evaluation of sources of vitamin D, especially cod liver oils and other fish oils, for the poultry industry as well as for the scientific study of rickets in chicks, there has been a demand for a suitable dry ration. State inspection laboratories, looking forward to the control of marketable sources of vitamin D, find it inconvenient to use a ration containing liquid skimmed milk because of the difficulty of procuring skimmed milk daily. Another objection to the liquid skimmed milk ration is the variable intake that follows its use. Consequently we have, during the past two years, attempted to develop a suitable dry ration for the study of rickets in chicks. Dry rations have been used in several commercial laboratories and in institutions studying the problem of rickets in chicks; but it would seem advisable if the ration here proposed or some other equally suitable ration could be more generally adopted.

A ration to be satisfactory must be palatable, give good growth and in the presence of vitamin D contain sufficient calcium and phosphorus in the proper ratio for optimum calcification of the skeleton. We believe, too, that the ration should be one that gives pronounced rickets in 4 to 5 weeks—in fact, may lead to a high mortality at that age. The chick itself is particularly suitable for studies of bone development because of its wonderful sensitiveness to the absence of vitamin D. One does not need a one-sided ration, that is, high calcium and low phosphorus, or high phosphorus and low calcium, to produce rickets in the chick as has been commonly used in the production of rickets in the rat. In the case of the chick severe rickets is readily produced where the calcium and phosphorus content of the ration is at a reasonable level, and with an optimum ratio, such as 2 parts of calcium to 1 part of phosphorus.

It is true with the chick, as with other animals, that the mineralization of the bones can be influenced by the level and ratio of calcium and phosphorus in the ration. With the use of what is known as the Wisconsin baby chick ration, in which the calcium and phosphorus are particularly high, that is, approximately 2.5 per cent. of calcium and .7 per cent. of phosphorus, rickets is delayed in the absence of vitamin D and fair mineralization of the bones results during the early growing period. On the other hand, in the ration that we are suggesting for a standard rachitic ration with chicks, the calcium and phosphorus are sufficiently high to give excellent calcification where vitamin D is adequately supplied, but a very distinct picture of rickets in the absence of vitamin D. The ration that we have finally adopted is one consisting of:

59 parts of ground yellow corn
25 parts of wheat middlings (standard)
12 parts of crude casein
1 part of common salt