A Simple Double-Surface Dialyzing Membrane

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Very high concentration of botulinus toxin Type D can be obtained by growing the *Clostridium* in cellophane bags immersed in appropriate media (*1*). However, it is very difficult to tie the end of cellulose sausage casings securely enough to prevent bacteria growing through the tie. The difficulty can be overcome by pulling the end of the casing back through the tube. This forms a double-walled seamless tube. For our purpose saline is filled into the annular space between the walls and the whole tube is immersed in nutrient medium. The inoculum is placed in the saline.

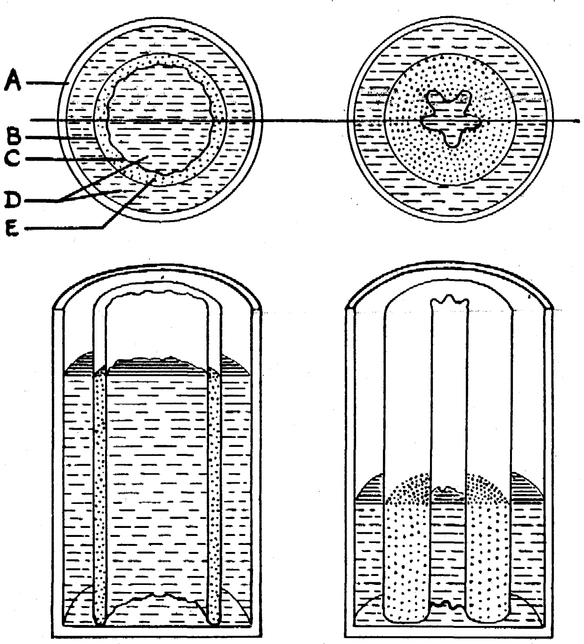

FIG. 1. At left, longitudinal and cross section of apparatus showing close approximation of cellophane walls when the level of outside liquids is high. At right, same cross section, but showing state when level of liquid outside cellophane walls is low. A—Container. B—Outside cellophane wall. C—Inside cellophane wall. D—Liquid outside cellophane container. E—Liquid inside cellophane container.

If the apparatus is required for dialysis, the liquid to be dialyzed is filled into the annular space between the cellophane walls. As the top is left open and as the membrane is flexible, the levels of the liquid inside and outside the membrane always remain the same. By varying the amounts of liquid inside and outside the bag, the dialyzing surface can be varied at will.

Reference

1. POLSON, A. and STERNE, M. *Nature,* 1946, **158**, 238.

Increased Radioresistance of Red Bone Marrow after Anoxia

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Jacobson *et al.* (*3*) have reported that the red bone marrow of rabbits, in which a regenerative anemia has been produced by phenylhydrazine hemolysis or by repeated bleeding, shows less histological injury following 800 r of total-body X radiation than does the normal. We have attempted to extend this to mice, using partial anoxia as the marrow stimulus.

One hundred and forty female mice (White Swiss Bagg, 18–20 gm) were randomly distributed into two groups. One was maintained at sea level pressure as control, and the other exposed to a simulated altitude of 15,000 ft (430 mm Hg) in an evacuated chamber for 10–14 hr a day. Both groups were kept at 25–30° C, and fed freely on standard chuck.

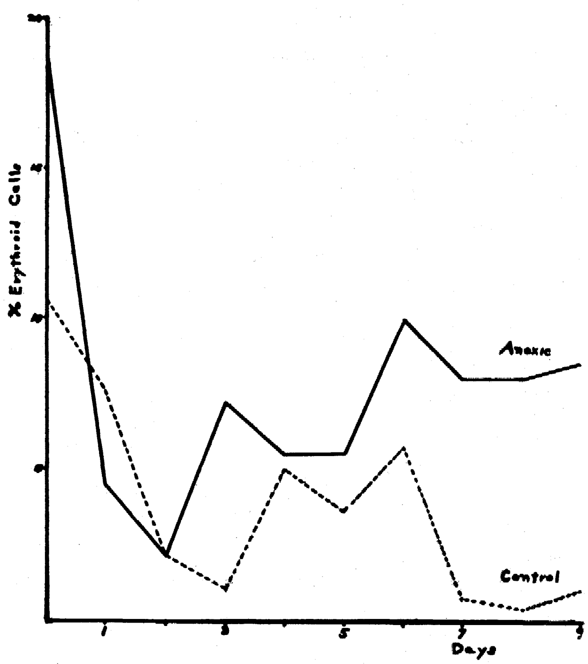

FIG. 1

Animals were sacrificed at intervals and the marrows examined as follows: Marrow from each femur was smeared and stained with Wright's stain. Late erythroblasts and normoblasts were counted together as erythroid cells and expressed as percentage of total marrow cells. Since early erythroblasts might be confused with myeloblasts and lymphocytes by the inexperienced observer, only the later forms of the red series were counted. Smears of marrow from each femur were counted by both observers independently. Each point in the figure represents the mean of 20 observations on five animals.

The percentage of erythroid cells in the marrow of this strain of mice was determined in 20 normal animals to be 10.6% ± 0.2%. Brecher *et al.* (*2*) found somewhat higher values, reporting total nucleated red cells.

The experimental group was maintained in the evacuated chamber until samples showed the erythroid cell level to have increased to 18.6% ± 1%. At this time both groups were exposed to 500 r of total-body X radiation and thereafter maintained at sea level pressure. The mice were placed 20 at a time in a paper box, 10 × 10 × 1.5 cm, and irradiated with a 200-kv machine filtered with 1 mm of aluminum and 0.5 mm of copper, and calibrated with a Victoreen r-meter.

The data are presented in Fig. 1.

The control group responded as would be expected from previous studies (*1*) and (*2*). There was a rapid fall in percentage of erythroid cells in the first two days, followed by a rise from the fourth to the sixth day. This apparent recovery coincided with the loss of myeloid elements, the percentage of erythroid cells falling off again as the myeloid series recovered.

The group which had been subjected to anoxia showed the same pattern to the sixth day. However, the sharp fall noted in days 6–9 in the control group was absent. The probability that the differences between groups on days 7, 8, and 9 were due to chance alone is 1/250. It therefore appears that the hyperplasia of the red marrow produced by exposure to low oxygen tension enhances the resistance of the erythroid elements of the mouse subsequently exposed to 500 r total-body X radiations.

References

1. Bloom, M. A. and Bloom, W. *J. Lab. clin. Med.*, 1947, **6**, 654.
2. Brecher, G. *et al.* *Blood*, 1948, **3**, 1259.
3. Jacobson, L. O. *et al.* *Science*, 1948, **107**, 248.

Comments and Communications

The System of Stable Nuclei

For some time it has been known that certain preferred numbers, N or $Z = 20$, 50, 82 or 126 give exceptional stability to a nucleus (Elsasser, W. *J. Physique Rad.*, 1933, 4, 549; 1934, 5, 389, 635; Mayer, M. G. *Phys. Rev.*, 1948, 74, 235). Just recently it has been pointed out that in the neighborhood of $Z = 82$ and of $N = 126$, nuclei with a number of protons or neutrons only approximately equal to these numbers have abnormally high binding energies, too (Way, K. *Phys. Rev.*, 1949, 75, 1448). The same conclusion had been reached independently by Mr. Wapstra of this laboratory in connection with his calculations of nuclear masses of natural radioactive elements (Rosenfeld, L. *Nuclear forces* I, Netherlands: North-Holland Pub.; New York: Interscience, 1948, pp. 525–529 and plate II).

As an example we shall give an approximative sketch of a series of isotopes of a single element with neutron numbers between 120 and 132. Nuclei with $N = 120$ and 121 will have roughly normal energy contents. The binding energy of the 122nd neutron is slightly enlarged, which brings the energy content of this nucleus somewhat below normal. The following neutrons are again added with binding energies larger than normal till the nucleus with the preferred number $N = 126$ has been reached. This is the isotope in which the energy content of the nucleus lies deepest below the normal level. The 127th neutron is bound with an exceptionally small energy effect, but the nucleus as a whole still has a lower energy content than it would have had under normal circumstances. It takes about four more neutrons, which are bound less tightly than the average, to bring the energy content of the nucleus back to normal, around $N = 132$. A diagram of the difference between the actual energy content of the nuclei and its interpolated normal value shows a horizontal line = 0 below about $N = 122$ and above about $N = 132$. Between these values a dip is observed with its lowest point at $N = 126$. It is difficult to say anything definite both about the actual width and about the shape of this dip, but it seems likely that it is steepest near $N = 126$ and flattens out on both sides.

Thus the stabilizing influence is not restricted to the exact preferred numbers but it is also active, though to a lesser extent, in nuclei containing a number of nucleons smaller or larger by a few units. These near-preferred numbers make a nucleus more stable than normal compared to ordinary nuclei but they decrease their stability towards nuclei containing a preferred or a nearer preferred number of nucleons. It can be demonstrated that a similar state of affairs occurs also in the neighborhood of other preferred numbers below $N = 126$ and $Z = 82$ and that it explains the majority of the apparent irregularities in the system of stable nuclei.

First it may be pointed out that, contrary to an occasional suggestion (Suess, H. E. *Zeitschrift für Naturforschung*, 1947, **2A**, 604), the excess binding energy is very nearly equal in a proton and in a neutron of the same preferred number. Proof of this fact is to be found in the perfectly regular series of half-lives of the $Z = N + 1$ nuclei and in the agreement of the positron energy limit of Sc^{41} with the value calculated from the liquid drop model (Rosenfeld, L. *Loc. cit.*, p. 383).

If the increased binding energy had occurred only in nuclei with "preferred numbers," only the stability of these nuclei and that of the adjoining odd-mass nuclei would have been affected. As it is, the extra stability of near-preferred numbers of nucleons is expressed in the nuclear energy diagram as additional local valleys super-