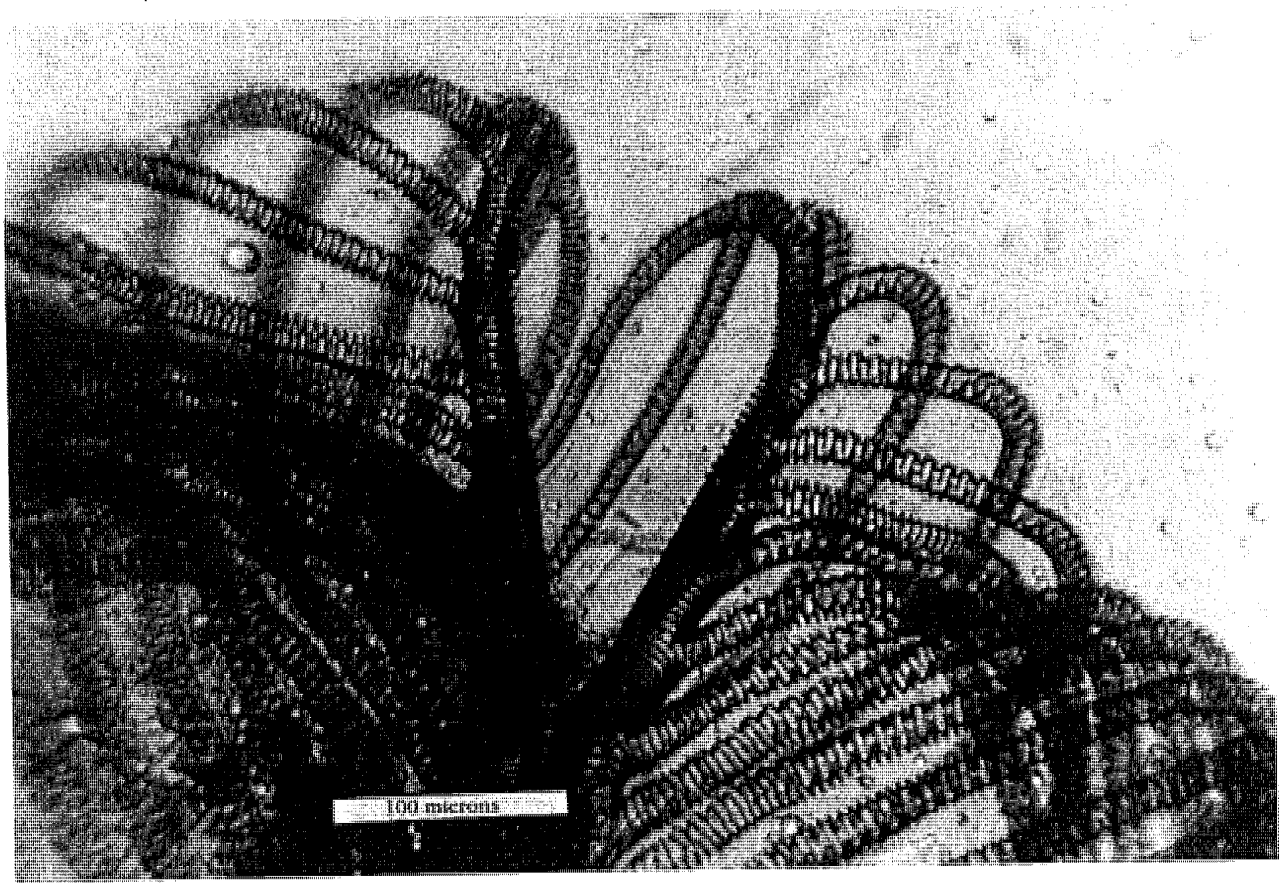
Journal of
THE MICROSCOPICAL SOCIETY OF SOUTHERN CALIFORNIA
Volume 3 Number 7 July 1998

Photography with Microlenses

Bert Loro



For nearly a century and a half after van Leeuwenhoek reported his amazing discoveries, in a series of letters to the Royal Society in England,[1] the simple microscope remained the chosen instrument for microscopical research. It was not until the technology for fabricating achromatic objectives was mastered in the early part of the 19th century that the compound microscope could finally compete with, and then overtake, the simple microscope in both useful magnification and resolution (not to mention, convenience!).

These early discoveries, which set the foundation of the science of microbiology, still fire the imagination of modern microscopists, many of whom find it difficult to believe that such observations could have been made with such simple instruments. To those who would like to see for themselves, but lack Brian Ford's access to the van Leeuwenhoek microscopes, I would point out that making micro lenses is not nearly as difficult as one might imagine. Water droplet lenses can be made in a matter of seconds, fuzed glass beads

in a few minutes and ground and polished lenses take a bit longer still and require more care and patience but give great rewards for the effort.[2]

So I am convinced that many DIYers have indeed seen for themselves; yet published photographs which demonstrate the remarkable images that these tiny lenses can produce are practically non-existent. Can this be because there is a belief that taking a photograph through such a tiny lens must be difficult? Once again I have to say that this is just not so.

If a microscope is set up and focused for visual use by a normal eye, that eye will be receiving light from each object point which is parallel or very slightly divergent. A photomicrograph may be taken simply by placing a camera, with its lens at, or very close to, the infinity setting, in place of the eye. It is immaterial whether the microscope is simple or compound.

You can take perfectly good photomicrographs with a micro lens in this way, although the camera lens is quite superfluous and doesn't improve the image quality one iota. But if the main purpose of taking micrographs with a simple uncorrected micro lens is to demonstrate what remarkable resolution and image quality can be achieved by such simple means you might boast to friends 'I took this micrograph with just a simple glass bead.' They, however, may become a little skeptical if you are obliged to add '...assisted by a $750, six component, f1.2 coated anastigmat'!

If the camera lens is dispensed with, the microlens can be made to project an image directly on to film. This requires just a small adjustment of focus. So I thought it might be helpful if I describe my own set-up and method for taking micrographs in this way with nothing between the object and film but a microlens.

In brief, the apparatus consists of an updated version of a van Leeuwenhoek microscope with a light source below it and a lensless camera connected above it by a light tight tunnel.

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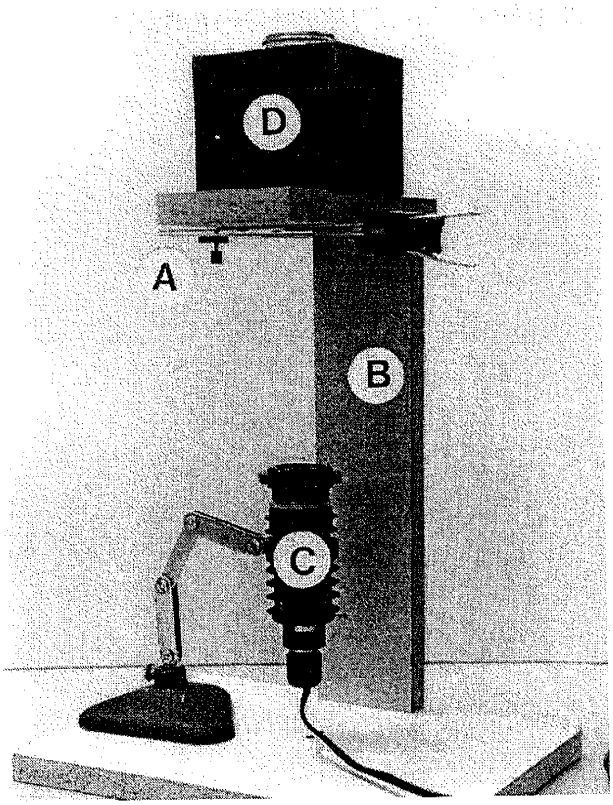

Fig. 1. The photographic set-up. The camera rests on the box extension D.

It is designed for use with transmitted light only. The reason for this is that, with lenses of very short focal length, top lighting is, to say the least, difficult to arrange, whilst transmitted light is simple and easily controllable. The illuminating aperture is controlled by varying the distance and effective diameter of the light source. Oblique light, as traditionally used for the resolution of difficult diatoms, is obtained by moving the source off centre.

The set up is shown (less camera) in Fig. 1. A focusing mechanism (A), which holds the object and microlens in close and adjustable proximity, is mounted on a wooden stand (B), over a light source (C). A self aligning light tight extension (D), and an SLR camera body are stacked together above the lens and may be removed and replaced rapidly without disturbing the optical arrangement. The extension, which serves to increase image distance, and hence increase the magnification, is a plywood box painted matte black on the inside. The image distance, lens to film plane, is 14.5 cm.

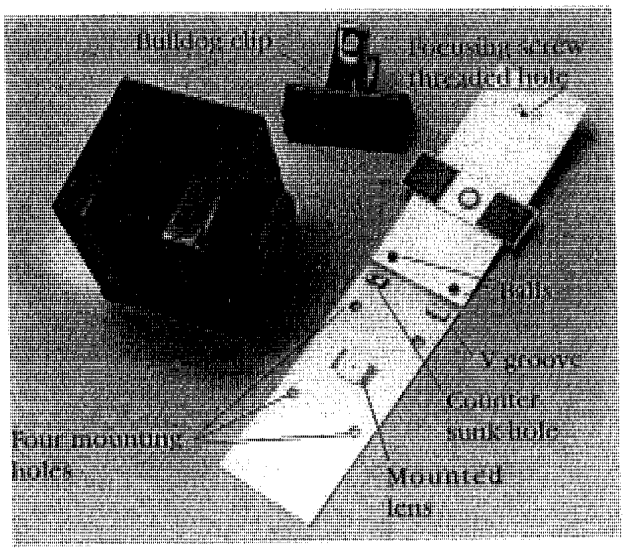

Fig. 2. The focusing mechanism and extension. A mounted lens is seen taped to the centre of the upper plate

The focusing mechanism (Fig. 2.) consists of two aluminum plates about 6cm.x 13cm. which pivot on two ball bearings which are cemented into countersunk holes in the lower plate. The cementing saves much time groveling around the floor searching for lost balls. The balls seat into a countersunk hole and a V groove parallel to the line of their centres in the top plate. (This is a kinematic feature ensuring perfect seating of the balls without requiring exactly matched spacing of seating holes.) The plates are held together against the focusing screw (#4x40 threads per inch) by the spring pressure of a large Bulldog clip.

Each microlens is cemented into its own small aluminum mounting plate which may be attached by means of adhesive tape to the underside of the top plate.

The object, on a microscope slide, glides on the lower plate on two small patches of Vaseline. This behaves as a kind of glide stage for positioning and helps reduce the risk of accidental displacement. The lens and object, of course, are aligned with holes in the two plates.

The light source is a low voltage, high intensity lamp fitted with a ground glass disc and an iris. The iris is typically set at 6 -12mm diameter at a distance of about 15 cm.

Most SLR focusing screens are too coarse and cluttered for focusing fine, low contrast detail. Since I do not have a clear focusing screen, I use the viewfinder only for rough focusing and framing. Final focusing is done using a good quality loupe to examine the unobstructed aerial image at the film plane. I have a loupe mounted on a cardboard tube of the correct length which replaces the camera for this purpose. The focusing mechanism has been found stable enough to

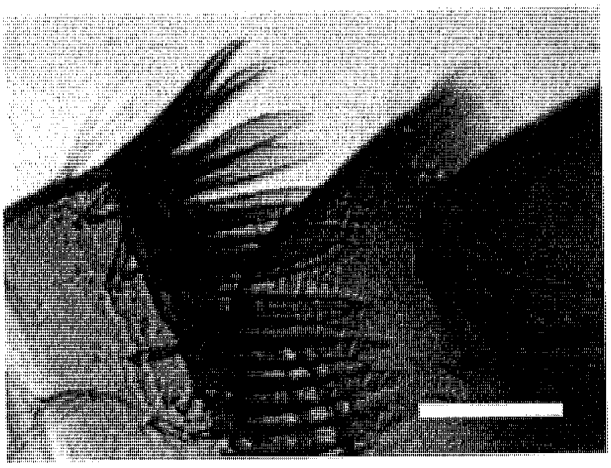

Fig. 3. The comb-like collar on the head of a dog flea. Scale bar = 100 microns.

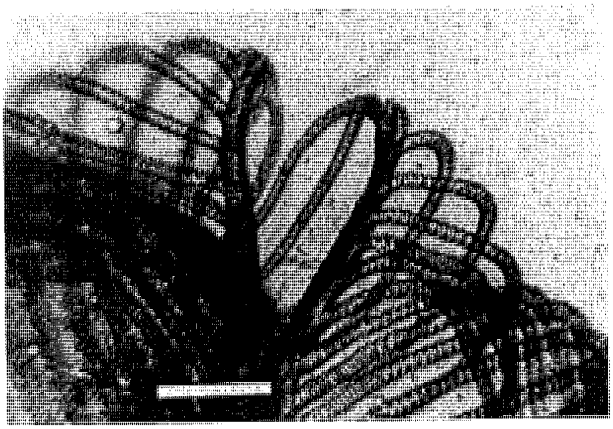

Fig. 4. Pseudotracheae on the proboscis of a blow fly. Scale bar = 100 microns.

hold critical focus indefinitely, even while the camera is removed to recheck focus between each of a series of exposures.

I use a long cable release and find that my 1980's vintage Minolta 'Aperture Priority' exposure control system gives satisfactory results with the camera set on 'Automatic.'

Figures 3 to 7 show some results using various lenses and techniques. With ASA 100 film, the exposures were around 0.25 to 0.5 seconds. Other technical details follow.

Figure 3. Taken with a water drop of about 1.7 mm diameter. The drop was placed on the slightly countersunk edge of a 1.1 mm hole with a fine hypodermic syringe. The hole had been made truly circular by lightly reaming with a scriber and the aluminum surface was made hydrophobic with paraffin wax.

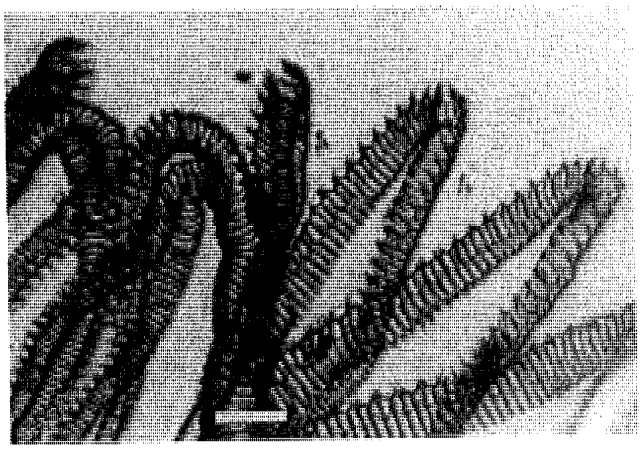

Fig. 5. Pseudotracheae at tip of blowfly proboscis. Scale bar = 25 microns.

Figure 4. Taken with a fused glass bead made by pulling a soda glass fibre, breaking, and melting back the end with a propane torch. The tail was cut off close to the bead so formed and a flat was ground and polished in its place to create a planohyperhemispherical lens. Diameter of bead 2.24 mm; focal length 2.12 mm.

Figure 5. Taken with a biconvex lens ground and polished from a plug of glass trepanned from a piece of sheet glass. (Method described in Ref. 2.) Radii of both surfaces 0.79 mm; focal length 0.94 mm.

Figure 6. Taken with a biconvex lens made in a similar manner to the lens of Fig. 4 except that a convex surface was ground and polished instead of a flat. Diameter of bead 1.15 mm; focal length 0.77 mm. The lamp was off-set to give oblique light at about 30° to the axis and 90° to the lines on the diatom. A medium green filter was used to improve photographic contrast.

Figure 7. Taken with the same lens as Fig. 6. Two similar light sources at about 30° to the axis and 120° to each other were used with a green filter.

A final word of warning. Anyone who tries his hand at photomicrography with home made microlenses will find it a fascinating and challenging occupation which could easily turn into an obsessive quest, with resolution as the Holy Grail!

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2. Loro, A. Antony van Leeuwenhoek revisited, *The Quekett Journal of Microscopy*, Vol. 37, Part 2, 1993

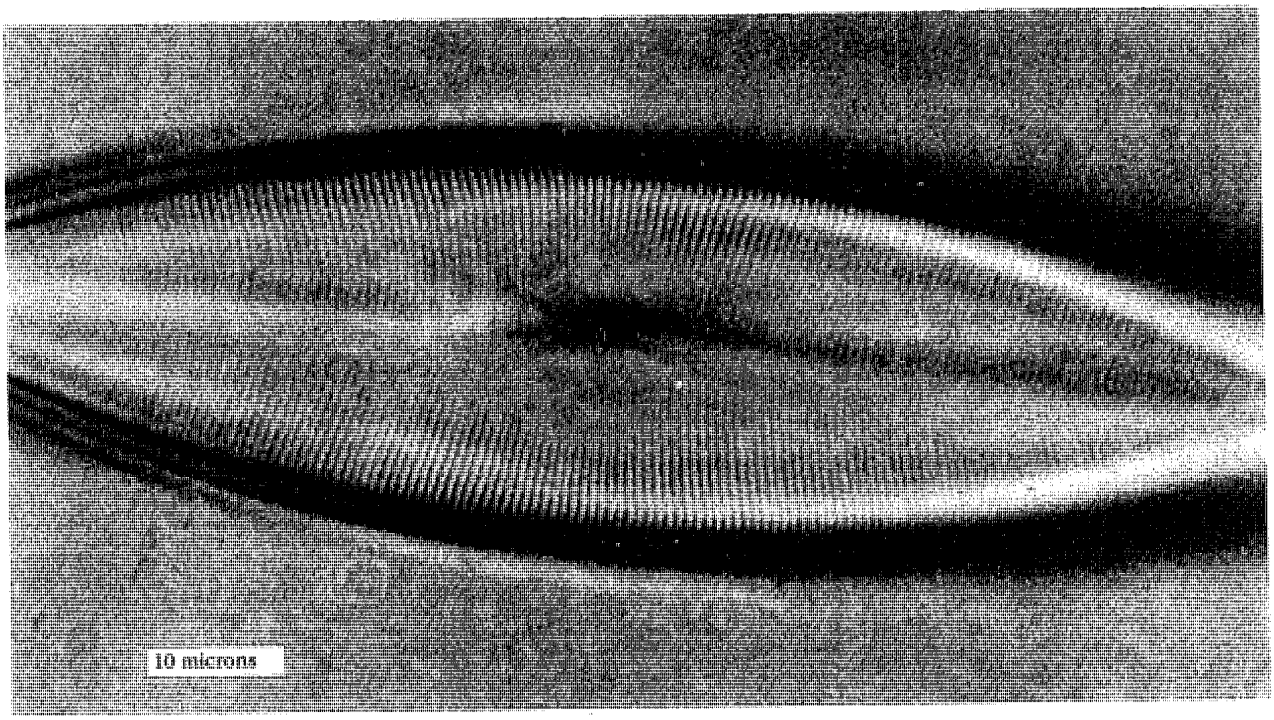


Fig. 6. Lines resolved on a diatom. Average spacing is just over 0.7 micron. Scale bar = 10 microns.

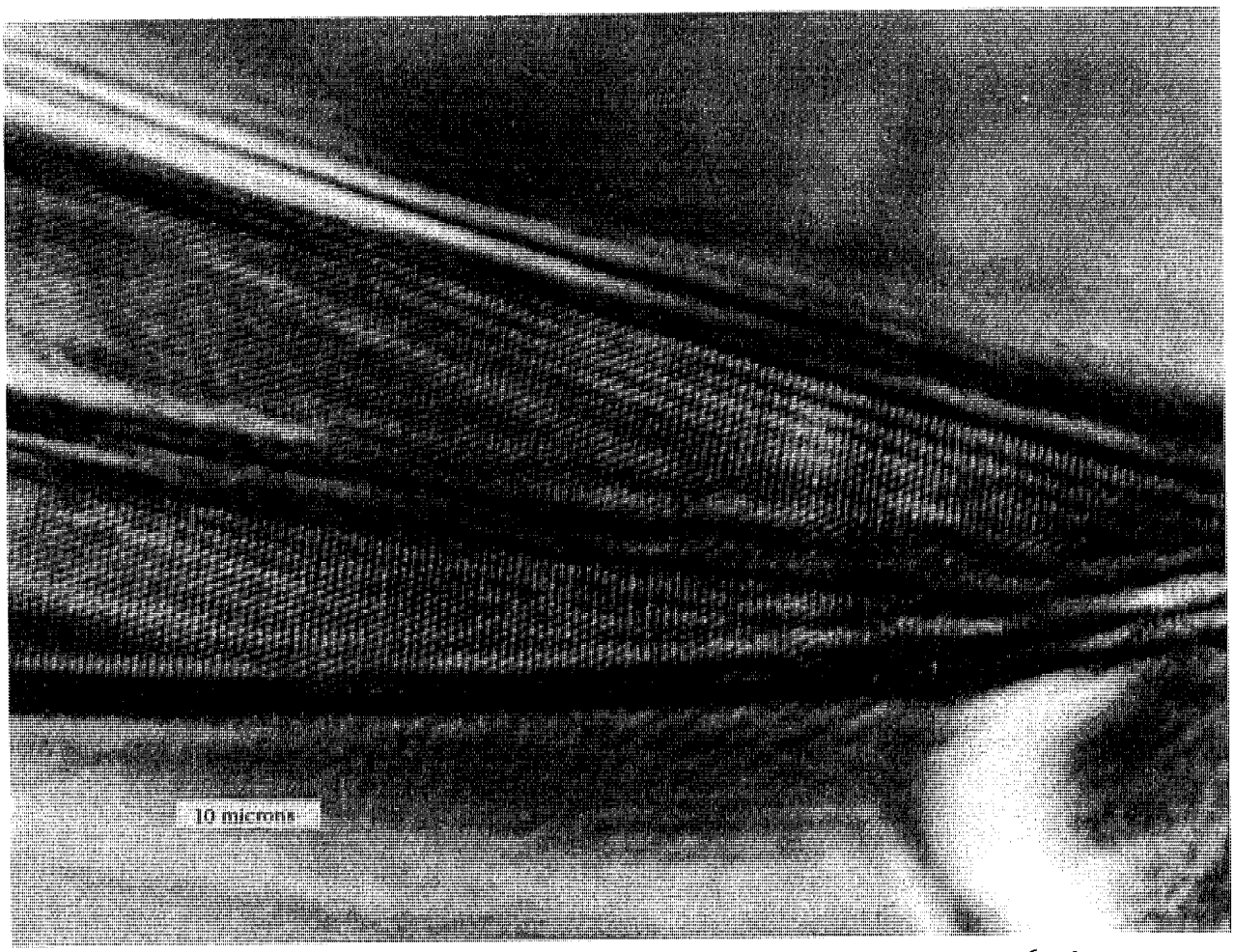
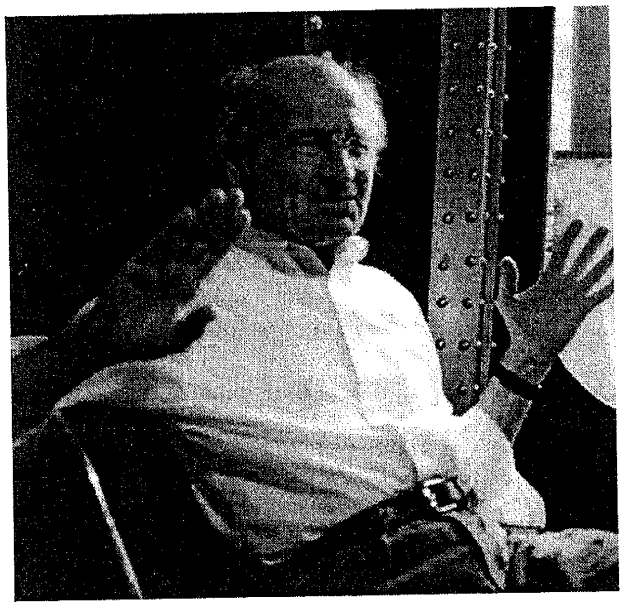


Fig. 7. Dots resolved on Pleurosigma angulatum. Dot spacing is just over 0.6 micron. Scale bar = 10 microns.

Member Profile

Parke W. Meek



At home. Venice , California. July 1998

With my older brother Ben in 1925

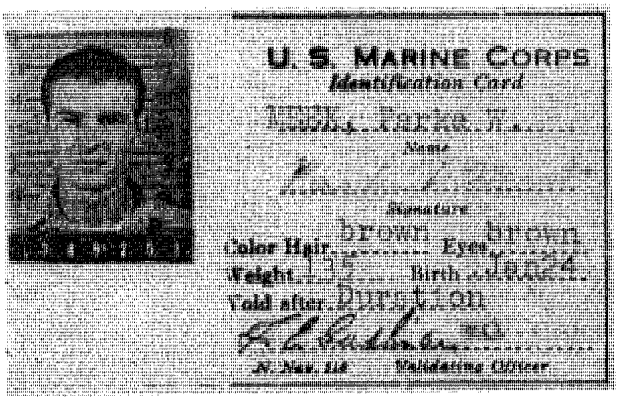
I was born in 1924 in Fort Wayne, Indiana. My mother was Irish and my father was Welsh and both gave me good advice. My mother told me once, "blarney won't get you anywhere, but it will sure smooth the way." My father was the best loved man in town. With his personality he could succeed at anything. He would take a route that was failing, build it up, then turn it over to someone else. Once in school I had a disagreement with a schoolmate and I decided to try to beat him up. I told my father about it and he said, yes I could do that, but I had to realize that I would then have an enemy. He said that he had never found any use for enemies. I took his advice and the kid later became my best friend. The same advice served me later when, in the Eames office, after chasing a guy with a hammer, I remembered Dad's advice and convinced him that we should be friends.

Unfortunately, my father's good nature served him poorly once. He was delivering something to a house with a vicious Doberman when the people were away from home. Even the Doberman liked him, but he had a heart attack in the front yard and the dog kept everyone away for hours after he died.

My brother, who is six years older, was a perfect boy, and when I came along my parents gave me a loose rein. I can remember going with friends to Trio Hamburgers where you could get three hamburgers for a dime. We sometimes stayed out all night. I was kicked out of high school in my freshman year after a run in with a teacher to whom I refused to apologize. I loved cars and got a job at a filling station to earn money. Then, at age 14 or 15 I worked for no pay in a civic theatre making sets. One of the first jobs was constructing a trap door to make Dracula disappear. A friend and I were given a dressing room to live in while we worked there. On Saturday nights, the troupe would play in outlying towns and I would drive the cast there in my car. After midnight all the bars were closed in Indiana, so we would drive to Chicago where we spent the rest of the night. I remember Joe's Club Deluxe with an all black band except for the red haired drummer where they had a hydraulically raised floor for jitterbug contests. One night at another club, both Louis Armstrong and Cab Calloway played. Later, I worked cleaning Checker cabs. One day, the boss asked if I wanted to make some extra money and I did by delivering bootleg booze. If a customer called and asked for Maggie, that was the code to place an order. I delivered Kessler's "smooth as silk" whiskey. I was underage, so could not be prosecuted if caught. I had a cousin in Indianapolis who ran a dry cleaners by day and a still at night. His booze was delivered in the pockets of overcoats.

In 1941, at age 16, I joined the U.S. Marine Corps. I was the youngest guy in the camp and wondered how I was going to survive. Then I understood that these other guys were not basically patriotic about the U.S., they were egomaniacs in love with the Marines. Their loyalty was to the Corps and their own ego. When I figured this out and decided to feed their ego, I got along fine and enjoyed the Marines well enough to stay in for 7 years.

Moving 75 mm gun to top of hill on Palau. Me inside circle.



Marine ID Card

I loved the South Pacific and the balmy climate. I learned how to acquire just about anything. Once after taking some army pumps to move shower water to the top of a hill, we had a problem when army people came to try to find their pumps. We just hid them and explained that all the piping in place was just waiting for the pumps to come from the States. I had a still made from kerosene refrigerator parts and the first thing I did when we arrived at a new place was to start a batch of mash fermenting. We even acquired china and white mess jackets from a passenger ship for the officers mess.

We spent time in New Zealand and Australia which I enjoyed immensely. In Ballarat, I met a girl named Judy Weatherspoon for whom I gave up alcohol and who I nearly married. We corresponded for some years.

We made landings on Guadalcanal, New Britain and Palau. In Palau we had to wade ashore a long distance from the Higgens landing boats that could not get through the shallow water. Morter shells were landing all around us, but they blew straight up in the water and unless one hit you almost on the head you were safe. Just after we hauled a 75 mm gun to the top of a hill, shown in the photo above, three of the men in the picture were killed by very accurate sniper fire. After that, while I was in front of the gun clearing away some

Nightclubbing with Eris

steel bars, the guy next to me was hit in the arm and a bullet went through my shirt as we scrambled back behind the hill. I seemed to live a charmed life. As a young kid, I did not take such events seriously. I even had fun, as It felt like I was on the winning team in a football game.

After the Marines, I married Eris, shown in the photo above, and we had a son Cole and now have two grandchildren, Dillon, 17 and Tyler 14. In order to learn to run heavy construction machinery, I joined the Marine reserves. Unfortunately, it was two weeks before the start of the Korean War and within three weeks I was sent to Camp Pendleton. The whole unit was almost immediately sent to Korea, but I was one of seven who were taken out for a construction unit that was forming. This never did get organized, which saved me from going to Korea.

My parents had started an antique shop in Southern Indiana, largely with stuff that I had collected in my childhood from trash cans and which they let me store in the cellar. It was close to the Kentucky border, which was not a very interesting place. I auctioned off the shop and moved back North to start a cabinet shop with two friends. One of them was a real craftsman and I learned a lot frm him. The last job we had was to build a Frank Lloyd Wright house in Fort Wayne Indiana for cost plus 10%. It is still there.

I returned to California, intending to relax for a month or two, but I stopped in a restaurant in Newport where I saw a want ad for a cabinet maker. The ad was for a place right next door to the restaurant, so I started work the next day. I ended up as foreman supervising the construction of rattan furniture. A designer from U.S.C. was hired and he mentioned that Charles Eames needed a cabinet maker to make prototypes. I had always liked Eames furniture and had a chair of his design back in Indiana.

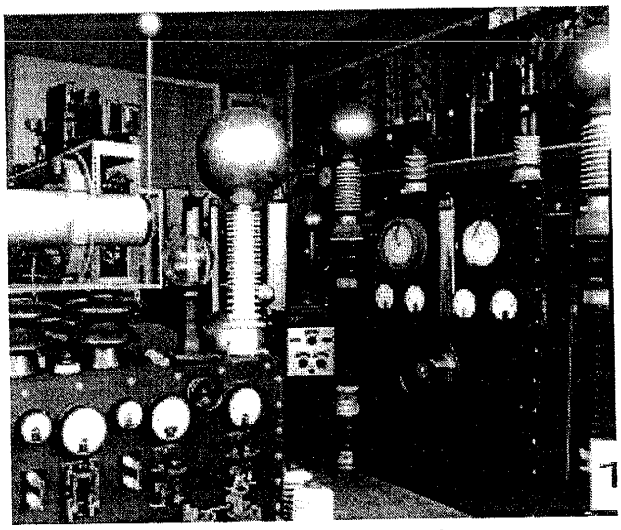
With Susan

When I applied for the job, I was asked if I had brought any examples of my work to show my skills. I said no, except for my Ford Woody station wagon parked outside that I had repaired after a Ford agency gave it to me as payment for another that I had fixed for them. After they inspected it, I was hired on the spot. I stayed with Eames for 25 years, starting when there were only five people in the company. In all the years I only took one day off sick, working 60 hours a week and looking forward to every minute. I never asked Eames for a raise, he just gave them to me. I was the only non-college graduate in the firm, although I had been accepted to MIT after the war on the basis of a test.

With Eames, I learned a great deal about welding, casting and other arts, never turning down an assignment, but doing whatever research was necessary to get it done.

In 1955, when Eames decided to make movies, I rented a big 35 mm camera and learned the movie business. We made films on subjects like toy trains and then corporate image films for companies, culminating in a seven projector film for IBM at the New York World's Fair and a seventeen projector film for a U.S. exhibition in Moscow.

In spite of all the work, I found time to race a 1950 MG Mark II sports car, once even finishing the Torrey Pines 24 hour race.



Scientific props for movie set

One day, I figured out that I was working 4 1/2 months just to pay taxes, so I quit to start my own business. I already had a sideline antique shop in Venice, so I used the space to make replica Art Deco furniture. This was very successful, but I eventually realized that I was tired of it when I spent two hours convincing a young couple not to buy a full set of furniture because I did not want to make it.

I sold everything except some weird stuff that I had which I now rent to the movie studios. I also build props using stuff that I have collected. I can build almost anything to look realistic, including cast plastic steel beams, huge gears, piping and valves, and structures that are a lot easier to handle than the real thing. Some of my props were used in the films: Batman, Casper, Jurassic Park, Dracula, Beetle Juice and the Adams Family as well as numerous television commercials. Among the things that I have collected are many microscopes, orrories and other scientific instruments. I especially like the older instruments that are the work of a single man.

Recently, I have, for some reason, been hired to make television commercials. In one for the House of Pancakes, there was no script. They just talked to me and I said whatever I wanted to. It turned out to be a bizarre ad as I told the truth that I ate breakfast at McDonalds and that pancakes gave me a stomach ache. This was nice work because it only took a couple of hours and I get paid every time they run it. About $8000 so far and also they paid $1000 for me to join the Screen Actor's Guild.

Susan Lieberman, in the photo above, my girl friend and business companion for the past twenty five years, saved my life during a recent heart attack. After a triple heart bypass two months ago I am deciding what to do next. I have always had fun every day, learning and living life to the fullest.

OTHER VOICES

Herb Gold

This month I'd like to direct your attention to *Rittenhouse, Journal of the American Scientific Instrument Enterprise*.This excellent publication is edited by Deborah Jean Warner of the National Museum of American History at the Smithsonian Institution. It is published by two scientific instrument dealers, Tesseract and the Antiquarian Scientist.They produce four issues per year and subscriptions may be directed to either of the publishers.

Quoting from the masthead,"This Journal aims to increase and diffuse knowledge about scientific instruments made and/or sold in the United States.The areas covered include mathematical, optical, and philosophical instruments, early electrical apparatus, sundials and globes."

The April 1998,Vol. 12, No. 2, contains an article that may be of interest to many of our members. Bud J. LaRue has written, *Robert B. Tolles and the Cone-fronted Objective*.This well researched piece discusses the general issue of providing oblique illumination and the specifics of Tolles solution. Tolles was probably America's most innovative lens maker who made many significant contributions to the art.

The author carefully describes several of the Tolles cone-fronted lenses in his possession and performs a number of comparison tests with Ross and Dallmeyer lens of the period.The superiority of the Tolles lenses is strikingly evident.

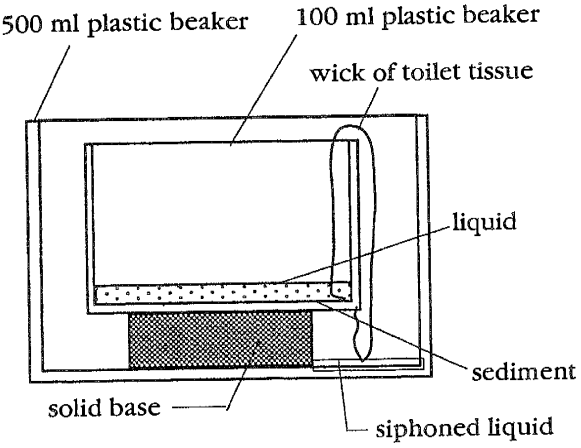
The second article is *Telescopes for Land and Sea* by Deborah Jean Warner.This is a thorough investigation of relatively small refracting telescopes in use in America in the late Eighteenth and early nineteenth Centuries. It is interesting to learn of the instruments issued to the officers of the Colonial Army and see a photo of George Washington's refractor.

The Micro-Siphon

Brian Damton

The separation of liquids from suspensions, or solids from fluids, are frequent operations in the pursuit of microscopy. In bulk proportions there is little problem in filtering, centrifuging, decanting or other methods, but when it comes to extracting the last drops of fluid, hard won specimens can be lost down the drain. When a sample of diatoms has been decalcified with hydrochloric acid, it is normally washed with copious amounts of water. Then it is dried out, before being subjected to the sulphuric acid stage treatment. After settling by gravity, the excess water can be decanted off, but great care is needed as the frustules are easily inclined to be swirled into a suspension and lost. Drying with some warmth is one way of driving off the last drops, but the micro-siphon speeds up the process without risk.

The wick of wet paper fibres from toilet paper or similar material causes the fluid to rise to the neck and then fall on the outside of the beaker. Since the terminaation of the wick is lower than the lowest input datum, then a siphon effect is set up which will drain the fluid in a few hours, without disturbing the sediment. Complete drying can then be affected with a little warmth in a very short period of time.This system may have applications other than diatom processing.



This article is reprinted courtesy of the Postal Microscopical Society from their Newsletter,The Balsam Post Issue No. 32, July 1996.

April 1, 1998 – Revisited

Richard M. Jefts

In the accompanying illustration, the background and upper left circled area labeled PLEUROSIGMA ANGULATUM / Conventional Light Microscope/Initial Magnification: 1562x," is an actual print from a photomicrograph that I took of that popular test diatom. Using oiled optics, fine grain black & white film and working in the far violet end of the spectrum, the original negative shows moderate detail in surface markings, pore structure etc.

To this background print two circular fields of view were superimposed, the whole then labeled, mounted on stiff cardboard and submitted at the MSSC April 4th, Saturday Workshop meeting as my contribution as an example of some of my on -going work . The two superimposed illustrations lower left and right do, indeed, show some very fine "added" details, both on the surface and deeper within the open latticework-like 'pores' - all in all, quite striking to the eye.

In making the presentation, the hardest part was keeping a straight face and keeping the general tone on a quiet and serious sounding plane. It was explained to the approximately three dozen members present that this was an extension of similar work of mine that they had recently seen, and then to comment (and to emphasize, but not overly emphasize!) " -April 1st-","-first day of the month -"," - work was completed three days ago -" (i.e.: first of April), etc.

As the general meeting proceeded, the offering made its appointed rounds and was viewed with varied expressions - from a quick glance to a detailed study, with raised eyebrows, with glances of approbation, to a cold and dead-pan silence

At the very end of the meeting, I asked to have a moment for an added postscript to the contribution When I then held up the plastic, open patterned table place-mat, (from which the two superimposed "photomicrographs" were taken), there was a quiet rustle of possible dawning comprehension. Then, when I added that the " ... radically different optical system" was a local Xerox copying machine, there was a brief burst of applause, possibly of some surprise and also quite possibly of 'suspicions confirmed!'

What may have helped during the initial presentation was that I had had a little previous practice at keeping a serious, dead-pan expression At the local (and very public) photo-copying center, a small group of people stood patiently, waiting and watching, while I tried different enlarging and reduction settings at various high and low light intensities, stacking a growing pile of pages, and looking critically for an 'acceptable' image. It was pretty obvious to everyone, that what I was doing was making photo copies of a large, floppy, bright yellow, open weave, plastic kitchen table place mat. With polite concentration, I didn't volunteer any information. The people waiting were slightly perplexed and a little unsure, but they were all very nice about it, too.

Nobody asked.

Errata

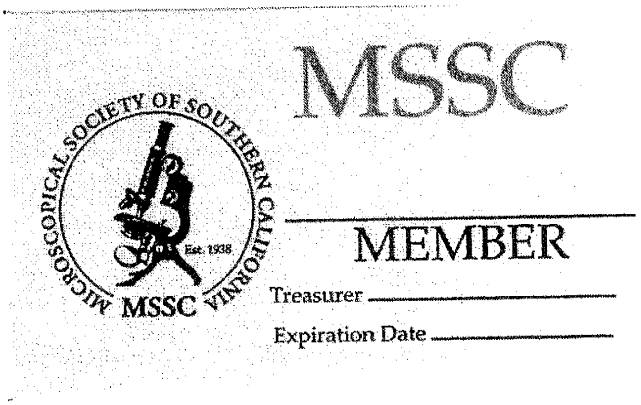
A few gremlins invaded our Merganthaler Lineotype machine when we were setting the type for the June 1998 issue. Please make the following corrections to page 112:

Figure 3.

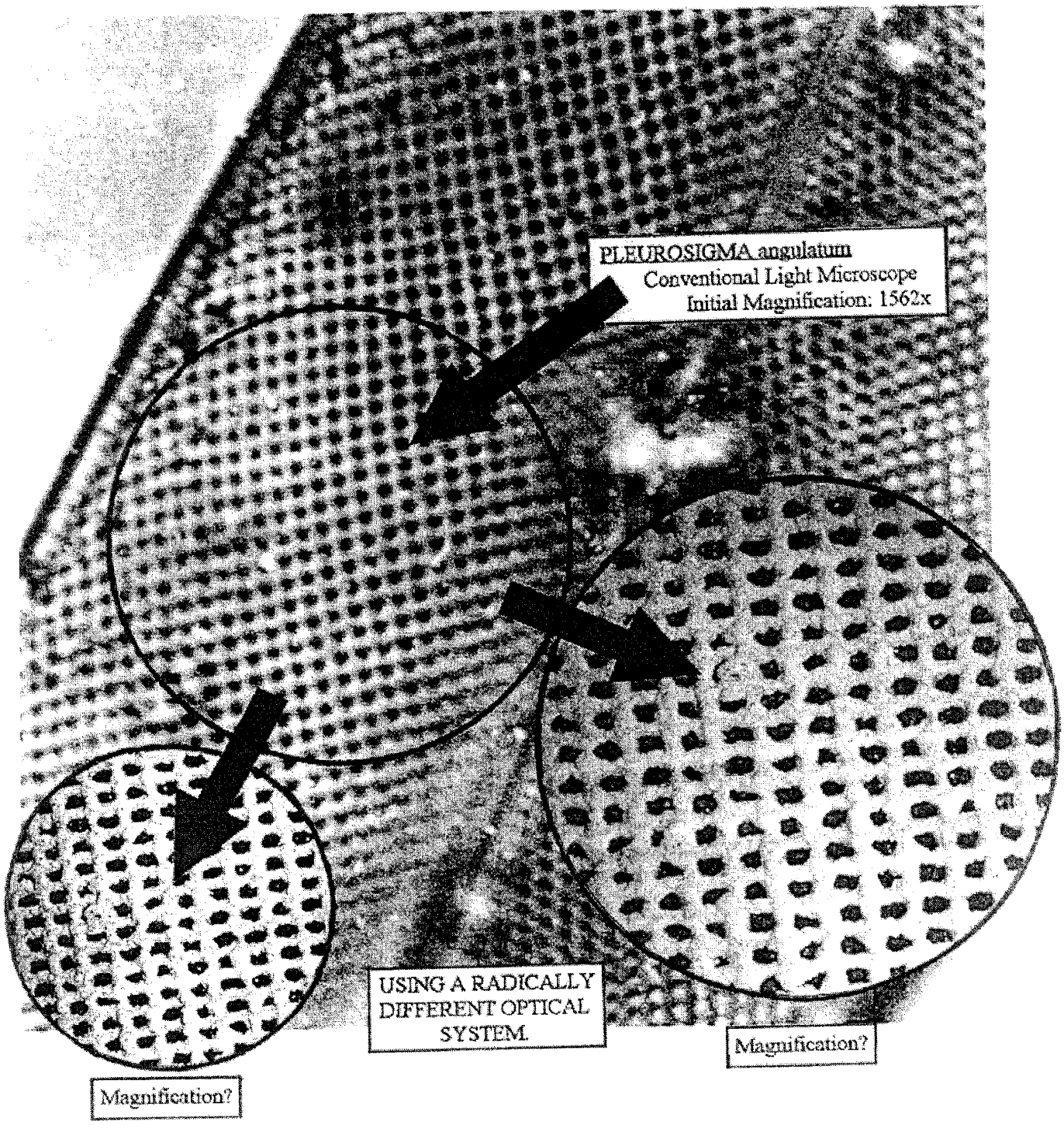
1. Very large brass forceps.

13. Empty hole.
14. Empty hole.
15. Empty hole.

For Sale. Beck Maltwood finder- in original case, very good condition.
Barry J. Sobel 1-818-986-5887 Home
1-818-986-6009 Office



The new membership cards that will be sent out by our treasurer, Dave Hirsch.



R.M. Jeffs / MSSC - APRIL 1, 1998

A Useful Procedure in the Restoration of POLARIZING MICROSCOPES

by George G. Vitt, Jr.

The MSSC Workshop of 4 April 1998 featured an exhibition of 15 polarizing type microscopes of different vintages and manufacturers. Besides each microscope being described by its owner, there was also a lively discussion on the design features peculiar to this type of instrument, many of which use the Ahrens prism as both the polarizing and analyzing element. Since many older instruments suffer from the de-cementing of these calcite prisms, this aspect of their restoration is an important matter. My Tech Note No.29 of 25 Oct. 1992 describes this delicate procedure and it was requested by those in attendance that this Note be re-published. So, here it is.

On October 25, 1992 I had the pleasure of meeting and spending a pleasant afternoon with MSSC member, Kevin Bennet, who is an avid avocational microscopist one of whose achievements, for example, has been the restoration of his own personal scanning electron microscope! He has a degree in Chemistry from MIT, has worked with and reveres the late Dr. Harold Edgerton (as I do), is married to a Wellesley girl, and is currently employed by the Mayo Clinic in Minnesota. Having immersed himself in crystallography, it is no wonder that a good part of our conversation was centered around polarization/petrographic microscopes - particularly the older models where calcite Ahrens prisms were used as polarizers and analyzers. Unfortunately, in a high percentage of such old microscopes, the Ahrens prisms have suffered either an optical deterioration of the balsam layer, or have become partially de-cemented due to mechanical failure of the balsam bond. Kevin described his method of disassembly, cleaning, and re-cementing of such prisms - a procedure equally suited to other compound optical elements made of glass and held together with balsam. I describe his method because of its potential value to fellow microscopists with a proclivity for restoration of these grand old instruments.

Calcite: Calcite ($CaCO_3$) is a naturally occurring transparent birefringent mineral, much of which comes from Mexico. It is also known as Iceland spar or calcspar. The large difference in its refractive indices (1.6583, 1.4864) makes it highly birefringent and most suitable for work with polarized light. It is insoluble in either water or organic solvents. Since it is relatively soft, its hardness being close to that of soft brass, it must be handled carefully to prevent it being scratched. **It is especially prone to chipping and fracture,** and one must <u>never</u> attempt to pry the balsamed elements apart with even so much as a sliver of soft wood! The old balsam layer must be fully softened and dissolved so that the prism elements, held in the fingers, can **literally be slid apart without force.** Here are the steps to repair a defective prism.

Repair of cemented (balsamed) calcite prisms:

1. With a very soft lead pencil, mark all adjacent parts of the prism so that they can later be re-assembled correctly. Carefully place the prism in a small covered beaker of Xylol and let it remain there, undisturbed, for **at least two weeks.** This will allow the Xylol to penetrate the balsam layer and render it fluid.

2. Obtain some best quality optically clear Canada balsam. (In the "as bought" condition, the balsam has a viscosity of maple syrup.) Place the small quantity required for the job into a perfectly clean balsam bottle. Heat the unstoppered bottle in an oven or water bath at 75 deg. C. for a length of time sufficient to drive off the small quantity of Xylol that had been used by the manufacturer to reduce the viscosity of the balsam. (Warm Xylol-free balsam has a viscosity of Karo syrup.)

   Note: If Xylol-containing balsam is used to cement optical parts, it will take forever for this solvent to escape into the atmosphere and render the joint mechanically strong, and the thickness of the joint will change unpredictably as this is taking place. If the balsam is Xylol-free, and applied warm to the optical parts, a mechanically strong joint is formed immediately upon its cooling.

3. With the fingers, remove the prism from the beaker and test to see if the parts **slide apart** almost of their own volition. If they do not, continue the soaking in Xylol.

4. Rinse the parts in fresh Xylol to remove every trace of remaining old balsam. Clean all the surfaces very carefully by breathing on them and **lightly wiping** with either a clean, often laundered handkerchief or a folded Kleenex tissue. An air syringe is useful for removing stray dust particles. Rubber or vinyl gloves are advisable to prevent the possibility of fingerprints on the optical surfaces.

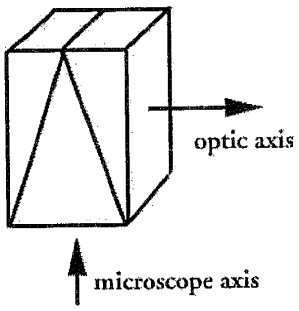
6. With a clean round-ended glass rod, that comes with the balsam bottle, apply one small drop of warm balsam to one surface of the prism and immediately align and lightly press the required piece up against it, exerting a **very light** pressure. Repeat for the other surfaces.

7. If the job does not satisfy you, the part can be returned to the Xylol bath and the process repeated until you are happy with the results. This is the beauty of Canada balsam - it allows for correcting your mistakes: it is dissolvable and, once set, is utterly inert and mechanically strong. Synthetic mountants do not offer such flexibility. No wonder that balsam has been used since time immemorial!

The Ahrens Prism

George G. Vitt, Jr.

Ahrens Prism: Calcite prisms, when used in the polarizing microscope, utilize the principle of double refraction (birefringence) to produce polarized light. Optically clear calcite is used and the prism is made by cementing the parts together with Canada balsam. Light entering the base of the prism is broken up into ordinary and extraordinary rays. The extraordinary ray has an index of refraction which is close to that of the balsam and lower that for the ordinary ray. Both strike the cementing plane of the balsam obliquely. The obliquity of the ordinary ray exceeds the critical angle between the ordinary ray and balsam. As a result, it is not refracted through the balsam (to travel through the microscope optics) but is reflected to the sides of the prism. Since the extraordinary ray does not exceed the critical angle between the extraordinary ray and the balsam, it passes through the prism with little deviation. The extraordinary ray is polarized with one plane of vibration; consequently, the light emerging from the prism is made up entirely of the extraordinary ray and is thus plane-polarized.



Microscopy and the World Wide Web

James D. Solliday

I didn't think it would ever happen to me, but after a certain amount of exposure, it finally happened. I joined the growing number of Americans who have allowed the computer to invade there home. I did not intend for this to happen, but, once I began to use a free e-mail service called Juno, I discovered how convenient instant communications could be. Juno was a very useful service, but the trouble was it would not support the transmission of images. With the growth of our Journal and the industrious nature of our members, it became more and more important that I be able to send both text and images back and forth. So here I am, with a new computer and access to the World Wide Web. To my delight, I have already found a large number of locations on the internet that provide assistance for the microscopist. This, of course, includes information that can be applied directly to almost any form of research you intend to do. For over ten years, I have studied the diatoms and spent a fortune searching out books and articles associated with my work. The first day after I set up the computer, I typed in the word "diatoms" and "shazam," an encyclopedic amount of material turned up. This was only the beginning, the subject of photomicrography turned up page after page of beautiful images. Difficult to find equipment which is sometimes needed by the microscopist can now be easily found on the internet. A good example is Taylor's Microcompressor. With this small, but powerful tool, I have been able to produce much improved photomicrographs of living microscopic invertebrates.

Working with the microscope is one thing, but collecting them requires a great deal of networking. The internet is the perfect forum for this. You can now find a number of auctions that can potentially provide you with objects of your own particular interest. Most of the antique instrument dealers have also added their businesses to the net. The book sellers for the most part have provided access to their data-base allowing you to find most anything your need. I could go on but I think you get the message. More and more of our members are getting on the internet. The officers of the Society do most of their communication by e-mail and many of the regular members are also available by e-mail. If you are not yet 'on line', don't feel bad as some of the benefits are out weighed by the amount of time you can spend looking though cyberspace. In time, however, this fascination with your new toy wears off and you eventually get down to work.

The officers of the MSSC recognize this new resource and would like to set up a forum to assist the members in sharing access to the World Wide Web. Resources and addresses on the internet that are of interest to our members can be included in a new section called Microscopy and the World Wide Web. Any Web Site that you find that is of interest can be sent to the editor and then included under this new column. Please include a brief description of the site so that others with that particular interest can give it a try. Occasionally, we can feature 'The Site of the Month' giving more details on that particular address. If you find a site that you feel should be 'The Site of the Month,' please write a detailed description and send it in. I don't know how this idea will work out, but we should at least give it a try.

It is hoped that this new column can have at least a half a dozen addresses each month. For those of you who may not know, Larry Albright has set up a Web page that describes the MSSC. It can be found at, www.plasma-art.com. Larry has kindly included information about our Society on his own Web page. The following is our first list of Internet Web sites associated with Microscopy.

Microscopy and the World Wide Web

http://www.plasma-art.com L.Albright's page,Web site of the MSSC, with additional links.

http://www.gate.net/~hltcompr Howard Taylor's Microcompressor (Working with Rotifers)

http://www.utmb.edu/mml/scopes/makers.htm The Microscope Gallery, description of makers and their instruments.
http://ib.berkeley.edu/golub U.C. Berkeley's antique microscope collection, donated by Golub.

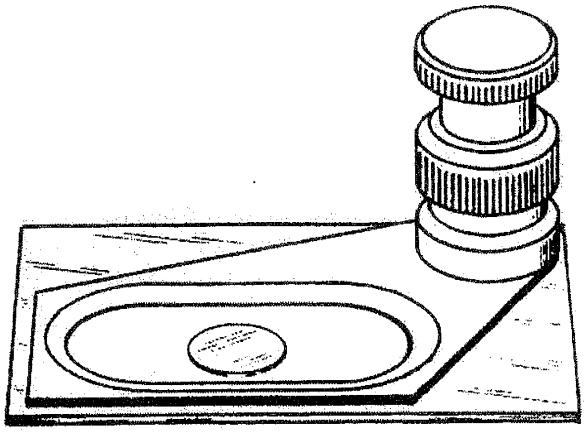
http://www.americanartifacts.com American Artifact, history of the microscope, illustrated.

http://www.micro.magnet.fsu.edu/galleria/index.html Great photomicrographs by M. Davidson.

The Site of the Month:

I would like our members to know about an important site that should be quite useful for anyone interested in working with microscopic invertebrates. I

am referring to Howard Taylor's Microcompressor (Working with Rotifers) located at http://www.gate.net/~hltcompr. The information available at this site represents a life time of work, all made available in a series of chapters. The primary subject of Mr.Taylor's research is Rotifers, but the techniques described are applicable to a wide variety of disciplines including protozoology, invertebrate zoology and all forms of aquatic limnology. Most of the information concentrates on procedures and techniques, some of which are impossible to find anywhere else but here. Technique is everything if you wish to be successful in working with microscopic organisms. The chapters are sent to your computer upon request and future articles under preparation can also be expected for those who need them. Mr.Taylor has published a number of articles in *The Microscope* (McCrone) which describe some of the innovations associated with his work. Not only has he invented a much improved, and by far the best microcompressor available, but he has also developed a precision micro-pipette. Taylor's pipette makes it possible to easily collect a single Rotifer from under a stereo scope. The microcompressor has been designed to be conveniently used on the modern microscope stage. It provides the precision and stability needed to manipulate a single microscopic organism without displacement from the field of view (see illustration). The



Mr. Taylor's Improved Microcompressor.

chapters include topics such as Collecting techniques, Equipment, Micromanipulation and Isolation methods. Also available are sections on Preservation, Storage, Staining, Drawing, Photomicrography and Record keeping. The above is only a partial list, there are more important topics coming in the near future. Take a look and, while you are there, why not sign up for a very educational experience at: http://www.gate.net/~hltcompr/ . If you would like to contact him by e-mail, please use the following: hltcompr@gate.net. E-mail is available through his Web site.

MSSC Member E-mail Addresses

Listed below are the member e-mail addresses that I have in the Journal database. Please check to see that yours is there, and that it is correct. If not please e-mail me the addition or correction and I will publish it next month.

Gaylord E. Moss

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Blankenhorn, Rick C.	rcb@gemmary.com
Busey, John	buse@prostar.com
Clark, James D., Jr.	jjclark@cts.com
Craig, Steve	scraig@leonardo.com
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McCormick, Thomas J.	tommcc@cerfnet.com
McDavid, Larry	Lmcdavid@lmceng.com
Moorhead, Wayne	wayneKip@ix.netcom.com
Morris, Ron	tus.ssl.com
Moss, Gaylord E.	mosss@att.net
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Solliday, James D.	jdsolliday@att.net
Stabinsky, Leon	stabin@earthlink.net
Vitt, George G. Jr.	gvitt@att.net
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Ziff, Stuart	stuartziff@prodigy.com

WORKSHOP of the Microscopical Society of Southern California

by: **George G. Vitt, Jr.**
Date: **Saturday, 6 June 1998**
Location: **Steve Craig's Lab.**, 36 persons attended.

1. **Steve Craig** announced that he had placed all the books belonging to MSSC on a top shelf in his lab. and are available for loan to the membership.

2. **Izzy Lieberman** described what he saw at the recent Concourse de Elegance (exhibition of classic automobiles) at the Loyola campus of Marymount College in Westchester, CA.

3. **George Vitt** brought an item that needed identification: a Reichert binocular microscope eyepiece assembly with optical tube with a swiveling ball-terminated pivoting arm. (This had been obtained by a friend from Reichert at the conclusion of WWII.) Allen De Haas identified it as being part of a Reichert metallograph and stated that it can also be used as an independent low-power microscope George then reported on his continuing work and studies in Photoshop. He also described the Ainsworth analytical balance, Type 10, which he had received as a gift from his niece, Katherine. If anyone needs to have their weights checked to 0.1mg accuracy, and up to 200g - see George.

4. **Richard Jefts** reported that Walter C. McCrone had been written up in a letter to Time magazine, in regard to his investigations on the shroud of Turin. He also showed a Dec. 1937 issue of *Popular Science Monthly* magazine which described a 12-foot microscope (a long distance scope); and the book *Mounting Microscopical Objects*, by Davies, 1890.

5. **Barry Sobel** brought in some of the small items that he had gotten in England. These included a chrome linen tester by Griffith and Tatlock (first half of 20th c), several different hand held magnifiers including large and small Coddington's and Stanhope's, a Nachet Polarizing Kit, some nineteenth century eyepiece micrometers, an uncommon form of compass microscope, and two different handheld John Browning "Rainband" spectroscopes. The other microscope is described as follows:

"Adams Universal Compound" type microscope, brass, c. 1830. Signed on the folding tripod base: "Cary London" with body tube mounted on the classic limb with rack and pinion adjustment for and aft motion of the arm, with a stage incorporating adjustable slide holders and articulated bullseye condenser, the limb supported through a typical compass joint, supporting a planoconcave mirror, over a tapering pillar. This type of instrument was first described by George Adams, Jr. in his "Essays on the Microscope" published in 1787. It differs from the slightly later "Jones Most Improved" type in that the latter has a sliding arm with a thumbscrew lock rather than the rack and pinion as in the present example and in the Adams type. In addition, it differs from the original Adams type, in its unique arrangement for the condenser mounted to the stage, allowing it to be used from above or below, a later development also found on some other Cary, as well as continental models of the period. It has an achromatic objective of the early English type, although it is not likely that this objective would have been the original. The 3-button English-style objective comes in a separate can. This type of achromatic objective was made from about 1830 on. This microscope objective proved to have excellent achromatic correction during our study after the workshop.

6. **Steve Craig** introduced Mr. & Mrs. Robert Conacher, of Wrightwood, CA, and they were warmly welcomed. Robert is one of the earliest members of MSSC.

7. **Jim Solliday** reported on the progress of our preparation for the MSSC photomicrographics art exhibit at the Palos Verdes Art Museum. Our 35mm slides had been returned and the images to be used are in hand. These will be given to member **Maurice Greeson** who will have them professionally printed (to avoid subject failure) at a nominal cost. Frames and glass will then be obtained, the prints and cards prepared, and prices assigned by the submitters. A descriptive short paragraph, printed on a small card, is to be submitted with each picture. This will be affixed to the wall with an adhesive clay next to each picture, to inform the viewer. The pictures will be hung from a nail in the wall - thus a wire on the back of each photo will be needed. The show opens on 11 Sept. 1998. There will be a program and refreshments. Jim then described the construction and use of the Abbe Test Plate, and other methods of testing objectives. He stated that he plans to prepare a workshop on "how to test objectives."

8. **Dave Hirsch** described an acquisition gotten on his recent trip to England: A c.1925-30 German portable microscope in a fine binocular-shaped leather case. This is a tall, slim monocular hand microscope which slips into the stand; with segmented objective,

substage mirror, cast-iron base, black brass; with Zeiss illuminator, 3 eyepieces, s.s. adjustable condenser, 6 stops in the ss. plate, and fine focus by a tilting stage. Dave then gave an itinerary of his trip and described his seeing the Arthur Frank Collection at the Royal Scott Museum, where he took some photos.

9. **Norm Blitch** showed a Nachet microscope, complete except for the condenser which fits into the substage bracket. He brought the Nachet catalog which illustrated this model. Norm also brought a 2nd Nachet, c.1870, which is listed in the Arthur Frank collection. He then showed a small monocular microscope, bought in 1939, with bulls-eye, a ball & socket joint, on a green base. His 3rd. mic. (not a Nachet) was a miniature replica of the previous one, with a simulated B&S joint. He showed a photo of a standard B&L medical microscope from the *Cochise County Historical Journal*, were it is described as being used by traveling doctors in the wilds of California (in the old days, that is).

10. **Stuart Warter** brought a very tall monocular "mystery" microscope by John F. Sidle, Philadelphia, 1879-80, and Lancaster, PA, 1880-, the base marked JNO.W. SIDLE. This microscope is either an early Acme #3, or a fore-runner of it, and may have been made prior to 1880 in Phila. It differs in several ways from the #3. First advertised in 1880 after the move to Lancaster. Acme Optical Works (Lancaster) consigned its entire production to J.W. Queen in 1881.

11. **Ken Gregory** gave some valuable information concerning the availability of lacquers suitable for restoring brass instruments. These are lacquers which can be obtained from musical instrument makers which they use on their brasses. Some of these lacquers are gold-colored. Ken then showed a Zeiss jug-handled microscope with rotating stage in fine condition. He also contributed several books to the MSSC library. Thanks, Ken!

12. **Myron Lind** brought a first example of a microslide which he had made. This was then put on a light table for inspection.

13. **Gary Legel** discussed the Jeff Weber rare book catalogs. He then passed out instruction sheets describing his method of constructing a heated stage using a 2x2" glass plate with indium-tin-oxide conductive coating, and the use of conductive epoxy adhesive to secure the two thin sheet-metal electrodes to its left and right edges. The sheets also contained a table listing plate temperature vs. applied voltage. Gary then handed out some of the stages he had constructed. Thanks, Gary!

14. **Chris Brunt** announced the happy and eagerly awaited news that his design of a sensitive log-scale photometer, with programmed microprocessor and LCD readout is in the works, and will be available as a kit to MSSC members in about a month! This promises to be a valuable contribution to the art and science of photomicrography - and should be a boon to all photomicrographers.

15. **Gaylord Moss** described the recent Optical Society of America meeting he attended where a diffraction limited IR zoom lens design was presented. All elements are controlled with 2 servo motors and there is a look-up table so that automatic corrections are made for temperature changes. He then stated that he will make a special cover for each year's set of copies of the MSSC Journal, for those who intend to bind these into yearly volumes. He said that back copies of the Journal are available.

16. **Larry Albright** announced that Mark Armitage will speak at the next meeting on the subject of radioactive halos in biotite and other minerals - and that the meeting will be in the music room of the Crossroads School. Larry then showed a marvelous children's scientific 'electric questioner' of the 1930s. This consisted of a battery-powered board with printed color graphics of scientific subjects, with questions and answers. Connecting with jumpers the correct pair of pin-jacks, a buzzer would sound. Many additional graphics boards on various subjects of natural science were included in the compartment in the box cover. Larry then showed an Aloe (B&L) double pillar cased microscope, c.1890, which he got at an e-bay auction.

17. **Jerry Bernstein** said he will write an article on lens testing.

18. **Alan de Haas** said that he has a Kilogram of thymol, a substance used for the killing of book-destroying silverfish. At the next regular meeting, he gave out small quantities in 35mm film plastic cans, along with cautions in its use.

19. **Allen Bishop** said that the Nye damping greases are not ideal for R&Ps, and recommended Rheolube 723 for gears and such. He showed a large amount of Zeiss literature and said that he would get a Zeiss person to give us a presentation at a regular meeting. He had the article *Microscopy from the Very Beginning* by Kapitza - something that everyone should read. He then showed a Zeiss jug-handled stand with rotating stages, in fine condition, c.1898-1922, and reported that Zeiss apochromats made after 1918 are 'probably OK'.

MINUTES FOR THE MSSC REGULAR MEETING OF 17 June, 1998

David L. Hirsch

AN MSSC FIRST! As of 1 July, 1998, we enter our 'period of correction'. We are taking the necessary steps to establish the first of January as the official starting date of the MSSC Fiscal Year instead of July 1 as in the past. The dues (now due) will cover the second half of 1998. The new millenium is coming up fast!.

For this six month period, the dues will be $25.00 for regular members and $20.00 for Corresponding members. The membership statements which are being sent out, will reflect this change. The dude who invented esprit de corps must have had the MSSC membership in mind, because your treasurer was the happy witness to a magnificent happening; Without the slightest hint or twisting of arms, more than a half of us present at this meeting, including new recruits, plunked down their dues. This magnanimous act is truly a first. Thank you, one and all!

Your MSSC membership cards have arrived. The membership cards project a strong statement of professionalism. The 1" x 3" size cards feature raised, two tone, thermographic printing and a logo that is second to none. Likewise, I have received the Treasurers 'official' rubber stamp and a 'for deposit only' stamp for banking the torrent of membership checks soon to flood my mailbox.

When you receive your new membership card, not to worry about the cryptic pair of alphanumeric characters marked on the lower right hand corner of the card. The numbers indicate the order in which the dues were received. The letters, 'R' or 'C', indicate whether you are a Regular or a Corresponding member. Now, that you have been confused with facts, lets see what happened at the meeting.

33 members and ten guests listened attentively as MARK ARMITAGE gave his well prepared and interesting talk on those enigmatic radiohalos. In addition to the biotite samples and other material exhibiting this phenomena, a number of slides were shown to illustrate the presence of radiohalos in various gem materials. The talk was discussed in detail in the last issue of this journal in the preview.

SHOW AND TELL. We MSSC members are serious about our Show and Tell events. No wax lips or rubber chickens ever grace our microscopical memorabilia showings; just those Symphonies in brass and glass which we all dote upon. On behalf of MAURICE GREESON, ALLEN BISHOP showed a circa 1925 Zeiss Wetzlar stand "F", complete with monocular and binocular heads. A custom fitted case contained accessories for the microtechnologist and the photomicrographer. Included among the many accessories was a shade which attached to the eyepiece of a monocular stand. The shade is mainly for the aid of those new to microscopy. Experienced microscopists have both eyes open when looking into a monocular microscope. The untrained observer is apt to see two separate images. By concentrating on the microscopic image, the other image appearing in the unoccupied eye will seem to disappear. For observers who cannot do away with the unwanted image, the eyeshade is used.

KEN GREGORY showed some interesting ophthalmologic devices including: a box containing about 30 trial lenses, a simulated retina with a series of small, round screens representing various inner eye conditions, a demonstration kit containing a pair of eye simulations made of uranium glass with the top sections ground flat and polished. By passing a concentrated beam of light through the 'eye', various lens conditions can be demonstrated. Ken also showed two types of ophthalmoscopes from the 1930's.

Largely through the efforts and encouragement by JIM SOLLIDAY, MSSC members are showing an increasing interest in photomicrographic technique. Jim showed some of the slides, including those made by MYRON LIND and others.

CHRIS BRUNT described a photometer that he is developing. The instrument will have a range of 6 decades, is microprocessor controlled, and includes a digital readout and other significant features.

OUR DOSSIER. The MSSC application file is gradually taking shape. The updated application form will include our new logo. All information contained in the file is kept confidential. MSSC members in good standing will be requested to fill out the new application form. A parallel file will be opened, including all individuals and societies receiving courtesy copies of the MSSC JOURNAL.

IF IT AINT BROKE, DONT FIX IT! There appears to be a concern in some quarters, that MSSC is becoming too large and that we should reduce the attendance.

Be advised that any attempt to cull or restrict membership or attendance at regular meetings and workshops is counter productive! Bear in mind that we are:"devoted to the study and practice of the Science and Art of Microscopy and to the preservation and study of scientific instruments related thereto." MSSC is a 'microcosm' which encourages interested parties, world wide, to join us and to participate in our activities.

We have seen the MSSC membership rise, from 63 people as our old life came to an end, to a whopping 93 souls when the books were closed on the last fiscal year. This increase is a testament to our unofficial slogan:"We Must Be Doing Something Right!" The membership mix comes from three main sources: dedicated members of record, members who resigned from the old Society and are returning to the fold and new members who heard of MSSC by word of mouth and via media announcements.

We draw upon an incredible spectra; from neophytes eager to learn about microscopes and microscopy, to erudite individuals, well experienced in the art and science of our Mother Subject. Here, is an admirable example of symbiosis at work, whereby the newcomer has at his or her disposal, a vast cadre of learned people eager to share their expertise with interested fellow members.

HEY STELLA! At a recent workshop, the procurement of MSSC inspired T-shirts was discussed. Since my wife had just purchased my complement of summer unmentionables, I enlarged the new MSSC logo and stuck it to the front of a white T-shirt. The sample was shown at this meeting and it impressed a number of us in attendance. Something to think about. Perhaps we might have one of our Adonis-like members model a prototype MSSC T-shirt for the Society. The estimated price; under $10 per copy. More about that later on.

LATE BLOOMER. At long last, I joined the increasing numbers of MSSC members who are on the Internet. e-mail addresses of all members so disposed are shown in the MSSC roster. Your Treasurer may now be reached at: dlhirsch@pacbell.net

A CASE IN POINT. A notable collection rates a well designed and constructed display case. To this end, JOHN de HAAS assembled a birch framed, glass enclosed case from a kit that he purchased from IKEA. The finished case is 18" wide x 12" deep x 6' tall. The shelves are of tempered glass. Chris Brunt helped John to add an efficient lighting system to the case. For details on this amazing display case, all interested MSSC members may contact John at: (310)391-5205.

SMICROSCOPE

Those who are interested in the origin of the word "Microscope" will find useful information in a paper by Professor Gilberto Govi on the alleged invention of a microscope by Galileo. A translation of this paper appeared in the Journal of the RMS, 1888 and 1899. It would appear that, at first, the Italian Occhiale (or Occhialino) meant either telescope or a microscope, the differentiation being supplied by the context: much in the same way as we use 'glass or 'glasses' to express several varieties of optical instrument. The word Microscope (from the Greek 'small' and 'to see') made its appearance early in the 17th century, and like the word Telescope, seems to have originated with the Academy of Lincei. Its invention seems to have been actually due to Giovanni Faber who, in a letter dated 13th April, 1625, and written to Prince Federigo Cesi, President of the Academy, says "I only wish to say this more to your Excellency .. concerning the new inventions of Signor Galileo . . As I also mention his new occhiale to look at small things and call it a microscope . . as the Linceum gave to the first the name of telescope so they have wished to give a convenient name to this also . ."

Among the references and allusions quoted in the Oxford new English Dictionary (sub Microscope) the earliest is from the English Philosophical Writer, Thomas Hobbes, who (1650) says, "There are now such Microscopes . . . that the things we see with them appear a hundred thousand times bigger.

The Latin form of microscope is microscopium, but we find Athanasius Kircher (1601-1680) adopting the somewhat longer word smicroscopium, probably considering that a more dignified derivation from the Greek could be made from words of the same meaning. No other writer however seems to have followed his example. It should be noted that the quantity of the first syllable is long, and that the pronunciation is therefore 'mycroscope' and not 'mickroscope'.

Watson's Microscope Record. Sept. 1927 - An etymological note by A.N.Disney, MA., Bsc., FRMS.

This is reprinted from the Balsam Post of July 1995 courtesy of The Postal Microscopical Society.

July Meeting

Wednesday, July 15 at 7 PM
Crossroads School
1714 21st Street
Santa Monica, CA

A Tour of the Stars and An American Microscope Collector in England. Barry Sobel

Along with his interest in microscopes, Barry Sobel is an avid and accomplished astromoner. His "Tour of the Stars" is a multimedia presentation made up completely of his own spectacular astrophotography accompanied by narration and special music that was composed for the last visit of Halley's Comet.

His personal observatory is of the highest order and as anyone who knows Barry will attest, he does not do anything by half measures. It promises to be a fascinating and entertaining presentation that will show the use of optics to look at the other end of the physical world from that of the microscope.

After the break, Barry will regale us with stories illustrated with slides from his recent trip to England meeting people and searching for antique microscopes.

This promises to be another of those very special evenings that is not to be missed.

Editor's Notes

I am a great admirer of the members of the Postal Microscopical Society in England and of their Newsletter, *The Balsam Post*. The article that they have kindly allowed us to reprint on page 134, The Micro-Siphon exemplifies the sort of small articles that they publish, along with the very detailed large and often multipart articles that also appear. In their publication, one gets the feeling of scholarly work done by amateurs by clever means. In their ingenious solutions, and in the real scientific knowledge and skill demonstrated, one can feel that the same traditions and attitude that led to the optical discoveries in the past in England are still present in the work of these amateur scientists in the England of today. It is a delight to be able to read their Newsletter and enjoy the aura of excitement with science that permeates it.

Gaylord E. Moss