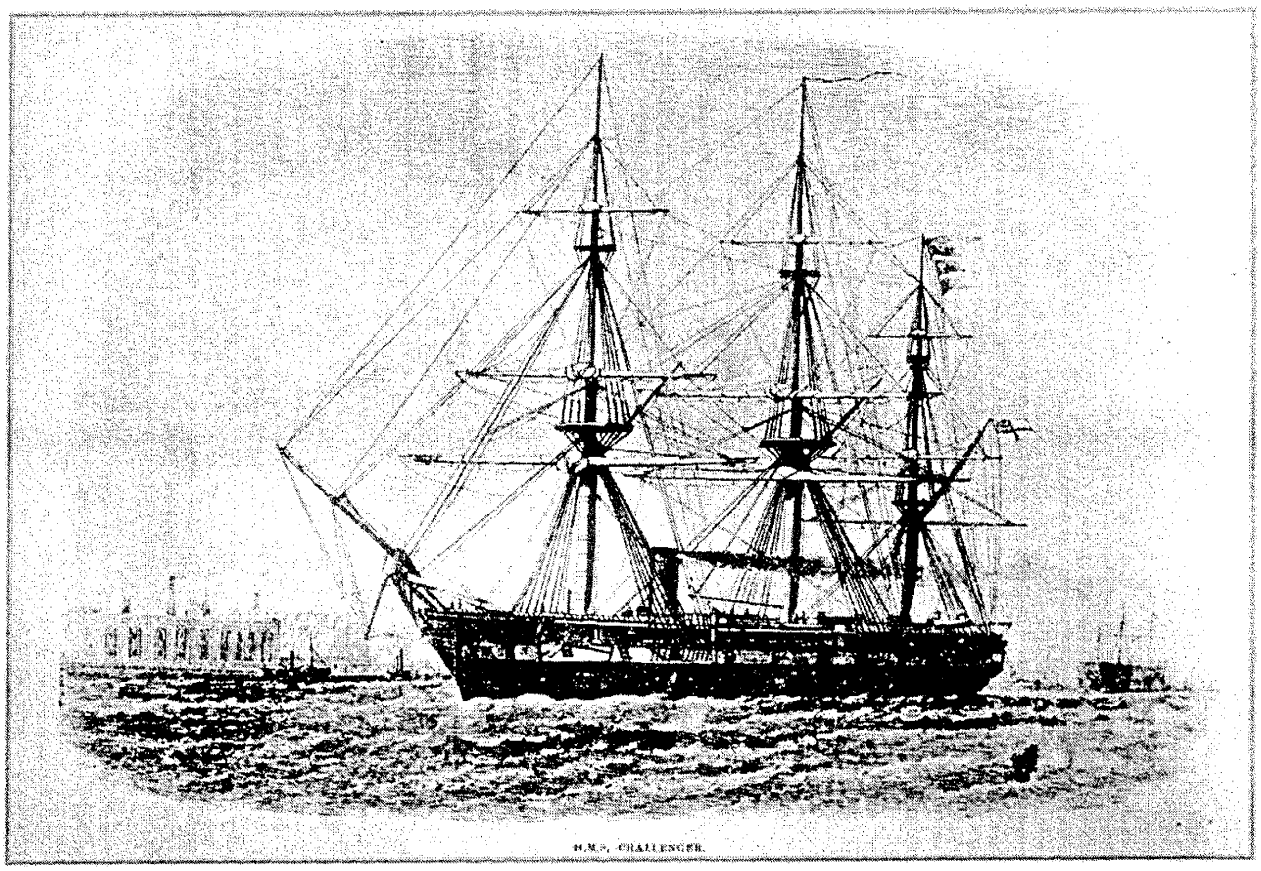
Journal of
THE MICROSCOPICAL SOCIETY OF SOUTHERN CALIFORNIA
Volume 5 Number 7 July 2000

Voyage of Discovery

The Challenger Expedition

John Field



H.M.S. Challenger - from Linklater, p. 22.

Between Trafalgar and World War I, the British Empire was the world's greatest power, and her Navy dominant. Man's enthusiasm for understanding his world was greater than ever before, leading to ever vaster enterprises of exploration. The greatest voyage of scientific exploration was that of H. M. S. Challenger. This voyage was the beginning of the science of Oceanography. It was also the demonstration that life exists at all depths, throughout the oceans. The voyage also discovered more species than any other single enterprise. Though not well remembered by many today, this was one of the great events in the history of science.

Challenger was a three masted, square-rigged Corvette, built in 1858. Built just fifty years after the first steam powered vessel, she was equipped with a four cylinder steam engine running on 45 to 60 p.s.i. of steam, and could raise 16,000 square feet of sail. The ship was 226 feet long, and displaced 2306 tons. Challenger was originally built for the British Navy, and had been equipped with about 22 cannons. During refitting for the voyage of exploration, all but two guns were removed, and a laboratory, winching facilities, and storage areas were added.

The project was conceived primarily by Dr. William Benjamin Carpenter, F.R.S. described as "a man of no ordinary mental grasp and range of study", and "one of the last examples of an almost universal naturalist". Professor Carpenter had strong support from influential men such as Lord Kelvin, and Prime Minister Gladstone. The Royal Navy provided a fine ship, and generally excellent officers and crew, numbering 243 men at the start of the voyage. The six "civilian" scientists proved a very fine group, and it was the major event in each of their lives.

Senior amongst the scientists was Charles Wyville Thomson, Scientific Director of the Challenger. Son of a physician, he enrolled at Edinburgh to study medicine, but switched to a study of natural history. Thomson had held professorships in botany, natural history, mineralogy, and geology, and was widely recognized for his leading role in the earlier Lightning and Porcupine expeditions in relatively near Atlantic waters.

Perhaps the most indefatigable member of the staff was Henry Nottidge Moseley, later F.R.S., and Professor at Oxford. It was said by very thoughtful people that "to walk with Moseley is to become sadly aware of one's fearful insufficiencies: he attracts people who will be useful to him, he sees forty times as much as others, and describes what he sees without pomposity, and with precision".

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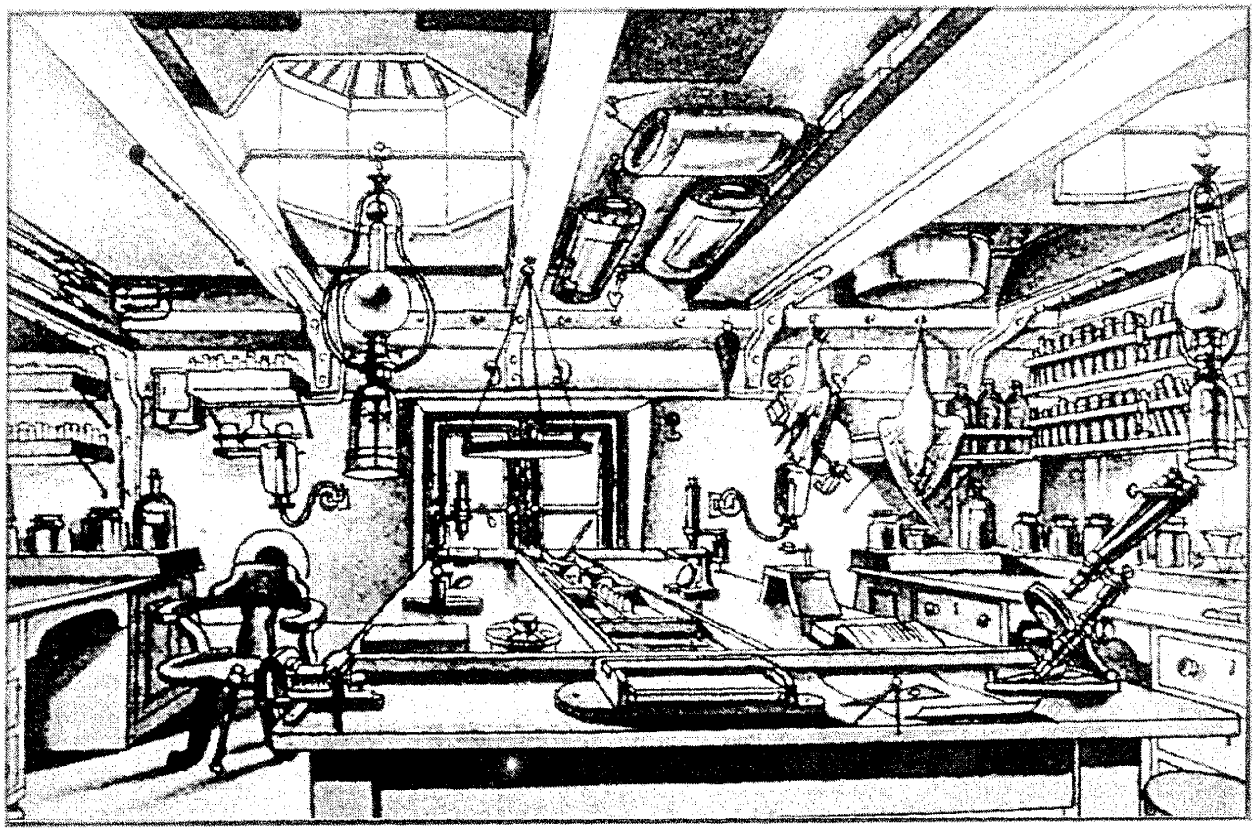
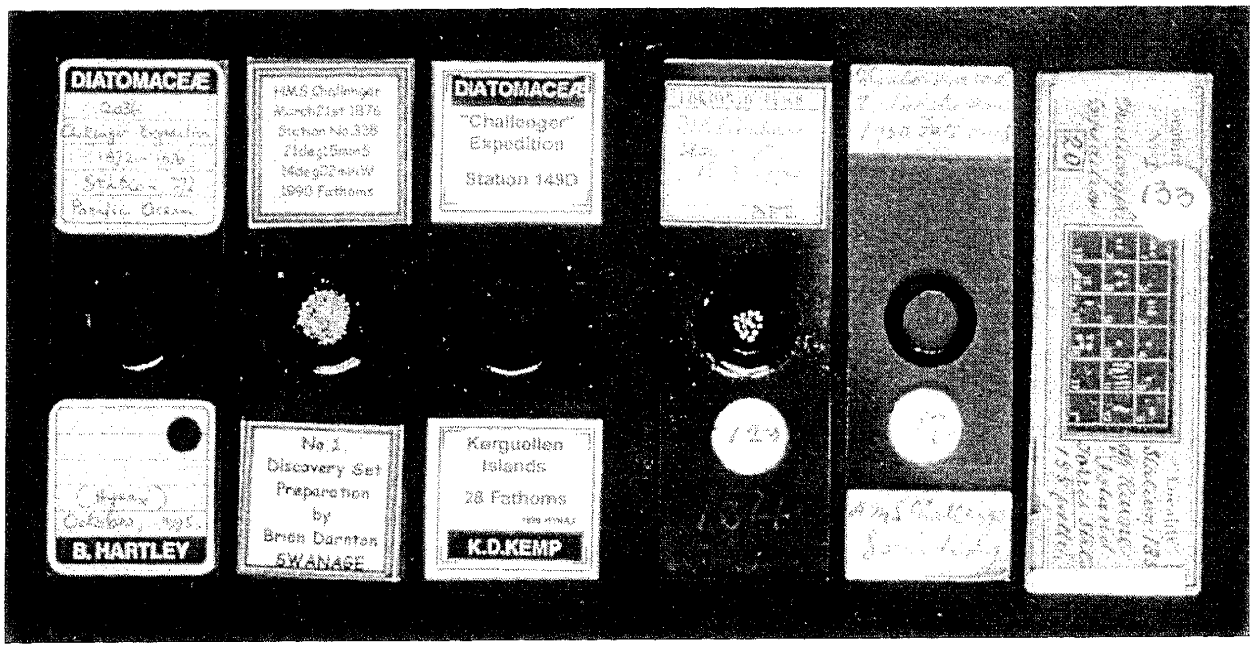


The Challenger's Laboratory - from Rice p. 299.

Part of the Challenger Collection at the Natural History Museum in London, from Linklater p. 271.



Some of my old and new (from original material) Challenger slides.

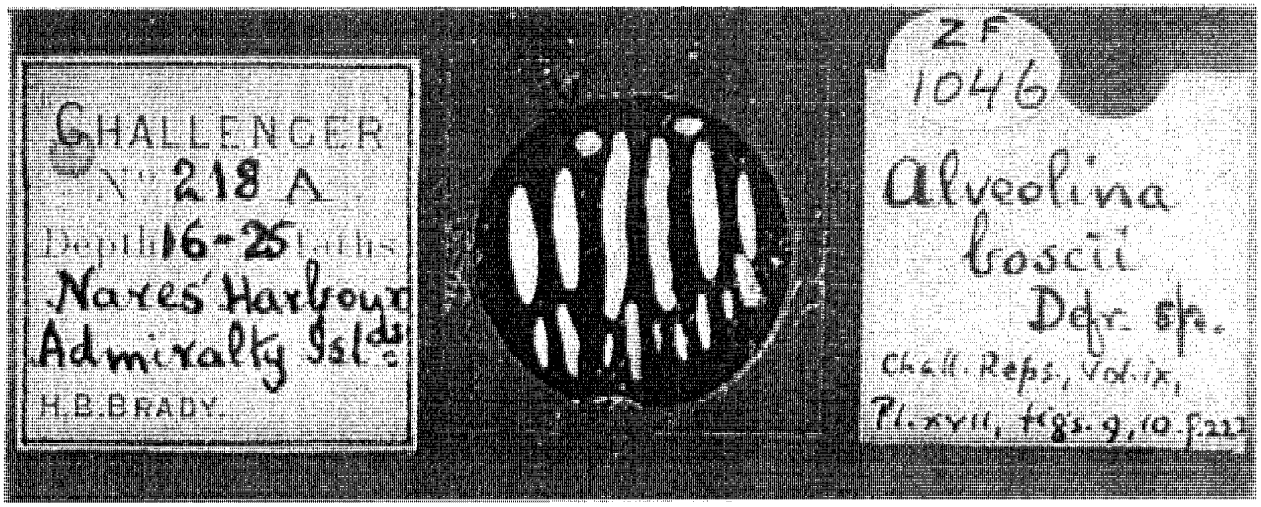
Probably most important of the scientists was John Murray, a robust and pertinacious naturalist, a man of tireless energy, and ultimately, the dedicated historian and patron of the entire venture. Ironically, he was added to the group as junior naturalist at the last moment, upon the resignation of a man appointed earlier.

Captain George Strong Nares , completely devoted to his most unusual (for a Naval Officer) task, ran his ship with precision and safety, with, it is said, much less need for the then very common severe physical discipline of some of the crew. It would appear that the military and civilian leaders, and most of the crew, were uncommonly competent, hard working, and devoted to the cause. Captain (later Admiral, Sir George) Nares himself compiled a report on currents for the Hydrographer of the Navy. Captain Nares left Challenger in 1874 to lead the Alert and Discovery Arctic expedition, and was replaced by Captain Frank Tourle Thomson.

Challenger departed Portsmouth December 21, 1872, and returned May 24, 1876, having traveled about 68,000 nautical miles during about 1000 days at sea. Some of the many stays in port were prolonged, usually for work on the ship. The equator was crossed eight times, and Challenger was the first steam powered vessel to enter the Antarctic, though her purpose was not to go as far south as possible, but only to ascertain the temperature and depth of the sea on which a galaxy of icebergs drifted. One man when asked for his opinion as to the expediency of proceeding farther into the Antarctic said, "he failed to see the utility of proceeding when there was so great a probability of no one living to carry home the tale".

Several dozen of the ship's crew deserted during the voyage, many in South Africa (the great Kimberly diamond mine had just opened) some in Canada, and quite a few in Australia.

Challenger carried enough fuel to raise steam for traverses at each of the 362 stations she studied, as well as for critical navigation, but the steam engines of the day were not very efficient, and the sails were the motive power for most of the voyage. The stations



A Brady foram slide from Challenger specimen (fromRice, p. 298).

were roughly two hundred miles apart, and at each station were made studies such as:

Exact depth measurement

Samples of bottom material

Sample of bottom water

(most stations) Bottom fauna by dredge or trawl

(most stations) Surface fauna from tow net

(most stations) Series of temperatures at dif ferent depths

(most stations) Sea water samples at differ ent depths

Atmospheric and meteorological observa tions

Direction and rate of surface currents

Direction and rate of currents at different depths

Salinity, density, and dissolved oxygen measure ments at various depths

To lower and raise equipment at great depths required several hours. A steam donkey engine was a great help raising the hemp rope. About every two hundred miles, the sails would be furled, the screw unlocked, steam raised, the ship turned head to the wind, sound, dredge, or trawl overside, and the studies began at that station. It was hard physical labor in good weather, and they encountered all kinds of weather.

The journey began to the south, along the Iberian coast, then west across the Atlantic to St. Thomas, north to Bermuda and then Halifax, then east, to the Azores. Having then come back near its point of origin, Challenger next sailed south and west to the coast of Brazil, then east to the Cape of Good Hope, continued east and south into the Antarctic, further east and north to Melbourne and Sydney, then north thru a complex east-west zigzag to Japan, a complex path across the Pacific, beneath the tip of South America, and finally north thru the Atlantic. It was a very different world from the one we know - Japan had just "opened" to the west; they met cannibals in New Guinea, and saw a race about to become extinct at Terra del Fuego. On many islands, birds (sadly) showed no fear of man.

Upon returning home, Wyville Thomson (and John Murray) recruited seventy-six carefully selected specialists to analyze the data and specimens, and prepare a final written report. Thomson's ill health, followed by an untimely death in 1882 led to John Murray tak-

Captain George Strong Nares
(from Linklater p. 15).

Henry Moseley (from Linklater p. 20).

ing over all responsibility for preparation, editing, and publishing of the fifty large volumes, which comprise the Report. Murray had noted phosphates in Challenger specimens from near Java, and this led him later to discover great phosphate deposits on Christmas Island. He founded a firm to mine and merchandize these, and thus earned great personal wealth, so that when the British Government's parsimonious treasury ultimately refused to fund the publications, John Murray personally funded all the publications, editorial expenses, and even commemorative medals to the crew and the consulting experts (most of whom spent years on their parts of the report). Nineteen years after the Challenger returned home, the great report was finished. An interesting irony was that Murray's phosphate firm paid taxes to the British government in an amount which exceeded the approximately 200,000 Pound Challenger expedition cost.

The expedition showed that:

Animal life exists on the ocean floor at all depths.

Animal life is not nearly as abundant at extreme depth as at moderate depth, but well developed members of all classes of marine invertebrates are found at all depths.

Deep-water fauna does exist largely near the surface or near the bottom. (less at intermediate depth).

At great depths echinodermata and porifera predominate.

Murray and (chemist) Buchanan opened up a new field on the nature and distribution of deep-sea sediment.

Probably one half of all species described proved to be entirely new to science.

Thus, nearly a quarter of a century after preparations for this Voyage of Exploration began, one of the most significant events in the history of science was brought to a finish by one man, now Sir John Murray.

John Murray (from Linklater p. 17).

Charles Wyville Thomson
(from Linklater p. 14).

It is interesting to read Moseley's concluding remarks in his thoughtful summary of the voyage. "I did not suffer at all from the confinement of ship life. It is wonderful how completely practice enables a man so to modify his movements so as to perform with success, in a ship constantly in motion, even the most delicate of operations. The adjustments of the body to the motion of the ship in ordinary weather, becomes, after a time, so much a matter of habit as to be quite unconscious. I found no difficulty in working with the microscope with the highest powers (1,100 diameters), even when the ship was rolling heavily."

"There are many worries and distractions, such as letters and newspapers, which are escaped in life on board ship, and the constant leisure available for work and reading is extremely enjoyable. I felt almost sorry to leave, at Spithead, my small cabin, which measured only six feet by six, and return to the more complicated business of "shore-going" life, as the sailor's term it. I had lived in the cabin three years and a half and had got to look upon it as home."

Presented, with projection and microscope slides, associated references and books, at the M. S. S. C. meeting of June 21, 2000, by John Field.

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The Polaroid DMC Digital Microscope Camera

George M. Kleinman

About a year ago, I gave up using film for photomicrography, and bought a digital microscope camera to replace my Olympus PM 10-AD photomicrography camera with automatic exposure control, which I had mounted on my Zeiss WL.
My favorite film for photomicrography had been Kodak's Color Photography Film, PCF-2483. With virtually no exposure latitude, it was a temperamental, difficult film to use: even with bracketing, you might find yourself with not even a single usable photomicrograph. It required E-4 processing, and had a tendency to render eosin-stained tissues in shades of fuchsia. When it was good, however, it was very, very good. No other film could capture the detail as well: it possessed fine grain, high contrast, and high color saturation to a degree that other films cannot match. Kodak, however, stopped production of PCF 2483 about 15 years ago, and no longer offers E-4 processing.

After trying various Ektachrome, Kodachrome, and Fujichrome films, and finding them less than optimal, I decided to switch to a digital camera. If I could not have optimal photomicrographs, at least I could have instant gratification. After consultation with the local microscope vendor, I decided on the Polaroid DMC.

As its name denotes, the Polaroid DMC (Digital Microscope Camera) is specifically designed for photomicrography.The unit comes with 2 meter long SCSI cable, a 25/50 DB to HD SCSI adapter, a power adapter to provide surge-protected 5.8 VDC, 3 amp power from 110-240 VAC, and software. Attaching the camera to a microscope requires a C-mount adapter, either 0.63 or 1:1, which is not provided.

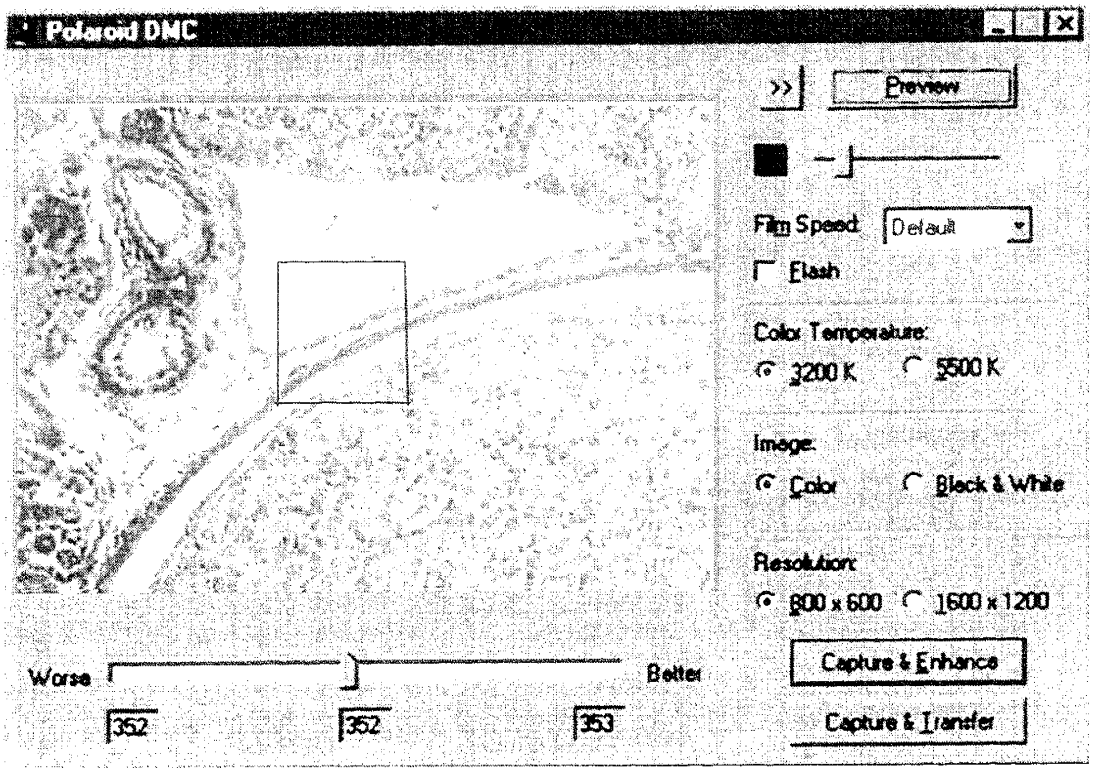
The DMC's 12.15mm CCD is capable of rendering photomicrographs with resolution selectable for 1600 x 1200 pixels or 800 x 600 pixels with 17.6 million colors or gray scale. This creates files of 5.6MB or 1.4MB respectively. Through the software, its ISO rating is selectable for 25, 50, 100 (film speed equivalent), and its shutter speed is selectable from 1/500 to 1 second. Color temperature is also selectable: 3200 K or 5500 K.

A SCSI (i.e. Small Computer Systems Interface) device, the DMC simply plugs into your PC's SCSI chain. Because it has only one connector, the DMC must be installed as the last device in the chain.

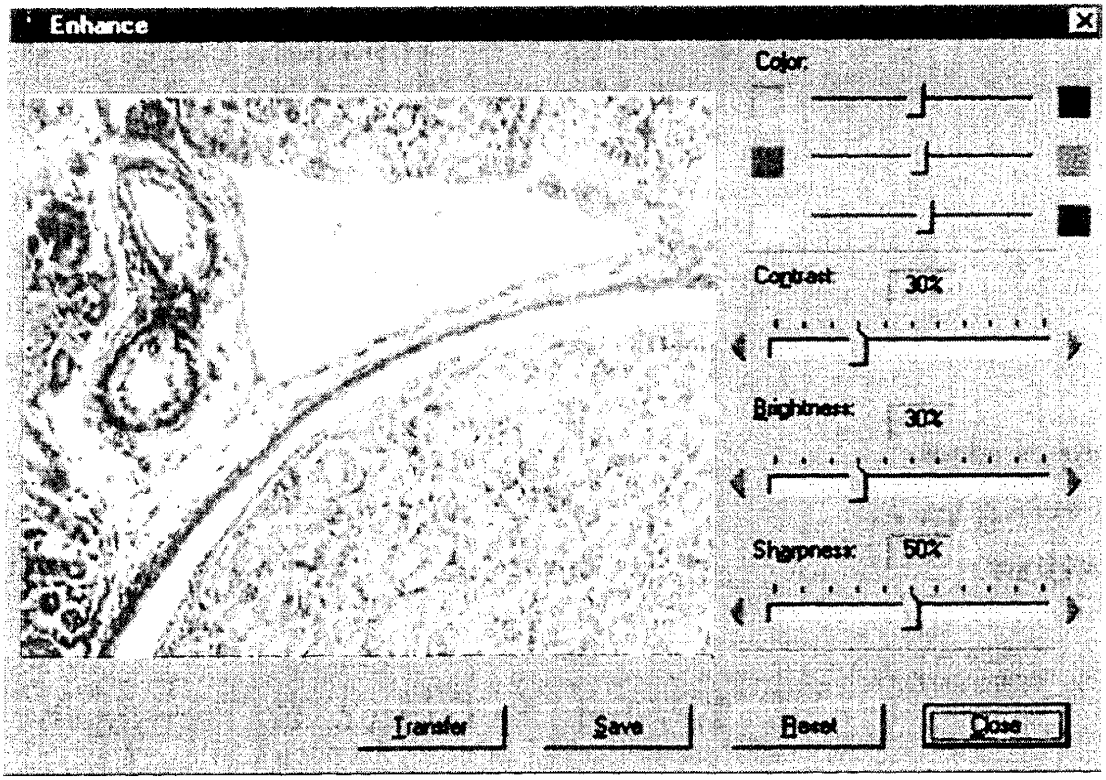
A black & white image is previewed on the computer screen, making it difficult to position the slide and focus the microscope optimally on screen.The software, however, compensates for this by providing a numerical reading for optimal focus. In the preview mode, there are 3 boxes below the image: from left to right, 'worst so far,î 'current focus,î and 'best so farî'- the higher the number, the better..
There are 3 options for capturing the image: 1, capture and save; 2, capture and transfer to another application, such as Adobe Photoshop; or 3, capture and enhance using the DMC's software. In practice, it is the second option that I use routinely.

The DMC software does provide adjustment for color balance, contrast, brightness, and sharpness., but for optimal results a program like Photoshop is required. I find that I always need to increase the color saturation, and to a lesser extent, the brightness and contrast. Sometimes sharpness needs to be increased or the color balance adjusted. Photoshop's dodge tool is invaluable for cleaning up backgrounds or removing the vignetting effect.

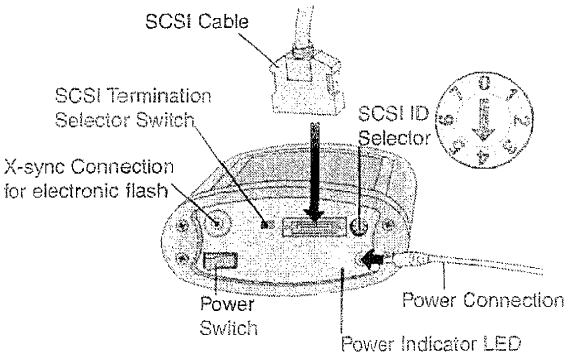
Polaroid recently decreased the price on the DMC from $5500 to $3900, and have released a second model, the DMC 1e, which has additional functions. Moore's law dictates further refinements and price reductions. The following photomicrographs of surgical biopsy or autopsy specimens were made with the Polaroid DMC on a Zeiss WL, with planapochromatic objectives



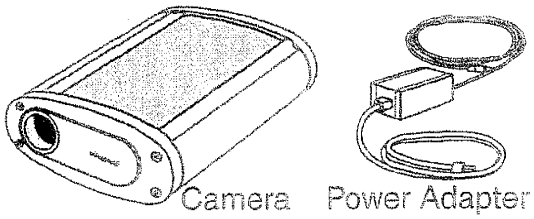
DMC software - preview mode: the square marquee is used to select the area where optimum focus is desired.

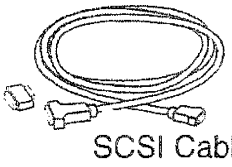


DMC software - enhancement mode: there are sliders for color balance, brightness, contrast and sharpness.

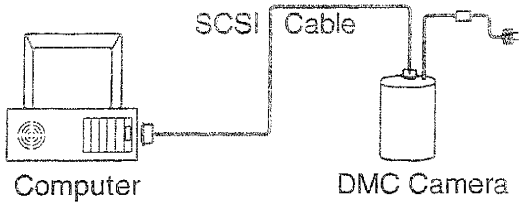


Camera switches

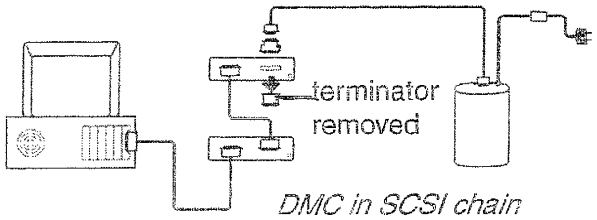




Components

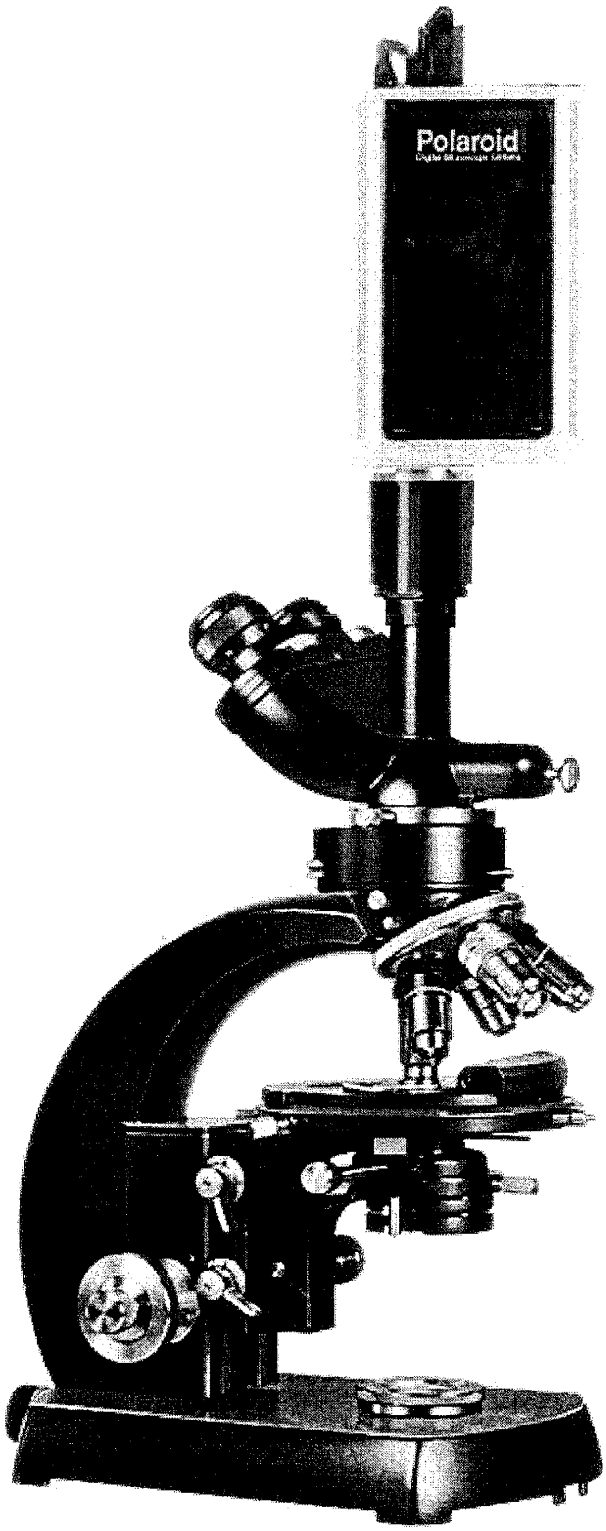


DMC as single SCSI device



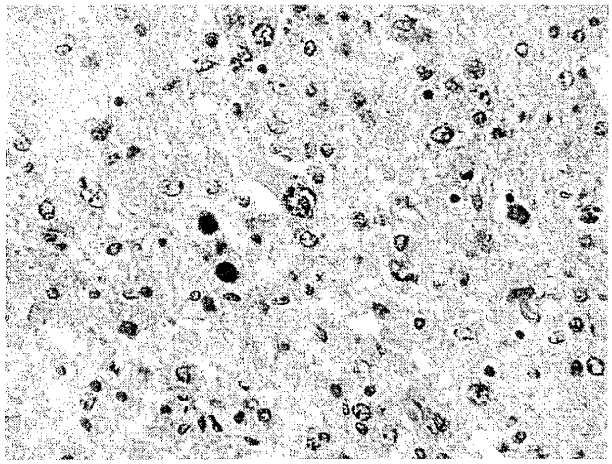
DMC in SCSI chain

SCSI Chain

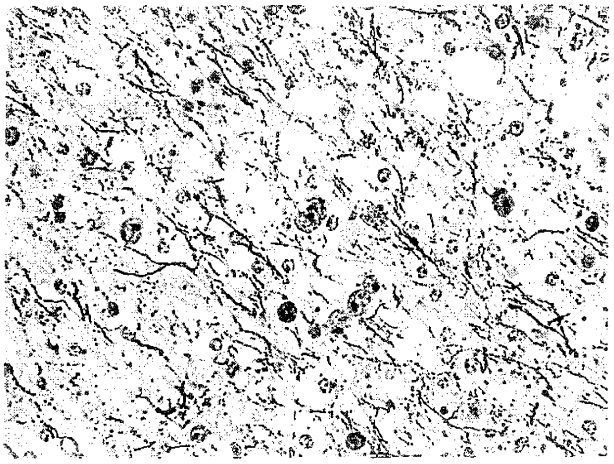


DMC

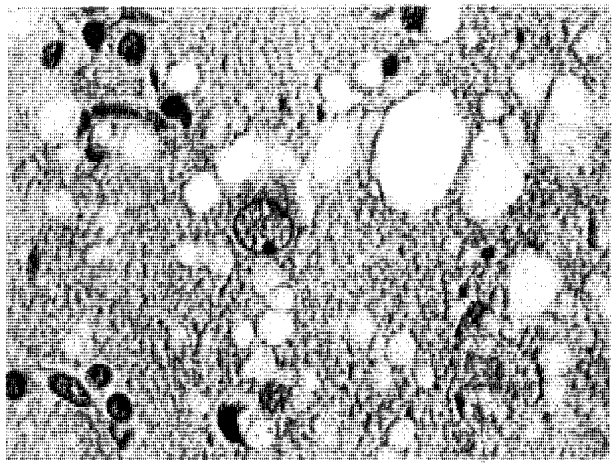
Autopsy, 40 year old man with AIDS; progressive multifocal leukoencephalopathy (luxol fast blue - H&E, 25X)



Autopsy, progressive multifocal leukoencephalopathy (H&E, 250X)



Autopsy, progressive multifocal leukoencephalopathy (Bielschowsky silver, 250X)

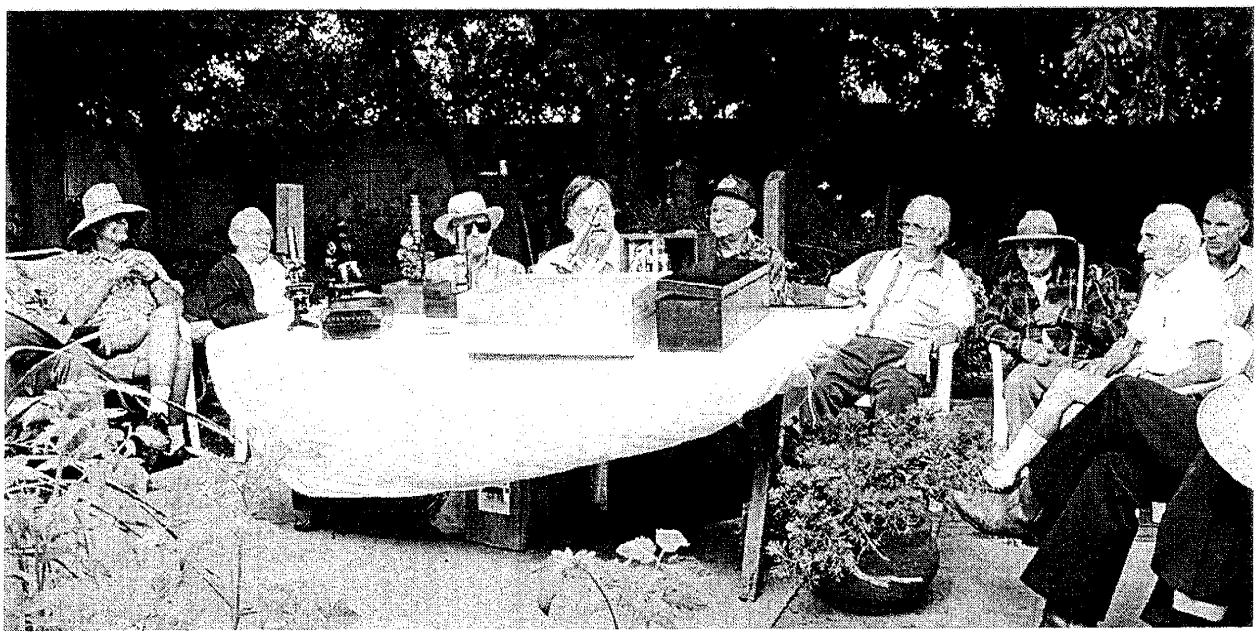


Brain biopsy, 63 year woman with rapidly progressing dementia; diagnosis: Creutzfeldt-Jacob disease.
(H&E 400X)

WORKSHOP of the Microscopical Society of Southern California

George G. Vitt, Jr.

Date: Saturday, 1 July 2000
Location: The Lieberman's residence - 27 persons attended



MSSC Workshop, 1 July, 2000; The first at the Lieberman residence. View from the patio main seating area toward those in the yard. Left to right: Gaylord Moss, Leon Stabinsky, Stuart Warter, James Solliday, David Hirsch, Pietro Teti, Leo Milan, John deHaas and Tom Boulger.

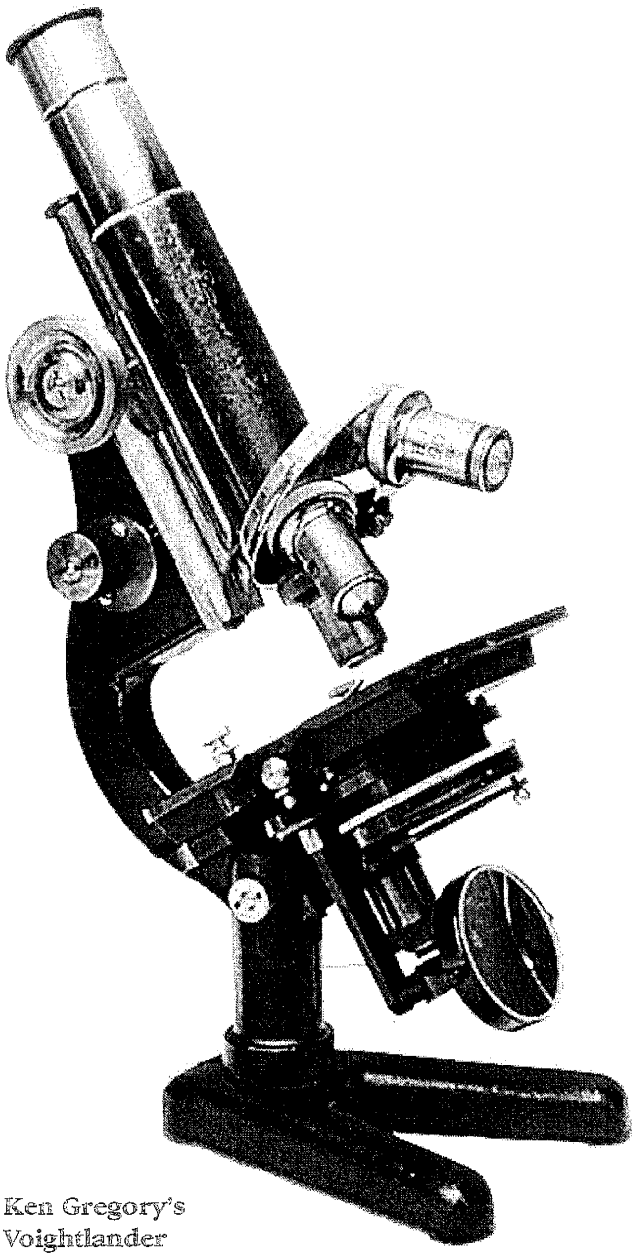
This is the first Workshop meeting to be held at the residence of Izzy and Elaine Lieberman. We wish to thank them for their generous hospitality, and look forward to many more workshops in such pleasant surroundings.

1. **Izzy Lieberman**, our new host, gave some introductory remarks to acquaint the members with his house and the points of interest contained therein. In particular, he described his air-damped Sartorius micro-balance - the last of the great balances. This is a very rare instrument since few were brought to the USA.

2. **Pete Teti**, who is in charge of our coffee and refreshments, stated that he will need some assistance in carrying out this task, suggesting a 6-months on, 6-months off cycle. We shall be looking for a volunteer.

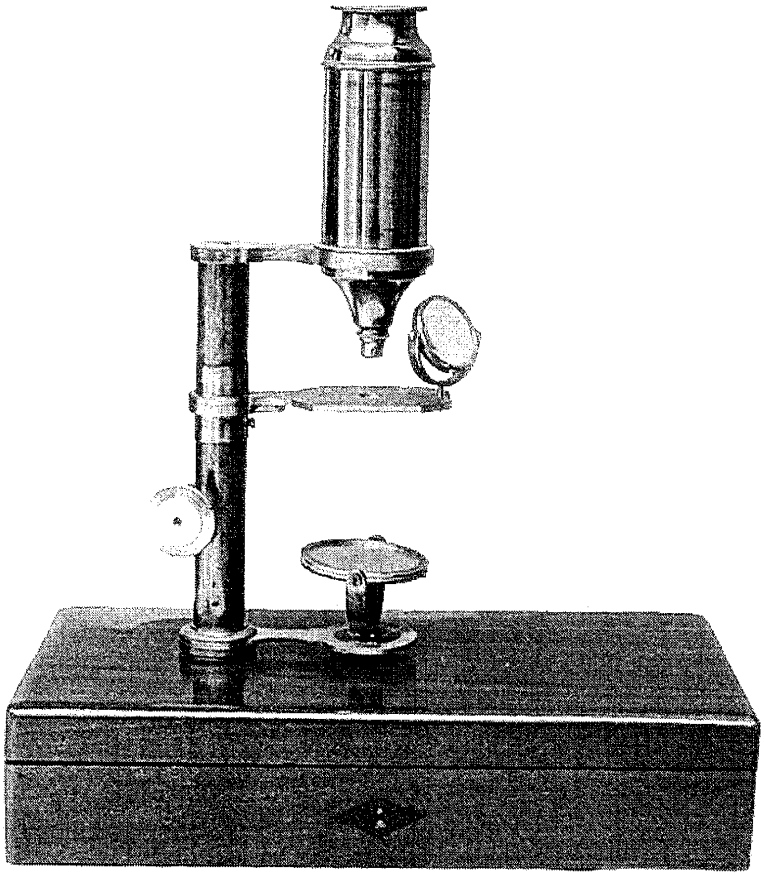
3. **Ken Gregory** showed a cased Voightlander microscope Made in Braunschweig, Germany. It had been bought by a G.I. in Czechoslovakia c.1940. It is a fine monocular microscope which needs some alignment and adjustment. Voightlander microscopes are not frequently encountered. Ken also showed a Zeiss traveling microscope with a folding V foot in a magazine-type case.

4. **Stuart Warter** showed two microscopes: a) An early (before 1831) box mounted microscope by Vincent Chevalier (father of Charles); b) A late, unsigned, pre-achromatic box mounted microscope with a Cuff style substage mirror bracket enabling adjustment in elevation and azimuth. Stuart is unsure of its country of manufacture but thinks it could be from either England, France or Holland - prior to 1870.

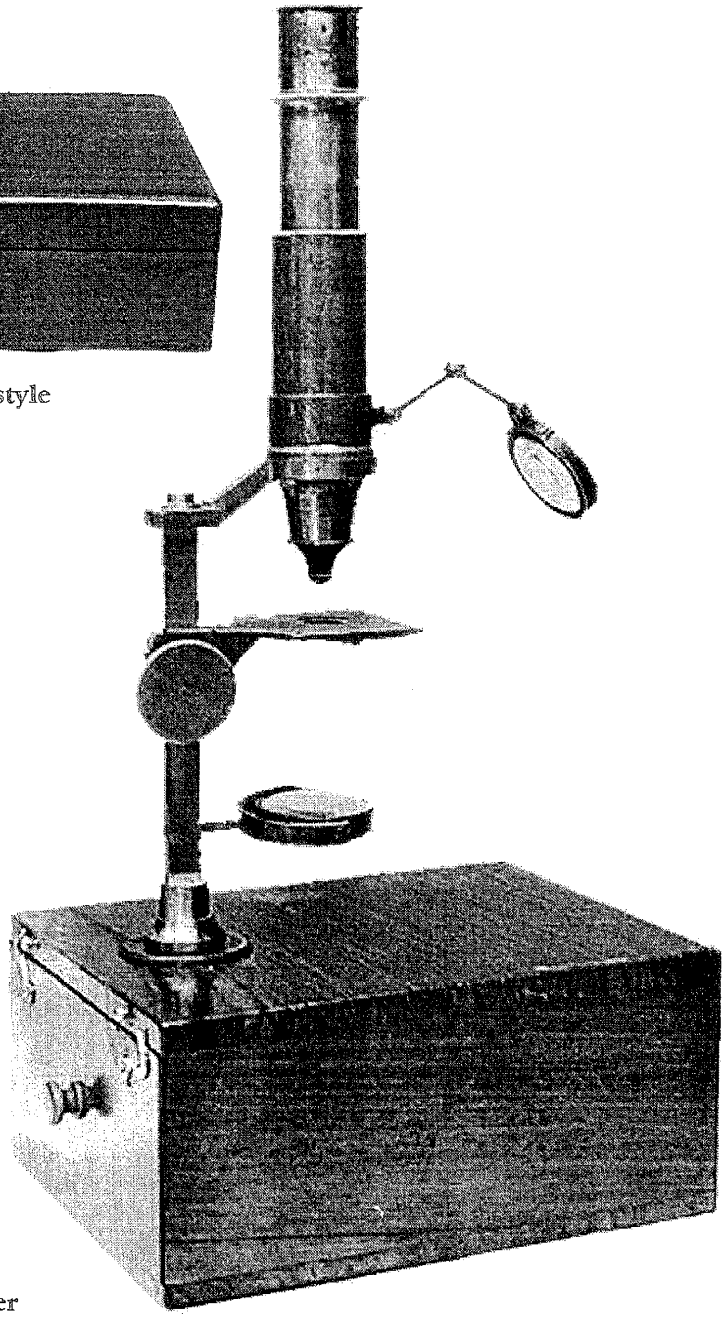


Ken Gregory's
Voightlander

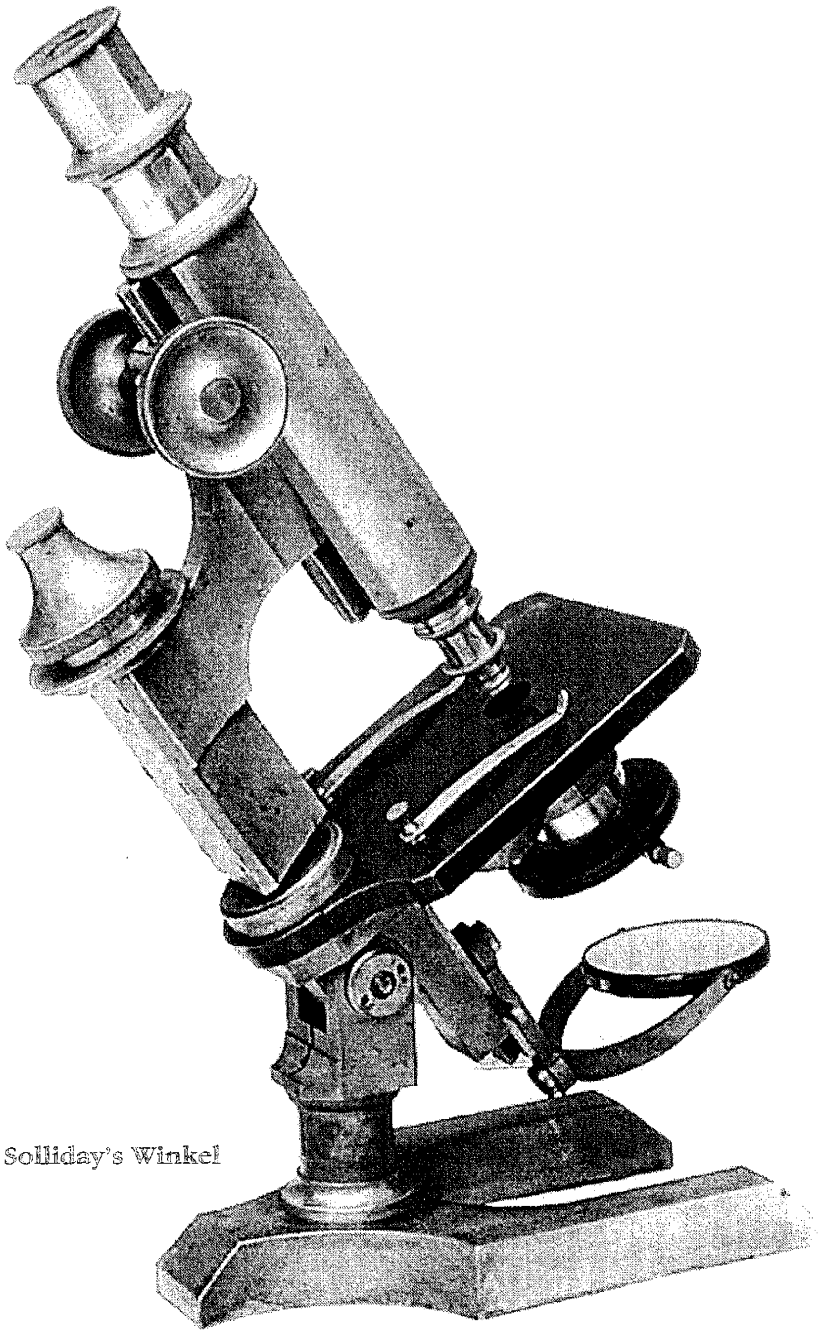
Ken Gregory's Zeiss
traveling microscope



Stuart Warter's pre-achromatic with Cuff style substage mirror.



Stuart Warter's
Vincent Chevalier



Jim Solliday's Winkel

5. **Jim Solliday** displayed a fine German compound monocular microscope, signed "R. Winkel, Gottingen, No.1946, 1894", the date being stamped under the signature. This is a beautiful brass Continental microscope completely coated with a Nickel finish, including the objectives. The finish and the rugged and well-designed construction indicate this is a high-end well-made microscope. The coarse focus is by rack and pinion. A micrometer screw having a large graduated ring mounted to its underside controls the fine focus movement of 1/300 mm per graduation. The screw is at the top of the limb, which has a distinctive triangular cross section. The backside of the limb is flat and bears the signature of the maker. The large 4 x 4" stage has the usual clips for holding glass slides. The stand inclines on a very large cradle joint which features a ledge appointed to the back at the top of the pillar. This feature is "characteristic" of the early Winkel instruments. Below the stage is a stem with a dovetail slide holding the adjustable mirror. The mount is pushed up and down on the dovetail by two levers or arms that extend on each side. The double-sided mirror is attached to the mount by a swinging arm. The substage condenser bracket swings out from the underside of the stage. The sleeve can be pushed up and down within the bracket limited by a slot and set screw. There is an iris diaphragm mounted to the bottom. Two accesso-

ries can be exchanged and inserted into the top of the condenser sleeve. One can select either a stop holder (with 2 stops) or an (optical) Abbe condenser. The optics include three objectives and two eyepieces. All are stored in a beautifully polished mahogany case carried by its nickeled handle. The case contains two sliding drawers (holders) on the upper left side. The top slide holds the two eyepieces, a No. 1 and a No. 4 Winkel. It also holds a nosepiece adapter and a Bausch & Lomb 1/12 inch oil objective. On the right side of the case is a perfect small 4"x4" mahogany hinged box. Inside are the following items: two substage stops, Abbe optical condenser and two signed "R. WINKEL" objectives. The objectives are marked, No.2 (signed) and a No.7 (signed). Both are coated with polished nickel. The key for the case is missing. The overall condition of this microscope and accessories is very good.

Jim supplied the following chronology:

1827-1905. Life of Rudolf Winkel, made microscopes in Gottingen, Germany with the founding of his firm in 1857.

1857: Rudolf Winkel established himself as a microscope maker, specializing in polarizing as well a's student microscopes, micro-photo, magic lanterns and grinding apparatus (FI/359). They were located in Goettingen, Germany. Their products were sold in N.Y. City by Dr. Zwingengerger (1909). In 1911 C. Zeiss became associated with the firm creating Winkel-Zeiss. Just before WWII Zeiss acquired control of the firm changing the name to Zeiss-Winkel. The Zeiss stands are still made in the Winkel factory.

1911: Zeiss established an interest in Winkel (Winkel-Zeiss).

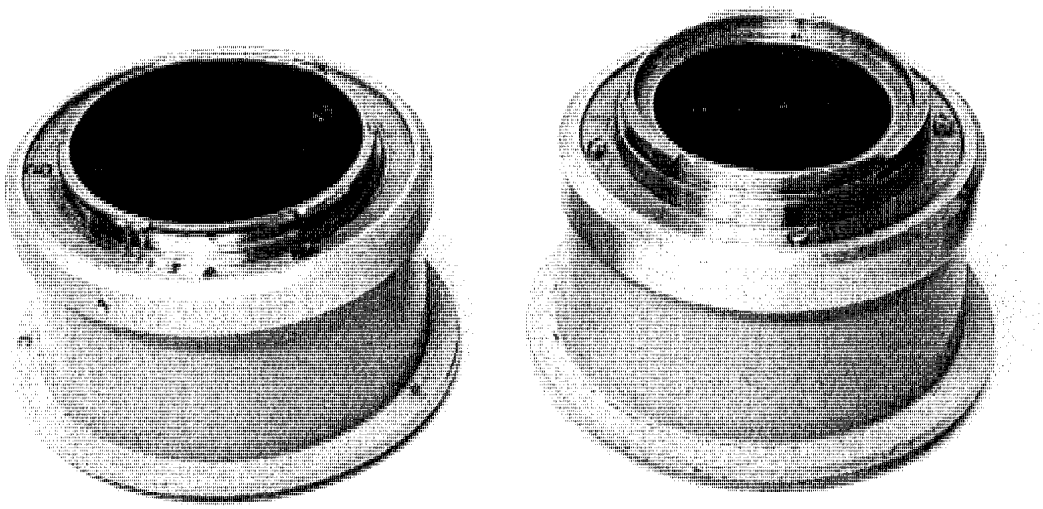
1957: Zeiss-Winkel celebrated the 100 th. anniversary (Winkel) and changed the name of the organization, R. Winkel GmbH to, Carl Zeiss, Werk Winkel (Letter to Erb from Zeiss, 1957).

6. **Tom Boulger** introduced a discussion on the material used to construct the Egyptian pyramids.

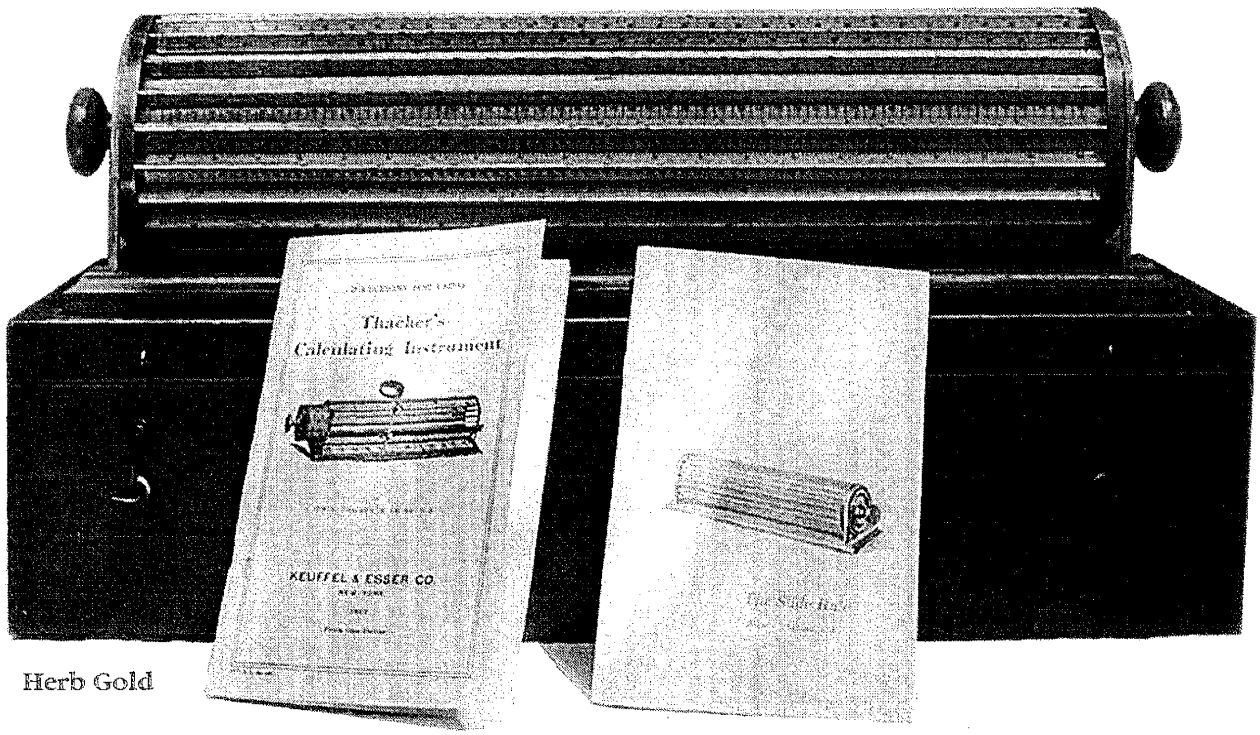
7. **Gary Legel** brought a variety of 'freebies' and stated that he has two Leitz Ortholux microscopes, one of which is for sale.

8. **George Vitt** told of his recent experience in photocopying with a digital camera (Nikon 950) from printed material in books and then observing the resulting histogram of the image, as shown in Photoshop. The tonal range of the original is small (10:1?) and, with auto-exposure, fits into the middle of the dynamic range of the digital camera. Thus, an uncorrected image, when viewed in Photoshop, shows the white page as a grey. All this can easily be corrected, however.

9. **Dario Solares** showed his newly acquired Nikon 990 digital camera and the custom adapted he had designed and made that allows the fitting of this camera onto a microscope eyepiece. Dario also displayed and described an adapter he had made for using Minolta cameras on his Nikon PFX photomicrographic unit (see photo). Dario has done an excellent job.



Dario Solares' Minolta adapter on right compared to original Nikon mount



Herb Gold

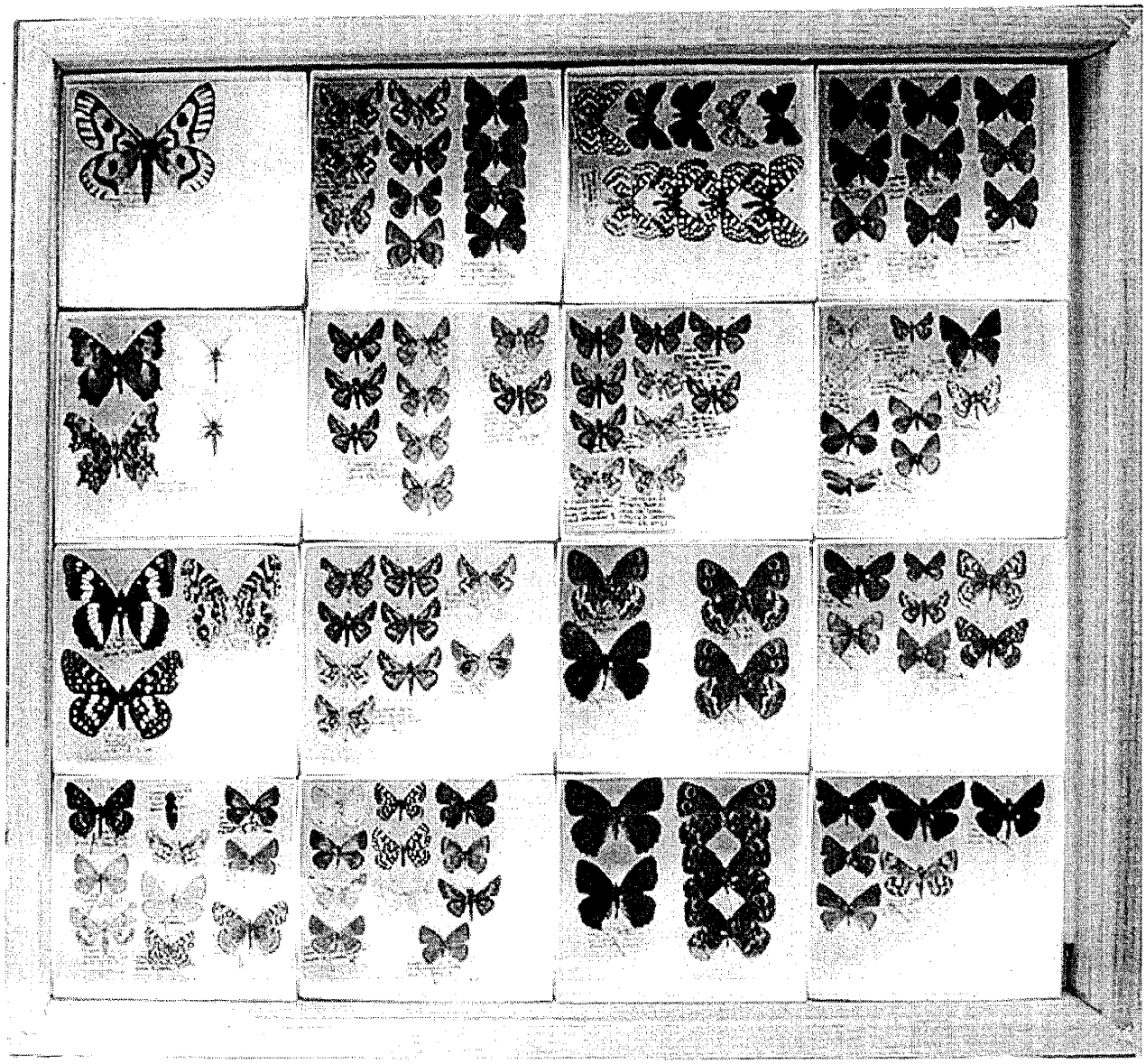
10. Peter Fischer showed some 3M Polymeric Multilayer Mirrors currently being manufactured by 3M. These thin (.004" or so ?) Polyester (Mylar) films give up to 99% reflectivity because of the well designed system of multiple layers of materials having the required thickness and index of refraction. These techniques are also being used by 3M to make "3M Colored Mirror Film" which is spectrally selective in transmission. It was noted that the sometimes indispensable Didymium filter, which cuts from 600-780 nm., can be obtained in this 3M material.

11. Herb Gold showed a cased Thatcher Calculator by Keuffel & Esser, c. 1940, in mint condition. This is a mathematical instrument which is, in essence, a 30-ft. Long slide rule which has been configured in 2-ft. Segments around the periphery of a cylinder. The 'slide' is now in the interior of the cylinder, being an easily rotatable cylinder (resting on strips of what appears to be chenille, velvet, or some such material) and the numbers can be read easily in the spaces between the outer segments. The master logarithmic scales had been engraved in England, and are printed on thick paper which is then varnished and affixed to the instrument. This calculator had been discontinued by K&E in the early 1940s, and probably no more than a few thousand have been manufactured.

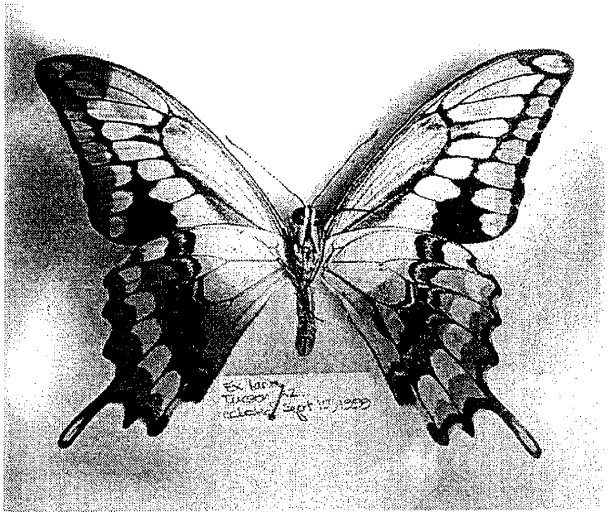
A Note on the Workshop Photographs

After the Workshop ended, George Vitt photographed all the items that had been exhibited, with Jim Solliday setting up the pieces, one-by-one, and Jack Levy holding the neutral grey foam board background. It was a fine production line and the job was done in a few minutes. The natural light, which was diffuse and indirect, proved excellent for this purpose. The Nikon 950 digital camera was on autofocus, center-weighted autoexposure, with aperture priority (f/3.9) hand-held from a steady sitting position.

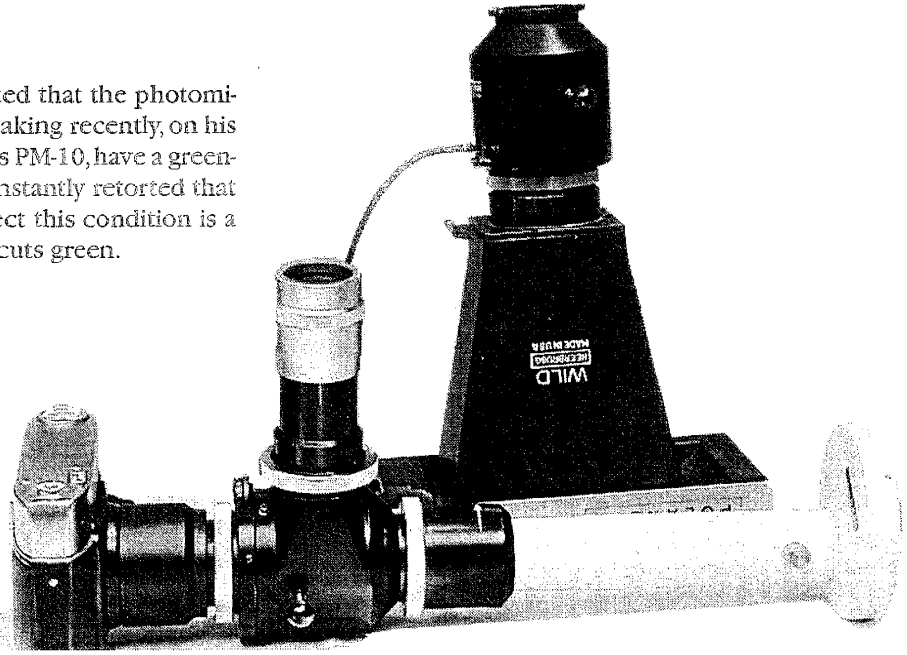
Color versions of some of these photographs will be posted on the MSSC web page hosted by Larry Albright. <http://www.plasma-art.com/MSSChtml>

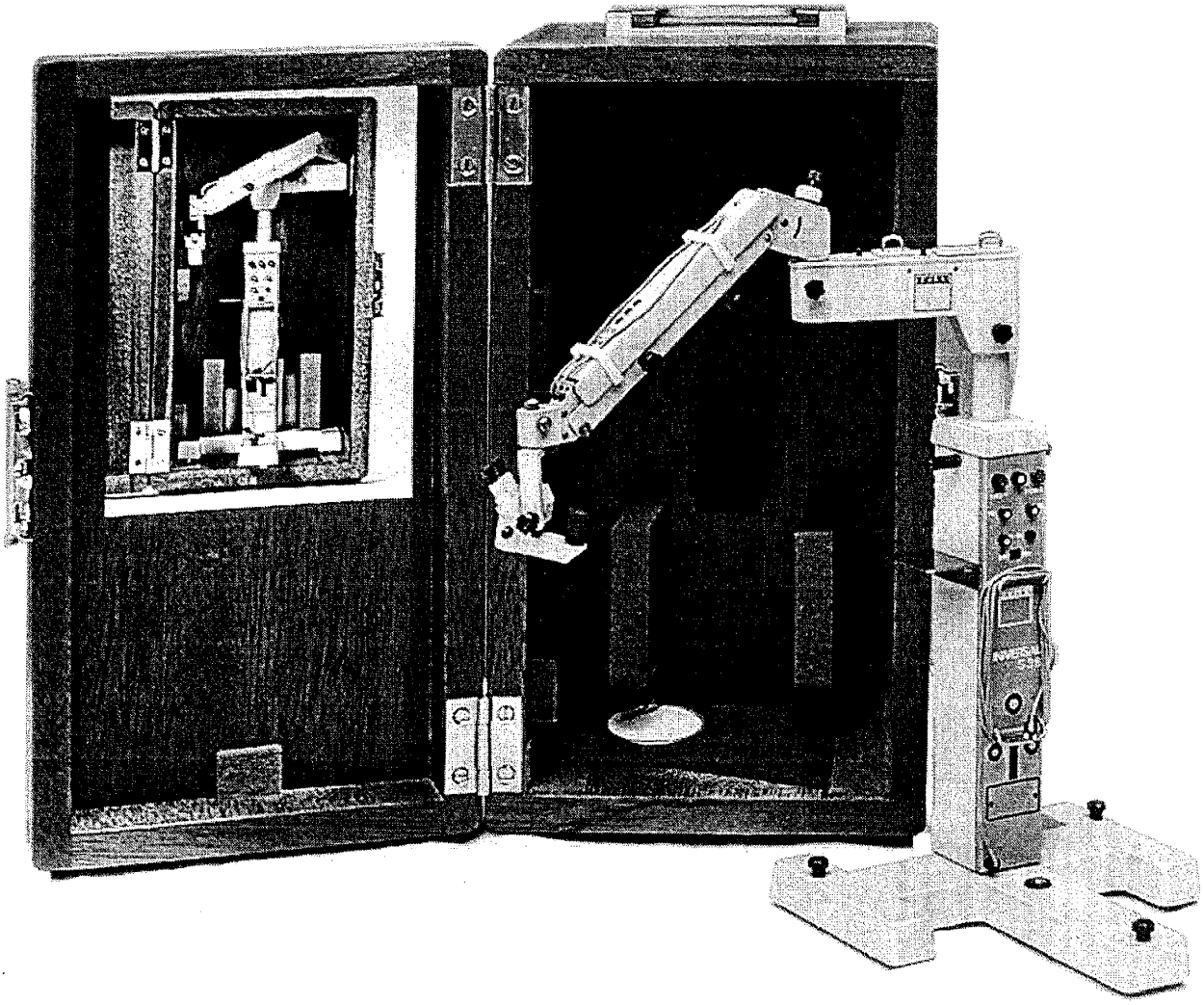


12. Jack Levy showed two aesthetic light colored and finely constructed glazed wood cases containing samples of butterflies and moths that he had collected. He gave a most interesting presentation on the subject of butterflies and moths, describing some not well known facts and his many years of effort in this field. So far, he has in excess of 40,000 photos of insects he has collected. Jack will be on a collecting expedition during the next 2-3 months, and should be back in October. It was mentioned that California swallowtails are greatly attracted to Phenyl!



13. **John Fedel** reported that the photomicrographs he has been taking recently, on his newly acquired Olympus PM-10, have a greenish tint! Alan De Haas instantly retorted that what is needed to correct this condition is a Didymium filter which cuts green.





14. **Allan Bishop** showed a marvelous cased articulated model (12" high) of the Zeiss "OPMI" Model S3B, which is still being manufactured. Model and case were made by Zeiss as a promotional aid. A very unique model in perfect condition!

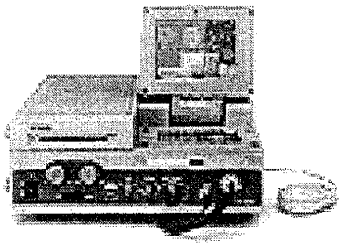
15. **Alan de Haas** reported that he has recently acquired a very rare book, *Physiological Objects*, by Helmholtz. It is so rare, that he thought it best not to bring it to the meeting!

MSSC July Meeting

Wednesday, July 19 at 7 PM.

Crossroads School, 1714 21st Street
Santa Monica, CA.

Digital Video Microscope System



Peter Fischer has arranged for an interesting guest speaker, Layla Gansoddin, the sales manager of Keyence who will demonstrate their digital CCD video microscope which shows 3-D and 2-D images of 900,000 pixels from macro to 3000x with an exceptonally high depth of field and color resolution. Claimed to be the best imagee quality available for such a system.

For a comparison at the other end of the price and quality scale, we will also have set up an Intel/Mattel toy video microscope which is remarkable for its $99 list price.

Don't miss this chance to see the "state of the art" at both ends of the scale.

Apology for the missing Journals the past months. Pressing affairs and computer glitches have delayed the publishing of several previous issues. I have decided to make this issue current and then to make up the earlier ones while putting out the forthcoming issues on time. This way, at least this and future months will be current. The missing ones will be issued as finished. G. Moss Editor

August Workshop

Saturday, August 5, 9:00 AM

The Lieberman Residence
3300 Corinth Ave.
Los Angeles, CA 90066
310-391-6076