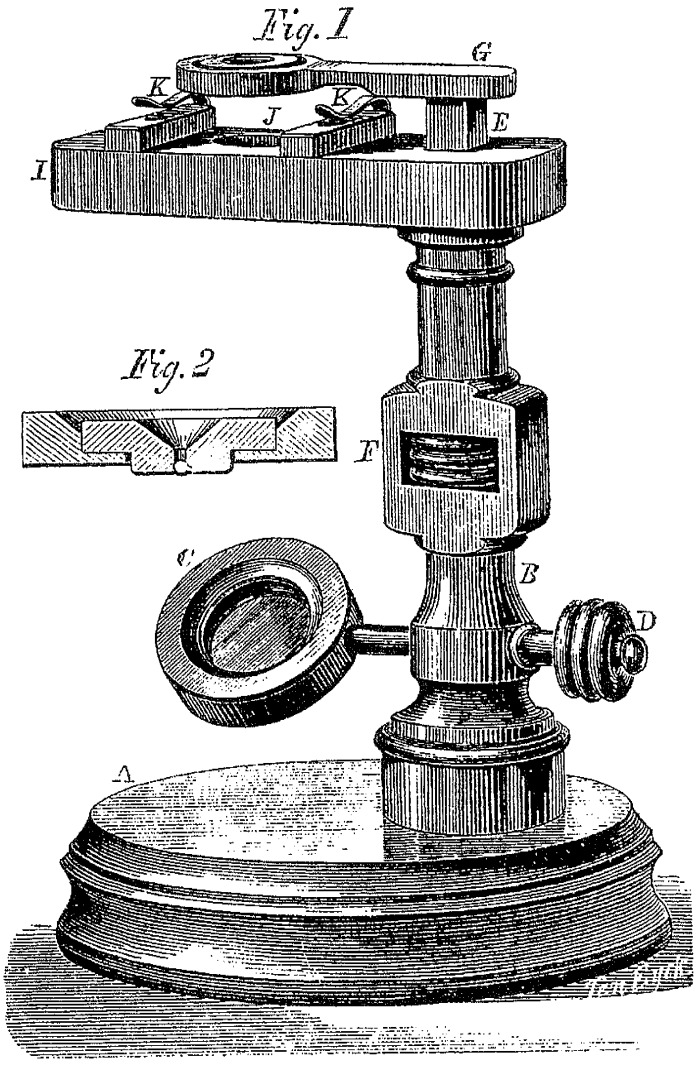
Journal of
THE MICROSCOPICAL SOCIETY OF SOUTHERN CALIFORNIA
Volume 2 Number 11 November 1997

JAMES LOGAN'S SIMPLE MICROSCOPE

DO IT YOURSELF

Stuart L. Warter



As so ably documented by Brian Ford,[1] simple microscopes are simple in construction only, and are not necessarily relegated to low power tasks (a la simple magnifiers and dissecting microscopes), being capable of producing quite high magnifications. They are simply defined as having a single lens, as opposed to those having two or more lenses, which are known as compound microscopes. Many of the great advances made by early scientists from the seventeenth to the nineteenth centuries were made with simple

microscopes. Until the development of the achromatic lens, compound microscopes were not particularly useful at high magnifications. So pervasive was the influence of the achromatic microscope, that the role (and usefulness) of the simple microscope for higher magnifications was largely forgotten, leading authors such as Padgitt[2] to misinterpret instruments like the subject of the present article as dissecting microscopes.

On August 17, 1869, James H. Logan, then of Washington, D.C., received a patent for a simple microscope, constructed mostly of wood, and supplied with high power globule lenses. Two such instruments survive in the Billings Collection[3] and one in the collection of the Royal Microscopical Society.[4] The Royal Society's instrument is complete and in particularly fine condition, having been presented to the Society in 1871 by Logan, and probably never used. It is signed "LOGAN'S SIMPLE MICROSCOPE" and "PATENTED AUG 17,1869". It is accompanied by an original cardboard box with three wood mounted objectives; the box is labeled: "GLOBULE LENSES FOR LOGAN'S SIMPLE MICROSCOPE" and "POWERS:

No. 1	150 DIAMETERS
No. 2	300 DIAMETERS
No. 3	500 DIAMETERS"

James Logan was active in microscopy for at least 14 years. In 1869, the year of his patent, he was in Washington, D.C., associated with the National Deaf and Mute College.[5] By 1893, he was in Allegheny City, near Pittsburgh, Pennsylvania, listed as interested in "Desmids, Diatoms, Microscopy, Histology, Protozoa."[6] According to Padgitt, he was a supplier of objects for microscopy, a dealer in used microscopes, and a scientific illustrator.[2]

Scientific American, currently a monthly magazine devoted to comprehensive articles on technical subjects directed towards the more literate elements of modern society, had its beginnings in the last century as a weekly newspaper dealing with newsworthy items and features on current scientific topics - a niche now divided among such publications as the weekly Science News and the monthly Popular Science.

On July 10, 1869, prior to the issuance of the patent, there appeared in Scientific American for July 10, 1869,

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a description and illustration of Logan's instrument, its use, and some hints for "do it yourselfers" such as the types of wood to use in construction along with detailed instructions for the home fabrication of the globule lenses. Globule lenses - small beads of glass drawn out in a flame and polished with jeweler's rouge - were the type of lenses made by Hooke and Leeuwenhoek in their famous pioneering microscopes. The article, which follows, is accompanied by a woodcut by the engraver Ten Eyck, who was to do many illustrations for Bausch & Lomb's catalogs.

Several months ago, I purchased a Bausch & Lomb "Model" microscope from a regular seller at a local monthly flea market. He said he had a "home made" wooden microscope at home, having obtained it from the same source, and promised to bring it the next month. With visions of Logan's microscope dancing in my head, I looked for him, but, of course, he never showed up, and I have not seen him since. Last month I came across the following article. Coincidence? Premonition? Who knows? Perhaps he is just taking a prolonged summer vacation. Hope springs eternal!

"Home Made" wooden microscopes do turn up from time to time, and are usually ignored, being viewed as mere curiosities. It might be wise to pay attention the next time one surfaces. (Considering the number of handymen who may read this article, I expect to see one or more in the not too distant future, but they will smell of fresh varnish....).

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2. Padgitt, DL: *A Short History of the Early American Microscopes*. London and Chicago 1975.
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4. Turner, GL'E *The Great Age of the Micro scope*. Bristol and New York 1989.
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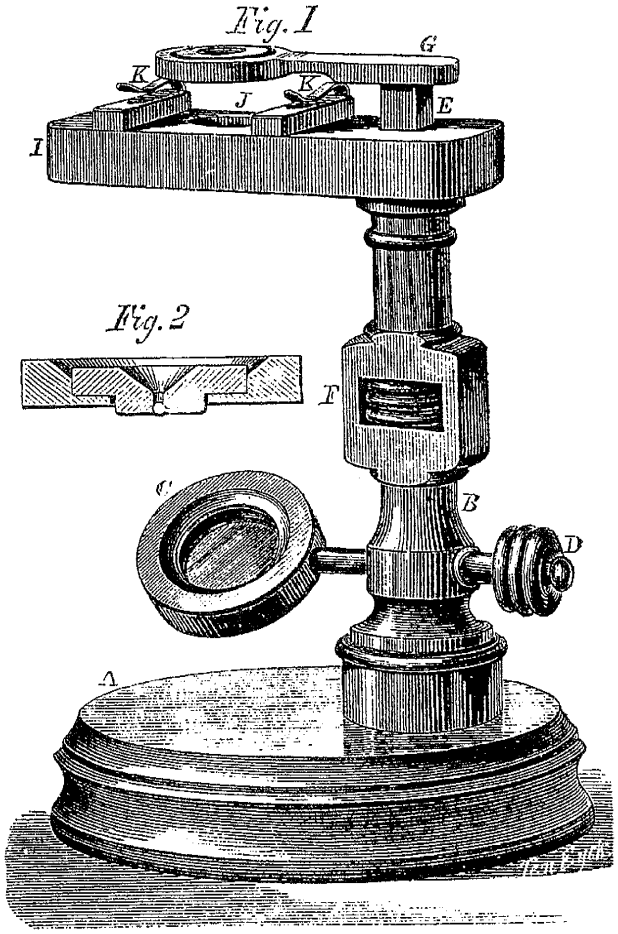
6. Warter, S L: Locations of Some Nineteenth Century American Microscope Manufacturers. *The Objective*, March 1995.

NEW AND IMPROVED FORM OF SIMPLE MICROSCOPE.

The chief peculiarities of this microscope are, its being made almost entirely of wood, the general arrangement, and, particularly, the mode in which the focal adjustment is effected.

The instrument (Fig. 1), consists of a circular base, A, from which rises a standard, B, having a mirror, C, attached to its lower part. The mirror is turned by the head, D, so as to reflect the light coming in front of the observer. Through the center of the standard runs a square groove into which a bar, E, of similar shape fits. An iron screw firmly secured to the lower end of this bar, fits into the head or nut, F, and by turning this the bar is raised or depressed The head, F, fits accurately into the cut made for its reception in the standard, which has two opposite sides flattened at this part in order to allow a slight projection of the head, thus giving the thumb and middle finger a good hold on it. A lens holder, G, is attached to the upper part of the bar, E. Several disks of wood having spherules or globules of glass mounted in them, are made to fit into this holder. When a change of powers is desired, nothing is necessary but to take out one disk, drop another in its place, and then make the proper focal adjustment. A full size section of part of the lens holder, showing the manner of mounting the globule and fitting the disk, is given at Fig. 2. At I, is the stage with an aperture at J for admitting the light from the mirror. To the stage are attached two spring clips, K K, for holding the glass slide containing the object firmly in its place.

Beneath these clips two transverse bars are fixed to the stage, and the slide resting on these is slightly elevated, thus giving the fingers a better hold in moving it about. A portion of the under side of the lens holder, G, is cut away, as shown in the engraving, in order that the spring clip passing underneath, may not prevent the lens from being brought very near the object, as is necessary when high powers are used. That part of the stage through which the bar, E, passes, is lined with leather moistened with a little oil. By this means the lens holder is kept free from any lateral movement while the focal adjustment is being made. The stage is $4\frac{1}{4} \times 1\frac{5}{8}$ inches, and is designed to allow the use of a full sized slide 3×1 inch.



The groove in the standard is planed in a piece of wood, another piece is glued over this, and the block afterwards turned to the proper form in a lathe.

Metal and rubber, or suitable combinations of these and wood, may be used in the construction of the microscope, but it answers equally well if made of wood. Hard and dark colored woods, such as black walnut, rosewood, mahogany, etc., are the best. The microscope from which the engraving was made, was made of black walnut oiled. None of the parts were of metal except the screw and spring clips.

In using the microscope the head for turning the mirror must be at the right or left hand, as may be most convenient, and the light must come in front of the observer. No advantage is derived from having the mirror fixed so as to reflect light from the left or right, because the arms, while moving the slide, will always cut off the light so reflected. The nearer the lens is to the object the greater is the care necessary in making the focal adjustment. In examining infusoria, or other objects found in water, a drop or two of the fluid may be placed on the middle of an ordinary slide and covered with a square of very thin mica or glass. Most objects, whether dry or in fluid, will need this precaution, which is often necessary to prevent the globule lenses from getting soiled by coming in contact with the object under examination. Care must also be taken that the mica or glass cover does not approach too near the spring clips, otherwise the fluid may be drawn under the clips and wet the stage. Should the globules get soiled, and rubbing them with tissue paper does not clean them, they must be punched out and replaced by new ones.

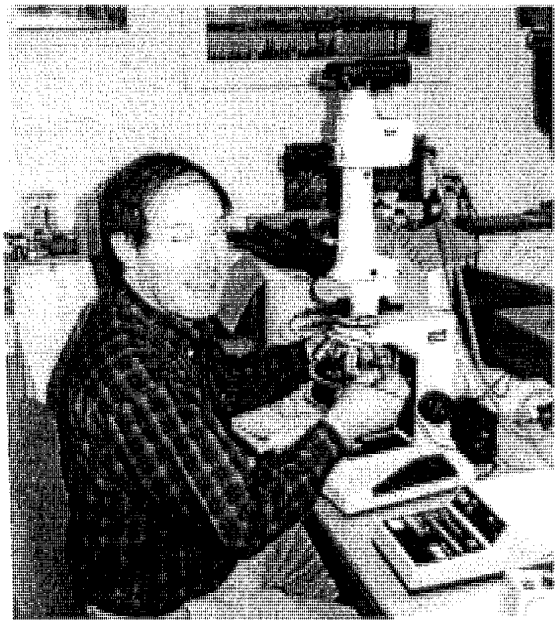
The microscope was designed with special reference to the most convenient and efficient use of these globules as magnifiers. Globules of high power were first made and used by Robert Hooke, an English microscopist of the seventeenth century. These when well made show objects remarkably well. They may be made to give enormous powers, and that, too, at a cost of only a few cents. It is not a very difficult matter to obtain with these a power of 1,000 diameters, or even more. The field of view is rather small and its extent is the same for all powers. This is because it is limited by the pupil of the eye, as may be readily proved by a simple experiment. Looking through a globule lens, arrange the mirror so that just sufficient light is given to make the field visible. Then suddenly turn the mirror so as to illuminate the field with a strong light when it will be seen to contract. With the larger globules the light given by the flat mirror is sufficient, but when globules having a focus less than $\frac{1}{4}\frac{1}{0}$ or $\frac{1}{5}\frac{1}{0}$ of an inch are used a concave mirror will be necessary. Any person may, after a little practice, be able to make and mount his own globules.

The globules should be made of French plate or other very pure and clear glass. The glass must be cut into a narrow strip, carefully cleaned, and then drawn out into threads in the flame of a spirit lamp. The threads should be made of different thicknesses and carefully kept on a clean plate. The wick of the lamp should then be pushed down until the flame is not more than half an inch long. One end of a thread is now to be held in the flame when it will melt and run up into a globule. When the globule is seen to be perfectly spherical it must be withdrawn, held a little while to cool, broken from the thread, and put aside until wanted for mounting. The larger globules are the most difficult to make, the fine threads melt and run up into perfect globules almost as soon as thrust in the flame. The hole in the disk for the globules must be burnt in and then cleaned by rubbing it with a piece of wood. Care must be taken that the inside of the hole is made dark in order to prevent all reflection of light. A needle will be convenient for burning in the smaller holes. The globule is then to be carefully placed in a hole with the broken end of the thread to one side, and may then be fastened securely by pressing it in a little. If desired, other forms of magnifiers, such as ordinary double convex lenses, Wollaston doublets, triplets, and Coddington lenses may be used.

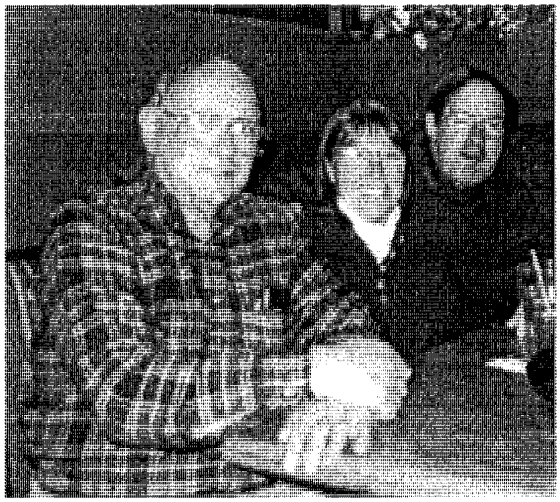
For the examination of infusoria, animal and vegetable tissues, and such other objects as are, or can be made transparent, these globules have been found to answer very well indeed. It is for the use of globules in such examinations that the microscope here described was devised. It was not intended for, and cannot conveniently be used as a dissecting microscope. By means of a globule magnifying over 500 diameters the writer has been able to perceive clearly the hexagonal markings on the most common diatoms found in the "Richmond earth." He has examined live diatoms and animalcules whose movements he has been able to follow, though not without difficulty when they were rapid. The reader will thus get some idea of what may be accomplished by such simple things as globules of glass.

This invention was designed by James H. Logan, who may be addressed for further information, at the National Deaf and Mute College, Washingon, D. C.

Pictures from Dave Hirsch's recent visit with MSSC member Myron Wright in Anchorage - See story on page 221.



Myron Wright at his microscope.



Dave Hirsch with Mary Bethe and Myron Wright in Anchorage Alaska

The Presentation of Brian J. Ford at the 28 October 1997 meeting of the MSSC

George G. Vitt, Jr.

Mr.Brian J. Ford gave an excellent presentation on the techniques used by A. van Leewenhoeck, and also on Mr.Ford's unprecedented discoveries and analyses of hitherto unknown original specimens that had been prepared by the Netherlands master and sent by him to the Royal Society where they languished unknown for some 300 years! The talk was accompanied by 35mm slide projection of original Leewenhoeck specimens photomicrographed by Mr. Ford through a Leewenhoeck single lens microscope, a modern optical microscope and also with an SEM.

Mr.Ford's Books: Brian Ford has a history of being an explorer in things scientific, and has been a prolific writer, having written some 25 books on scientific subjects. He also worked as a science consultant for the BBC. His first and most successful book documented German secret weapons. A few of his books dealing with microscopy are: *The Revealing Lens, Mankind and the Microscope* (1973). John Bunyan, who had been knighted by the queen and is a past president of the RMS wrote the forward to this book; *The Optical Microscope Manual, Past and Present use & Techniques* (1973); *The Single Lens, the story of the simple microscope* (1985) - with which we are all familiar. His most recent, and probably his most magnificent publication is *Images of Science, A History of Scientific Illustration* , Oxford Univ. Press, 1993. It is a large folio of 208 pages with magnificent color plates.

Comparison of Imagery: His talk was accompanied with a fine selection of 35mm slides, some of which were taken through simple lenses of the type used by Leewenhoeck. Photography through such lenses, which are some 1/32" in diameter, is quite difficult. He also took photos through simple lenses which were made by Horace Doll, a world-class microscopist, who is known internationally for having made the most powerful simple lens in all history. He also repaired old lenses of the type made by Powell & Lealand, and Quekett members sent their old style lenses to him for repair. He also made a micro-writing machine which enabled him to do the smallest micro writing that had ever been done. Brian Ford was well acquainted with Horace Doll and was quite inspired by him. (Mr.Doll passed away about 4 years ago, in his 80s or 90s). The comparison of photos taken through the single lens to those taken through a modern microscope revealed that the informational content of the single lens images was practically equivalent to the others, except for some expected chromatic aberration at the edges of the field of view.

The Presentation: Brian Ford illustrated his presentation with slides made of original Leewenhoeck specimens which had been discovered by Mr.Ford inside small envelopes pasted to the back of letters that Leewenhoeck had sent to the Royal Society c.1670-80. These specimens were not recorded by the Royal Society when they were received, so that no one knew that they existed. Mr.Ford's investigation unearthed these specimens some 300 years later! He then thoroughly examined these specimens both with the light microscope and with the SEM. He discovered that Leewenhoeck's sections were extremely fine, he having used a straight shaving razor, cutting the sample so that several sections of it were 'feathered', producing extremely thin "wedge-shaped' portions. This proved that Leewenhoeck had great dexterity and manipulated the specimens with great precision. Using the SEM Mr.Ford found and identified a few red and white blood cells on one of the sections and concluded that these undoubtedly came from Leewenhoeck's sectioning razor, which he also used for shaving himself!

Mr. Ford stressed that Hooke magnified familiar things, while Leewenhoeck revealed previously unknown things such as algae, bacteria, spermatozoa, and protozoans - identifying as mats of dried algae what had been previously believed to be black 'paper' that the angels had sent down from heaven! Leewenhoeck visited London c.1664 and was exposed to Robert Hooke's book and, no doubt, was inspired by him and also became familiar with the methods he used to make simple lenses - as Mr.Ford also reported in his book.

Brian spoke with a great deal of enthusiasm for the subject, and was both informative and entertaining, having a direct way of speaking and an excellent sense of humor - holding the attention of the audience without difficulty. The combination of the slide show and his thorough knowledge of the subject was very informative, and everyone enjoyed it.

Mr.Ford and MSSC: This was Brian's first exposure to MSSC and he was able to see the excellent collections of microscopes and books at the homes of several members: Norm Blitch, Leon Stabinsky, Barry Sobel, Jim Solliday and Larry Albright at whose home he stayed during his visit. He particularly enjoyed seeing Stuart Warter's collection of instruments and books. He was impressed not only with the libraries he had seen, but also with the size and scope of the collections of instruments. After seeing what we had here in Southern California, in his closing remarks, he made an appeal to the Society saying how fortunate he thought we were and how much we had here for conducting research. He stressed that some plans ought to be formulated to preserve these collections after the demise of their present owners. He added that we not only had a fine organization, but that we were really a fraternity of friends who encouraged one another. Although this was Mr.Ford's first visit here, we all look forward to seeing him again before another year passes!

WORKSHOP of the Microscopical Society of Southern California

by: George G. Vitt, Jr.
Date: Saturday, 5 October 1997
Location: Steve Craig's Lab, 35 persons attended.

Once again, there has been set a new record for attendance at theWorkshop. Unfortunately, no suggestions on ways to discourage attendance have come from the membership.

1. **Chris Brunt** suggested that a good subject for some workshops would be the restoration of instruments. Attendees thought that this was an excellent idea.

2. **Larry Albright** reminded us that **Brian Ford** will give his presentation on 28 October at the Crossroads SchoolTheater. Larry then gave a formula for the care and keeping of "Vinegar Eels", which can be an interesting subject for microscopists: mix 50% apple juice, 50% water, add small pieces of apple - and the creatures are guaranteed to appear (not by spontaneous generation) and prosper for an indefinite period.

3. **Gary Legel** brought for sale an Olympus PM-6 photomicrography unit and a Russian 35mm camera (similar to the Pentax). He then explained how he attained parfocality between the image seen in the eyepiece and the camera film plane when using his Russian MBS-10 stereo microscope

4. **Steve Craig** introduced guest **Herb Gold** who brought and described a superb microscope that he had brought. It was a beautifully cased Thomas Rylands (Manchester), double-pillar binocular microscope with two mahogany cases filled to the brim with accessories of every description. The entire outfit is in pristine condition and will be a most interesting subject for a writeup in our Journal. Herb joined MSSC at this workshop. WELCOME ABOARD, HERB!

5. **Gaylord Moss** described his recent visit with **Larry Albright** to member **Lee Gonzales** in Lone Pine, and his incomparable hospitality and showed color photos that he took there. Lee shared with Larry and Gaylord many of his techniques for slide making. Gaylord also showed photos taken on the same trip of various old mining machinery (c.1870-1930) laying about,unprotected in the environs of the famous California gold-mining town of Bodie - now a ghost town. He described the electric generator, driven by a Peltier wheel via a 6-foot wide leather belt, the straight transmission line leading to the mining site, and the methods that had been used to extract the gold, i.e., through the use of mercury and,later cyanide. He then told of the showing of Steve Craig's amazing video of flagella "in action" that was shown at the recent meeting of the Lorquin (entomological) Society. There was a general discussion on the mechanism of true rotary joints and "biological motors" in living organisms.

6. **Larry McDavid** showed a reprint edition of the 1851 3 volume catalog of scientific instruments and lab equipment of John Griffin & Sons. (London, est. 1825). The single volume reprint combined the three original volumes. The reprint was done by MSSC member **Rick Blankenhorn**, who is selling it for $125.

7. **Peter Fischer**, who had been on a lengthy business trip to the Far East, reported that no antique microscopes are to be seen on mainland China, but that there are available current Japanese and Chinese models and more recent used instruments. The prices are outrageously high, a microscope that would have a fair price of $3,000 in the USA, is priced in China at $14,000! Stereo microscopes almost identical to the WILD M3 and M7 are being manufactured in Kwantung Province and are sold by Edmund Scientific Co. (Barrington, NJ). A microscope similar to the WILD M5 is being sold for $1,325 whereas WILD originally sold theirs for $3,000. Peter related an interesting story: In 1977 China ordered 500 Wild stereo model M5 microscopes (6X-50X) that were intended for use in agricultural research. Such an inordinately large order upset Wild's schedule applecart, but their deliveries were too slow for China and, 5 years later, the Chinese started to manufacture these themselves. These microscopes and their accessories are now available in the US under different labels.

8. **Herb Gold** displayed and described his marvelous "Smith & Beck 6 Coleman St. London 1538", compound binocular microscope,"Large Best or No. 1 Stand", with two fitted boxes full of original accessories and an original case. Bracegirdle, page 68, dates it 1856/7. It was accompanied by the Science Heritage facsimile edition of Richard Beck's, *A Treatise on the Construction, Proper Use, and Capabilities of Smith, Beck, and Beck's Achromatic Microscopes*.This book amounts to a veritable operating manual for the system as it describes the use of (almost) every accessory.The stand is in outstanding condition albeit absent the original lacquer.

The instrument was the personal property of Thomas Glazebrook Rylands (1818-1900) of Warwick, England (near Manchester). Rylands was a gentlemen scientist

extraordinary, being a member or fellow of almost every English scientific society. His family owned a wire mill, and the Library in Manchester had been founded by one of his descendents. Being a liberal, Thomas supported abolition and pointedly did not join the RMS! A photocopy of his biography was also shown.This instrument came from a direct descendant of Rylands.

Gaylord Moss and **George Vitt** suggested that this instrument and its attendant documentation and accessories might make a good article for the Journal. Herb said that he would be delighted to help that idea come to fruition.

9. **Barry Sobel** remembered that during a prior workshop someone had requested to see what the images looked like through the antique instruments we collect. To that end he set up two demonstrations.

During the workshop he borrowed a modern AO microscope from **Steve Craig** and next to it set up his Smith and Beck "Number 2', or "Best Small Portable" microscope with a fine John Browning Water immersion 1/8 inch in it. He then put a similar bacterial gram stain slide on each and let everyone judge for themselves the quality of the more than one hundred year old water objective side by side with the modern oil immersion objective. It was clear that most felt that the Browning objective was the equal of the modern oil immersion lens.

Barry also brought a rare Cary-Gould type of microscope signed by Dollond. It is unusual in that it folds down into the box on a hinging mechanism rather than screwing onto the case. It was complete with 2 Lieberkuhns, stage, stage forceps, stage-mounted bullseye condenser, understage gimbaled mirror, and an uncommon addition of a wheel of objective lenses similar to that found on "Jones Most Improved" stands. Barry also set this up for viewing with one of the original bone sliders with a fly's wing as the subject. Participants could observe the specimen under all the different powers of the wheel.The microscope is about a foot tall when erect, and the box measures about 8 inches by 6 inches, the optical tube unscrewing from the arm for transport. The main stand can then fold down into the case which is blue velour lined. Also included was a circular live box and 3 bone sliders. It has rack and pinion focusing and is in fine condition with original lacquer but lacks the lock mechanism on the case.This instrument probably dates to the late first half of the nineteenth century. Since we were on the subject of Dollond, Barry also brought a little Dollond telescope with wheel of eyepieces, quite similar to the wheel of objectives of the microscope.

8. **Steve Craig** announced that he has cultures of various organisms with flagellae, and that we were encouraged to take home samples of any of these. (Steve's video-photomicrography of euglena and their flagella were featured in a recent Science TV show). He suggested that the periodic addition of spring water and a few grains of wheat would keep the colonies in good shape for a long time.

9. **Richard Jefts** had planned to bring a large book of J.B. Dancer micrographs but forgot it and promised to bring it to the next meeting.

10. **Dave Hirsch** gave an animated account of his recent visit to member **Myron Wright** in Anchorage, AK. Dave noted that the latest bulletin of the Scientific Instrument Society mentions the MSSC. (That was how new member **Herb Gold** found us.) He added that in this issue of the bulletin, **Ray Giordano** has a good article with a listing and description of 30 scientific instrument dealers in the US. Dave also talked about the response that he got to an article in the Scientific Instrument Journal with the very controversial title "To Polish or Not to Polish."

11. **Ken Gregory** displayed a very nice B & L dissecting microscope c.1916. It can be converted from a stereo dissecting to a triple nosepiece instrument.

12. **Jim Clark** had returned from a model engine exposition in Eugene Oregon. He gave a booklet of low cost physics demonstrations to **Stuart Ziff.** Jim had used these experiments in his classes. He also said that he will be in the Galapagos to watch the February 26th solar eclipse. **Larry McDavid** said that he will be in Venezuela for the same event.

13. **Leo Milan** showed some prints with the latest Kodak premium processing that gives you a proof sheet of mini prints to order from. Leo added that his wife is encouraging him to make prints rather than slides.

14. **Myron Lind** showed a number of fascinating old medical instruments, saying that he would trade microscope slides for such instruments.

15. **Jim Solliday** related a story in which someone found a 60 pound ball of black substance in the basement of a museum among some microscopist's effects. To everyone's amazement, it turned out to be very valuable Turkish opium!

16. **Annaliese Grohs** talked about SEM filaments, not tungsten but LAB 6. This material gives better electronemission but can be destroyed if the vacuum in the SEM is broken.

17. **Larry Albright** brought some vinegar eels that **Lee Gonzales** had given him on Larry's recent visit to Lone Pine. **Dave Hirsch** mentioned that, when he

was a boy, he had read about vinegar eels and found some in his mother's kitchen vinegar. When he proudly showed them to his mother, it was the last time that they had vinegar in the household.

At this point, we were treated to a "micro-Albright": Someone stated that a certain one of our members would be the perfect person to give us a talk on microscope restoration. Larry immediatly chimed in with, "Yes, that is where he shines."

18. **Gary Legel** has a friend at Cedars Sinai Hospital who may assist us in the use of our SEM. Gary sold an Olympus PM-6 photomicrographic attachment at this workshop.

19. **Julian S. Pulido**, whose business is called "Cross Sections Unlimited" which makes superb micrographic studies of materials, became a new member of MSSC.

Ron Morris Elected a Fellow of the Royal Microscopical Society

Ron Morris at the Crossroads School SEM

Ron Morris has been elected a Fellow of the RMS, probably the world's most prestigious microscopical society which was founded in 1839. Ron will be active in the semiconductor materials committee as well as the sections on electron and light microscopy.

Ron is currently doing research on materials for microelectronic applications at the Silicon Systems Corporation. See the June 1997 MSSC Journal for Ron's member profile.

Report on the Maryland Scientific Instrument Show

Barry J. Sobel

This show is sponsored by the Maryland Microscopical and Scientific Instrument Society. The show this year was quite well attended both by dealers and visitors. There was a five dollar admission charge and dealer tables were $80 each. The show was run by John Ptak who did a very professional job, in light of the recent unfortunate death of Dr. Sam Koslov who had run the show for many years. No more than two dealers were permitted to share a table. Unlike our west coast shows, the Scientific Instrument Society is not represented at this or any of the other east coast shows. The show's offerings included a wide selection of antique and modern instruments; everything from clocks, some mechanical music devices, and reproduction nautical instruments to vintage microscopes. Some of the dealers had just returned from England and other parts of Europe with a good selection of things at reasonable prices. As always, there were bargains to be had, but prices were on average, just that, average. In some cases, prices were exorbitant. An example was a small unsigned French microscope projection attachment of only average quality with an asking price of $3400. On the other hand, I picked up a modern hand-held AO refractometer with original instructions and box for $100. Most of the dealers I spoke to did quite well. Some representative items and their asking prices were: a signed but polished Charles Chevalier small microscope in its original case, about $3000; a Spencer with Serial Number 13, but in poor and incomplete condition, $3700; a Cary-Gould microscope complete in original box for $850; a particularly fine air-siren for about $600; a very fine Silver Negretti and Zambra barometer, thermometer, and compass compendium in original case, $700; and a small set of prisms on stand with case $200. A turn of the century microscope slide cabinet with glass doors and room for 600 slides for $370 including shipping sold early as did many other things. Some books were available and some antique microscope slides. Modern microscopes and accessories were not lacking and you could find almost any objective or accessory there at bargain prices. Another bargain was a turn of the century comprehensive set of oculars and objectives by Zeiss in a beautiful wooden case for $1000. Perhaps the most unusual, albeit unsigned, microscope was a large binocular all-brass instrument with a bulls eye condenser pillar screwing into the foot. More than one MSSC member came away with several little gems, some of which we hope to share with the membership. I even found some gifts for my wife and daughter. As always, the show was great fun and time for reunions with many old friends, something I enjoy even more than the instruments.

IN APPRECIATION

Richard M. Jefts

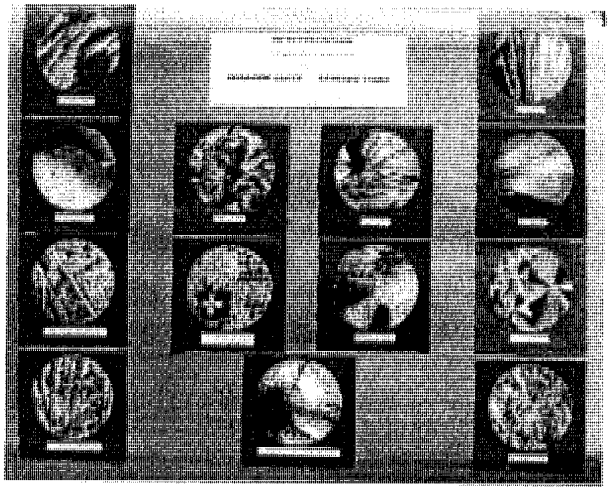


Fig. 1

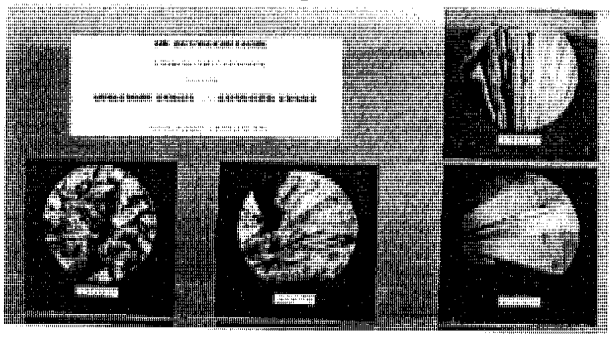


Fig. 2

Recently made available to members of the Microscopical Society of Southern California, for loan and viewing, are a series of standard microscope slides of chemical crystalline formations. These slides, prepared many years ago by the late Edward Lowe and the late William Sokol, are exceptionally fine examples of the time, patience and imaginative artistry necessary to produce crystalline specimens of such complex design, and that display, under simple polarized lighting, such a variety of brilliant and spectacular colors and tones. Various techniques were used in the preparation of these slides; saturated aqueous or alcoholic solutions of single chemicals and oft times two or more chemical compounds in solution were combined in various ratios and evaporated to dryness. Single compounds and sometimes two or more dry compounds were combined, subjected to heat on a slide and the components, being allowed to melt directly or to dissolve in their own water of crystallization, were cooled and so recrystallized. Very tiny crystal "seeds" or sometimes small inert particles added to the cooling mass, can frequently cause sites of foci from which radiating bands and other complicated patterns can sometimes form. Similar "star bursts" and other designs can often be formed by applying a point source of pressure - such as a pencil point - to the crystal forming mass, while cooling under a fairly thick cover slip. By

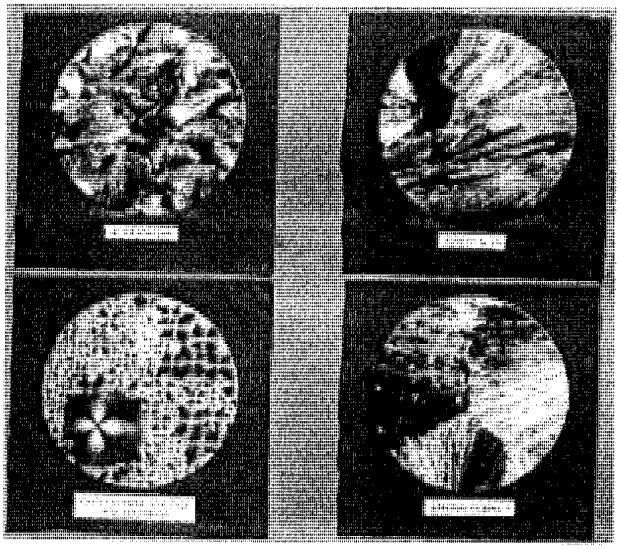


Fig. 3

these and other innovative techniques, an infinite array of interlocking crystal masses, plates and needles are more or less randomly generated. Although the preparations are available to all members, not everyone may find it convenient to spend the needed time with the slides and especially with the added necessary facility of crossed polar illumination. With this in mind, many dozens of crystalline preparations were examined and from a few of the winnowed down and chosen slides, selected areas of especial interest, in patterns and display of colors, were photographed. For this session, Kodak Gold, ASA/ISO 400, color print film was used, at a uniform magnification of 37.5x, with a Leitz Ortholux and an Olympus PM-6 camera. From the many resulting low power photomicrographs, a bakers dozen of the color prints were picked, cut to a 3 3/4" diameter, classic circular format, mounted on a heavy 22" x 28" blue cardboard and the whole appropriately labeled. Fig. 1 shows the board with all thirteen color photomicrographs, while Fig. 2 has four of these circular photos and the main heading, which reads:

IN APPRECIATION
A Bakers Dozen of Slides
prepared by
WILLIAM SOKOL and EDWARD LOWE
Photomicrographs by Richard M. Jefts

Fig. 3 is a slightly further close-up of four of the mounted photos. The resulting modest display is a very small but perhaps representative cross section of just one phase of our former members' many skills, and is a tip-of-the-hat to their work and to their efforts. Both Ed and Bill, greatly respected, very active and highly influential in those more formative years of the Society, have passed away, but a legacy of much of their work is still with us.

Member Profile

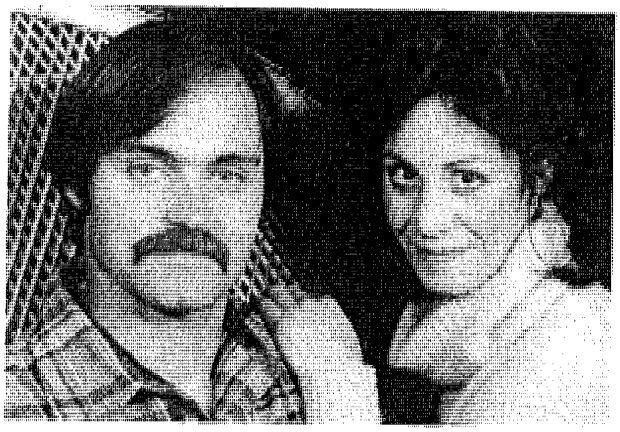
James D. Solliday

Fire Department Photo (1996)

The year 1950 was a good time to be born, it was also the beginning of a great decade in which to grow up. Things were much different then, especially in the way people looked at life. Unlike today, if someone would have publicly called for a day of psychic convergence, they would have been taken away in a little white truck. During the fifties, science had become the standard by which things were evaluated. The application of science had brought a great deal of optimism to American society, and a young kid growing up at that time could hardly overlook the progress. To make things even more interesting, my father was an amateur astronomer who worked for an aerospace company. One of my earliest memories was climbing up a ladder and looking through a 10-inch telescope. I was awe struck to behold the brilliant colors of the Orion nebula. It was more than I had expected, and it opened my imagination to the possibilities of exploring nature. By the time I reached age 5, I could name most of the constellations in the Northern Hemisphere and could point out the path of the Milky Ways across the sky. With encouragement from my father there was very little doubt that I was going to be a scientist.

I was born in Minneapolis, Minnesota, and no doubt was a big help to my parents who at the time were going through college. I am told that I was permitted to sleep in the back of the class room and was famous for my quiet temperament. After two years of academic success, I moved to Iowa where my brother Timmy was born. By the time I was 3, we had moved to California. My father was hired by the Douglas Aircraft Company to work on the new DC-6 airplane. I remember living in a big silver trailer located somewhere near the racetrack in Inglewood. The trailer experience was short-lived as we were soon in a house with a very big yard. It was in that yard that I first looked through that wonderful 10-inch telescope. By the time I was 4, my second brother Joel was born. The configuration of our family was now established and remained so for the next seventeen years, we grew up as the three boys. When I was 21, my parents produced my third, and final brother, Leslie, although this was not part of their master plan. Leslie now has a boy of his own.

By the time I started school, my mother was working as a teacher. By the time I was in the fourth grade she was the principal. This was a difficult situation as I was regularly informed that I was to be an example for the other kids. I don't recall causing her embarrassment, but I would just as soon not bring up the subject with her as she may have a better recollection of that particular time. Because of my mother's position, I had the privilege of receiving about half of my education in the parochial schools. Exposure to good teachers and membership in a positive family encouraged my interest in art and science. I was also fortunate to have had parents who did not believe in TV, and I was 13 or 14 when we finally did get one. In the meantime, I was obliged to explore the world with my own imagination. This was a marvelous time in my childhood; I learned to love books and always pored through the *National Geographic* when it appeared in the post box. By the time I was eleven, I had built a model airplane in the back yard with a wing span of 12 feet. It was complete with a rotating propeller, cockpit and an instrument panel. I can't tell you how many Japanese Zeros I shot down in the course of the next few months. This was also the time for an erector set and a chemistry set (in the 1950's, they still had a few interesting chemicals available in the sets). I remem-

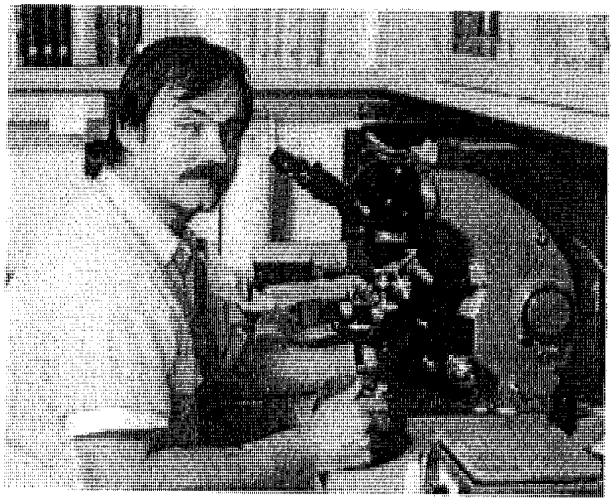


Jim and Laurie (1984)

ber impressing my little friends by handing them a corked test-tube just filled with a mixture of baking soda and vinegar (BOOM). I now thank God that no one was ever hurt.

Mark lived behind us and was my best friend. We used to save our pennies so that we could purchase "Perfect" glassware at the toy shore. Although I still occasionally looked through our 10-inch telescope, Mark's grandmother had given him a microscope and our disparity needed to be resolved. My mother was soon convinced of my deprived state and provided the funds to purchase a wonderful "Perfect" microscope from the familiar toy store. The microscope was added to the table which housed the chemistry equipment, rock collection and other articles of natural history. It was now time to use the microscope. Mark and I found a small Argentine ant and taped it to a glass slide. I believe the objective turret was set at 4X when I first squinted through the eyepiece. The image was quite unexpected, the mandibles of the ant were fiercely snapping away and the head was weaving in a very threatening manner. The image appeared much bigger than I had expected and a sense of terror filled my 10 year old mind. I was unwilling to touch the stage and remove the monstrous and very provoked ant. The microscope was set aside as I realized I preferred my baking soda and vinegar explosions.

I graduated from Rolling Hills High School in 1969 and subsequently spent the next summer exploring Europe, spending most of my time in England. By the fall, after returning home, I entered college. I was attending both Pasadena and Long Beach City Colleges at the same time, and by 1970 it was no longer so clear as to just what sort of career I would pursue. My studies, however, took me in the direction of biology with the ultimate intention of becoming an oceanographer. At the same time, my experience in photography placed me in charge of the campus photo lab. I ended up doing the photography for the yearbook as well as all the basketball games. One summer, Mark's father



Jim in the lab at home (1993)

asked me to manage a restaurant located inside his popular ice arena. The decision to accept this challenge changed everything, and by the end of the summer I was offered the opportunity to purchase the franchise. Rather than go for my master's degree, I decided to go into the restaurant business (I was young). After managing the establishment for the summer, I became aware of the potential rewards associated with running a successful business. Apparently I was offered the franchise because I was the only person to have turned a profit on the property within the past few years. For the next four years, I was an entrepreneur and managed to make a decent living. However, the difficulty of owning and running a business was that I took almost no time off and, in four years, I never went on a vacation. It was a hectic pace and one which I was not willing to keep up forever. Back when I was still in college, I had spent one summer working at the YMCA as a lifeguard. During that time I gained experience as an instructor in first-aid and scuba diving. When I found out that Costa Mesa was looking for a firefighter, I decided to take the test.

With only three positions available, I did not expect to land the job, especially when 2000 individuals turned out to take the test. I was surprised when the fire chief invited me in for an interview. It was eighteen months between the time I took the test and the time I began employment with the department. In the meantime, I had returned to college with the intention of extending my education. In preparation for work as a firefighter, I concentrated my studies in the areas of fire science, EMT, anatomy and physiology. I was hired on October 13, 1975, and entered the fire academy with a great deal of enthusiasm. Any glamour I may have associated with the job of firefighter was soon set straight after acquiring a bit of experience. Fighting fire is a dangerous and taxing proposition requiring a great deal of knowledge and skill. It is not at all as depicted in popular films, and the expec-

tations brought to the job are soon replaced with the realities of extreme fatigue. Contrary to popular beliefs, it is not often just a mater of putting water on the fire. When inside a burning structure, you normally do not even see the fire. Inside a building the heavy black smoke remains confined and often banks down to the floor forcing the firefighter to blindly crawl through an unfamiliar maze dragging a charged hose line behind. The safety equipment weighs over 40 pounds and the hose line can weigh up to 80 pounds a shot. Finding the fire is usually a mater of following the sounds of rapid combustion. Approaching the fire is always accompanied by an increase in the intense heat. At this point it is usually impossible to even see your hand in front of your air mask. If the smoke isn't too thick and you do manage to find the fire, you normally see nothing but an ominous orange glow. By now you are hoping all this heavy smoke (the product of incomplete combustion) does not flash-over and fry both you and your partner. If you open your nozzle for a quick burst directly over your own head and no droplets come back down, you know your in trouble. This means all the water has vaporized into steam making the probability of flash-over eminent. If you attempt to put the fire out by opening up your nozzle directly into the orange glow, you will almost certainly cook yourself and your partner. Applying a large amount of water directly into the fire will produce a large volume of rapidly expanding steam turning the room into a pressure-cooker. By now you are depending on the truck company to have cut a hole in the roof which you hope will ventilate much of the heat. If you've gone too far into the building to escape and your team mates on the roof fail to do their job, you could again find yourself in a very bad situation. At this point, the objective is not to drown the fire but to begin cooling the area above the fire with controlled bursts of water. The water is converted to steam and at the same time absorbs much of the heat manufactured by the fire. It requires a certain amount of BTU's (British Thermal Units), or units of heat to convert water to steam. Care must be taken to ensure the steam is not produce too quickly but at the same time you must begin to suppress the fire before it has the chance to convert you into simple little hydrocarbons. After you've faced down the monster, you then have 3 or 4 hours of grimy clean up and strenuous overhaul. The entire exercise usually provides a great deal of stimulation for the adrenal glands. If you are lucky, you won't have another call for at least a few hours. Now doesn't all this just sound wonderfully glamorous?

Fighting fire is only a small part of our work. One day we responded to a call at a Christmas party and ended up doing CPR on Santa Claus. All the kids were crying and Santa's wife could not be consoled when, even after our best effort, the man could not be saved. I don't think I was able to go back to sleep for the rest of that night. On the other hand, I have had the privilege of bringing a number of new babies into this world. When asked why I do this sort of work, the answer is sometimes difficult to explain. But somehow, being a firefighter becomes part of your identity and, though the job can often be miserable, I always have a very good feeling about who I am.

The most important event in a man's life can be the day he meets the right woman. I clearly remember seeing her for the first time through a crowd of people and after making eye contact, I remember seeing the most wonderful smile. This was all the encouragement I needed. One day before we got married, Laurie stopped by the fire station to deliver one of her freshly baked batches of chocolate cookies. After she left, one of the fellows I worked with told me I was in serious trouble!! It seems that I was stung by Cupid's arrow of destiny. The inevitable wedding took place in May of 1981. Seven cars, seventeen cats, one add-on and dozens of microscopes later we remain happily married.

The one thing that has stayed with me, wherever I have gone, is my interest in photography. Within a year of being hired as a firefighter, I was the department photographer and producing training programs. Now that I had settled into a career I wanted to do more with the camera. I began with macro-photography which led me to the study of insect. Macro-lenses and extension tubes were soon inadequate in my quest to record the very small wonders of nature. I began looking for a microscope and at first was put off when I found out how much they cost. Thom Kurt of McBain Instruments told me about the Microscopical Society and I soon met Henry van Duuren. I was told that I needed a stand with a trinocular head and Henry had just given his to Mr. Hinkle. I purchased Henry's stand from Hinkle which at the time became my first good microscope. It was a Swift instrument and came equipped with the Quad Phase system. After getting aquatinted with the microscope I dedicated the next year to perfecting the art of photomicrography. I joined the Microscopical Society in late 1979 or early 1980 and gave my first slide presentation a year later. As a result of my work in photomicrography I was motivated to form a small business called Educational Photo Lab. This enterprise was dedicated to the illustration of the microscopical world resulting in a healthy number of photomicrographs that have been used in various publications as well as a number of textbooks. Biologically oriented media programs were produced for application in an educational setting. My experience running the Junior Firefighter program helped in conducting science fairs as part of the business. I have presented a number of these media programs, utiliz-

ing music and multiple projectors, before the Microscopical Society.

Some of my other activities include managing the American circuit of the Postal Microscopical Society as well as membership in the International Society for Diatom Research. My work in the study of diatoms has led to a number of publications, as well as the establishment of the Bill Sokol Collection. I am also an active member of the Quekett Club. I do not recall having participated in any Clubs or Societies before coming under the influence of the microscope. After becoming associated with the Microscopical Society I found that one microscope was not sufficient. I'm sure this state of mind is somehow symptomatic of membership in the Society; at least this will remain my excuse for now. I'm sure my wife feels I long ago overdosed on the excessive accumulation of microscopes. Henry's Swift served me well for the first few years but it was eventually replaced with the SRL, the top of the line model by Swift. That was soon replaced with a Leitz Dialux and a Olympus PM-6 which was mounted on the trinocular tube. The Swift was sold to help pay for a new Olympus BHS and soon the Leitz was also gone in order to make room for the Vanox. At some point a Zeiss Universal and Leitz Ortholux fell into the middle of things. Of course I needed plenty of slides to photograph and books to reference the usual investigations. This all seems quite normal. Just like the alcoholic only needs a few drinks, I only needed a few microscopes. At least my addiction doesn't seem to bother my liver, at least not yet. If it were not for my wife holding onto my collar, I would by now, most certainly, have been sucked into the tube of my microscope. Its quite astonishing how many hours I have spent squinting through an eyepiece, when inevitably she would peak into the room and remind me that it was already 2:00 o'clock in the morning. How time flies when you're trying to photograph that newly found specimen of Paramecium bursaria.

For the past few days I have been thinking about the choices I made in my life. I cannot imagine a better time in which to have grown up and I am excited to think what the future might hold. My adventure with the microscope has taken me in different directions and I have not been able to predict what will come next. There are always new areas to explore as the potential for discovery remains unlimited. The history of the microscope continues to be a fascinating source of study. The computer and the microscope are moving closer together with unpredictable consequences. My work with the microscope has brought into my life many wonderful new friends; sharing the fun is what it is all about. I look forward to continuing my association with the Society and participating in its future growth.

Visit with Myron Wright in Alaska - (photo on page 212)

David L. Hirsch

Although it was too early for the Iditarod and too late for fall foliage, I spent five pleasant days in Anchorage, Alaska. I met with corresponding member MYRON WRIGHT and his wife, MARY BETHE. As my host and guide, Myron acquainted me with the beauty and grandeur of Alaska, which is truly Americas' last frontier.

Myron has gained wide reknown as a photographer of nature. His work includes photography using a Kodak "Cirkut" panoramic camera, (Circa 1915). Photos are taken using a 450 mm lens with an 0.125 second exposure at f:64. To produce a panoramic picture which may capture an azimuth of 360 degrees, the film unrolls as the whole camera rotates on the tripod. The film traverses a slit, where it is exposed to light passing through the lens, after which the film is wound on a take-up reel, ready for processing.

All Alaska, in effect, is Myron's studio. His work entails aerial photography, utilizing a camera which he modified from a camera originally designed for use in military aircraft. Myron, incidentally, flew as both a commercial pilot and a bush pilot, and has more than 8000 flying hours to his credit. Myron is an ardent microscopist, whose principal stand is a well equipped Nikon Optiphot polarizing microscope, to which he added four Planopot apochromatic objectives, a camera attachment for 4x5 plates, a 35 mm camera and many other accessories.

His interests include other aspects of optics. Myron showed me a Feuss-Wulfing spectrometer, circa 1911; an instrument accurate to 2 angstroms. He modified the spectrometer to include an illuminator and a filar micrometer/eyepiece. Near completion is an optical bench which he designed and built. He is seeking parts, including a right angle telescope attachment which one of our members may be able to supply. We will be reading more about Myron in future issues of the Journal.

He welcomes correspondance from all MSSC members. Write to: Myron Wright 13720 Karen Street Anchorage, Alaska 99515 (907)345-6014

GOODS GEAR AND GADGETS

Richard M. Jefts

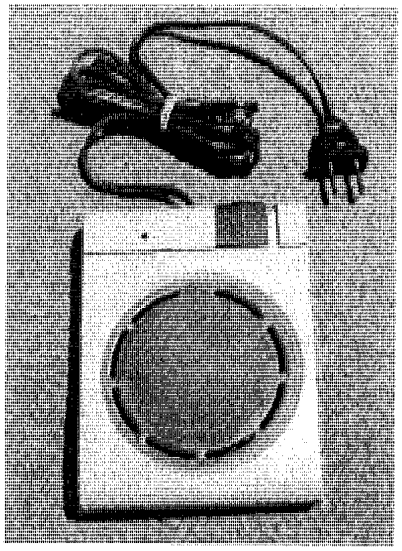


Fig. 1 Electric beverage warmer

Fig. 2 Added heat resistant device to regulate temperature

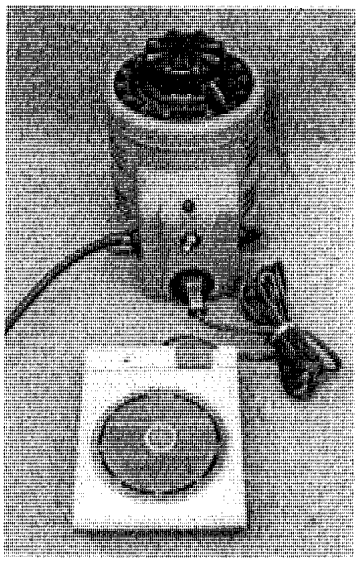


Fig. 3 Variac to regulate temperature

Except for the occasional use of an alcohol lamp, there are, purposely, no open flames in my work place - no Tirrill, Meker or Bunsen burners. Hot plates, then, are the safer units of choice for warming and boiling. Relegating the more powerful and versatile commercial models for the heavier heating tasks, a handy gadget, in use for some years now, is a simple electric coffee, tea or general beverage warmer. Shown in Fig.1, the 4" x 5" warmer was purchased for a couple of dollars at a local swap meet. It will heat up and hold any moderate volume of water at 160 degrees F., or about 71 degrees C. This, by chance, is a practical degree of gentle heat for making up many chemical solutions, and biological reagents, stains and dyes. However, its greatest use, I have found, is as a simple yet efficient microscope slide warmer. If the unit, as such, has any drawbacks, it is that it is limited to a straight on- and-off switch, and so there is no control over the degree or intensity of the heating. Fig.2 shows one way to help solve the problem. Any heat resistant device that can form a platform of some arbitrary height above the base, will moderate the temperatures nicely. Here, with two slides warming in place, is one such platform that works well - an inverted Pyrex No.3140 crystallizing dish. Fig.3, with a single slide in the heating area, shows how we can add markedly to the systems efficiency by plugging a variac, or variable resistance transformer in-line with the warming plate itself, now allowing closely controlled heating with a twist of the dial. To this, we can add the old trick, used on some commercial units and all homemade slide warming devices - a simple means of off-setting a series of slides to so create areas with varying degrees of warmth: directly over the center of the heater for the warmest, and out towards the end of the strip for the coolest. Here, in Fig.4, a 3" x 10" x 1/8th. inch strip of brass, it being an excellent conductor of heat, serves as the off-set shelf or platform, and is shown with eight slides in place, being subjected to varying degrees of warmth. The whole unit takes up little space on the work bench or when stored in a cabinet or drawer, is a bargain if found second hand and still relatively inexpensive if purchased new. And if you should end up with two of them, so much the better, for then you can, while drying those ringed slides or balsam mounts, help stay warm yourself, on those colder winter evenings while hunched over the microscope, with your spare warmer and a pot of coffee, tea or hot chocolate.

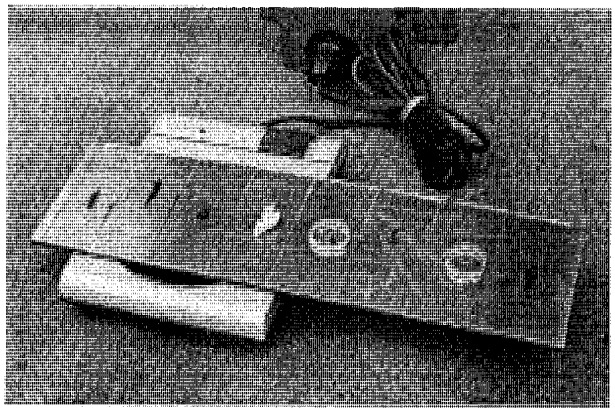


Fig. 4 Brass strip to provide variable temperatures.

MICROSCOPICAL SERENDIPITY
Water Drop Microscopes

David L. Hirsch

In the Persian fairy tale;"The Three Princes of Serendip" (1754), the Royal trio "have the faculty of finding valuable or agreeable things not sought for." How does this relate to microscopes? Say that magic word, and an intriguing mix of lenses, tubes, stages, mirrors and bases begin to titillate our imagination and inspire us to further pursue the subject.

There is nothing wrong with being titillated from time to time, but we should not overlook other devices which, like microscopes, serve to magnify objects. We are aware of magnifiers using single or multiple lenses, and these can be discussed at another time. For now, let's review some unique magnifying devices and while we're at it, let serendipity be our guide and see what we come up with.

A pinhole magnifier may be thought of as a 'lensless' magnifier, akin to the pinhole cameras we made back in High School. The 'magnification' occurs when the observer looks through the pin hole in a card at a closely held object. Explanation is based on the understanding of the visual angle. We know that the apparent size of any object varies in accordance with its distance from the viewer. Picture an approaching object which seems to grow as it moves toward us. The 'growth' is due to the fact that the angle which is subtended by light rays from an object at theoretical center or "nodal point" of the eye increases as the object is brought closer to the eye.

Referring to Fig.1, the visual angle (alpha) subtended by an object of length (L) is placed as shown diagramatically in this figure. The image of the object appears on the "screen" representing the retina of the eye. If the least distance can be further reduced, as from (d2) to (d1), the visual angle will increase, resulting in an increase in size of the image on the retina.

The eye cannot focus properly at very close distances because of limitations in the ability of the iris to contract, and of the focal length of the lens to decrease beyond a minimal value. The small diameter of the pinhole in the magnifier acts as a secondary iris. This external 'stopping down' of the pinhole enables the object to be brought closer to the eye, further increasing the visual angle, resulting in what is perceived as a larger image, to appear on the retina. The trade-off is decreased brightness of the image, requiring greater illumination.

To make a pinhole magnifier, draw, and fill in a spot about .50" Dia. with a black marking pen on one side

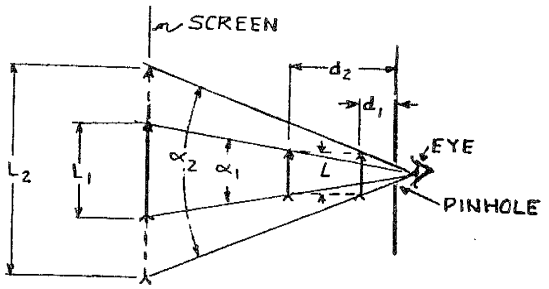


Fig. 1 Visual angle.

of a business size card. See Fig.2. Prick a small hole with a fine needle in the center of the circle. Hold the card close to your eye with the black spot toward you, and look at a brightly lighted object, such as newsprint held close to the pinhole on the opposite side of the card. The object will appear to increase in size as it is brought closer to the pinhole in the card.

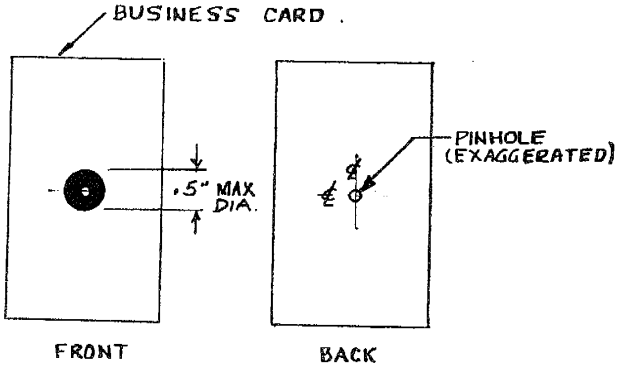


Fig. 2 Construction of pinhole magnifier.

The world's first microscopist was probably a heavy jowled gent who walked on his knuckles and resided in Neanderthal, a valley in Western Germany. We may fancy him looking at a bug through a drop of water formed from dew condensed on a spider web. "Eureka!"he grunts, I have just invented the world's first water-drop microscope!" Being an animal imbued with curiosity, he marvels at HOW things happen. In time, Man begins to ask:"Why?"As for instance, WHY does a lens make objects appear larger than they are? Rather than emulating the Neanderthal Man in seeking answers, let's start with something more 'civilized'.

Beeler & Branley, in their book: *Experiments With a Microscope*, make a magnifier as shown in Fig. 3a. Place a drop of water on a clean glass slide to form a plano-convex lens. Level the slide on two supports such as spools to keep the drop from being shaken out of position. Bring the eye close to the water drop and

look through the drop at specimens such as diatoms.

By now, you should be convinced that water is good for something other than drinking or for taking showers, so let's carry it a step farther and use water to

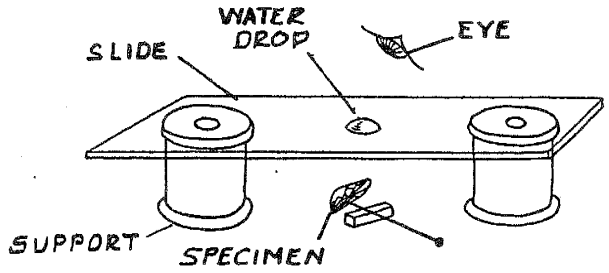


Fig. 3a Simple water drop microscope

produce a double convex lens. The simplest approach is to form a closed loop of thin wire around a small nail. The loop should be completely closed and rounded. Use an eye dropper to fill the loop with water to form a double convex lens. Hold the lens close to the eye and look at an object such as a prepared slide. The specimen will be magnified several diameters. A well made lens may magnify up to 100 times!

The next 'breakthrough" is the set-up shown in Fig.3b. The lens holder is a strip of metal 1"wide and 4" long obtained from a beer can (any brand). Drill a small

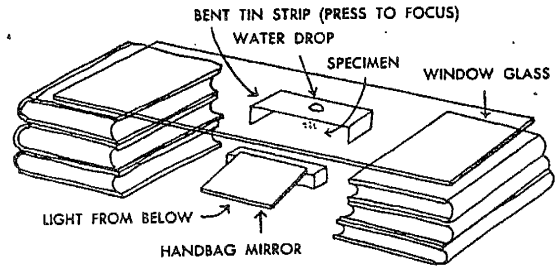


Fig. 3b Simple water drop microscope with substage illumination mirror.

hole, about .093" Dia. through the center of the strip and remove any burs from the hole. Bend both ends of the strip .25 " and complete the setup as shown in the figure. A thin film of petroleum jelly around the lens opening will act as a water repellent to assure a rounded water drop. Fill the hole with water from an eye dropper to form a drop which extends the same distance above and below the hole. Note that with the force of gravity and surface tension in conflict with each other, the upper and lower contours of the water drop will tend to become assymetrical as the size of the drop increases. As we attempt to increase the size of the drop by adding yet more water, the force of gravity wins over surface tension and the drop falls away. To operate this 'microscope', adjust the mirror below the stage to illuminate the specimen. Press gently on the metal strip to bring the object into focus.

Light is refracted when it passes through the lens at an angle. When glass, for example, is formed into the double convex lens of a magnifier, transmitted light will be concentrated at a single point, called the focus. If you place your eye at the focal point, objects seen through the glass appear larger than they actually are as shown in Fig.4.

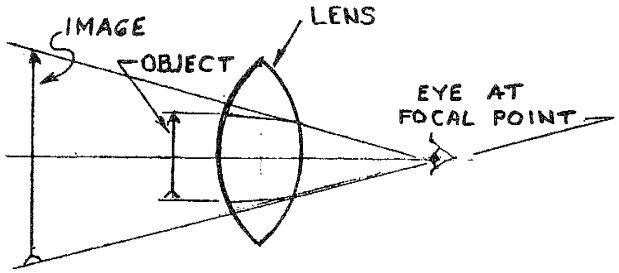


Fig. 4 The double convex lens.

A water drop, by its' very nature, has a short focal length. The water-drop lens diameter is limited because, as noted earlier, the fluid lens is held together by surface tension and acted upon by the force of gravity, mandating vertical orientation of the optical axis. Surface tension is the 'raison d' etre' for the water drop microscope. It is defined as: "a condition that exists at the free surface of a body (as a liquid) by reason of intermolecular forces about the individual surface molecules. Surface tension is manifested by properties resembling those of an elastic skin under tension". This condition is more pronounced when the water-drop is surrounded by a medium (air) which is of a markedly lower density.

Concerning the liquid lens, there are avenues of investigation which may be worth pursuing, such as: 1. Transparent fluids with refractive indices and surface tensions other than that of water, such as glycerine and sodium silicate (water glass) 2. Fluids tinted blue, or with other colors to act as combined lenses and filters. This lens portion is a rounded, tapered hole in which the water drop is retained. (See Fig.5) Drill a hole of about .070" dia. in a .031" thick metal sheet such as brass. Holes larger or smaller than .070" dia. may also be evaluated. With a countersink bit, form a 60 degree cavity flaring outward at the bottom of the hole to aid in producing drops with convex surfaces. Remove burs which may have formed on both sides of the hole. Remove all dirt and greasy substances from the top and bottom areas around and in the hole after fabrication. Coat the area surrounding the hole with a thin film of water repellent, such as petroleum jelly. The film prevents 'wetting' of the surface area around the hole, assuring the sphericity of the water drop. Wipe off residue with tissue.

With the large diameter of the tapered hole facing downward, place a drop of water in the hole. Due to surface tension, the water drop will tend to assume curved surfaces at the top and bottom of the cavity, to

form a lens of short focal length in the approximate range of .125" to .250". Depending on the size and shape of the water drop, magnification will vary. Getting the water drop of the right size and shape may be a bit tricky, so be patient and steady of hand. A small plastic dropping bottle such as those used for dispensing eye drops proved ideal for creating water drops of optimum size. When the water drop is in place, lightly tapping the end of the assembly will aid in centering and settling the water lens.

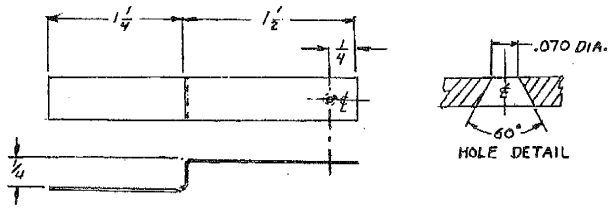


Fig. 5 Construction of a 'focussing' water drop microscope.

Carrying the water-drop microscope concept a step farther, we use Leeuwenhoek derived logic to emulate his timeless masterpiece. We fashion our version of a water-drop microscope from a length of brass strip, .375" wide x .031" thick x 6" long. A couple of bends gets the device looking like the illustration in Fig.6 The dimensions shown are tentative and may be changed along with the configuration as the prototype is finalized. For the 'lens', we selected an opening 0.070" diameter, tapered and oriented as as shown in detail in Fig. 5. Adjusting screw (A) acts as 'fine' focus, moving the water drop 'lens' in a vertical direction. The specimen holder, or stage (B), is actuated by course adjustment (C) to move vertically, serving to set the initial distance between the stage and the water-drop lens, and to rotate the specimen. A small diameter hole in the middle of the stage retains a pin (see detail) for holding small objects such as insects. The bend-back of the stage screw holder and the inclusion of a helical spring (D) to take up slack on the stage mount, complete the instrument. An auxiliary stage attachment along with self-sticking black and white stage covers are also provided.

A yoke-mounted, 0.780" Dia. plane mirror (E), with adjustability affording six degrees of freedom, enables incident illumination of the specimen. The mirror mount partially disassembles for storage. A microscope lamp or ordinary daylight suffice for illumination. Going ergonomic, we do Tony Leeuwenhoek one better by attaching the microscope to an all-brass stand (F), which allows the instrument to be either hand-held or to sit on a table. The base is a solid slug, 1.63" Dia. x 0.88" high, fitted to an 0.38" Dia.x 5.5" long post. The mirror system mounts on the post. The top of the post is attached to the instrument with a #8-32NF slotted and knurled head machine screw. A

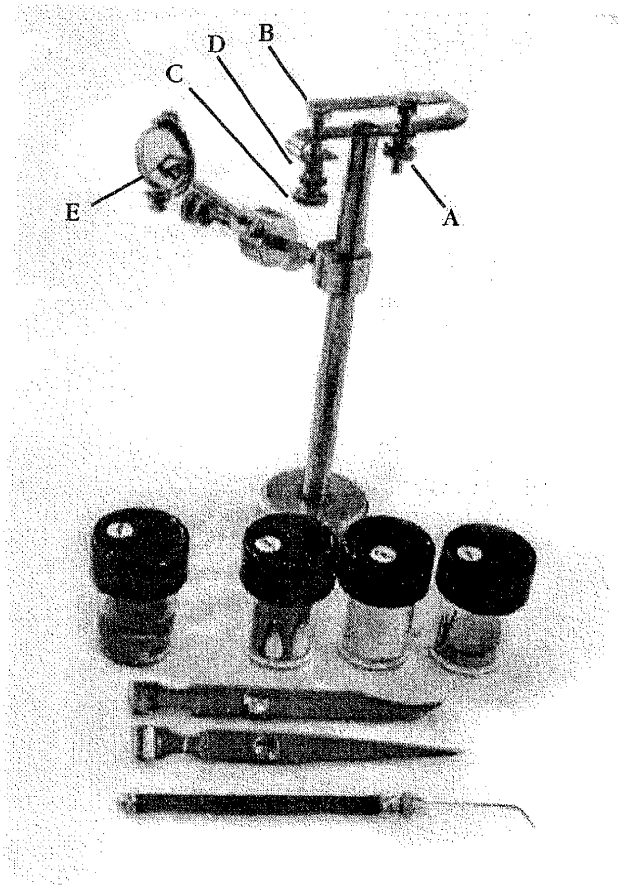


Fig. 6 Construction of the Hirsch Leeuwenhoek-inspired water drop microscope.

circle of felt secured to the bottom of the base prevents marring Mom's table.

As a finishing touch, we built a case from .25" thick mahogany (I cheated and possibly broke the law by using a discarded box from Cuban cigars). The fitted case (Fig. 7) includes accessories such as straight and curved forceps, 4 screw-top containers which hold respectively: water, slightly tinted with methylene blue for making "lenses", cotton swabs for 'removing' lenses, stage covers, stage pins and specimens, a probe with a bent tip and a small plastic dropping bottle (not shown).

For the Ultimate Water-drop Microscope (UWDM), an extensive search through my 'vast' reference library revealed a device which may be the ultimate example of Yankee Ingenuity. In the 1934 edition of Raymond F. Yates' *Exploring With the Microscope*, he describes a "water-drop microscope made from ordinary household materials". Mr Yates claimed that: "— even the rankest sort of tinker, one with hands that are all thumbs, can assemble the device in an evening's time". Being a CGNP, (Certified Grumpy Nit Picker), I did a time study of the device and determined that at least 20 'tinker' hours would be required to complete this example of do-it-yourself overkill.

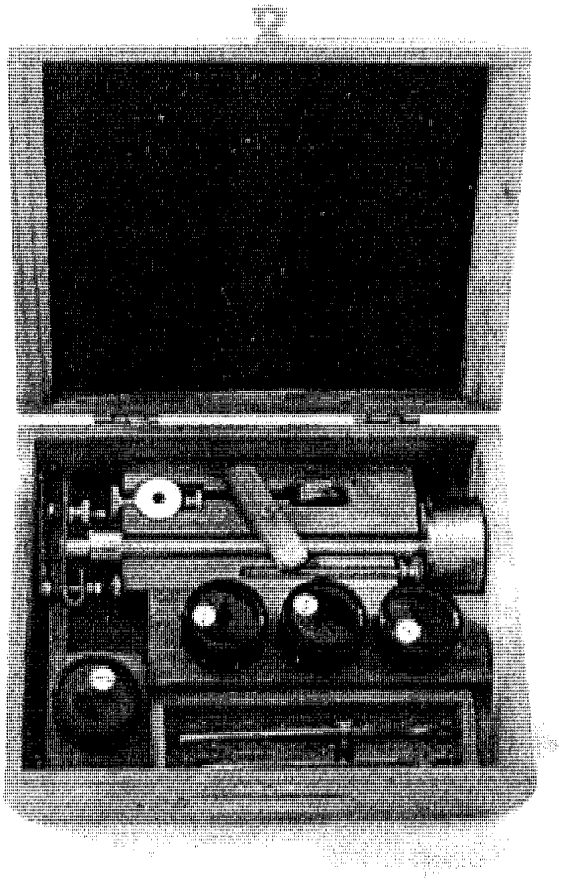


Fig. 7 Hirsch cased microscope and accessories

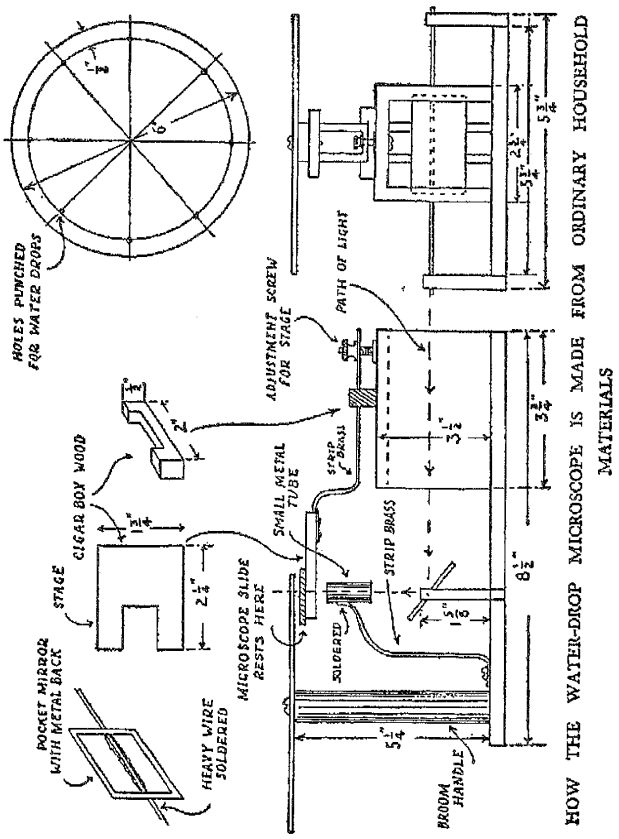


Fig. 8 Yates water drop microscope

For those of you who would accept the challenge, Fig. 8 shows how the UWDM is built. Fig.9. shows the device in use. As with the Leeuwenhoek instrument, the user must have his eye up close to the lens. Obviously, the lad with the Fantastic Sam haircut isn't seeing much, other than the top of the disc. We have shown that substances other than glass may provide the refracting medium essential to the function of the light microscope, but don't expect to find water-drop microscopes on the market. The way is open for those who are scientifically curious , to develop their own versions of this fluid lens device.

Fig. 9 Using the Yates water drop microscope

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Minutes for the MSSC Meeting of 28 October 1997

David L. Hirsch

STANDING APPLAUSE. The large number of attendees at tonight's meeting were amply rewarded by the fine presentation by BRIAN J. FORD. He discussed the microscopes made by Leeuwenhoek and the works of this pioneer in microscopy. Leeuwenhoek fans may learn more about this man in the book: *Beads of Glass: Leeuwenhoek and the early Microscope*, available from the bookshop in the Science museum, London.

Brian is the author of many scientific books among which is: *The Single Lens*. This book is a classic on that topic, and graces the libraries of many MSSC members. VP GAYLORD MOSS video-taped and Pres. George Vitt photographed the momentous occasion for the MSSC archives.

HI, FELLOWS! We noted that Mr. Ford is a Fellow in the Linnean Society and the Royal Microscopical Society. We are proud to announce that he will soon have an American colleague; MSSC member RON MORRIS who was recently nominated as a Fellow in the Royal Microscopical Society. Ron described the nominating process and the requirements set forth by the RMS for those so honored. Way to go, Ron!

THE SALES TABLE. Some interesting offerings graced our sales table. GARY LEGEL brought in a Japanese made microscope kit and a Bausch & Lomb binocular microscope of recent vintage. JIM SOLLIDAY offered an unsigned French "household" microscope in a mahogany case, a Bausch & Lomb monocular stand with sliding tube and a vertical fine adjustment on the post. Jim also offered a cardboard slide box with 12 individual slide trays.

THE EVENT YOU'VE BEEN WAITING FOR! In conjunction with the "Single Lens" topic of the evening, we saw an excellent array of the many varieties of single lens microscopes. This display was in keeping with a long established tradition among Society members to bring in microscopes relating to the speakers' topic.

JIM SOLLIDAY showed a massive aquatic microscope, circa 1864, made by Smith & Beck, and designed by Charles Darwin. The instrument mounts on a mahogany base and stores in a well equipped case. Jim also showed a Withering botanical microscope, circa 1796. The lens mounts in an ivory ring and the microscope fits neatly in a pocket size wood case.

BARRY SOBEL displayed an Ellis aquatic microscope of a type used by Karl von Linne (Linnaeas), a Swedish naturalist who proposed (1735) a classification of plants and who established the system of binomial nomenclature, in which each species receives two names, that of the genus to which it belongs and that of the species itself. The microscope, circa 1765 is unsigned. Accessories in the mahogany case which also serves as a base, includes 2 lieberkuhns, a stage forceps and a substage concave mirror. Barry also displayed a later type of aquatic microscope (early 19th century), signed by Cary. The stand has rack and pinion focus and a similar mechanism (later called an aquatic movement), which effects horizontal translation of the lens holder. This microscope, which is similar to the latter stand, mounts on top of its' mahogany case. It is equipped with a concave substage mirror, and a rectangular stage with clips. Accessories include 4 lenses, 2 lieberkuhns, and a glass stage plate.

STUART WARTER presented his collection of single lens instruments, uniquely arranged under a glass dome of the kind which once displayed dried flowers in Victorian parlors. The instruments included: a W&S Jones compass microscope, circa 1800. It has an ivory handle and comes in a red leather case containing a lieberkuhn and a lens of high power.

A W&S Jones botanical microscope, circa 1820 which mounted on top of its red leather case containing 2 single lenses, stage forceps, and a bone slide: a mid-19th century screw barrel microscope mounted on a bell shaped base with a hole in the bottom. The instrument has some historical significance, having been used reputedly by a physician in the Western gold camps.

A Bausch & Lomb "American Agriculturist" microscope, circa 1887, having 3 lenses and a stop, all of which are mounted to swivel on a post. The stand is made of nickel plated brass. A plane mirror, horizontally adjustable, fits within the base. The microscope was used to examine seeds. In contrast to the impressive display of single lens microscopes was the photo album presented by your favorite Treasurer. The album contained photos taken at a previous workshop and the many snapshots taken on my recent Alaskan safari, including photos of Myron Wrights' workshops and optical equipment.

DOWN TO BUSINESS. As of this writing, MSSC has a total of 71 paid-up members. 17 members, both regular and corresponding, listed on the 1996-1997 roster have not yet sent in their dues. It is now past the deadline for payment of dues and regrettably the names of members-in-arrears will be dropped from both the roster and the MSSC Journal mailing list.

A REMINDER. Several MSC members have joined our ranks since the beginning of our fiscal year. Some of those members may have attended the regular meeting where the main speaker was Klaus Kemp from England. Klaus is the gentleman who gave a brilliant lecture and demonstration on slide preparation involving the arrangement and mounting of diatoms and butterfly wing scales. He offers such masterpieces for sale and several MSSC members have already purchased his slides. Klaus' slides make notable additions to collections. For a list of available slides and prices, contact John Field at: (408)246-1383.

THAT TIME, AGAIN! Most of us MSSC members have long since digested the sumptuous comestibles served at last years' Christmas party. The time is nigh for our coming Yuletide feast. See the date and location on the back page, and remember, our coming festivities are open to ALL MSSC members and guests. By the way, many attendees at last year's party considered it to be among the best affairs held since we first met as a Society.

November Meeting

The Photography of Stan Baird

A Retrospective

Micro and Macro, 2-D and 3-D
by Steve Craig

Wednesday, November 19 at 7 PM
Crossroads School
1714 21st Street
Santa Monica, CA

Stan Baird was an active member of this Society for many years. Upon his death in December of 1996, see MSSC Journal of January 1997for details of Stan's life and accomplishments, Steve Craig inherited many of Stan's remarkable photographic slides. These include some exceptional 3-D photography which Steve will show as part of his retrospective of Baird's photos of an immense variety of subjects which range from microscopic views of diatoms, insects and minerals to macroscopic views of flowers and seashells to steam engines, landscapes and aerial scenes.

Polaroid spectacles will be provided to view the spectacular 3-D images. Stan used his aerospace background to design and build superb specialized photographic equipment, especially for 3-D. Steve will show and describe some of these units that Stan sold commercially with his company Baird Photo Systems..

This will be a beautiful presentation with the added technical interest of the best in stereo photography.

The artistic talent of Stan Baird, which shows in all his photographs, is revealed in the following notes from the brochure of the Baird exhibit at the California State University Northridge in November of 1975.

H. Stanley Baird, Macrophotographer

The eye of an artist and the lens of a camera are combined by H. Stanley Baird to create masterpieces of vivid beauty. The colors and designs created by nature fascinate Baird, whose subjects range from fossil specimens to chemical slides. He is intrigued by the extent of detail the camera sees that the human eve cannot perceive.

Born in Michigan in 1913, Baird moved to California as a small child. The natural beauty of the land inspired him to take up the hobby of photography, although he is an aircraft and aerospace engineer by vocation. He and his wife Antoinette and two children Richard and Randi have lived in the west San Fernando Valley for the past twenty eight years.

Baird uses the techniques of microphotography, which is the taking of larger-than-life photographs with ordinary camera lenses, and photomicrography, which is the taking of photographs through a microscope lens. The full glory of the colors is captured through the use of a new process called the Cibachrome 'A' positive color printing process, which produces rich, brilliant color in a glossy finish similar to black plexiglass. The picture then seems to pop out almost three dimensionally.

In 1959 Baird became interested in the fields of mineralogy and paleontology. In order to bring out the minute detail of small mineral and fossil specimens, Baird photographed them through the lens of a microscope. He was impressed by the vibrant colors and unbelievable beauty of the tiny specimens. He compiled a series of stereo slides which he and a mineralogist from Australia used to illustrate lectures given to mineralogy classes and clubs throughout Southern California.

Several years ago while visiting botanical gardens Baird became interested in using these same photographic techniques to capture the intricate detail of flowers This led to a series of Photoflorals of breathtaking beauty.

Most recently Baird has turned his artistic eye and his camera on the chemical world. While photographing chemical slides for a friend, who is a chemical engineer, he was struck by the colors of the chemicals A series of Lens Paintings created by photographing combinations of chemicals was the result of this new interest.

Baird's work is a stunning example of the use of photography as a means of artistic expression It is also a celebration of the infinite wonders of the universe and a reminder that we are surrounded by beauty, if only we take the time to look

MSSC Christmas Party

Date: Saturday December 20, 1997
Time: 3:00 PM Dinner served at 5:00
Place: Ernie and Margie Meadows
707 Greentree Road
Pacific Palisades, CA 90272

Ernie Meadows and his wife Margie 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. 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 early so that Beverly will be able to plan her provisions.

Editor's Notes

I apologize that my bookeeping is not what it should be. Some members who have joined after the first of July may not have received all issues of the Journal since July. If this is your case, please let me know so that I can complete your second half of 97 Journal collection.

There is a proposal afoot to change our yearly membership to a calender year instead of the past system of having dues paid on the first of July. This would make a yearly membership correspond to the year's Journal. This seems preferable in that a year's membership would then include the full year's Journal which is numbered and indexed by the year. Ed.