

Basic Cell–Cell and Cell–Surface Interactions in Liposome and Cellular Systems.

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Abstract: *Experimental evidence on long, thin tubular structures (with or without transport gondolas) in giant phospholipid vesicles indicates an important role of phospholipid nanotubes in intracellular and intercellular transport and communication. In this work, we present evidence that nanotubular structures similar to the ones observed in giant phospholipid vesicles exist also in fully differentiated cells.*

We have used sub-micron metal-rod decorated surfaces, “nanolawn” structures, as a substrate to study cell–cell and cell–surface interactions of primary murine astrocytes. Astrocytes are the major cell group of the brain, comprising about 50% of the cells. They support neurons both physically as a cell matrix and physiologically by providing a stable microenvironment and growth factors. Astrocytes form multicellular syncytia in vivo that provide neuronal homeostasis by taking up neurotransmitters and buffering the ionic content of the extracellular medium in the brain. Using nanolawn as the matrix for differentiation, we could observe how astrocytes form nanotubular protrusions to make contact with the matrix and each other. The thin tubular structures were very similar to those in pure phospholipid systems. Furthermore, gondolas on these nanotubes have been observed suggesting a transport function for cellular material. It could be theoretically shown that curvature-induced self-assembly of interacting anisotropic membrane components may lead to the spontaneous formation of thin nanotubular membrane protrusions in systems of giant liposomes as well as in astrocytes. This self-assembly may represent a relevant physical mechanism of nanotube formation even if membrane skeleton elements, such as actin fibers, were not essential for the nanotube formation.