BioS368 Cell Biology Laboratory at Lehigh University: Cell Culture and Fluorescence Microscopy

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Cell culture and fluorescence staining/labeling techniques that allow observing organelles, proteins and nucleic acids in cells are important techniques that are applied by Cell Biologists all over the world. The Cell Biology Laboratory at Lehigh is a unique experience to learn and apply state-of-the-art fluorescence microscopy techniques. The course has four main sections: (1) Students thoroughly learn how to culture immortalized cell lines, (2) to stain sub-cellular structures in fixed and living cells using specific probes and antibodies (including double and triple color labeling), (3) to express and observe proteins tagged with fluorescent protein probes (GFP and derivatives, RFPs) in **living** cells, and (4) to interfere with cellular processes using specific drugs. Pursued experiments are not standard experiments available commercially in kit form, but are based on actual, unique research projects pursued in the instructor's laboratory that have been adapted to the classroom. Students maintain their own cells during the entire course and grow cells in dishes and on cover slips for experimental manipulation and microscopic examination. The course is designed to give students a hands-on experience in cell biological experimentation, and even to contribute directly to discovery! Interested? Note, that all cell images presented here were acquired by previous BioS368 Cell Bio Lab students.

Cell Culture

Cell culture under the laminar flow hood

HeLa cell growth curve and calculating duplication time

Splitting cells

Counting cells with a hemocytometer

Cryopreserving cells/starting a culture from frozen cells

HeLa cells seeded on different matrices

HeLa Cells in Culture (they look as other non-cancer cells do)

Lots of cells in the incubator

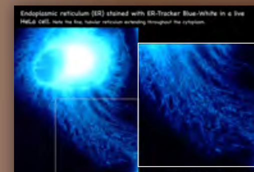
Contaminations:

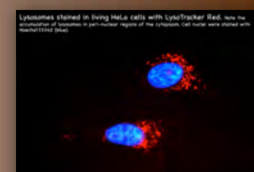
Counting cells

Live-Cell Stains

DNA and RNA visualized in a living HeLa cell.

The Golgi apparatus of living HeLa cells stained with BODIPY TR-labeled Ceramide.


Endoplasmic reticulum (ER) stained with ER-Tracker Blue-White in a live HeLa cell.

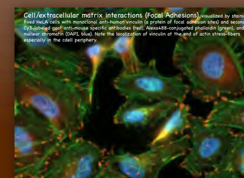

Lysosomes stained in living HeLa cells with LysoTracker Red.

Triple live-cell stain.

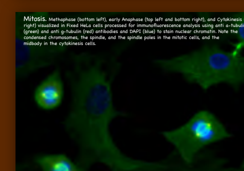
Mitochondria-Microtubule interaction.

Fluorescence Microscopy

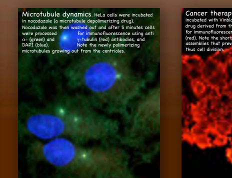
Stains in Fixed Cells

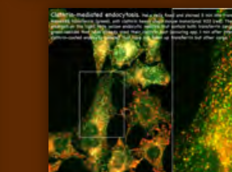

Cell/extracellular matrix interactions (Focal Adhesions)

Cell-cell Junctions (Adherens Junctions)


Mitosis.

Functional Assays


Microtubule dynamics. Cancer therapy drug action.


Clathrin-mediated endocytosis.

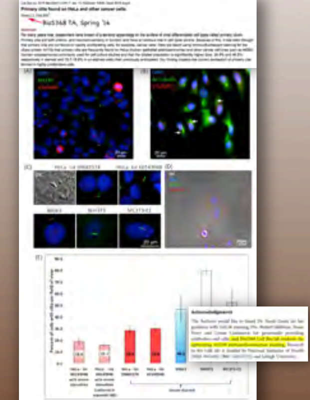
Cell-to-cell communication via gap junction channels

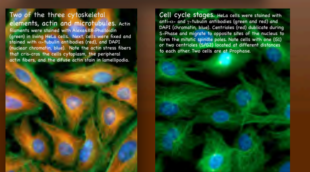
Fluorescent Proteins (GFP, RFP, Dendra2, etc.)

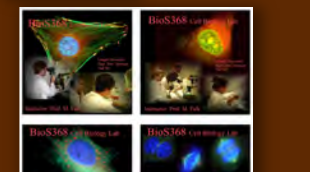
Expression of green (GFP) and red (DsRed) fluorescent proteins

Photoconversion.

Discovery




Two of the three cytoskeletal elements, actin and microtubules. Cell cycle stages.



BioS368 Cell Biology CD-ROM covers designed by M. Falk

Acknowledgements. I thank the many generations of Lehigh students who have taken my class, showed their excitement and dedication, and had fun learning hands-on science, and contributing to discovery!

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