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Isopropyl alcohol, a convenient laboratory anesthetic for cats.

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In connection with a comparative study of normal and secondary alcohols the author had occasion to inquire into their comparative narcotic properties. It was noted that when a suitable dose of isopropyl alcohol, a drug which is comparatively cheap, is administered to cats by the stomach tube, a general anesthesia is produced lasting for many hours and indeed in some cases for several days. In order to use this drug as an anesthetic for cats, the animals must first be completely anesthetized with ether, a stomach tube is then passed and a dose of isopropyl alcohol from 5 to 5½ c.c. per kilo weight of the animal is introduced into the stomach together with two or three times its volume of water. The stomach must be empty before the administration of the drug. The brief-lasting stage of ether isopropylol anesthesia is quickly followed by a complete narcosis, produced and maintained by the isopropyl alcohol alone. Indeed it is usually not necessary to take the cats off the table after the administration of the drug by stomach tube. The blood pressure curve obtained with such animals is remarkably high and the circulation is certainly much less depressed than by certain chlorinated hypnotics which have been used as anesthetics for cats. The effect on the respiration in larger doses than above is more depressant but when the proper dose is administered the animals continue to live with very good circulation and satisfactory respiration for many hours.

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Apparatus for micro-manipulation and micro-injection.

By ROBERT CHAMBERS.

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This apparatus is designed for the purpose of dissecting living cells or injecting substances into them, and for isolating micro-

organisms. Its advantage over that which Barber described in the *Philippine Journal of Science* in 1914 is its simplicity of construction, and the accuracy with which it can be manipulated.

The apparatus consists of two instruments, the micro-manipulator for producing movements in the microscopic field in any of three dimensions and, second, the micro-injection instrument for securing the necessary pressure to drive or suck substances through a micro-pipette. The method of making glass micro needles and pipettes is given in full in Barber's paper and in mine in the *Biological Bulletin* of 1918.

The micro-manipulator is small and compact and can be attached to the stage of any microscope. It consists of a system of rigid metal bars connected together with spring hinges. By turning certain screws the bars are forced apart. On reversing the screws the springs return the bars to their original positions. The instrument moves the tip of a needle or a pipette in three arcs at right angles to one another. The arcs are small enough so that, in the microscopic field, the needle moves practically in straight lines. The movements are fine and steady enough to be under perfect control when viewed under the highest power of the microscope. The instrument can be used singly for one needle only or with a companion when two needles, or a pipette and a needle, are to be used simultaneously.

In the micro-injection instrument mercury or an inert oil (Nujol) is used to procure the necessary pressure. The instrument consists of a thin-walled steel tube about six inches long and half an inch in diameter, one end of which is provided with a stopcock. The other end leads into a small steel tube fine enough to be flexible and long enough and so bent that, while the large tube lies on the table beside the microscope, the tip of the fine tube can be held in the pipette carrier of the micro-manipulator. Into this tip a glass Barber pipette is sealed. Mercury or oil is introduced through the stopcock of the large tube and is forced on into the micro-pipette. The stopcock is then shut off. By means of leverage clamps on the thin-walled tube the mercury or oil can be driven through a pipette having an aperture of only one micron in diameter. By turning the screws of the micro-manipulator the tip of the pipette can be brought into a hanging drop in a

Barber's moist chamber. Release of pressure on the steel tube draws substances into the pipette. Injection and suction in microscopic quantities is accurately controllable as the meniscus of the mercury or oil in the pipette responds instantly to the pressure of the leverage clamps.

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The effect of experimentally induced changes in consistency on protoplasmic movement.

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Agitation by means of a micro-dissection needle tends to cause the protoplasm of a living cell to pass from a more solid to a less solid phase.

In marine ova, where one can closely follow the solidifying of the protoplasm just prior to cell division, mechanical agitation will cause the protoplasm to revert to its original liquid state so that the egg reverts to the shape of a sphere. If the egg so treated be subsequently left undisturbed the solidifying process starts up again with the result that the egg undergoes normal cleavage.

In a previous communication[1] the writer has described the structural relations of changes in protoplasmic consistency of the *Amœba* to the formation of pseudopodia. The maintenance of pseudopodia depends upon a relatively solid state of certain parts of the *Amœba*.

A resting *Amœba*, with numerous slender pseudopodia all over its surface, is relatively solid. Upon mechanical agitation the pseudopodia are retracted as the *Amœba* becomes more liquid. Fresh pseudopodia in an agitated *Amœba* tend to be broad lobate and, if the agitation be continued, all of the *Amœba* liquefies. The entire body then becomes, as it were, a single pseudopodium with a peripheral current of granules flowing away from its anterior end and a central current flowing forward. An *Amœba* in this extreme state does not change in position as the back flow tends to equal the forward flow. *Amœbæ* which are experimentally

[1] Chambers, Robert, PROC. SOC. EXP. BIOL. AND MED., 1920, xviii, 66.