

produce slight differences in distribution of all chromatin, and different fixing fluids also form a slightly different intergranular substance which would cause the granules to have a different appearance.

Putting all things together we may conclude that during life the granules have the same refractive index as the remainder of the cell, but that they are formed elements in the cytoplasm as much as ordinary chromatin is a formed part of the nucleus. It is probable that all chromatin is more or less plastic, for different fixing fluids produce a slightly different disposition of chromatin in the nuclei of all cells. It seems to me to be impossible to answer Flemming's objection that the cone of origin of the process of spinal-ganglion cells is always free of granules, if the latter are precipitated elements in the cell.

Many authors, including De Quervain,⁸⁴ Held, Flemming, v. Lenhossek and others, consider the Nissl granules are made of fine particles embedded in another substance. It is true that the Nissl granules, in the different cells, but more particularly in the spinal-ganglion cells, do not appear homogeneous. Is this due to one kind of substance embedded in another different substance, or is it due to irregularities in contour of the same substance? I think the latter is the correct explanation. In sections $1\frac{1}{2}$ thick and stained with eosin and toluidin blue, iron-alum hæmatoxylin or other dyes, or treated to liberate the "masked" iron, the same result was always obtained; the granules appeared homogeneous but of different densities. The edges of the granules are never straight, a circumstance that many have noticed, and thus a section of the cell must contain different thicknesses of the material. The granules often contain vacuoles, which would also tend to give them a heterogeneous appearance. The vacuolated appearance is also due to inequalities of the surface of the granules, for one can see in almost every preparation how a section at right angles to the plane being examined would appear to leave cavities in the chromatic material.

I do not intend to discuss in this paper the arrangement of the Nissl granules in the cell, and shall refer only to the presence or absence of these granules in the axis cylinder and cone of origin of this process. The history of development would tend to show that the Nissl granules would not be found in the axis cylinder process, and this is what all observers who have worked with material that had been fixed and then

⁸⁴ De Quervain, Fritz, "Ueber die Veränderung des Centralnervensystems bei experimenteller Kachexia thyreopriva der Thiere," Virchow's Archiv. CXXXIII, p. 527, 1893.