

## Endosis and Exosis: New Names for Fusion and Budding

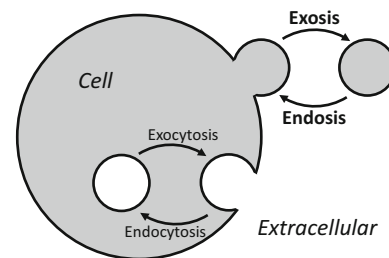
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To the Editor,

Endocytosis and exocytosis are named for the fact that vesicle action (-osis) is movement into (endo-) or out of (exo-) the cell (-cyt-). Vesicle budding and fusion of extracellular vesicles to cells are also commonplace processes in biology (Mause and Weber 2010; Nabhan et al. 2012) but lack formal names. For instance, budding occurs from cells infected by enveloped viruses or undergoing apoptosis and from apocrine glands and megakaryocytes. The products of budding are sometimes referred to as “exosomes” (Keller et al. 2006). Fusion of external vesicles to a cell is exemplified by HIV fusion to natural killer cells. Budding and subsequent fusion of exosomal vesicles containing fibroblast growth factor-2 may illustrate both processes (Taverna et al. 2003).

Topologically, these processes are distinct from endocytosis and exocytosis. They are not inversely related or mirror images, as they would be if the cell membrane were simply a plane, because the cell membrane is closed, encompassing the cell contents, so prefixation based on the inverse (in-) or opposite (anti-) nature of the processes would not be appropriate. They could be referred to jointly as the converse (con-) of endocytosis and exocytosis in the sense that the processes are reversed: they involve outward rather than inward bending of the cell membrane.



**Fig. 1** Proposed terms for budding (exosis) and fusion (endosis)

Alternatively, names could be based on vesicles moving away from (ab-) or toward (ad-) the plasmalemma or as external instead of internal processes. However, each of these leads to cumbersome terminology.

Instead “budding” could be called “exosis” and “fusion” “endosis” (see Fig. 1). These terms are memorable and simultaneously convey symmetry and contrast with the terms endocytosis and exocytosis. They lack the root that refers to the cell, which is appropriate because these processes are extracellular actions of vesicles rather than intracellular. Furthermore, they complement the established nomenclature that endocytosis leads to endosomes and budding to exosomes. The complementation would be perfect if endosomes were instead called “endocytosomes.”

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