Southern Norway and the Lapps, respectively, the annual absorbed dose to ferritin was 60 and 730 mrad, and to haemosiderin 100 and 1,210 mrad. The 1969 doses (erg) for sites 5 and 14 are calculated as : whole body, 2.1 and 25.3 g rad; whole blood, 1.4 and 16.6 g rad; erythrocytes, 1.3 and 15.3 g rad; red bone marrow, 0.05 and 0.6 g rad; ferritin and haemosiderin, 0.014 and 0.17 g rad, respectively. In 1969 males have higher ^{55}Fe concentrations than females ($P<0.002$ by t-test). This is in agreement with Jaakkola[5], who also found higher levels among male Southern Finns in 1965–1966. Several other investigators, however, have found higher female levels[1–4,6,7,11]. My measurement results can be explained by the sex difference in iron metabolism. If it is assumed that fallout ^{55}Fe was all released into the stratosphere in a single injection—say in 1962—human blood levels would start to increase after about 2 yr[10]. Because of their higher metabolic rate, female values would rise faster and reach a higher peak than the values for males. This would also cause a faster female decrease after peak time, and the clearance curves for males and females would cross after a certain time. This seems to have occurred in Norway before 1969. In accordance with this theory, the sex difference was found to be less pronounced in 1967 (Table 1).

Men and women between the ages of 18 and 76 participated in the study. They showed no statistical difference in values according to age, but a tendency towards lower values was observed during the twenties, and peak values occurred at about fifty years of age.

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Possible Significance of Filaments in Sieve Elements

OF the several theories of sieve tube translocation at present being investigated, the surface action theory of van den Honert[1] appears to have the least favour. Opponents to this theory have pointed out that the surface area requirements of such a system are beyond the capacity of the sieve tubes[2], but calculations based on evidence from electron micrographs make this a contentious issue.

Several workers[3–6] have pictures of sieve plates of different species with the filamentous "p-protein" passing through the plates. Several authors have reported the diameter of these filaments to be within the range 60 Å to 240 Å. I have calculated the effect such filaments would have on the actual surface area within a single sieve element, making a number of assumptions.

First, the filaments have an even distribution through the pores and are continuous throughout the lumen[7]; second, 50% of the surface of the plate is "open" (a standard value for most calculations[8]); and third, 20% of the cross sectional area of the pore is occupied by these filaments.

With these assumptions 10% of the cross sectional area of the lumen would be occupied by the filaments. For convenience in calculation, a sieve element was treated as a right cylinder 250 μm long and 20 μm diameter, well within the range of sieve element sizes reported by Esau[9].

In this instance, the cross sectional area of the sieve element would be $10^{-6}\pi$ cm², and the 10% occupied by the filaments $10^{-7}\pi$ cm². Taking a mean value of 120 Å as the diameter of these filaments, the cross sectional area of one filament would be $36\pi\times10^{-14}$ cm². Thus the number of filaments, N, can be calculated for a single sieve tube as: $N=\dfrac{10^{-7}\pi\,\text{cm}^2}{36\pi\ 10^{-14}}\ \text{cm}^2$

i.e. $\dfrac{\text{(area occupied by filaments)}}{\text{(area of one filament)}}=2.8\times10^5$ filaments in each sieve element. Therefore, the effective surface area of the filaments in a single sieve tube would be $N\pi dl$ (where d is the diameter of the filaments and l is the distance between the two sieve plates) $=2.8\times10^5\times\pi\times12\times10^{-7}\times2.5\times10^{-2}\ \text{cm}^2=2.65\times10^{-2}\ \text{cm}^2$. The volume of a sieve tube of these dimensions would be 7.85×10^{-8} cm³, giving a surface area to volume ratio of 3.4×10^5 cm² ml.$^{-1}$.

The generally accepted value[8] of 10% (approximately 0.3 M) for the concentration of sucrose in sieve tubes permits a calculation of the number of sucrose molecules in an individual sieve element. In one sieve element of these dimensions there would be 1.41×10^{13} molecules of sucrose. The effective surface area within the sieve element was changed to equivalent planar dimensions, and the molecular capacity of the surface in terms of a monomolecular layer of sucrose molecules was calculated. Using a radius of 5.3 Å for the hydrated sucrose molecule[10], the surface area available is equivalent to a monomolecular layer of 2.36×10^{12} molecules, within an order of magnitude of the number of sucrose molecules in the sieve element.

While it would be brash to assume that the entire population of sucrose molecules might be in association with the filaments, the calculations suggest these capacities may be approached. A surface phenomenon could explain bidirectional flow in individual sieve tubes[11–13] and could account for minimal water movement[14,15] if only the hydration spheres of sucrose molecules were moved. On this basis I believe that a physiologically mediated process on the surface of the filaments should not be discounted.

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