Featured Publication Note
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Transepithelial Projections from Basal Cells are Luminal Sensors in Pseudostratified Epithelia

The morphologically dominant epithelial cells of several tissues have been extensively studied. These cells use complex mechanisms to detect both apical and basolateral stimuli and modulate their function in response to physiological demands. Less is known about basal cells, which are believed to be restricted to the basal region of pseudostratified epithelia. It is thought that these may function as stem cells and participate in basolateral signaling.

In this study, researchers have shown for the first time that basal cells of the upper respiratory tract and the male reproductive tract (e.g. the epididymis) extend long and slender cytoplasmic projections that reach toward the epithelial lumen and can cross the tight junction (TJ) barrier.

The epididymis is lined by a pseudostratified columnar epithelium containing principal cells (tall, columnar cells with many long, thin stereocilia), clear cells and basal cells. A Z-series (0.1 mm intervals) through an epididymal section was collected and was imported into Volocity for 3D reconstruction (see figure). Using Volocity 3D volume rendering, researchers were able to clearly see that basal cells reach the luminal side between epithelial cells. In the figure, the contact of the basal cell with the epididymal lumen was only apparent by looking at rotations around the x axis, due to the presence of long stereocilia in adjacent principal cells, which mask the small apical pole of the basal cell. Final animations were then exported from Volocity as QuickTime movies (see movie).

One role of the epididymal epithelium is to establish an optimal luminal environment for sperm maturation and storage. Using Volocity, researchers also showed that the cytoplasmic projections of basal cells in the epididymis express the angiotensin II type 2 receptor (AGTR2), which is involved in regulating male fertility. They provide evidence that activation of AGTR2 by angiotensin II in the epithelial lumen is communicated from basal cells to neighboring clear cells, which respond by increasing luminal acidification.

A model was proposed in which basal cells sense the luminal environment of pseudostratified epithelia and modulate epithelial function through crosstalk with other epithelial cells. This novel mechanism for hormonal signaling might also be applicable to other pseudostratified epithelia.

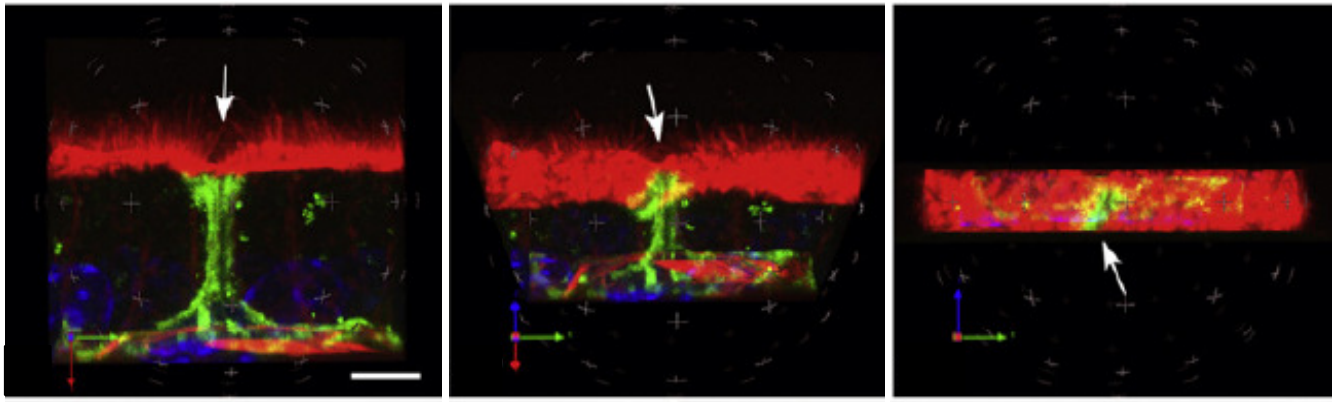

Figure: Basal Cells Cross Tight Junctions
The figure shows rotations of a 3D reconstruction of epididymis. Basal cells were stained for Cldn1 (green) and principal cells were labeled for F-actin (red). A Cldn1-positive basal cell reaches the luminal side (arrow) between principal cells. The scale bar represents 5 µm.

Movie:
http://download.cell.com/mmcs/journals/0092-8674/PIIS0092867408013123.mmc10.mov