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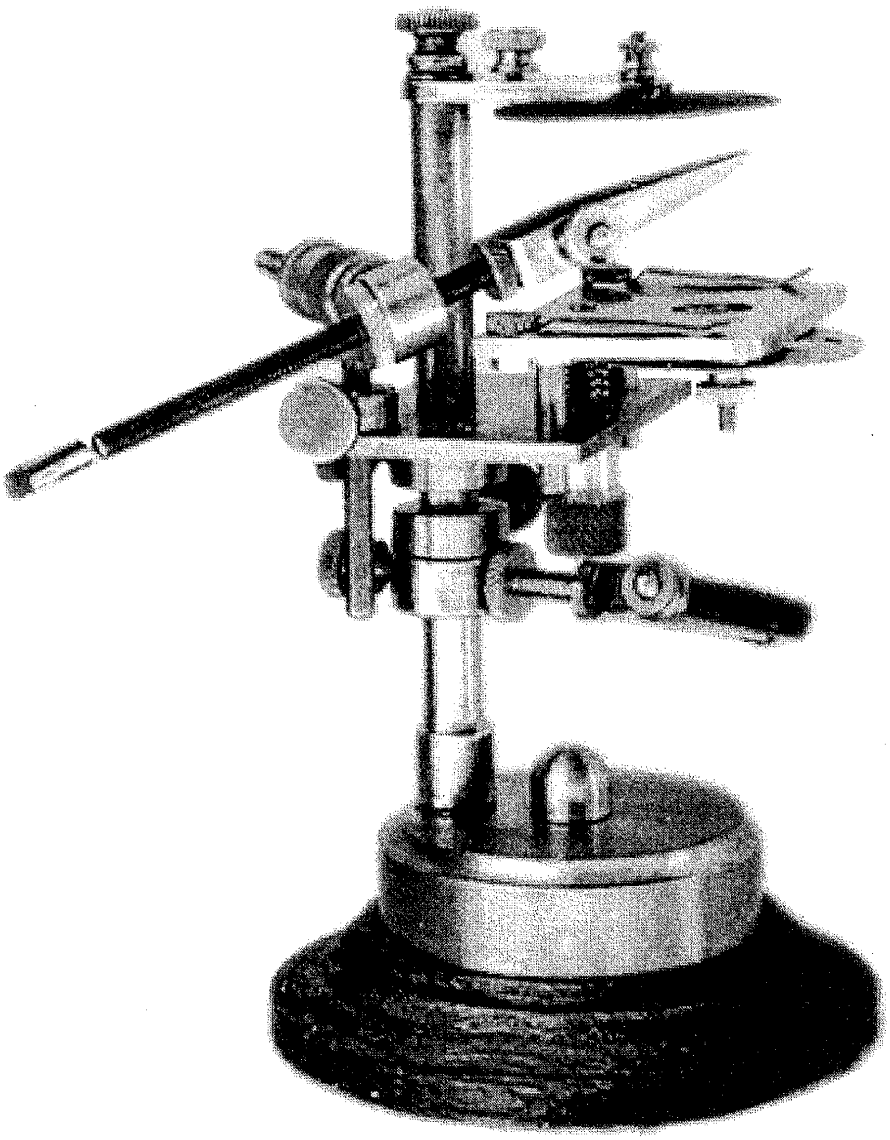
HIRSCH GRAND MODEL WATER - DROP MICROSCOPE

David L. Hirsch



"Microscopical Serendipity, " an article appearing in the November,1997 issue of the MSSC Journal, discussed magnifying methods using lenses other than glass. The magnifying capability of substances such as water was demonstrated by simple models, culminating in the construction of a detailed microscope using a single water drop. This exercise showed that much was yet to be learned about optical applications of fluid transparent substances at room temperatures. Two fluid substances which act as refractors

of light are water and glycerine. Water was chosen here as the optical medium because of availability. Glycerine and other applicable fluid materials will be evaluated later on. With the exception of distilled water and thickened cedar oil, etc., which are used in immersion systems for objectives, there are few applications where water or other fluid substances can be expected to replace or augment glass as lenses in light microscopes. In searching for information on water-drop microscopes, many vintage and contemporary light microscopes were evaluated. It was noted that for the most part, water-drop microscopes were treated as scientific curiosities in a few books, and further searching did not reveal any such instruments made for the commercial market. If you know of any, please contact the author in care of the MSSC JOURNAL Before we do any sketching, selecting or chopping away at our supply of wood and metal, let's talk about water drops, or 'fluid lenses. As with glass lenses, the index of refraction of the material influences the magnification thereof. The Index of Refraction is defined as: "the ratio of the velocity of radiation (as light) in the first of two media to its velocity in the second as it passes from one into the other."

INDICES OF REFRACTION

Substance	Absolute Index
Air	1.0002926
Glycerine	1.4729
Diamond	2.419
Rock salt	1.516
Glass	1.5 to 1.9
Water (20 deg.C.)	1.333

Generally speaking, substances with higher indices of refraction are capable of producing higher magnification.

A HAND HELD WATER-DROP MICROSCOPE. The Leeuwenhoek inspired water-drop microscope discussed last month, laid the groundwork for construction of two more versions of water-drop microscopes. Figs. 1a and 1b show a hand held instrument with a simple method of focussing; an adaptation of the 1835 "Most Improved" design by J.Amadio.[3] In Amadio's stand, the focus is effected by raising or lowering

MSSC Journal
Volume 2 Number 12 December 1997

CONTENTS

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one edge of the stage, using an adjusting knob located beneath and at one side of the stage. This method is inefficient because the stage area is hinged at one side and when raised, does not translate uniformly in the vertical sense, resulting in an image which is not focussed evenly along its width.
The water-drop microscope shown in the figures, uses

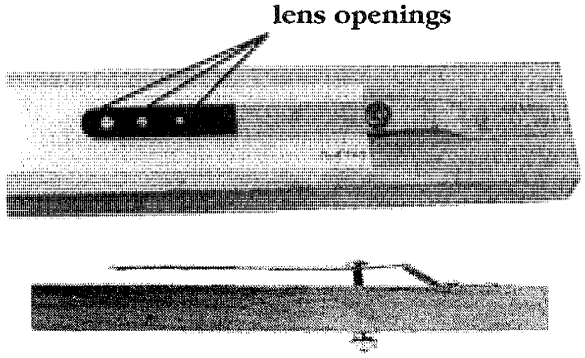


Fig. 1 Two views of a hand held water drop microscope

a variation of the Amadio focussing system, with fair results. The long arm of the prototype which holds the lens at its free end, moves through a minimal angle to bring the object into focus. Because of the resulting short vertical translation of the lens, any inconsistencies in focus, though existing, are virtually undetectable. An optional three apertures are used here, with hole diameters of: .05", .07" and .09" respectively at the bottom, flaring upwards at the top side at a 60 degree countersunk angle. After forming the holes, burrs on both ends were removed with fine abrasive cloth, then wiped clean. To minimize reflections, the top surface of the arm around the hole(s) is coated with flat black enamel. The focussing arm is mounted on a wood base. An 8-32 x 1" machine screw passes through the arm and block, and is secured to a knurled nut which, when rotated, raises and lowers the arm. A water-drop 'lens' is applied to one or more of the lens openings. A dispenser, such as a small bottle used for applying eye drops, aids in sizing and placing the drop.

THE 'GRAND MODEL' WATER - DROP MICROSCOPE'. The detailed, all brass microscope (shown in two views in Figure 2) was developed and constructed with features germane to stands furnished with glass lenses. Some of the parts and subassemblies used here were influenced by availability of scrap items which could be integrated into the overall design.

A. Lens Holder Support Arm. The arm, consisting of a .125" thick x .56" wide x 1.75" long bar of half hard brass, supports the lens holder. A detent screw incorporated into the arm locks the lens holder in position. The arm can swivel, and is locked to the post with a knurled nut.

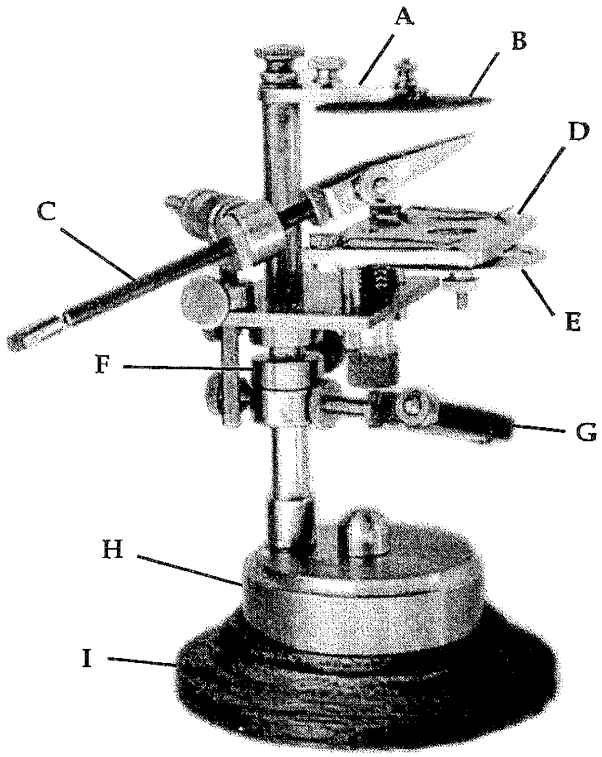
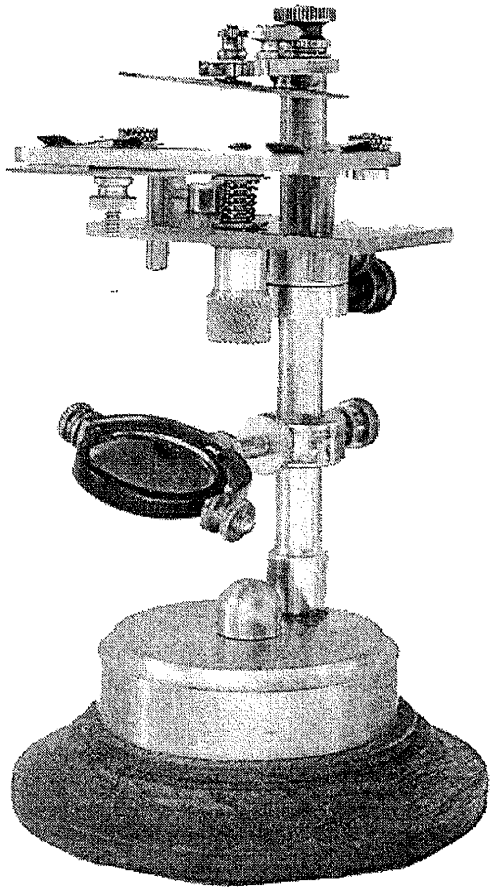


Fig. 2 The Grand Model Water-Drop Microscope. Designed and built by Dave Hirsch



B. Water-Drop Lens Holder. A .031" thick x 1.75" diameter brass disc serves as the water-drop-lens holder. Four 60 degree tapered lens holes were drilled 90 degrees apart on a 1.00" base circle. The sizes and configurations of the tapers are determined empirically. If a hole is too large, the surface tension retaining the drop will be overcome by the force of gravity, and the drop will be unstable and collapse if disturbed.

Determining the size of the tapered hole: the configu-

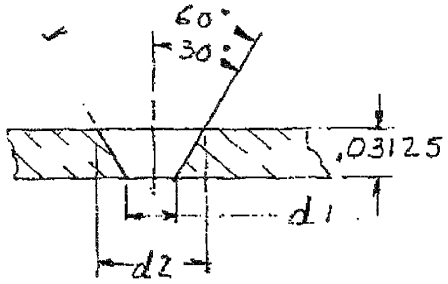


Fig. 3 Tapered hole size determination

ration of the tapered hole is shown in Fig. 3. Note that the holder is assembled to the arm with the larger diameter of the tapered hole facing upward.

Tapered Hole Size Determination

D2 is determined as follows:

d1 = drill diameter, inch

d2 = taper diameter, inch (to be determined)

t = thickness of disc, inch = .03125

countersink angle /2 = 60/2 = 30 deg.

tan 30 = 0.57735

d2=d1+ 2(.03125)tan30 = d1+.0361

Drill No.	d1	d2
48	.076	.112
51	.067	.103
54	.055	.091
58	.042	.078

Four detent holes on a 1.50" diameter base circle are on the same radii as the lens holes. The holder, which is attached to the end of the support arm, has a knurled edge and rotates about a center bolt. The holder has a dull black coating on the top surface to reduce reflections. The bottom of the holder is buffed to a mirror finish to provide a reflective surface for illumination akin to the function of a leiberkuhn. With slight modifications, the lens holder can be adapted to retain glass beads in the manner of microscopes made by Leeuwenhoek.

C. The Specimen Holder. The dual function holder consists of stage forceps and a mounting pin combined on opposite ends of a threaded arm. The holder is stage mounted and affords full motion and adjustability of the forceps/pin arm.

D. The Stage. Built in two sections, the front part of the stage is joined to the rear part by a pair of sliding posts. Focussing is effected by an easily accessible spring loaded screw and knurled thimble combination located centrally below and between the stage sections. The vertical translation of the forward stage section is controlled by rotating the knurled thimble. Stage clips, a locking collar and a mounting flange for the specimen holder complete the stage assembly.

E. The Substage Aperture Disc. A disc with 4 holes of .50", .375", .25" and .125" diameters, respectively, mounts beneath the stage. Each hole lines up with the .50" diameter opening in the stage and can be locked in position. To aid in rotation, the disc has a knurled periphery.

F. Stage Collar. This collar mounts below the stage and locks to the column The collar retains the stage assembly at any fixed height, allowing the stage to swivel about the post.

G. The Mirror. The gimballed mirror mounts on a collar which can be locked in position on the column. The mirror can be adjusted and detented vertically and radially.

H. The Column and Foot. The foot is 2.50" diameter by .625" high, secured to the column by a #10-32 NF x 1" long flat head machine screw. The column is a .375" diameter x 4.50" long brass rod, internally threaded #10-32NF x 1" deep on both upper and lower ends.

I. Base. The microscope is mounted on a turned base made of maple. The bottom of the base is fitted with three brass thumb tack-type pads located 120 degrees apart to assure stability.

THE MICROSCOPE CASE. A carrying and storage case is shown along with fitted contents in fig.4. The case is made from .25" thick Honduras Mahogany and is provided with a drawer for storing accessories. The drawer and its contents are shown in Fig.5. The drawer contents include the following containers: (a) extra dropping bottle for glycerine, etc. (b) specimen jar (c) small parts jar, (d) jar of cotton swabs, (e) stage forceps rod. The right hand interior wall of the case supports a holder for the stage forceps/mounting pin assembly. Another holder for a dropping bottle is secured to the inside right hand portion of the door. Two forceps are provided and are mounted on the inside of the door. The external dimensions of the case are: 9.88" high x 4.75" wide x 5.00" deep. A brass carrying handle and a locking hook are included. Total weight of the cased microscope and accessories is 4.5 pounds.

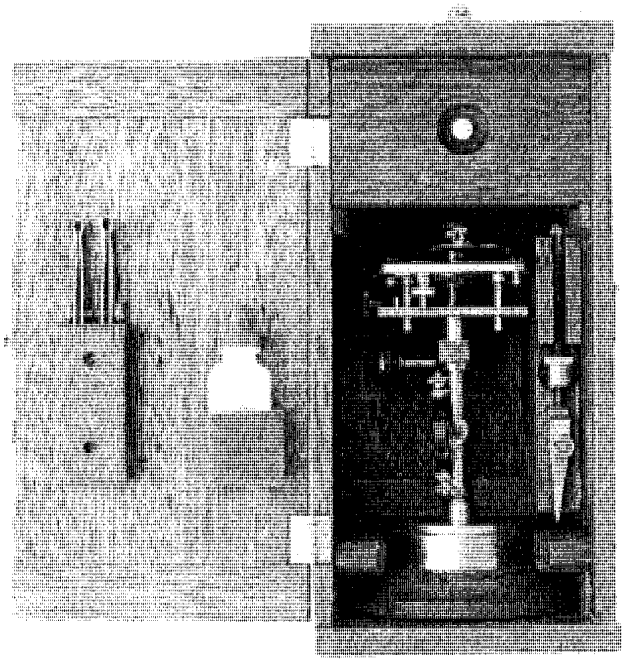


Fig. 4 Carrying and storage case fitted for Grand Model Water-Drop Microscope

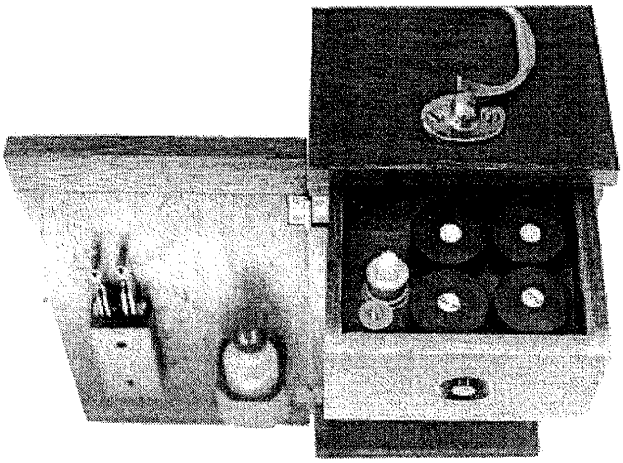


Fig. 5 Accessory drawer

1. Select a lens hole and lock it into position over the stage opening.
2. Use the dropping bottle to add fluid to the lens opening in the disc. Tap disc lightly to secure the water drop.
3. Place a slide on the stage and secure with stage clips if required. Adjust stage height and lock into position about .25" from bottom of disc.
5. Adjust mirror for best illumination.
6. Bring eye close to the lens and focus the microscope by means of the substage focussing screw.
7. Move slide to bring various features of specimen into view.
8. After use, remove fluid lens by absorbing it with a cotton tipped swab.
9. To observe solid objects held by stage forceps, lower the stage and adjust stage forceps to bring specimen in position beneath the lens. Use forceps for holding items such as mineral fragments. Use pin portion to hold small insects, etc.

THE NEVER-ENDING STORY. Humility aside, the 'Grand Model' might be considered an ergonomically altered Leeuwenhoek hand held microscope, where neck pain and eye strain were usually experienced when using the original instrument. The water-drop microscope was built more like modern microscopes to facilitate viewing by the user. Why then, do we complicate matters by insisting on the use of water drops for lenses? We don't have to use water, so let's concede to the genius of that 17th century Dutch draper and trade the water-drop lens for beads of glass. Now, it's back to the drawing board, where we will do a little brain storming and chin chucking on how to make and use glass bead lenses.

IN RETROSPECT. Inspiration to pursue projects such as this can occur at any time and any place. Start with assembly and parts drawings for best results. MEASURE TWICE - CUT ONCE! When finished, there remains a dust and debris laden workshop with hand tools scattered about, causing one to ask how do those Yankee Workshop fellers keep their shop so clean. The task is finished only when the shop is cleaned up and put in order, ready for the next microscopically influenced project.

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WORKSHOP of the Microscopical Society of Southern California

by: **George G. Vitt, Jr.**
Date: **Saturday, 8 November 1997**
Location: **Steve Craig's Lab,** 30 persons attended.

1. **Ernie Meadows** introduced guest **Bill Grieb** who is a biochemist and who had worked as a molecular biologist at the NIH, and now works on various projects with **Ernie Meadows; Barry Sobel** introduced his daughter, Alexis, whom we have had the pleasure of seeing at several MSSC meetings where she had been very helpful.

2. **Steve Craig** described his vacation in northern California, showed the book *Butterfly Magic*, and described his attending a dinner meeting of the San Francisco Microscopical Society, in Berkeley, where **Brian Ford** was also present and who "raved about the MSSC." He then told of the Stanford University movie theater in Palo Alto with its great organ music - where he saw *Casablanca* and *The Maltese Falcon*. Steve had visited **John Field,** who showed him some "mind boggling" slides by **Klaus Kemp.**

3. **Barry Sobel** announced that **Brian Ford's** trip to MSSC had been financed by **Larry Albright** to the tune of $400. It was suggested, and unanimously agreed (and also at the subsequent general meeting) that members contribute about $10 each in order to defray Larry's expenses.

4. **Jim Clark** reported that Brian Ford's *Images of Science* is available for $19.95 via e-mail at Bargain Basement/Remainder sales. Jim will get the (800) number for those interested.

5. **George Vitt** reminded everyone that the MSSC Christmas party is scheduled for 20 Dec 97 at 3pm. **Dr. and Mrs.Myron Lind** and **Ernie Meadows** very graciously offered their places of residence for the party. After some consultation, it was announced that the party will be held at Ernie Meadows' home. Attendance cost is $14 per person, with check made out to Steve Craig's daughter, **Beverly Black**, who will do the catering. Desserts are to be brought by the members. George also announced that the fiscal year will start on 1 Jan 1998, and that election of officers will be held at the regular meeting of January 1998. There was a general discussion on methods available, at places like Kinko's, for binding the yearly Journals of the MSSC: **Gaylord Moss** and **Larry McDavid** suggested two methods: 'Double Binding' where the sheets are held rigidly together with plastic strips and thru-rivets, and 'GBC 19-hole' where 19 rectangular holes are punched with a special puncher and the pages held together with a strip of 'plastic claws'. The latter method allows the copy to lie flat if copies are to be made. George then told of his results in scanning **John Chesluk's** arranged diatom image made on at aluminum photo-sensitized plate, and also the scan of **Richard Jeft's** recent photomicrograph (T-Max B&W film) of an unidentified form of diatom which, for want of a better name and because of its shape, we are currently calling the 'twist drill'!

6. **Richard Jefts** showed the book *The Revealing Lens* by Brian Ford, which he recommended as a provocative and interesting book. He also recommended B.Bracegirdle's *Microscopic Photographs of J.B. Dancer*, still available from member **J.B.McCormick** for $100. There was a discussion on microphotography: **Jim Clark** told of a 1923 issue of *Scientific American* which showed a micro-writing machine, and **Jim Solliday** gave some interesting facts about J.B.Dancer.

7. **Barry Sobel** has written an article on the Scientific Instrument Show he had attended recently in Maryland. He showed a number of items obtained there: optical bench c.1900; A/O portable refractometer, (apparently of the Reichert design while, for purposes of comparison, Steve Craig passed around his Reichert-style portable refractometer for wine makers); pocket spectroscope; books; accessories; French camera lucida; small Wollensak telescope c.1950; Henry Crouch's diaphragm condenser set; linen tester (c.1870, Belfast); live boxes; a small and rare cased Busch mic. c.1930. Barry then described: his cased Zeiss refractometer for measuring the r.i. of Lard(!), offering it for sale at $85; a 1910 B&L catalog showing 'B&L Projection Apparatus for Microscopes'. Barry also brought many antique microscope objectives for sale.

8. **Jim Solliday** described the Watson vertical illuminator accessory, c.1920, which uses the partially-inserted prism immediately above the objective. There was a discussion on the relative 'goodness' of such vertical illumination beam splitter accessories. Jim had several items for sale: *Atlas of Invertebrate Structures*, B.Bracegirdle; and a cloth-bound slide case, c.1900, for holding 250 slides.

9. **Dave Hirsch** showed an album of photos he had taken recently during his trip to Anchorage, AK, where he visited MSSC member **Myron Wright**. Myron has a fine optical/photographic and microscope lab in his home, is a pilot, and has taken outstanding panoramic color photos using the large Kodak Circuit Camera. His panoramic view of McNeil River Falls with bears feeding on salmon, is absolutely outstanding. Dave had high praise for Myron and his achievements and hos-

pitality. Later, Dave showed two versions of a Water Drop microscope that he had designed and constructed. The first is a very simple device which serves its purpose, while the other is of elaborate brass construction, cased, and with many adjustments and bullseye illumination.

10. **Gary Legel** displayed a very effective 12-volt halogen microscope light source that he made of a tin can, gooseneck, and a parabolic quartz halogen projector lamp with dichroic reflector for radiating heat to the surrounding black can.

11. **Bill Hudson** announced that the DeVry swap meet is closing down.

12. **Ed Jones** showed the books *Extremely Weird Micro-Monsters* and *Science Through the Microscope*, Aladdin Books, Ltd., London, a large out-of-print book with fine illustrations of visible and SEM photomicrographs, both by Shooting Star Press and gotten at an outlet. Ed circulated a multicolored shirt cloth sample (similar to that sold by Edmund Scientific Co.) as an example of material he studies in his forensic work, and a catalog of natural history books. Ed described his use of 3-M 'Post-it' note paper, cut to proper size, as a good means of holding a multitude of small specimens in position, the whole then being slipped into a small zip-lock transparent plastic baggies which cost $1.80/100.

13. **Stuart Ziff** displayed a tour-de-force **4-Bar Linkage** mechanical hinge of his own design and construction. He used a pair of these precision hinges on a very high quality storage/display wood case for a precision glass structure of his design which dynamically displays certain thermodynamic behavior of gases and liquids in the most intriguing way (Mercury, Neon, etc.)! Stuart is an expert glass worker and has a fully equipped glass lathe. His 'technical glass sculptures' have to be seen to be appreciated! To understand their workings, however, is not an easy task.

14. **Jim Clark** displayed a Leica IIIf on a Leitz Micro-Ibso, c.1950s, and showed the booklet *How to Make an Optical Bench*, Edmund Scientific Co., and the book *Popular Optics* with Sam Brown illustrations.

15. **John de Haas** showed the publication *How to Use the Microscope* by Hartley, and offered to lend it to anyone who is interested. (Note: our British book advertiser, Savona, usually has this book).

16. **Gaylord Moss** told of the great utility and relatively low price of certain products which transform the computer into a multi-channel laboratory measuring instrument. These include sensors, sampling, signal conditioning and processing circuit boards, and software. The company that makes these goodies is the Vernier Software Co. (OR). **Jim Clark**, who has been friends with the company's president, David Vernier, spoke very highly of him and his products. They enable students to set up a microprocessor-controlled lab. where multi-channel measurements are done in real time, and the data can then be processed in various ways. Gaylord then described his close range observations of a dragonfly catching insects in Palm Canyon, near Indian Wells (CA). By moving his hand very slowly he could touch it repeatedly without alarming the insect! He described the factors that make the dragonfly so extremely maneuverable in flight, and a perfect predator - its four independently driven wings which give it superb aerobatic ability, contrasting it to the resonant system wing motion of flies, which is very energy efficient, but guarantees capture by the dragonfly due to inferior maneuverability.

17. **Larry McDavid** showed the books *Low Cost Physics Demonstrations* by R.L. Wild, U.C. Riverside, and a catalog of replica skulls of all types by *Skullduggery*, Tustin, CA. He then demonstrated a special meter for measuring the mineral content of water samples, and discussed in reverse osmosis and activated charcoal filters to produce water suitable for making of 'proper tea'.

18. **Tom McCormick** remarked that water dissolved solids are needed by humans, and that drinking of distilled water is to be discouraged. He then showed a mystery item - two parallel magnesium wires, held by a cap-like plastic cylinder at one end - and of undetermined use.

19. Note: Due to the author's inadvertant placement in computer memory of **Stuart Warter's** input to the **October 1997 Workshop**, and its resultant absence from that writeup, we correct that error by including it below:

Stuart Warter showed Bausch & Lomb's New Student's Microscope, introduced in 1886. They had purchased the rights to George Wale's patent on the radial arm, and made this microscope and their large American Concentric model with Wale's limb. The Student microscope had Wale's patented concentric inclination which was intended to keep the center of gravity unchanged at any angle and a cast iron split horseshoe base to allow the uprights to act as a clamp as the knob was tightened on the joint, as well as a fine focus mechanism which was actuated by a screw-driven lever that moved the block bearing the body tube against the arm along a race of three steel rollers; it was only made in this form for 3 years, being replaced by 1889 with a similar appearing model having a conventional inclination joint and a solid horseshoe base. Its arm was similar to that on the Model Microscope which used their usual leaf spring fine focus mechanism .The American Concentric was still being offered in 1889.

Member Profile
Alan deHaas

November Workshop 1997

In Steve Craig's Lab, November 1997

As is generally accepted, the learning of, or at least familiarization with any subject, is greatly enhanced by the appropriate environment. At the age of 1 1/2, my parents moved to a rather spacious 3 bedroom apartment in Manhattan. One bedroom was immediately converted into a laboratory. By the age of 2, I was parked outside the lab listening to my father giving lessons in microscopy and microtechnique. I do not know how much of that could have sunk in, but it was a start.

The fun began just a half a year later when, tools in hand, already ailing radios and cameras fell victim to my curiosity. I started browsing through my first real book when I was three or four - a German chemistry text. When a book is correctly illustrated, it is surprising how much can be relayed into the mind of someone who can barely read. My next "text' was the New York laboratory supply catalogue. From what I remember, the learning process seemed best and easiest between 3 to 10 years of age. Much occurred at 4. I received my first microscope, a good solid Spencer monocular, attended New York Microscopical Society (NYMS) meetings as regularly as the weather permitted and got a chance to observe and actually do some embedding and sectioning while my father was working on fur specimens for Max Bachrach.

This early exposure to science, proper procedure, mode, method and vocabulary, generated many problems at school. In kindergarten, the teacher asked each of us to draw a picture of our favorite pet. Not knowing or caring for the dogs and cats other kids thought of as normal co-residents, I drew a paramecium. The teacher would not accept the picture until I could spell the word. Not being bright enough to use that as a teaching technique, she thought she had won. The next day, with mild annoyance, she had to accept the drawing. I remember very well, at about the same period, sitting on the living room sofa for two hours asking questions of Joe Tates about electron microscopy. He was a real teacher, willing to spend time relaying information for no other reasons than the enjoyment of imparting data and seeing that information being appreciated.

I kid you not - the following actually occurred. I had used a phrase which I thought was common jargon. My second grade teacher complained to my mother, "What is the naked eye? Who ever heard of a dressed one?"

My father tried to make a few extra dollars servicing microscopes for Marburger Surgical. I instinctively liked the place just as I enjoyed my pediatrician's office or

Hacker instruments. To me all these were just an extension of Macy's basement. If it existed it was worth investigating.

I did not have real friends my age, but my acquaintances were marvelous. Many of them became friends later - members of the NYMS, specifically: Herman Adler, Barry Nathanson, Roman Vishniac, Feinberg, Ashby and Boone.

What I was forced to realize very quickly was that the average teacher was not the least bit interested in providing the rigorous definitions and proper learning environment that I expected from school. The vice principal at P.S.186 told my mother that the school is just a baby-sitting service and that the school's responsibility was to deliver me into her hands at the end of the day in no worse condition than I had been in that morning. "if you want your child to learn anything you have to teach him at home." That was 44 years ago in the "good" new York city school system. Compliments go to my third grade teacher, Mrs. Wagreich. She aimed the instruction at the members of the class who could be taught. She would not let the others hinder the learning process, but did not leave them out.

I was thrown into complete shock when, in 1956, we moved to Los Angeles. The teachers here could not be taught. I am sure that there were better instructors, but I did not have them. Due to my lack of self-discipline I, in part, gave up. The school, afraid of the so called "psychological consequences", allowed me to skip only 1/2 year instead of a year or a year and a half. At the sixth grade level in Los Angeles the school system was prepared to teach what was accepted as normal for the second and third grades in New York. By junior high I had completely unlearned how to learn in school - the perfect desired outcome for the "no-one-is-better-than-anyone-else" behavioral scientists. I found that this educational mode persisted despite the fact that we had acquired the habit of always moving to be proximal to the best school. It is very fortunate that instruction at home continued. That was not an effort or work.

The small apartment we lived in necessitated that our little microscope service facility take up part of the living room. No matter what the conditions, we always had to have some space allotted in that manner.

Fairfax high school was much better. The teaching staff at least knew that they were indeed teachers. Not being a natural competitor or joiner I never entered any contests or engaged in school sponsored activities. I became one of the school's "mad scientists", who, with one devious accomplice almost incinerated our apartment. Various government agencies and their regulations make it impossible for kids to do now what we did then. We at least learned what not to do. I must mention that except for my brief excursion into rapid oxidation reactions, my mother put up with, enjoyed and supported every collection and endeavor. She still does.

The College of Engineering at UCLA was the only school to which I applied. This was based on the quality of the staff and on my requirement for physical comfort. There was an invitation to go back east, but I knew the east coast. My nose and joints did not deserve refreezing.

Twice each day I walked by the glass blowing shop in engineering. I wanted to learn enough about the practice and the art of scientific glass blowing to make glass to metal seals and light bulbs. My counselor, Dr. Knapp, said something probably never to be uttered again by anyone. " I have some extra money in my grant. Why don't you use it for glass blowing." (Extra money?????) Three years at UCLA led to a need for experience in industry, so there was summer employment at IBM during the fourth year, revamping the electronics package for a numerically controlled milling machine. The extension classes were an interesting addition: 7 in technical cinema production, 2 in comedy, 1 in musical comedy and others including one superb class in holography taught by Leith, Upatniks and Gabor. I also sat in on the exobiology course that my father was taking.

After graduating from UCLA there was a brief excursion into the stock market. For some strange reason I thought that it might be nice to be an investment counselor. It took six months for the realization to hit me that I had neither the gall or the guts to subject other peoples hard earned money to economic mayhem. Back to engineering -

McDonnell Douglas and Hughes Aircraft each employed me for a little over a year. I never did learn to play politics. When the aero-space industry layed off, one year apart, both my father and me, it was a great favor. In 1970 deHaas optical engineering was created. It had existed on an informal basis, family owned and operated, for over twenty years.

Having missed for too long the NYMS milieu and information exchange, and after some goading on my part, in 1971 we revived in our little house regular meetings of the Southern California Microscopical Society which had been founded in 1938. Now, 26 years later, after several restructurings, it has become the current MSSC. I thank the current administration for smoothing out over time the often bumpy road to the formation of a society that is both stable and productive. It could not have turned out better.

A while ago I built a room specifically for photomicrography and photomacrography. It is only 12' x 16' but the footing is made of 8 1/2 cubic yards of concrete and there are twice as many J bolts as required lock-

ing the framework into position.Two Aristophots, one for 35mm the other for 4 x 5 are permanently set up on one table.Across the room is an Ultraphot III. Everything else one can imagine being in such a room fills the rest of the space leaving very little open area to function easily. (the "everything else" that one can imagine also fills the house).

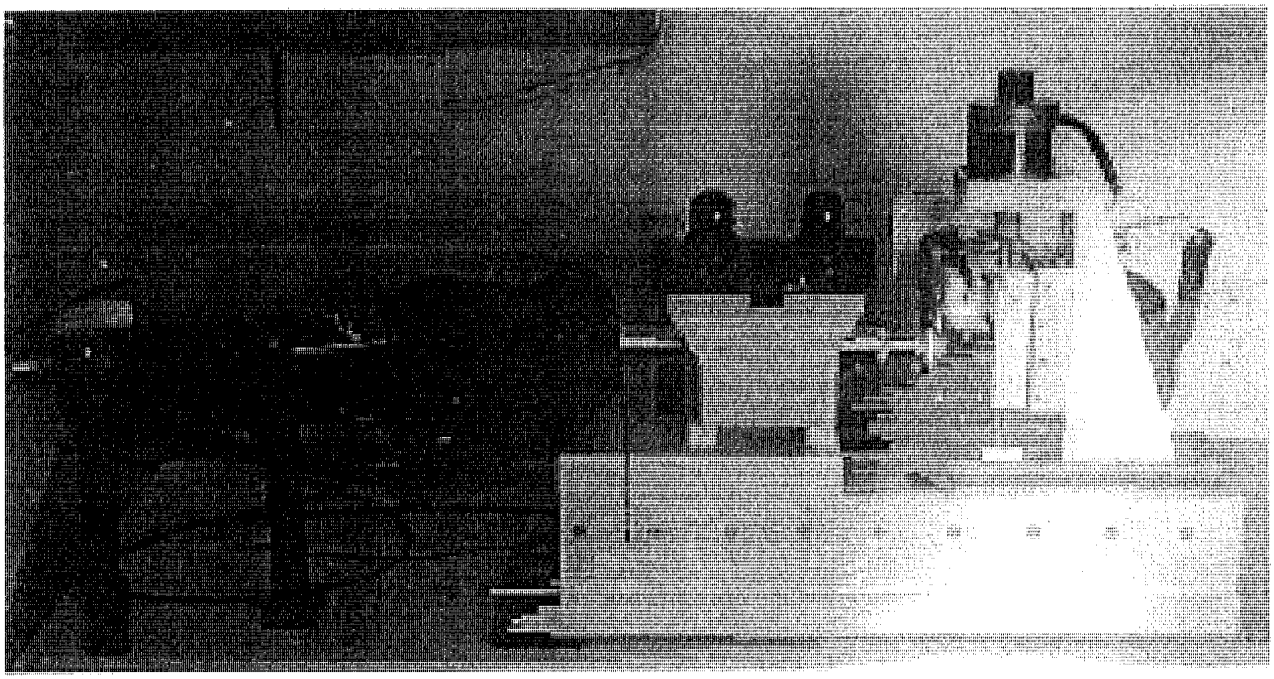
I spent 71/2 years as a consultant in microscopical procedures to an oncology research group at UCLA. This afforded me the opportunity to design and build time lapse equipment, temperature controlled stages, cloning aids, phase attachments and other goodies. Through the dermatology department I met a doctor for whom I concocted an autoscanning autofocus microscope for quantifying skin details - wrinkles, scars etc. We produced equipment, 96 units in all, for Hoffman LaRoche and Lederle Laboratories to photographically record and study wrinkles, hair growth and actinic keratosis.This was accomplished with the help of Al Beck at cine-mechanics and my cousin, Henrik deHaas. The favor is returned when possible, helping Henrik with electronics.

Yes, optics and microscopy sometimes step aside for electronics. Many years ago a friend, Dave Geren, and I designed and made the prototype of a crystal controlled time-lapse system with the hope that it would be used on skylab.That device is now the property of the MSSC. We also produced the first portable audio board to use multiplexed LED vu meters. It was a superb device, as good as or better than studio boards on the market at the time. (and that is not just specsmanship). I never sought a patent for any of my inventions. It would be nice, however, to see some of them developed; a system for high frequency linear modulation of gas lasers, two Faraday rotation devices one for the accurate determination of extinction angles and a spectrograph in which the circumferential band spread is electronically controlled, etc.

So, my work is microscopy and I like to buy, sell and collect microscopes. Then what could my hobbies possibly be? When funds are available an addition is made to my as yet small collection of books on the development of science and technology. Also, as anyone who has met me knows, eating is not just an occasional activity. I don't really regard that as a hobby, but cooking is, and "three meals a day" was never a consideration.

I have enjoyed what little teaching I have been able to do; trying not to be the type of instructor I so detested as a kid, by giving to every question as complete an answer as possible, being sure the student understands what has been said; and under no circumstances disregarding a question or leading a student astray or selling short the abilities of an open mind no matter what age the student happens to be.

Although it must have been early on, I do not know what started my interest in surplus.After employment in the aero-space industry I took the opportunities which presented themselves to partake of the usable industrial discards. I acquire these for convenience. It seems silly to waste time and energy going to stores to buy what I feel should be at hand, be that an electronic component or an objective. Through connections developed over the years one microscope has become over thirty. Herman Adler once asked me, "into how many microscopes can you look with one pair of eyes?" I of course knew what he was inferring, but I still cannot answer that question.



Autoscanning, autofocus microscope developed for quantifying skin details.

COLLECTING ANTIQUE MICROSCOPES

Barry J Sobel

Collecting antique microscopes is a very interesting and ever-more popular hobby. The microscope was probably invented by Hans and Zacharias Janssen about 1590. Their instrument was not very practical nor apparently used for much study, since little information about it exists, other than that it was a two-lensed compound microscope. The first people to publish detailed microscopic observations were Robert Hooke (in England) and Antony Von Leeuwenhoek (in Holland). Hooke published the famous book *Micrographia* in 1665, with illustrations of magnified observations of various small insects and such. Van Leeuwenhoek went a step further studying for the first time, things invisible to the naked eye; he had a distinct advantage over Hooke, in that he used single lensed (simple) microscopes of high optical quality. Although Hooke's microscopes were more impressive looking, and at first glance, easier to use, their resolution (and therefore useful magnification) was severely limited by the chromatic and spherical aberration inherent to lenses at the time. His compound (multilensed) instruments actually "magnified" these defects. Since that time, microscopes have been made in ever-increasing numbers, particularly in Europe. The first commercial American microscopes (at least those for which there are any definite records), were first made about 1840 by Charles Spencer, and were horizontal in design, apparently copied from the designs of Amici and Chevallier in Europe. The Spencer company continued to make microscopes well into the 20th century (as American Optical). Although the microscope was invented around 1600, major advances in it had to wait until the nineteenth century, when sturdier construction, and solutions to spherical and chromatic aberration were found.

Microscopes which date to the early 18th century are still available on the market. 19th century microscopes are widely available, and many early twentieth century instruments quite common. This is a hobby where there is something for everyone and prices range from a few hundred, to fifty thousand dollars or more. Really fine microscopes may be had for a few thousand. Great rarities command tens of thousands. The finest and rarest examples sometimes reach up to one hundred fifty thousand dollars or more at auction. This is not very high, when one considers the prices of certain stamps and coins for example, of equal rarity. Within the field, one may seek a general collection, or specialize in a specific size, type, date of origin, country of origin, or maker. One of my good friends limits himself to very small microscopes and considers anything taller than 5 inches too big. Another collects only the largest. Still another, collects only simple[1] microscopes, another only nineteenth century achromatic instruments. The choice is yours.

How should one get started? I recommend getting a few good books on the subject, such as those written by Gerard L' E Turner (for European models) or the book by Padgitt for American instruments. These will allow you to become familiar with the various types and makers in a general way, though even those with extensive experience will sometimes come across an instrument that is not recorded. In addition, microscope clubs or societies exist in many places all over the world. Perhaps the most famous is the Royal Microscopical Society in England. Of course, reading this you are probably already a member of the MSSC! People in these societies and clubs are usually very happy to help with specific questions.

To begin a collection is relatively simple. Nice stands can be obtained from antique instrument dealers either by catalog, or at scientific instrument shows or fairs. These take place in New Jersey, Texas, Maryland, Los Angeles, and San Francisco every year. An even better source (if you can find one) is to find another collector wishing to sell some of his or her scopes. Finding instruments both here and abroad can be a challenge. Antique stores occasionally have nice examples, sometimes for relatively low cost. Interesting early twentieth century stands are common and often quite interesting. There are, however, some early twentieth century instruments which have become quite uncommon or even rare however. Flea markets and swap meets, both domestic and foreign are possible sources, but be prepared to get up very early (e.g. 4:00 a.m.) and spend long hours to find relatively few, but occasionally fine, instruments.

Finally, if you are brave and knowledgeable, auctions are another place to find antique instruments. This, however, requires considerable knowledge and experience, especially if you are absentee bidding and unable to examine the instrument yourself. After a period of years of experience, and after many mistakes, I have gotten a "feel" for the different auction houses here and abroad and can sometimes predict what condition the instrument will be in. In part this requires knowing the person running the auction and, in many cases, very closely examining the accompanying photographs. Even the latter is not easy; defects can be missed in the photos by even experienced eyes. Another problem with auctions is that every serious collector knows about them and so competition can be

keen and even price the instrument out of reach. Your biggest asset in these circumstances is to know a lot more than the auction house about the instruments they are selling. Sometimes an important instrument is overlooked by the auction house and given too low an estimate. Finally, a lot depends on the competition at the auction. Some auctions seem to have no competition at all. Others seem to have very determined collectors who will not give up. In these circumstances you cannot win unless you are willing to pay much more than the average price of the instrument. In some cases, not being there leads to you losing by a tiny amount over your bid; do not let this deceive you though, you do not know when your competition would have given up if you were there! Do not let yourself get too discouraged if you lose at auction; there will usually be another opportunity. I am only very aggressive in my bidding if I think they have very much underestimated the value or the instrument is so rare that it is not likely a comparable one will be on the market again. I recommend you seek personal advise from some the members of your society before risking any major sum of money in an auction.

Be prepared to spend more for a "signed" instrument made prior to 1900. This refers to the makers name being engraved or stamped on the instrument. Some signed instruments do not have the maker's name but rather only the reseller's. The value of these instruments is not as increased by the "signature" as a maker's signature, but this area is gray at times. Dollond, for example, might sell some instruments actually made by Carpenter, even though he also made some of his own; James Smith was well documented to make instruments for Carpenter!. On the other hand, beautiful and well made unsigned instruments are often a bargain. An instrument which is otherwise identical to a signed five thousand dollar instrument, might only cost half that much; I have many unsigned instruments in my collection. In addition, certain names are well-known for their very high quality and, all things being equal, usually command a higher price. Examples include English instruments by Powell & Lealand, and Tolles among American stands. In addition, if a microscope is not only signed, but signed by the originator of that type of instrument (e.g. Culpepper *type* signed "Culpepper fecit"), it may also command a very high premium; these are not uncommonly double or triple the price of instruments which are unsigned or signed by another maker.

The name is not the only factor however. With few exceptions, complete outfits with all the original accessories are rare. For this reason, a 100% complete original outfit with many accessories may command two to three times the price of the instrument alone. In addition, certain types of instruments are less common and therefore in greater demand. Examples include the Adams type, Cuff type, and the Culpepper type. In addition, older models are usually more valuable. This is particularly so with American instruments, where a 1910 model Bausch and Lomb may be worth only two hundred dollars while its 1875 counterpart, may demand two to four thousand dollars. I have also noticed that instruments which appear in books and catalogs seem to command a slightly higher price because of the apparent legitimacy when listed. This too is not an all-or-none phenomenon though, since the fact that an instrument is not listed may indicate it is extremely rare! Condition is also very important; with few exceptions, most instruments in poor condition are not very valuable or desirable.

Do not be fooled by the appearance of an instrument; brass was still in use in the twentieth century, and companies like Bausch and Lomb and Spencer made instruments well into this century, often with some brass components.. Some of these are so common they are available quite inexpensively. These inexpensive early 20th century instruments are often a good way to get started, however, particularly since they are usually superior optically. On the other hand, some nineteenth century scopes are partly painted, and the inexperienced collector may think they are of more recent vintage than they are. This was particularly true of American stands, some of which were painted in the mid nineteenth century.

The accessories for microscopes are often as interesting as the instruments themselves. They include such things as polarizers, camera lucidas, liveboxes, oil lamp illuminators, freestanding condensers, dark field adapters, reflectors, stage forceps, compressors, extra oculars or objectives, etc. Finding these for sale alone is uncommon and these accessories may command a sizeable price, particularly when signed and early.

Microscopes are often classified by function (e.g. dissecting microscope), optics (simple or compound), construction (e.g. Lister-limb), or by the name of the instrument maker who was most responsible for the design (e.g. Culpepper *type*). Freestanding microscopes can also be monocular or binocular. Some microscopes were also intended for multiple viewers. These included lucernal microscopes which projected images onto the rear of a small screen, and "solar" microscopes which used the sun as a light source to project the image onto a wall. The solar microscope was usually designed to fit through a window shutter, and required a clock-driven reflector (or a human being) to keep the sunlight correctly oriented while the earth rotated; the mechanical device is called a heliostat and is a rare instrument. In the nineteenth century, patrons paid for admission to a solar microscope "lecture" much as we pay for admission to a movie today.

Any serious collector should study the history of the microscope in detail and get as many contemporary

and antiquarian references as possible. The more you know, the better. Many of my best bargains were the result of careful research leading to my knowledge being greater than the seller. A beginners list appears at the end of this article..

All of the above types of instruments are available from dealers who specialize in microscopes. Fortunately, a very representative collection can still be assembled. When money is no object, some dealers will actually develop a collection for you, saving you the considerable time and effort needed to amass a complete collection. Several members of the MSSC have microscopes for sale and we have several members who are part-time dealers. Several full-time dealers also belong to our group.

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BOOK REVIEW

Barry J. Sobel

Notes on Modern Microscope Manufacturers. Quekett Microscopical Club 1996. Available from The Gemmary or Savona Books. It costs less than twenty dollars.

One of the worlds leading authorities on the history of the Microscope is Dr Brian Bracegirdle. His accomplishments include some wonderful references for those interested the history of the Microscope, including A History of Microtechnique (2nd ed 1986, Science Heritage, Chicago); this is the "bible" on the history of microtechnique and belongs in the library of anyone interested in the subject.

Notes on Modern Microscope Manufacturers is a special book which consists of an introduction with several pages of annotated references. This feature is excellent since it really allows you to understand what each reference entails and includes. This is followed by an alphabetical listing of all the "modern" microscope manufacturers. Modern for the purpose of this book starts about 1850, but if a maker was in business earlier, his work is included.

The book is very succinct but also very informative. One of the most useful features is the fact that the serial numbers in this book, in contrast to others, is not based on museum "estimates" or anyone else's, but for the most part hard evidence. For example, the serial numbers for Smith and Beck are taken directly from the company records. In addition the historical notes often include information not easily found elsewhere. The book is a quick and easy reference however and therefore not encyclopedic. A few makers are not listed and details are lacking in a few cases. I know from personal knowledge that in some instances the reason for the sparse data is that such data just is not currently known!

Dr Bracegirdle is to be highly commended for publishing what is essentially his private database. I have found this book to be an essential, highly readable, and highly reliable reference. I refer to it almost every day and recommend it highly without reservation. Like most other works by Dr Bracegirdle, it belongs in the library of anyone interested in the history of the microscope, particularly in the nineteenth and twentieth centuries.

GOODS GEAR AND GADGETS

Richard M. Jefts

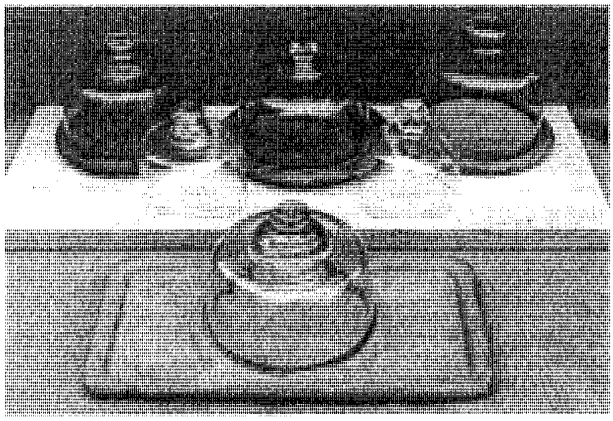


Fig. 1 Typical glass domes

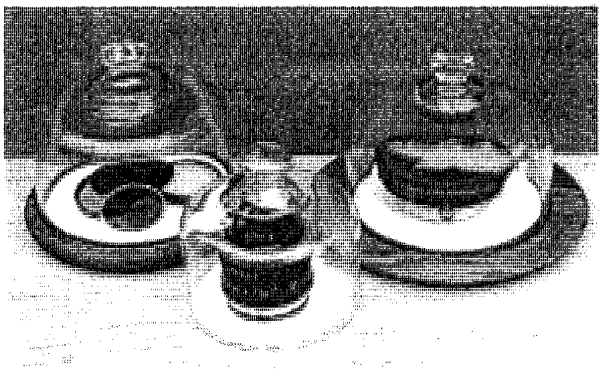


Fig. 2 Glass filters, 35mm lens and X-Y stage under glass domes

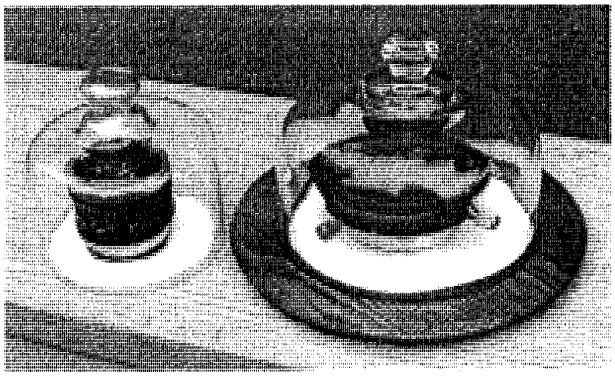


Fig. 3 Covered lens and X-Y stage; with and without grooved wooden baseboard

Too modest in intent to be called a department or column, this (as it turned out) monthly contribution was originally submitted, a few months back, as occasional filler material for our growing MSSC Journal - for the possible use by our esteemed Editor, Gaylord Moss, who, like all editors everywhere, is always in need of material to flesh out a blank spot or fill an empty page. (All members please take note.) Perhaps, then, having served to some degree its original intent, and with our Journal growing wonderfully well in both quality and quantity, this might be an appropriate time to bring these contributions, along with the calendar year, to a close - and with a suggestion that might not be totally inappropriate in itself.

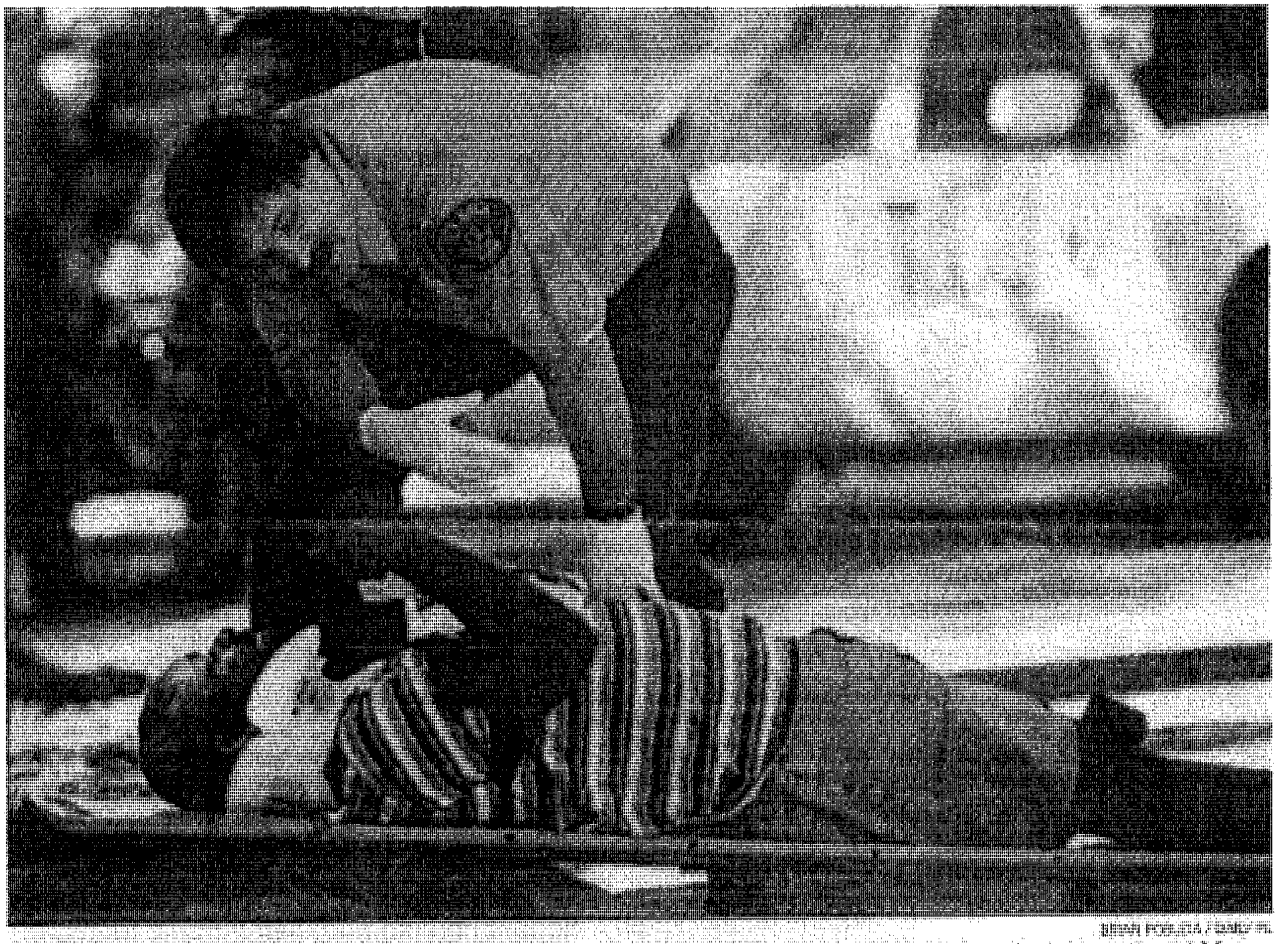
Back in the beginning, it was suggested that small, squat, plastic drinking vessels, with the stem cut short to serve as a handle, can be inverted and used as excellent little bell jars. And so, in a sense, we will go full circle, for there we considered small plastic cups, while here we graduate to glass and on a somewhat larger scale.

Domed-shape glass covers and wooden boards, with circular grooves to accommodate the circular glass rims, are designed essentially for use in slicing and serving various cheeses. They have also found favor for serving and storing candies, small pastries and similar light edibles. Heavy walled, with a solid glass knob, two sizes in general seem to be popular: 4 1/2" to 6 1/2" in diameter, and 3" to 4" in inside height. These glass covers are found frequently and inexpensively in thrift shops, at garage sales and swap meets, both alone and with their wooden baseboard counterparts. Either way, they are handy gadgets. Alone, they serve on the lab bench as both practical and elegant small glass bell jars for a great variety of items needed to be kept dust free, yet both handy and visible. With their rims set in the baseboard grooves, they serve well for such a task as drying prepared slides at ambient temperatures, and if the grooves are further sealed with thin strips of resilient foam rubber or plastic, they will prove to be workable desiccators for drying specimens with commercial drying agents or easily prepared anhydrous calcium chloride, copper sulfate, etc. Conversely, the unit can be used as a moderate humidity chamber, retarding excess drying by keeping a wide mouth vessel of slowly evaporating water along side the covered specimen or sample.

Fig. 1 shows half a dozen typical glass domes, with and without a wooden baseboard: Fig. 2 shows a group of covered glass filters, a wide angle lens from a 35mm SLR camera and an X-Y adjustable glass and metal stage assembly. Fig. 3 shows two of the latter in closer detail. As usual, anything that promotes harmony in the microscopists household, is to be greatly encouraged. So, should you pick up a few extra glass domed covers, you might donate them to the lady of the house, for they really do work well for the purpose for which they were designed. And if it should just ever happen that you needed one or two for some urgent project, you will always have a modest but ready supply from her pantry, storage cabinet or handy kitchen shelves.

Jim Solliday Profile Follow-Up

After Jim Solliday's profile article was published in last month's MSSC Journal, the following picture appeared in the local paper. This illustrates the comment that Jim made that "fighting fire is only a small part of his work as a firefighter," and shows why he has so much satisfaction in the work that he does which helps so many lives.



Jim Solliday of the Costa Mesa Fire Department tends to an accident victim Thursday morning at the intersection of Mesa Drive and Santa Ana Avenue. The incident involved two cars and a total of three people were injured.

WANTED - I have recently acquired a Spencer Model 37. Because it is in need of work and various and sundry parts to turn it into a complete scope, I would like to obtain one in that series from which I could scavenge stop screws, objective clutch mounts, locking lower iris etc. If you have such an instrument and wish to part with it please call Alan deHaas in the evening at 310-475-5623.

Minutes for the MSSC Meeting of 18 November 1997

David L. Hirsch

Although some of our members were sidelined by the onset of the flu season, 31 regulars and 7 guests were in attendance to make this another successful monthly gathering of the clan.

A STUDY IN DEPTH. Using Polaroid glasses provided, the membership was treated to a display of photomicrographs of diatoms, crystalline structures, etc., and photomacrographs of objects such as flowers, seashells and mechanical devices. The collection of slides comprised the magnificent scientific and photographic heritage of the late Stan Baird. STEVE CRAIG gave a presentation in which he included an attention holding commentary on the life and work of Stan Baird, who was an active member of the Microscopical Society for many years.

IN ADDENDUM. A MSSC thank you to JOHN de HASS for his added vital comments on mineral sections. John gave an excellent running commentary on all the mineral specimens shown. He mentioned that large mineral specimens are rare and expensive, and that perfect micro mineral crystals can be seen by means of the microscope. An excellent source for minerals and supplies can be found at Bourget Bros., in Santa Monica. For details, call (310)450-6556.

THE LIGHT BENEATH THE BUSHEL. LARRY ALBRIGHT has a talent which has come to light! Larry is an accomplished crystal photomicrographer. He showed photographs of a series of slides featuring crystallization of various materials. Using polarized light, Larry produced artistically and technically perfect photographs. Included were shots of slides featuring the tips of the soft curl of downy feathers.

SHOW AND TELL. The production and presentation of stereoscopic images had been previously discussed in a lecture and in an article in the MSSC Journal on stereomicroscopy. To complete this trinity, Guest BOB SMITH showed us a small but representative portion of his collection, which includes over 1000 (!) 3-d cameras and viewers. Included among the samplings shown, were dual mirror systems from 1827 and stereodaguerrotypes from 1839. The finely crafted wood and metal instruments were a far cry from the mass produced plastic devices of the 1950's. A 1915 Eica (?) Dresden camera had Karl Zeiss Jena lenses mounted on a single bellows and equipped with Compur shutters, could convert from stereo to panoramic by shifting an internal septum. Also shown, was an ancestor of the Rolleiflex in a stereo camera, having ten glass plates which were successively exposed; a precursor of the roll film camera. The fine display also included modern 3-d cameras such as the Stereo Realist, Lionel, Tri- Vision, Nimslo, Nishika and disposable 3-d cameras made of cardboard.

THE BOOK WORM. A good reference library is a necessity for microscopists and those with microscopical affinity. Two books of interest are mentioned here: *Exploring With the Microscope*, by Werner Nachtigall, published in 1996 by the Sterling Publishing Co., New York is one such volume. The 160 page book is an excellent source of reference for microscopists at all stages of expertise. So far, the book has been available to regular members, but our corresponding members may learn about availability by contacting VP GAYLORD MOSS at: (310) 827-3983 or at: mosss@att.net. A second book, *The Complete Book of Rocks and Minerals,* by Chris Pellant is an excellent reference source for the rockhound cum microscopist. Published in 1995 by DK Publishing, this 256 page book, classifies minerals by group, composition, hardness, cleavage, and fracture. The color photographs of rocks and minerals are profuse and of very high quality. I obtained my copy at the Price Club in Inglewood, California. For information, call Price Club Member Service at: 1-800-774-2678

KEEP 'EM MOVING! We must get the "last full measure of devotion" from our meetings because the time we members have to get together is very precious. Heed the words of JIM SOLLIDAY urging us to get maximum use of the time. Jim made a plea for more members to make use of the second half of the meeting to show their own work, or bring forth some pertinent discussion.

Many moons ago, I attended the Clarkson College of Technology in Potsdam, New York, and I recall a plaque in the lobby on which was carved a quotation from the Bible, something about: "A workman who needeth not to be ashamed". Some members may hesitate to stand up and be heard for fear of criticism, or whatever is that fuels their reticence. 'Taint so! We are a mutually supporting group with a common interest. We stand by one another to disseminate knowledge in the microscopical milieu, so make your voice heard! This applies equally to our corresponding members, where the means of communication are only a phone call or an e-mail or snail mail contact away.

SOCIETY BUSINESS AND RELATED MATTERS. Comes January, and the Great MSSC Election will take place, sans torchlight parades, bobbing banners and campaign buttons. Its not too early to give a thought as to whom you would like to man (or woman) the MSSC Ship of State for the coming fiscal year.

Speaking of fiscal years, steps are being taken to shift the fiscal year from its former ponderous July 1 to June 30 time frame to a January 1 to December 31 time frame. More about that later on.

I wait with baited breath (there's a pun in there, somewhere) to find out what will be deliciously reposing in the pots, pans and casseroles which will be prepared by our Chef Supreme, BEVERLY BLACK. Look for the the map and directions on the back page which will lead you unnerringly to our Christmas party site at the home of MARJ and ERNIE MEADOWS.

MSSC JOURNAL SUBJECT INDEX – 1997

MSSC JOURNAL SUBJECT INDEX – 1997
continued

MSSC JOURNAL AUTHOR INDEX – 1997

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continued

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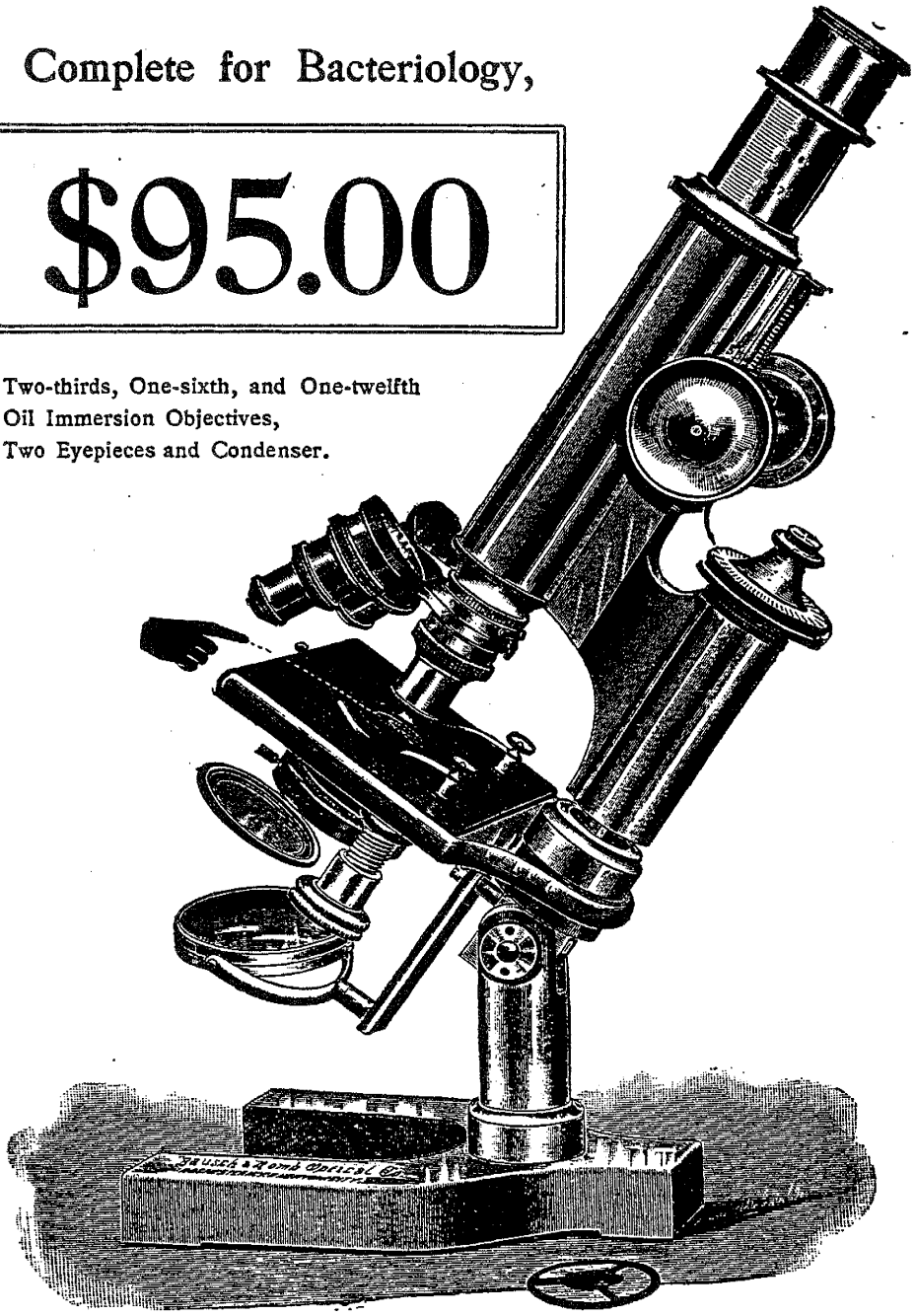

BAUSCH & LOMB OPTICAL COMPANY,

560 NORTH ST. PAUL STREET, ROCHESTER, N. Y.

xliii

courtesy of Richard M. Jefts.

MSSC Christmas Party

Date: Saturday December 20, 1997
Time: 3:00 PM Dinner served at 5:00
Place: Ernie and Marjie Meadows
707 Greentree Road
Pacific Palisades, CA 90272
310-454-7854 or 310-459-4788

Ernie Meadows and his wife Marjie have graciously offered to host the MSSC annual Christmas Party in their lovely home in Pacific Palisades. As last year, the full turkey dinner with all the trimmings will be provided by Steve Craig's daughter, Beverly. Members, please bring desserts to share. The cost will be $14 per person to be sent to Beverly Black c/o Steve Craig at 3455 Meier St. Los Angeles, CA 90066.

Please send your checks ahead so that Beverly will be able to plan her provisions.

DIRECTIONS

From the San Diego Fwy (405) Take 405 Fwy to Sunset Blvd. West - Approx. 5 miles (14-15 signals) to Brooktree Road. Turn left (south) onto Brooktree. One short block to Greentree, right turn. Two long blocks to cul-de -sac. Park on circle; walk up redwood path to the house on the right. There is parking for six cars at the house.

From the Santa Monica Fwy (10) Santa Monica Fwy to Pacific Coast Highway north to the third signal-right turn onto Chautauqua. (Note-not sharp right turn which would put you on Channel Road.) Take Chautauqua about one mile to Sunset Blvd. Right turn, one long block to Brooktree Rd. Right turn, one short block to Greentree Rd. Turn right. Two long blocks to cul-de -sac. Park on circle; walk up redwood path to the house on the right. There is parking for six cars at the house.

Alternate route from the Santa Monica Fwy (10) if beach traffic is heavy. Santa Monica Fwy west to 26 th St. Go north on 26th approx. 2 miles to Sunset Blvd. Just past San Vicente Blvd. 26th changes to Allenford. Turn left at Sunset. Three signals to Brooktree Rd. Turn left. One short block to Greentree Rd. Turn right. Two long blocks to cul-de sac. Park on circle; walk up redwood path to the house on the right. There is parking for six cars at the house.

From Wilshire Blvd. Go west on Wilshire Blvd. past the San Diego Fwy (405) and the VA hospital. Turn right onto San Vicente. Go past the Brentwood business area to 26th St/Allenford. Right turn to Sunset. Turn left at Sunset. Three signals to Brooktree Rd. Turn left on Brooktree. One short block to Greentree Rd. Turn right on Greentree. Two long blocks to cul-de -sac. Park on circle; walk up redwood path to the house on the right. There is parking for six cars at the house.