IMAGES IN SCIENCE

Editor Lennart Möller

Michael Peres

I serve as the Chairman of the Biomedical Photographic Communications department at the Rochester Institute of Technology(RIT) located in Rochester New York USA. I am also a Professor in the School of Photographic Arts & Sciences, where I teach specialized courses in photographing using a light microscopes as well as other magnification imaging systems. I first got interested in the bio-medical photography while working on my first university degree in Biology in 1975 from Bradley University. After several early humbling experiences trying to photograph my experiments, I became immersed in photographing biology as I worked on completing my requirements.

After finishing this program, I worked for a brief period as a photographer's assistant before deciding to go back to school for studies in bio-medical photography at RIT. I completed my second degree and moved to West Virginia where I worked as a medical photographer for almost 2 years. I eventually moved to Henry Ford Hospital in Detroit, Michigan in 1983 where I was supervisor of the medical photography department. During this time, I became board certified as a biological photographer, made several presentations, and won numerous awards for my scientific photography.

In 1986, I was hired at RIT as an instructor in the Biomedical Photographic Communications department. During my career at RIT, I completed a Master's degree in Instructional Technology. I have also authored numerous publications, presented over 100 oral papers and conducted more than 35 imaging related workshops in locations such as Canada, Sweden, Tanzania, Germany, the Netherlands, Australia and all over the USA. I have been a member of Bio-Communications Association for 25 years and I am a member of the Ophthalmic Photographer's Society.

My recent responsibilities include serving as the Chairman of the Lennart Nilsson Award Nominating Committee, being one of the Co-Coordinators of the annual RIT Big Shot project as well as developing and producing the Images from Science project with Professor Davidhazy, also of RIT.

In April (2003), I was one of the 2003 Eisenhart outstanding faculty award recipients, an Award given for outstanding teaching at the University. Winners are chosen through a rigorous peer review. Additionally, I was the co-recipient of the RIT 2003 Paul Gitner Award for Outstanding Achievement in the Graphic Arts for my work with Professor Davidhazy on the Images from Science project.

Under the microscope

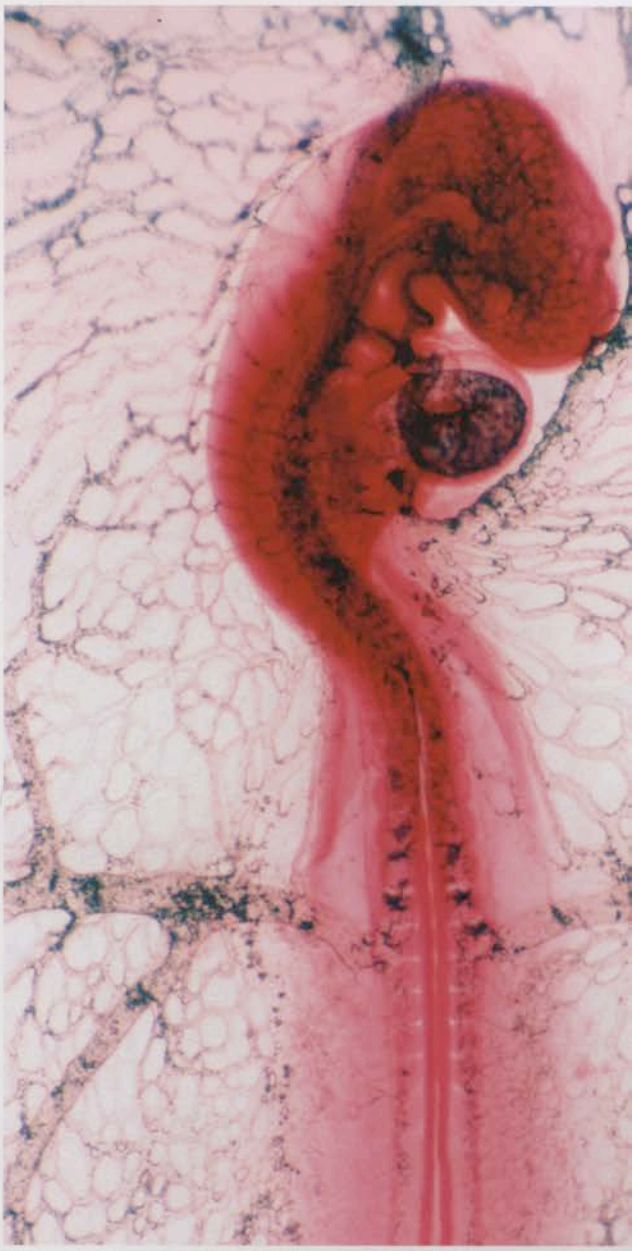
I had my first serious experiences using a microscope in a histology(the study of tissues of living things) class during the mid 1970's. I was fascinated by the internal organization, structure and shape of the subjects I was learning about. I still have many of my primitive drawings from that class that helped me to differentiate human muscle cells from connective tissue.

The first thing that occurs when you sit down at a microscope is an orientation problem. A microscope produces circular images with a limited field of view. Most of the field of view will be out of focus and it may also have contrast problems. With these problems controlled, subtle adjustments can be made to increase the quality of the image. Solving these problems is required before any serious level of investigation can begin.

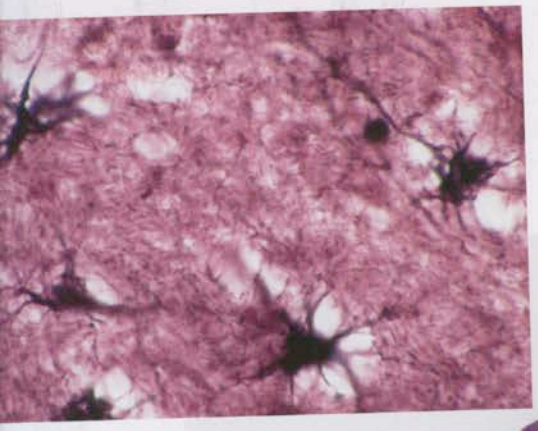
Many of the subjects seen in the following pictures were smaller than grains of rice. They were full of structure, colour, texture and information. Locating specific structures required careful scrutiny of the subject to locate the important structure from the sample as a whole. It was time-consuming and required significant concentration.

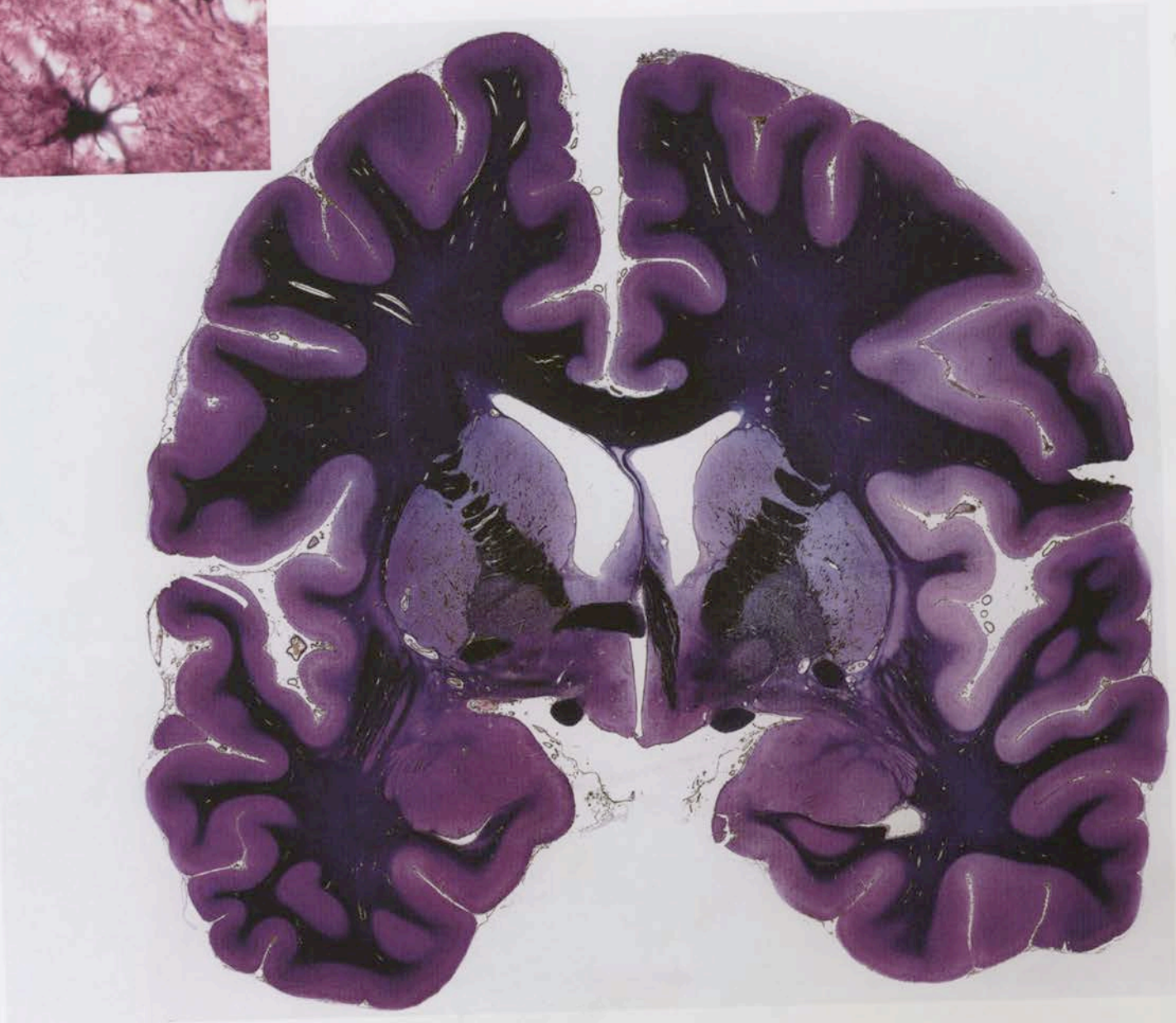
When photographing for science, the goals of the photography are clear. The picture needs to be photographically accurate and contain the precise scientific information in a very direct manner. It should be noted that subjects that will be photographed via a microscope require special preparations. These preparations might be performed by technicians with special expertise and might include isolating a live subject in a drop of pure "clean" water, having biological samples cut into 4-6um slices, which will ultimately be stained to make structure more visible, or by grinding and polishing minerals.

I have principally used the microscope as my camera for these pictures. These photographs are not really about science, although the pictures are all scientifically accurate. I have sometimes tried to photograph in ways that are accurate, while knowing the pictures might not be seen that way. I have tried to photograph samples in ways that make them seem elegant, although they m not be. Using the magnifying lenses found on a mi scope has allowed me to analyze a world not seer most.

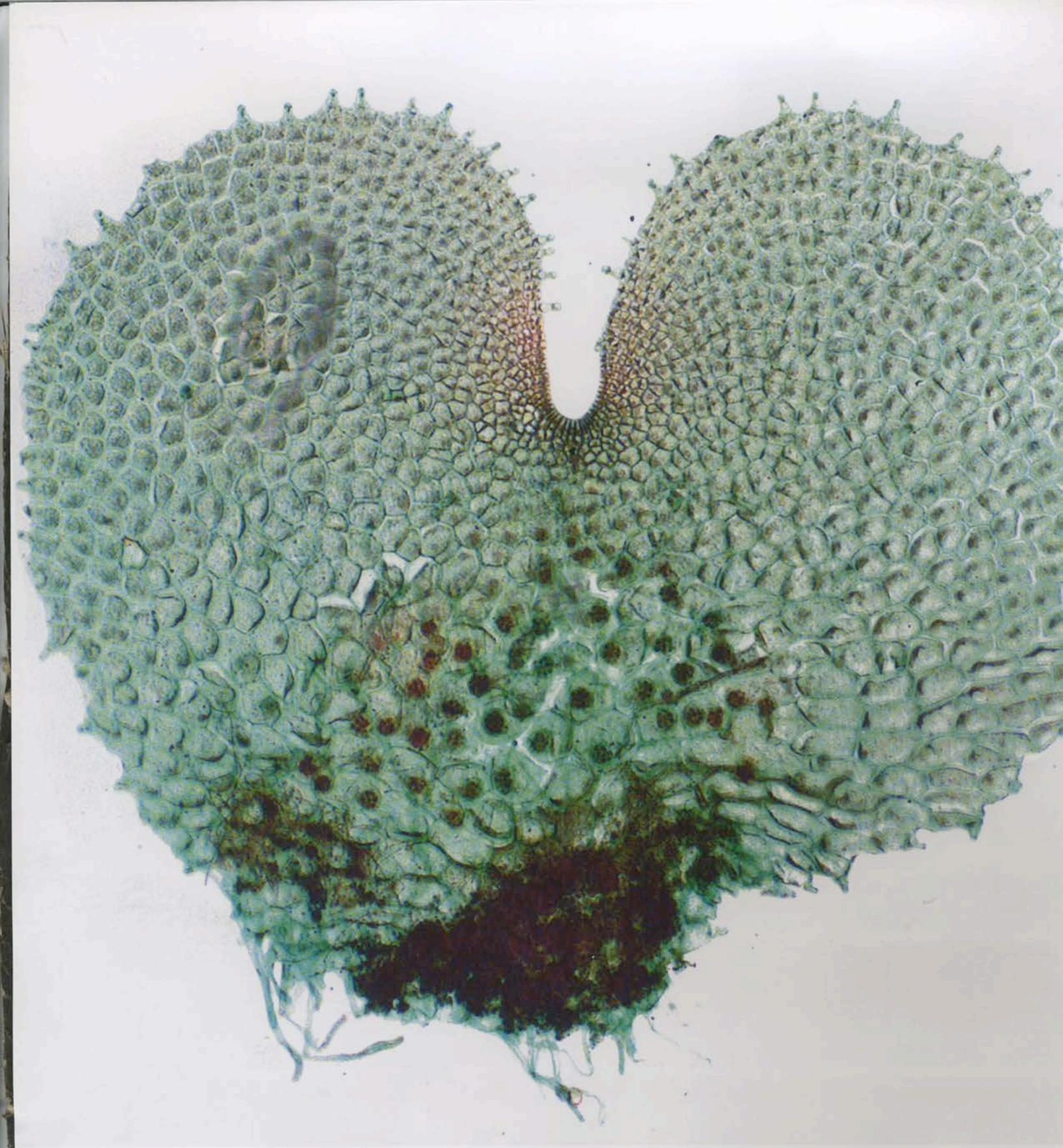


This picture of a chicken embryo was made via brightfield microscopy to reveal the detail of the subject's developm at a magnification of x10, using 35mm colour slide film.

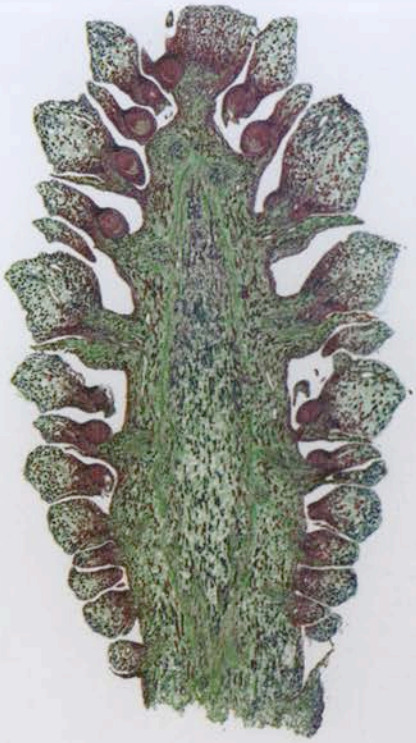




The smaller photomicrograph is of astrocytes, a type of nerve cell found in all regions of the central nervous system that includes the cerebellum, cerebrum and medulla which are the other parts of the brain and the spinal cord. Astrocytes are thought to be part of the suspension system used by blood vessels that enter through these regions.This picture was made using a brightfield microscope with a camera magnification of approximately X650, on 35mm colour slide film. The photograph of a coronal section of cerebellum was made using wide-field, brightfield illumination methods with a large-format film camera to reveal shape, colour, organization and structure of this region of the brain at a camera magnification of x1.



The picture shows Fern prothallium antheridium and was made from "whole mounts" of microscopic plant samples that required special preparations to render them soft and flat. The large photomicrograph is of a heart-shaped fern gametophye containing its antheridium. These are revealed as dark sites where sperms will ultimately develop. Also visible are the rhizoids, the precursors of a root system at the bottom of the subject. The picture was made at a camera magnification of x2, using a brightfield microscope with an SLR digital camera.



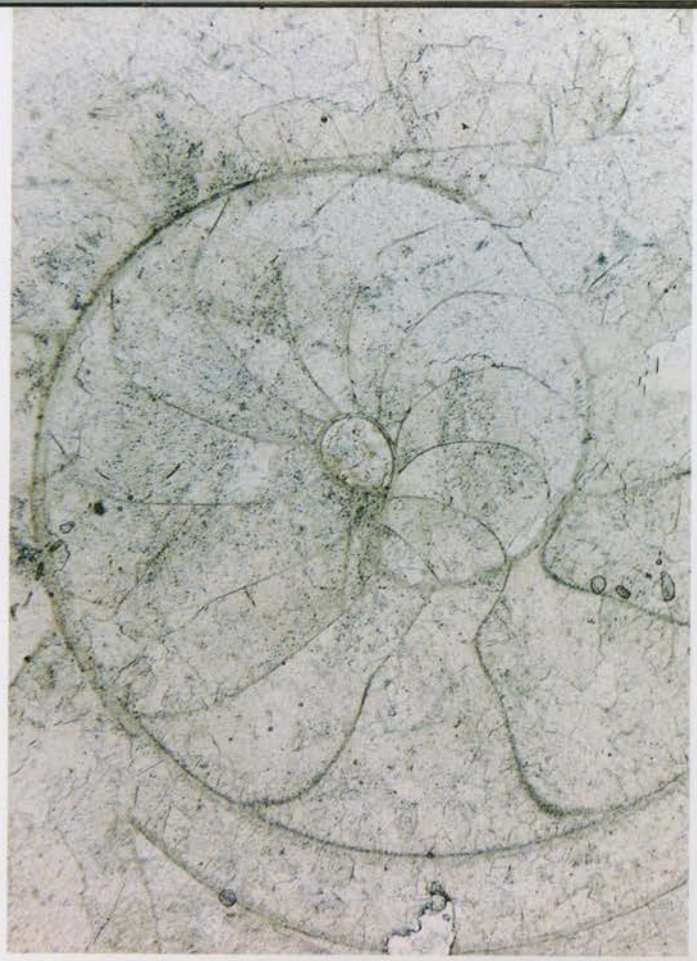
The subjects in the top row left to right are: a pine ovule, revealing a mature archigoniium; a male pine staminate cone containing pollen; in the bottom row left to right are pictures of two different stages of Fern prothallium, a short lived portion of the plant development's cycle characterized before the plant reaches maturity as an adult. The pictures were made using a brightfield microscope with a SLR digital camera. The pictures were made at magnifications ranging from x2 through x5.

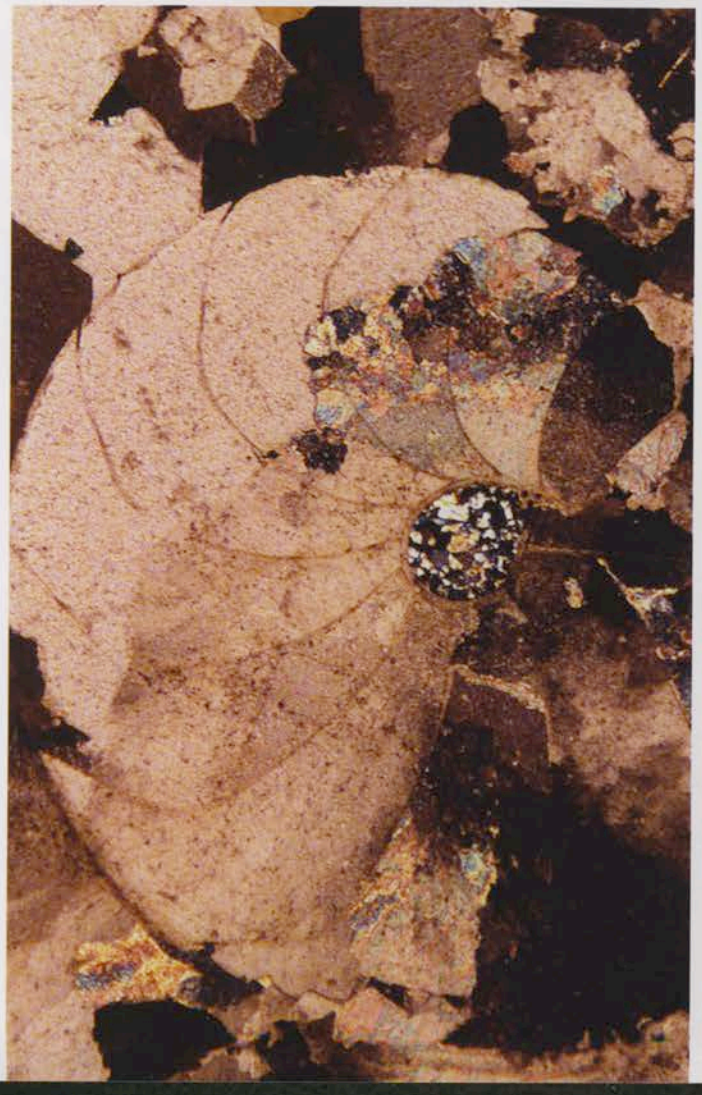
Assassin Bug

Culex mosquito

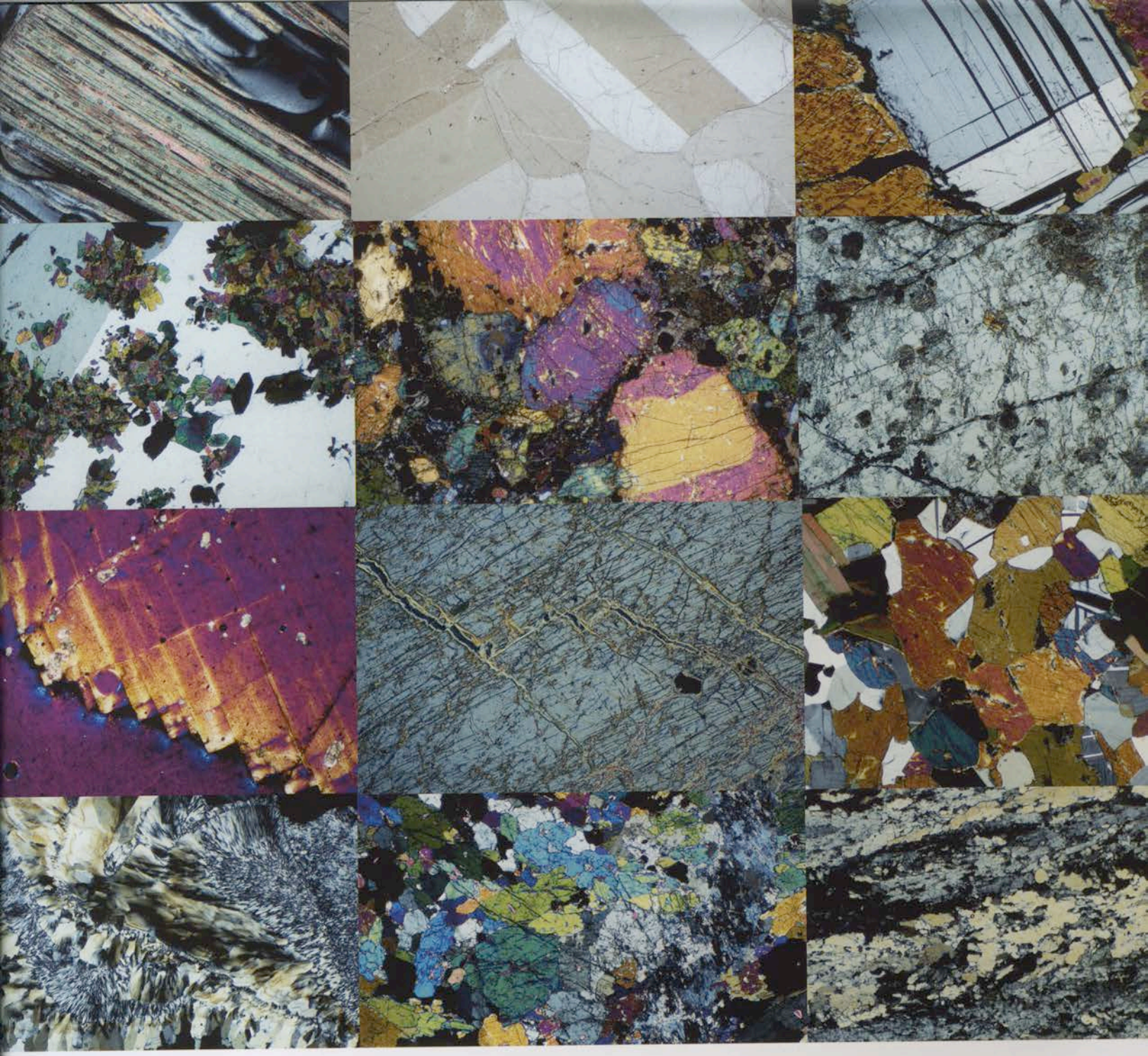
Similar to the plant preparations, the following pictures were made from "whole mounts" of insects that required special preparations to render them soft and flat. The pictures were made at a camera magnification of approximately 3x, using a brightfield microscope with an SLR type digital camera

Ixodes dammini at the nymph stage. The deer tick is the carrier of a bacterium that causes Lyme disease, which is common in the US. This picture was made using darkfield microscopy to increase the drama and detail of the subject at a magnification of 10x, on 35 mm colour slide film.





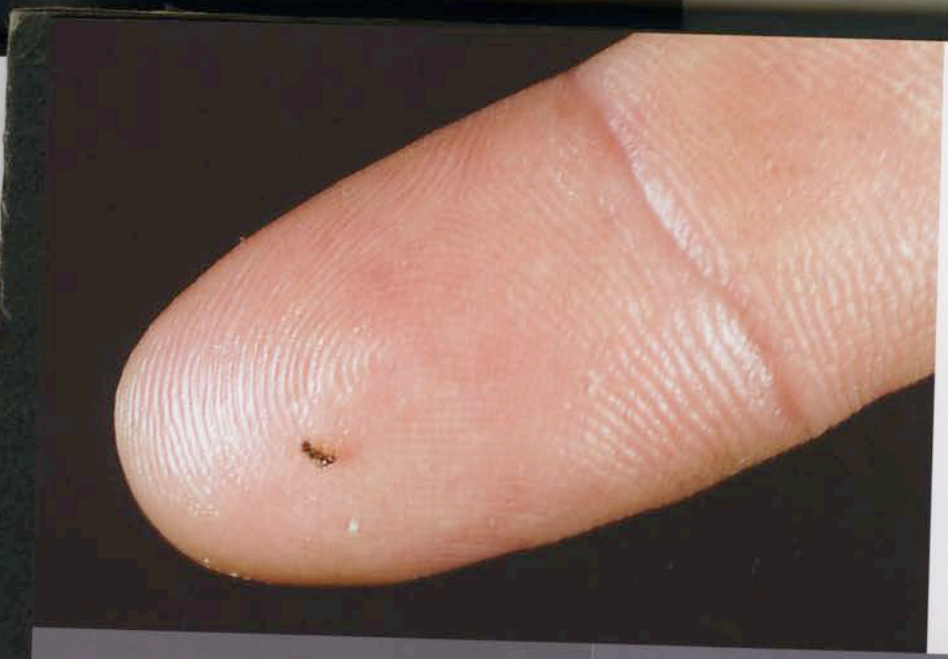
These two pictures were made of a cephalapod fossil featuring a nautiloid. This subject was initially found imbedded in rock (minerals), and then harvested from the dig. It was subsequently prepared by grinding it down to an approximate thickness of 15-20 µm. The top photograph was made via a brightfield microscope using a 2x magnifying objective (lens). The bottom photograph was made using the same lens, but the illumination technique was changed to create polarized light. In polarized light microscopy, information about the subject can sometimes be observed. This might include the presence of bi-refringent compounds, which are materials with multiple refractive indices. This phenomena is observed as various colours. In geology and chemical microscopy applications, samples can sometimes be identified by the shape and the characteristic colour of the crystal. This type of microscopy is also common in the world of forensic investigation.



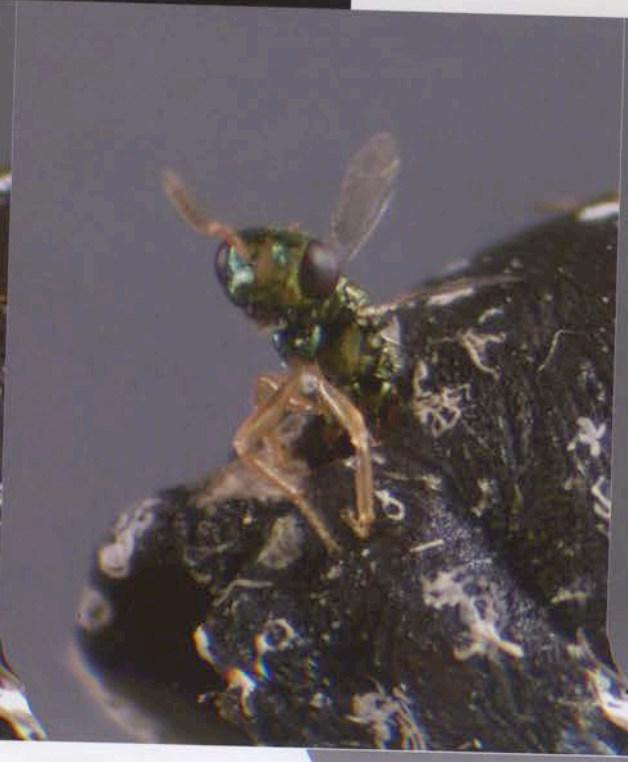
	2	3
	5	6
	8	9
	11	12

1Muscovite
2 Anorthosite
3 Labradorite
4 Epidote
5 Diopside
6 Orthoclase
7 Halite
8 Topaz
9 Hornblende
10 Quartz
11 Jacupirangite
12 Gypsum

These subjects were prepared separately by grinding them down to an approximate thickness of 15-20 µm. The photographs were made using a special illumination technique called polarized light on a light microscope. In polarized light microscopy, information about the subject can sometimes be observed. This might include the presence of bi-refringent compounds, which are materials that have multiple refractive indices. Bi-refringence can be detected as colour patterns. The colours might be similar to what is seen when a small amount of motor oil lies on a water puddle found in the street or on soap bubbles. In geology and chemical microscopy. Samples can sometimes be identified by their shape and characteristic colours of their crystals. Samples might also be classified by the grain size of the minerals when observed through the microscope. Minerals might be classified as small or large grain materials. Diopside, which is seen in the second row in the middle, would be an example of a large grain mineral while epidote or orthoclase would be classified as small grain minerals. This type of microscopy is also common in the world of forensic investigation where many crimes are solved through the pictorial information that can be obtained from the trace evidence.



Photographing small live mobile samples under the mic
scope provides significant challenges. Controlling and li
the range of movement is imperative, using appropriate
methods that do not result in a change of morphology
Additionally, the use of electronic flash is required since
subjects move relatively fast and "stop action" photogra
methods are essential.



The subject is a small wasp, which is hatching, named Nasonia vitripennes, or "jewel wasp". This small wasp is predatory and lays its egg in the egg case of a common species of fly. These pictures, at a magnification of 10x, reveal a mature wasp hatching from the fly egg casing.

▲ Batrachospermum sp. is a macroscopic filamentous (tree-like) freshwater red alga characterized by reddish plastids (chloroplasts) that most often inhabits cold running streams or cold spring-fed ponds and lakes throughout the world. This photograph of a live sample was made via a light microscope and an electronic flash, using darkfield illumination.

▲ Cocopod, is a small very mobile microcrustacean found in open and quiet water habitats. Their antennae, which beat like micro rowing oars, give them the name oarfoot. They are food for larger aquatic animals like fish. They are the first microcrustaceans to emerge in the spring after the filling of temporary ponds. Cocopods range in size from 1-3 mm. This photograph of the live sample was made via a light microscope and an electronic flash, using darkfield illumination.