

Marshall (Chip) Montrose, PhD

Professor and Chairman

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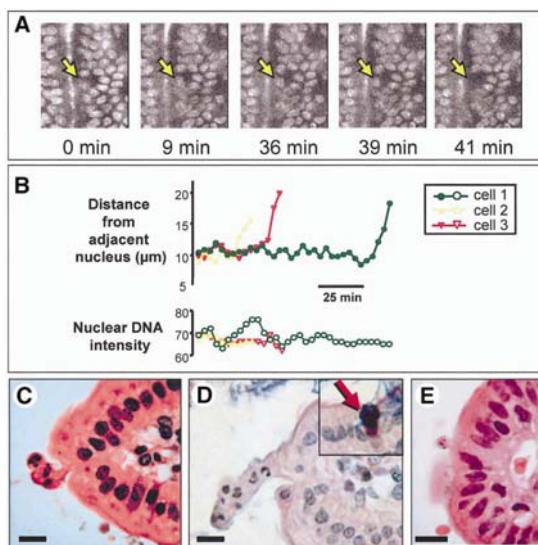
Description of Research:

Dr. Montrose studies ion transport regulation in stomach and large intestine. He is testing the hypotheses that regulation of the extracellular pH directly above the gastric epithelium is mediated by cyclooxygenase-1, and is integral to the ability of the tissue to recover from limited damage to the epithelium. He is using two-photon light absorption to produce micro-lesions (1-4 cells) targeted at the gastric surface epithelium, and monitoring the tissue recovery in real time (60 min) using two-photon and confocal microscopy. Additionally, Dr. Montrose is studying the regulation and function of NHE2 and NHE3 (Na⁺/H⁺ exchanger) in the large intestine. These two Na⁺/H⁺ exchanger isoforms contribute to sodium and water absorption, but their relative contributions remain uncertain. He is testing several hypotheses about the differential responsiveness of these two isoforms to extracellular and intracellular pH microdomains near the membranes. Experiments use cells transfected with fusion proteins combining NHE and fluorescent proteins so that they can investigate whether pH near the mouth of the transporter is altered (pH-sensitive fluorescent proteins) or if translocation of NHE to the membrane occurs in response to altered ionic conditions (pH-insensitive fluorescent proteins). He is also using live tissue confocal microscopy to ask if Na⁺/H⁺ exchange function is present in the base of colonic crypts (long believed to be an exclusively secretory structure) of NHE1 and NHE2 knockout mice.

Collaborations:

Dr. Montrose collaborates with Dr. Shull to explore the function of NHE2 in the colonic crypt epithelium using knockout and transgenic animals. Dr. Montrose also collaborates with Dr. Matthews using the **Integrative Morphology Core** to study the epithelial barrier and transport in the small intestine in response to acute injury or the physiologic renewal of the epithelial cells. Dr. Shroyer collaborates with Dr. Montrose to study animals that lack goblet cells in the distal ileum.

Representative Figure:



Biogenesis of discontinuities in the small intestinal epithelium caused by cell shedding. (A) Time lapse images of a Hoechst 33258-stained cell being shed (arrow). (B) Upper graph of internuclear distance between 3 shed cells and their immobile neighbors. Lower graph of nuclear fluorescence intensity in same cells over same time course showing lack of nuclear condensation. Panels C and D are fixed sections of mouse tissue showing cells being shed from the murine villus tip stained by H&E (C) or stained for mucins (D, arrow in inset shows goblet cell). (E) Fixed section of human small intestine stained with H&E. Bars = 20 µm. Fig. 6 from *Gastroenterology*, 2005; 129: 902-912.