Dictionnaire des maladies éponymiques et des observations princeps : tissus : régénération cellulaire des tissus par culture in vitro (histologie)

CARREL, Alexis. - Rejuvenation of cultures of tissues.

In : Journal of the American Medical Association., 1911, Vol. 57, p. 1611

showed the typhoid bacilli was from the house well, and considering the chemical partial analysis and the negative colon test, it seemed very reasonable that urine could be the only condition giving rise to the situation.

With the vaccination of the entire household and nothing further transpiring after three months, and with the above record, I consider that I am justified in assuming the contamination of the well by some of the laborers mentioned, and that the contamination was urinary in origin.

193 York Street.

REBREATHING IN ANESTHESIA

(Concluded from page 1599)

ABSTRACT OF DISCUSSION

ON PAPER OF DR. GATCH

DR. YANDELL HENDERSON, New Haven, Conn.: It seems to me dangerous to have a man breathe for any length of time through a long tube in that way. Too much stress is laid on various fixtures; there seems to be too much ventilation. We used to think we should give the patient plenty of oxygen; this apparatus is designed to keep carbon dioxid in. We already have a tube, the trachea. A man told me this morning of a case in which the trachea and blood-vessels were cut and as soon as he sewed up the trachea the man began to breathe normally. That shows that in order to keep a man breathing vigorously he must breathe through a tube, and Nature provides it. When a man breathes through his mouth he gets more ventilation than when he breathes through his nose. Carbon dioxid is a diffusible gas; if the skin is off and there is congestion and disturbed vascular conditions it is because of the absence of carbon dioxid; if carbon dioxid is put over the surface these changes do not occur. We do not draw fresh air into our lungs. It would be the simplest matter in the world for Nature to have devised a mammal as a long breathing animal in which the lungs collapsed every time; it would be a simple matter for the thorax to go down until the lungs collapsed completely; then when we took a respiration we would draw fresh air in. But it does not work that way; to a large extent it is an effort to prevent carbon dioxid from getting out rather than to get oxygen in.

DR. J. F. HULTGEN, Chicago: The case Dr. Henderson referred to came to me accidentally. There being no surgeon around, no one but interns, I had to sew up the man's trachea, which he had cut with suicidal intent. He was fainting from lack of blood when he came to the hospital. The man coughed and sputtered around on the table and so we anesthetized him through the tracheal opening. His breathing was very shallow, and I had an intern stand with a stethoscope to hear if the heart was beating (it had been suggested that we let the man alone, as he would die anyway). I put in two or three sutures on either side, not touching the cartilage, and as soon as I had these sutures in I had the intern tighten them, he holding them on one side and I doing the same on the other side, thus approximating the two ends of the trachea. As soon as we did this, the up and down movements of the chest became very extensive—more so than normal. It seemed to me this might be made use of in a great deal of thoracic work and lung surgery; that artificial tracheotomy of this sort might be advantageous. This was such a remarkable case that the nurses and those around were called to witness it. The author has brought up an interesting point about anesthesia. When I was an intern we used to give the anesthetic with a cone; we had the patient sleep for hours with this cone, pouring in a dram or two of ether at a time. The carbon dioxid theory of Dr. Gatch I think offers a good interpretation for this.

DR. W. D. GATCH, Baltimore: I do not oppose the use of the old-fashioned etherizing cone. It can probably be used so as to meet the physiologic requirements more nearly than an open mask.

REJUVENATION OF CULTURES OF TISSUES *

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The duration of the life of cultures of tissues, up to now, has been very brief. In approximately from three to fifteen days after the preparation of the culture, the growth becomes progressively less rapid until it stops altogether. Following this, the tissues die and the cells disintegrate.

It may easily be supposed that senility and death of tissues are not a necessary phenomenon and that they result merely from accidental causes, such as accumulation of catabolic substances and exhaustion of the medium. The suppression, then, of these causes should bring about the rejuvenation of the arrested culture and thus increase considerably the duration of its life. As it would be important, for many reasons, to keep tissues alive outside of the organism for a long period of time, I attempted to develop a method for the rejuvenation of the cultures of tissues.

The rejuvenation consists in removing from the culture substances that inhibit growth and in giving to the tissue a new medium of development. It is accomplished by extirpating with a cataract knife the fragment of coagulated plasma containing the original piece of tissue and the surrounding new cells, which are washed for several minutes in normal or slightly hypotonic Ringer's solution.

Afterward, the fragment is placed in a hypotonic medium composed of three parts of normal plasma and two parts of distilled water. The time of rejuvenation is chosen before the appearance of the changes of senility or when they are just beginning to appear. The process described is repeated more or less frequently according to the rate of the growth and the condition of the cells.

The results of rejuvenation were studied on cultures of connective tissue. The original connective tissue was taken from the spleen, the skin, the pericardium, and the portal vein of sixteen- to twenty-day-old chick fetuses. The first rejuvenations were made when the cultures were still in the period of full growth or at the beginning of the declining period. A few hours after the passage into the new medium, elongated cells or chains of cells radiated through the plasma, and the growth went on rapidly. The washing and passage into new media were repeated when the rate of growth decreased or when large granulations appeared in the cytoplasm of the cells.

Many of the cultures were rejuvenated five, six, seven, eight and even nine times. It was observed that after the seventh or eighth passage, fusiform cells appeared in the new medium as rapidly as after the second or the third passage. Thus, the occurrence of senility in these cultures was prevented and the length of their life very much prolonged. A culture of portal vein after the ninth rejuvenation is still growing actively on the thirty-first day of its life outside of the body.

These results demonstrate that rejuvenation of the cultures of tissues is possible. They show also that, under the conditions and within the limits of the experiments, senility and death are not a necessary, but merely a contingent, phenomenon.

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