SHORT COMMUNICATIONS

THE DEVELOPMENTAL FATE OF ENDOPLASMIC RETICULUM IN THE SIEVE ELEMENT OF *PISUM**

By S.-Y. Zee†

The development and the function of the endoplasmic reticulum (ER) in the sieve element have been studied by many workers (Esau, Cheadle, and Risley 1962; Northcote and Wooding 1966; Cronshaw and Esau 1967; Wooding 1967). From these studies one can see that the ER system plays an important role throughout sieve element development. This report describes the sequence of development of the ER in the sieve element and provides further information on observations already reported (Zee and Chambers 1968).

Experimental

The region of the tissue studied is about 5 mm from the tip of the epicotyl. The epicotyl was obtained from pea seedlings germinated on filter papers in Petri dishes under continuous light for 5 days. The whole epicotyl still attached to the seed was immersed in a 4% solution of glutaraldehyde buffered with cacodylate buffer (pH 6·7) for 2 hr at room temperature. Slices 1–2 mm thick were obtained from the required region and fixed again in the same fixative for another 2 hr. Afterwards the tissue slices were washed in the same buffer for 3 hr (three changes) and then post-fixed for 1 hr in a 2% osmium tetroxide solution buffered with 0·1M cacodylate. Observations were made in a Siemens Elmiskop I electron microscope at 80 kV.

Results and Discussion

In the young sieve elements of *Pisum* the paired membranes of the ER enclose a space of about 400 Å and have ribosomes on their outer surfaces (Fig. 1). As the sieve element matures the tonoplast starts to disintegrate. It is from the beginning of this stage that the ER appears to undergo some profound changes.

The rough ER becomes smooth by losing its associated ribosomes. These smooth ER membranes persist throughout the development of the sieve element until finally they are stacked together along the lateral walls of the morphologically mature sieve elements.

Moreover, at the very young stage of development of the sieve element some portions of the rough ER appear to appose to each other and, by what appears to be a "zipping up" process, form the sieve-tube reticulum (Fig. 2). In profile the sieve-tube reticulum appears as a tripartite system composed of three membrane-bounded layers: an electron-lucent layer, an electron-dense layer, and another electron-lucent layer. The total thickness of the structure is about 600 Å and each component is about 200 Å. The outer surface of some of the sieve-tube reticulum is still associated with ribosomes, while others become smooth. These units of sieve-tube reticulum may appose another unit of ER or another sieve-tube reticulum unit resulting in the formation of a series of sieve-tube reticulae (Fig. 3).

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† Botany School, University of Melbourne, Parkville, Vic. 3052.

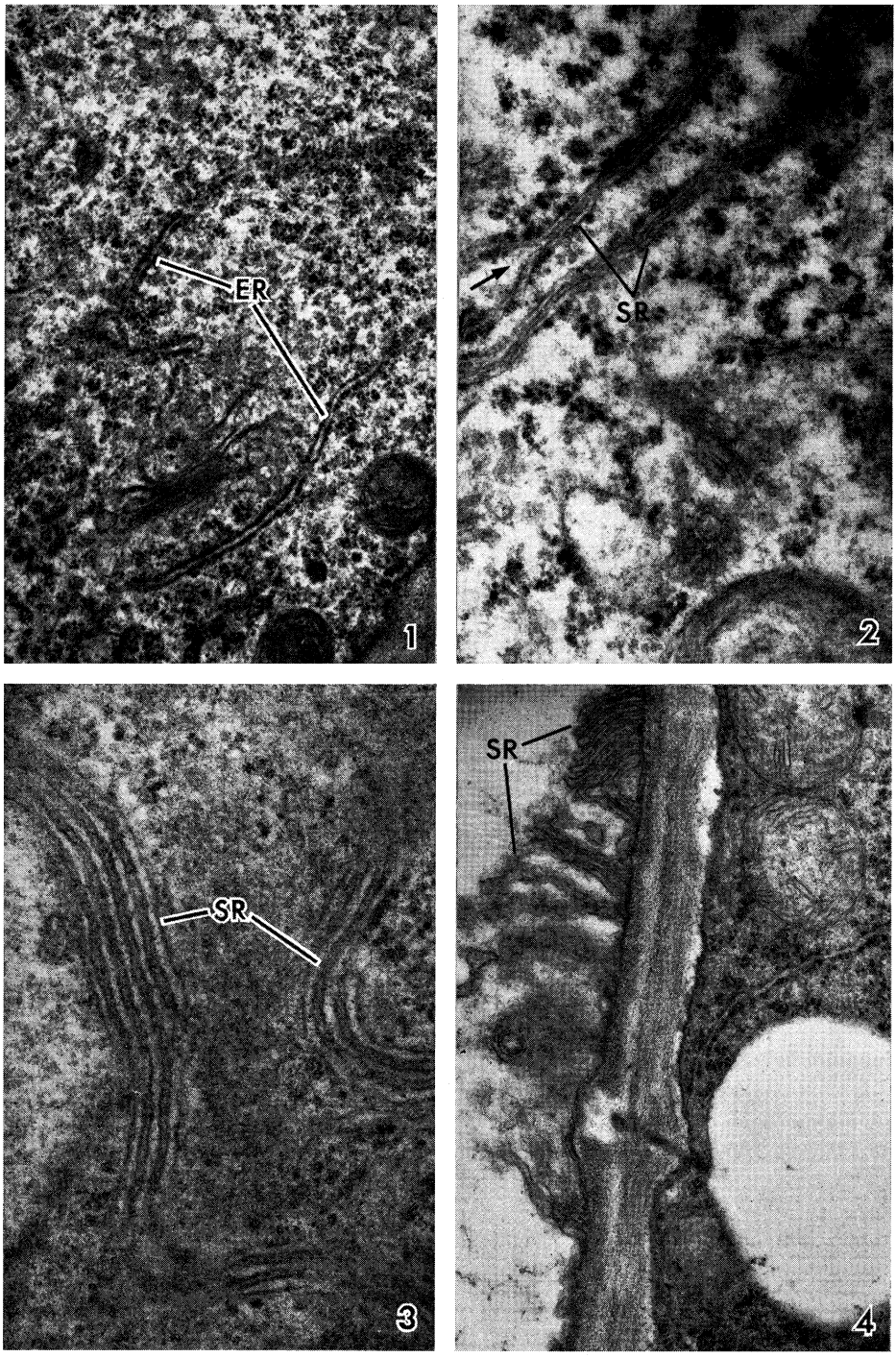

Fig. 1.—A portion of the cytoplasm of a very young sieve element showing the general profile of the endoplasmic reticulum (*ER*). ×24,000.

These units of sieve-tube reticulum may often be seen situated randomly within the mictoplasm but occasionally they may be seen in close association with the nuclear envelope and the pore sites between the sieve element and the companion cell. The sieve-tube reticulum has not been found attached to the sieve plate or its pores.

In the morphologically mature sieve elements the sieve-tube reticulum is found mostly attached to the lateral walls (Fig. 4). The sieve-tube reticulum is never found arranged in a completely orderly pattern within the lumen of the sieve element. It is therefore difficult to establish if this structure is a kind of precursor to, or remains of, the transcellular strands such as those reported by Thaine (1962) and Thaine, Probine, and Dyer (1967).

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Fig. 2.—A portion of the cytoplasm of the sieve element at a late stage of development. The endoplasmic reticulum starts to form sieve-tube reticulum (*SR*) by the "zipping up" process (arrow). ×45,000.

Fig. 3.—Multiple units of sieve-tube reticulum (*SR*) present in a late stage of development of the sieve element just prior to morphological maturity. ×60,000.

Fig. 4.—Profiles of sieve-tube reticulum (*SR*) present in the morphologically mature sieve element. ×32,000.