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Imaging in Focus: Imaging the dynamics of endocytosis

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Summary

Endocytosis, the formation of membrane vesicles from the plasma membrane, is an essential feature of eukaryotic cell biology. Intense research effort has been dedicated to developing methods that can detect endocytosis events with the highest resolution. We have classified these methods into four families. They exploit the physical properties of endocytosis, namely: 1. Distinguishing extracellular from internalised cargo in fixed samples, 2. Monitoring endosomal acidification, 3. Measuring the turnover of endocytic zones and 4. Detecting vesicle scission. The last three families, all based on fluorescence imaging, are used to study endocytosis in living cells. We discuss the advantages and limitations of these methods and conclude on the future developments required to tackle the upcoming challenges in this fundamental field of cell biology.

Introduction

Endocytosis is a universal feature of all eukaryotic cells. Literally meaning getting inside ("endo") the cell ("cyto"), the term was coined by Christian De Duve during a symposium entitled "The Lysosome" in 1963. Nowadays, it refers to the process by which a substance - proteins, lipids as well as components in suspension or solubilized in the extracellular fluid - gains entry inside the cell by being engulfed in a membrane surrounded vesicle. After their formation at the plasma membrane, endocytic vesicles mature and fuse with other intracellular organelles, which defines the endosomal network. In this review, we will restrict the use of the term endocytosis to the formation of vesicles