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Editorial Foreword

'Cell Secretion' Review Series

Cell secretion - finally sees the light

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Guest Editor for 'Cell Secretion' Review Series

It has been a quest for nearly a century, and finally 'Cell Secretion', the universal and the most fundamental of cellular processes, has been unraveled. The critical breakthrough came with the discovery of the ***'porosome'***, the universal secretory machinery at the cell plasma membrane, where membrane-bound secretory vesicles dock and transiently fuse to expel intravesicular contents to the outside [1–7]. What took so long for this discovery? The answer is simple: like other such pioneering discoveries, the development of the necessary tools, followed by their skillful use, combined with keen perception of the discoverer, *Professor Bhanu P. Jena*, made it possible.

The discovery of the 'porosome', a new cellular structure at the plasma membrane of live secretory cells, is a landmark in cell biology. The further determination of the porosome's morphology and dynamics at nanometer resolution and in real time in live cells, its function, its biochemical composition, and its structural and functional reconstitution in lipid membrane, are ground breaking and pioneering contributions [1–7]. With the development of the light microscope over 300 years ago, cell biology was born but in its infancy was limited; even micron size objects and less than 50 nanometer deep, remained unresolved and invisible under the light microscope. Similarly, even though the electron microscope (EM) is capable of near nanometer resolution, structural alterations introduced during sample preparation may have precluded earlier discovery of the porosome. Furthermore, observation of cell dynamics is not possible using EM since cells are no longer alive following processing for electron microscopy. Professor Jena and his research team circumvented these limitations faced by both light and electron microscopy by using the Atomic Force Microscope (AFM), a force spectroscope for imaging live cells in 3D, at nanometer to sub-nanometer resolution in real time. The 100–150 nm in diameter porosomes at the plasma membrane in live pancreatic acinar cells, chromaffin cells, growth hormone cells of the pituitary, and β-cells of the endocrine pancreas [1–6, 8], and the 8–12 nm porosomes at the nerve terminal [7] were observed for the first time in live cells using the AFM, and further confirmed by EM.

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This discovery has not only revolutionized our understanding of cell secretion in particular, and of the cell in general, it has given birth to a new field ***-'Nano Cell Biology'***.

Cell secretion involves the fusion of membrane-bound secretory vesicles at the porosome and the release of intravesicle contents to the cells exterior. The molecular mechanism of membrane fusion [9–14] and the regulated expulsion of intravesicular contents [15–18] during cell secretion have all been determined. These discoveries have resolved one of the most fundamental and important workings of Nature and is one which will profoundly impact human health and medicine.

In this special issue on 'Cell Secretion', a review by Prof. Jeftinija and a minireview on the discovery of the molecular machinery and mechanism of cell secretion are published [19, 20].

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