

New Canadian Studies on Cystic Fibrosis

Cystic Fibrosis ("CF") is an inherited disease that affects the epithelial ("surface" or "lining") tissue throughout the body. A defect in the protein molecules that conduct chloride ions across cell membranes causes a wide array of symptoms: extra salty sweat that can be itchy in hot weather; acid in the small intestine that makes it hard for enzymes to digest food; and most seriously, a lack of lubrication on the cell surfaces that leads to a build up of sticky mucus clogging the lungs and sinuses and various ducts. This build up leads to infection, inflammation, allergic reaction (e.g. asthma), and the release of toxins and even stickier DNA from all kinds of ruptured cells. Once, people with CF usually died in infancy. Now, with pills to help their digestion, antibiotics to fight infection, and regular physiotherapy to clear the lungs of mucus, they can expect to survive to about 30 years of age.

In the Department of Chemistry at McGill University, the laboratories of Graham Darling and Jik Chin are investigating several areas relevant to understanding CF. One project is the preparation and calibration of new fluorescent chemical indicators to "probe", by means of fluorescent microscopy (see picture), the reactions of individual cells to various stimuli. This helps them to understand the mechanisms of inflammation and spasm within specific tissues in infected lungs, and to identify which drugs could best help in various situations. Another project is the preparation of new artificial enzymes that could specifically digest and loosen mucus in CF-afflicted lungs, or deactivate toxins there, or aid in the digestion of food. Finally, work is also being done on an artificial "chloride channel" molecule that, inhaled as a mist, would enter the membranes of lung cells and allow the re-establishment of the natural mechanisms for clearing out mucus as it is formed.

This research combines the specialties of synthetic organic chemistry, polymer chemistry, coordination chemistry, biochemistry and analytical spectroscopy. Though currently targeted towards CF, results may also be relevant to helping people with other diseases, and even to applications outside the field of medicine.