Figure 1

In practice a great deal can be learned about these films with relatively little expenditure of effort. The five layer film shown in Figure 1 is a section of a soft, flexible packaging film. It was cut free-hand[2] by drawing a **fresh razor** across the surface while supporting the film (cut to a thin strip) between the thumb and forefinger of the other hand and observing with a stereomicroscope. For the less experienced, the strip of film may be placed on the stage and sections obtained using the fingernail as a guide as described elsewhere[3].

The section shown permits clear recognition of the individual layers and measurement of their thickness. A preliminary indication of the composition of the film can be obtained by the use of stains. The bottom layer of the film shown in Figure 1 has been stained blue by short immersion in a stain specific for polyamides, thus demonstrating that this layer is nylon.
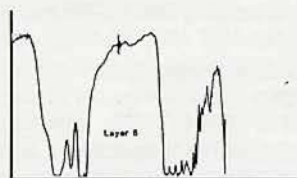
Figure 2
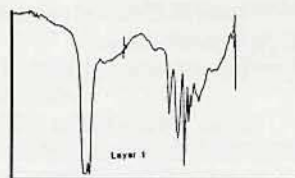
Figure 3
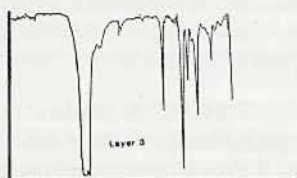
Figure 4

The stain does not interfere with the subsequent spectroscopic examination as seen in Figure 2. Although somewhat thick, the layer is clearly identified as nylon. The color of the layer is helpful in orienting difficult specimens on the FTIR microscope. Layer 1 is Surlyn (Figure 3) while layers 2,3, and 4 are thin, but distinct, layers of ethylene vinyl acetate (EVOA). Melting point determination, as seen in Figure 4, revealed that each layer of EVOA has a different melting point indicating differences in composition not seen in the spectra. The entire examination took less than a hour with sample preparation occupying only minutes.

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[1] Sorby, H.C. Proceedings of the Royal Society(@ (1867) p.33.

[2] Dieter Kranter in his excellent Mikroskopie in Alltag (Franck'sche Verlags handlung, Stuttgart Germany 1968) recommends that male microscopists shave with a straight razor to develop skill at freehand sectioning.

[3] Palenik, S. and Fitzsimons, C., Fiber Cross Sections Part II, Microscope 38 (1990) p. 315.

The Biological Images Project

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The Biological Images Project is the culmination of the four summers I have spent at Apple Computer. In short is is a software package which allows students to manipulate and explore biological images (i.e. micrographs, CTs, MRIs, etc.). Consisting of four sections - interface, biological images, image processing, and communication software - this package can serve as a powerful educational medium. The interface supports the more traditional forms of teaching - textual notes and brief lectures. The collection of biological images allows students to visualize biological structures in ways they never have before and exposes them to a variety of scientific techniques and tools. Image processing lets the student interact with the images, to manipulate, explore, discover and in some ways gain ownership of the image. Finally the communication package will provide the students a medium to share their discoveries in an interactive manner and submit them to peer review.

The key to this project is the images themselves. In total I am hoping to collect between 40 and 60 high quality biological images from a variety of media - light and electron microscopy, MRIs, CTs, X-rays, ultrasound, PET scans, etc. These images will be used only for a prototype version and will certainly not be distributed without their author's permission. The major requirement for these images is that they can be explored/analyzed through image processing. This can include simply enhancing the image to see structures better, morphometrics, particle counting and analysis, artificial color enhancement and animation. I am looking into possible software packages for three dimensional reconstruction but at this point only two dimensional data or animation of serial sections will be supported. Although aesthetic images are certainly a plus the most important characteristic is that some manipulations can be done to them. Examples of such images include - using particle analysis to find the number and area of food vacuoles in a protozoa, measuring DNA length of a virus which underwent osmotic shock, coloring and animating a collection of confocal laser scanning microscope images of a cell in metaphase to measure chromosome size and see if an antibody tag cross reacts, a freeze fracture preparation of a nucleus to estimate the size and number of nuclear pores, a serial collection of MRIs that when animated produces a "movie" of the brain, enhancing and rearranging chromosomes in a karyotype to check for chromosome abnormalities, etc. The rule of thumb to see if an image is appropriate for this project is to determine if more information can be gained through using a computer to view and analyze the image than by simply seeing the image in a text book.

This project depends upon the voluntary support of the scientific and educational community; I greatly appreciate your time, support and input. If you I have any images which you feel would be appropriate for this project, think you know people who would, or have any comments regarding my work, I can be reached at (408)974-3210 or e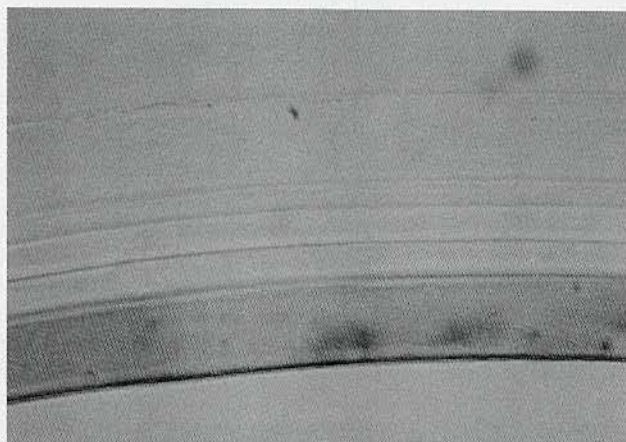lectronically at MPenn@Applelink, Apple.Com.