Journal of
THE MICROSCOPICAL SOCIETY OF SOUTHERN CALIFORNIA
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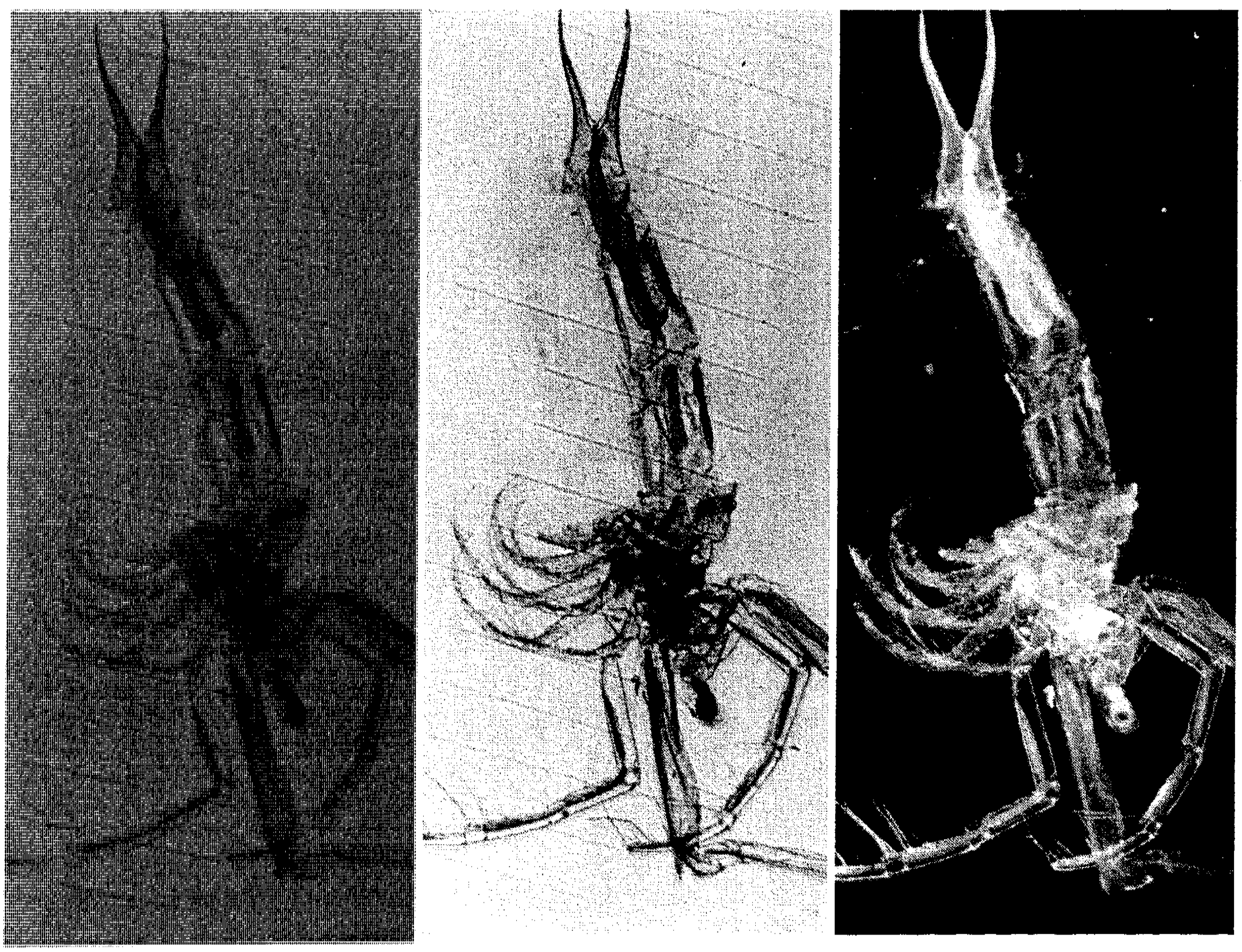
Lighting for the Stereo

Bert Loro



It is generally considered that the best brightfield microscopic images are obtained when the object is illuminated by a cone of light centred on the axis and filling about 60-90% of the aperture of the objective. These images are created by local reduction of the background intensity by the object, which absorbs, scatters or changes the phase of a portion of the light falling on it. On the other hand, a strikingly different but equally valid image is obtained if the object is illuminated by light from entirely outside the acceptance angle of the objective. In this case, the image is formed only by light scattered into the objective to give a brightly illuminated object on a dark field.

The contrast scales of these two image types are in direct opposition, much like the contrast scales in a photographic negative and positive. For the same object, the image brightness ranges downwards from a bright background and upwards from a dark background in the two cases. Either one alone can give useful images of excellent contrast, but if they are present together they compensate each other and drastic reduction of contrast results. This is what happens if an objective of moderate aperture is used with a wide open condenser of large aperture, or with a large area diffusing light source.

This problem has been recognised and understood for at least 150 years. Indeed, many low powered microscopes from the 19th century were fitted with a substage disc of stops to intercept light from too wide an angle. Is it not remarkable then that the majority of modern stereobinocular microscopes are supplied with a diffusing disc of ground or opal glass filling a large stage aperture, as the only provision for transmitted illumination? One would be hard put to devise a worse system.

I will resist the urge to philosophise as to the reason for this sorry state of affairs and will get on with the real purpose of this article which is to describe a single source illuminator for the stereobinocular microscope giving correct illumination for high quality brightfield images and which can be switched to give brilliant darkfield images at the flip of a lever.

BASIC OPTICAL SYSTEMS

The problem with providing correct brightfield illumination for a stereobinocular microscope is that it is really two microscopes with their axes converging on to the same object. It is therefore necessary to provide proper illumination aligned with each of these axes. This is not quite as difficult as it may sound (Loro, 1996)[1].

In this design, two apertures in a metal plate covered by a ground glass diffuser are illuminated by the single

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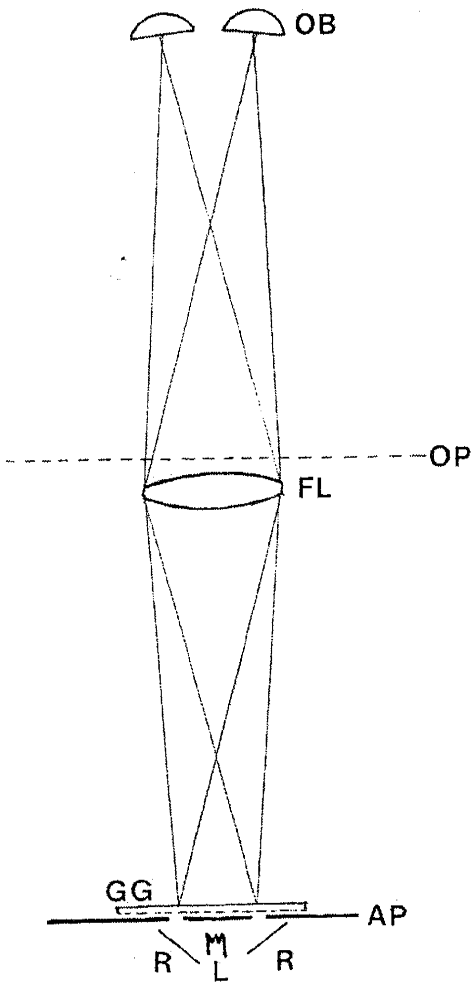


Fig. 1 Schematic of brightfield optical system. L halogen lamp. RR reflectors, AP aperture plate, GG ground glass, FL field lens, OP object plane, OB objectives.

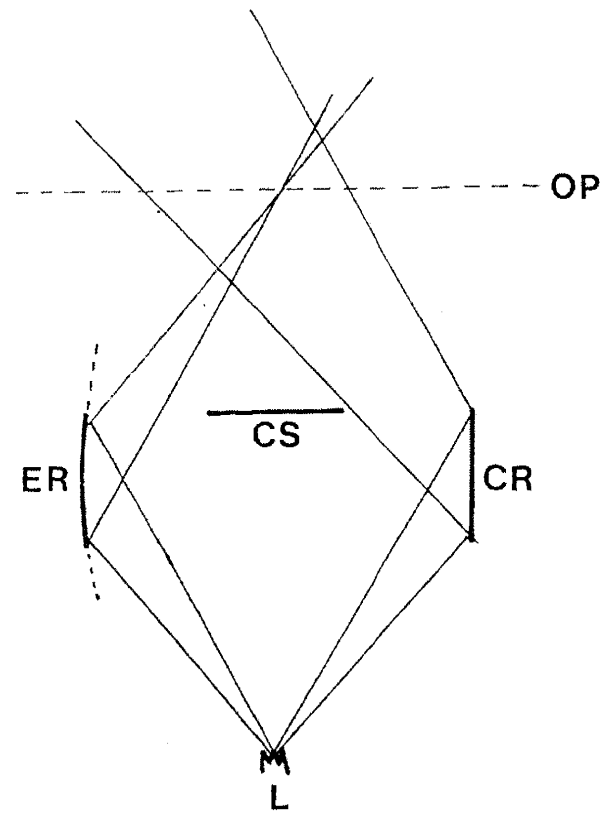


Fig. 2 Schematic of darkfield optical system. L halogen lamp. ER elliptical reflector with idealised ray trace, CR alternative cylindrical reflector with idealised ray trace, CS central stop, OP object plane.

source, aided by a reflector, to act as secondary sources. A field lens located below the object produces aerial images of these apertures close to, and centred in their respective objectives, Fig.1- The size of these images serve the usual function of a substage condenser iris in defining the extent of the objective apertures illuminated, while the size of the field lens acts like the lamp iris in a Kohler system in defining the illuminated area of the object plane. The normal requirements of microscopical illumination are thus fulfilled for both axes.

The darkfield illuminator consists simply of a ring reflector having an elliptical inner surface. The source and object are located at the two foci of the ellipse which are also conjugate optical foci. Hence light from the source is focussed back onto the object. A central stop, to shield the objectives from direct light, completes the optical system, Fig.2.

In order to switch between lighting modes it is necessary to move three components into or out of the optical path as required, whilst the other components can remain fixed. Therefore the field lens and aperture plate and the central stop are mounted on paddles attached to a shaft which is rotatable between limit stops, Figs.3 & 4.

CONSTRUCTION

A major consideration in designing a modification of this type is to keep the lighting system within the vertical space available for it. The focal length and diameter of the field lens are critical parameters in this respect. I was fortunate in working with a pillar mounted microscope on a DIY base (Fig. 5) which considerably simplified the matter but I was still concerned with minimising the height. Every solution is likely to be different so it is pointless to dwell too much on the details of one particular design, but the fabrication methods and test technique which I found helpful may also help others who might contemplate such a project.

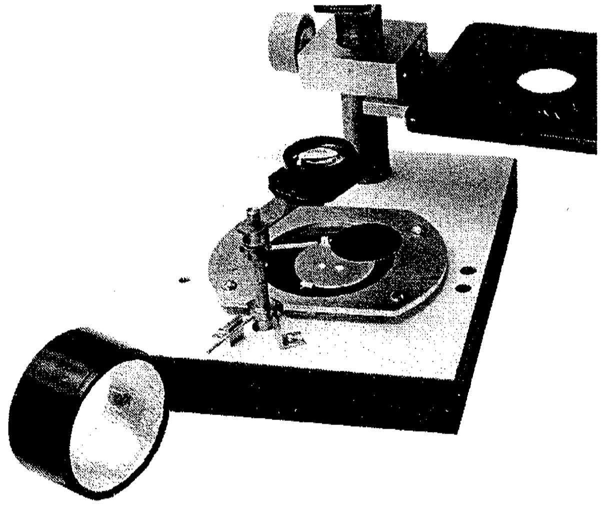


Fig. 3 Illuminator with stage displaced and elliptical reflector removed to show aperture plate and field lens aligned on axis for brightfield opearation. Note setting lever to left.

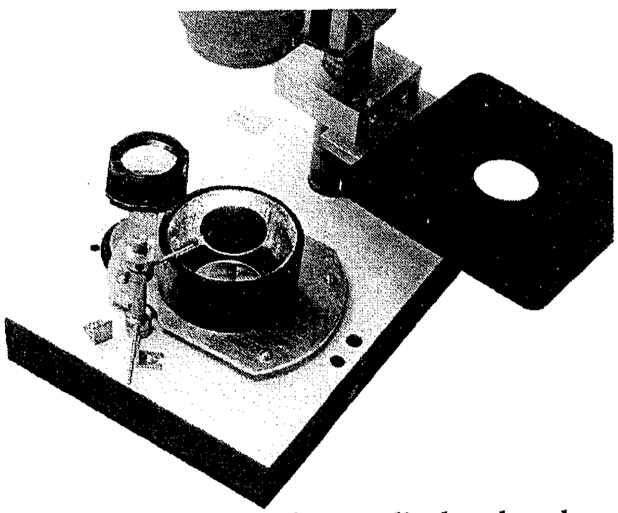


Fig. 4 Illuminator with stage displaced to show central stop on axis for darkfield operation. Setting lever to right.

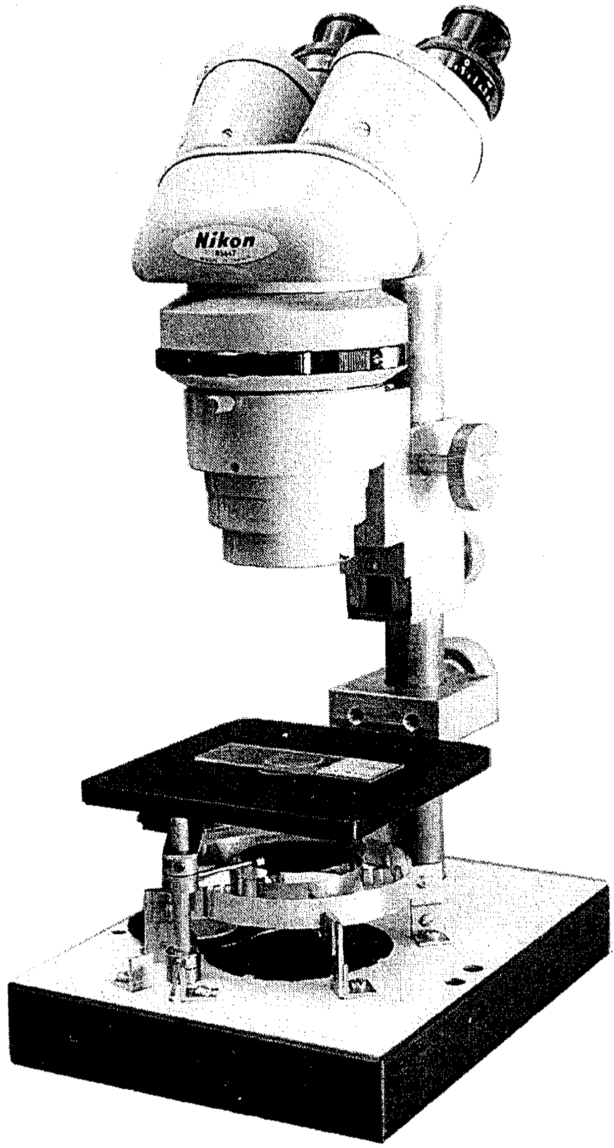


Fig. 5 The Nikon stereozoom microscope on its DIY stand. Below stage is a concentric double cylindrical reflector, one of several reflectors tested during development.

A search of my extensive junk boxes failed a suitable field lens so I purchased a two lens pocket magnifier ($6.50Cdn).The two biconvex lenses mounted close together produced a doublet of 37mm focal length, 27mm clear aperture and about 1 cm thick. Once this lens was settled upon, the plane of the aperture plate was located at the conjugate focus of the objective entrance pupils.The size and positions of the apertures were found and marked for drilling by viewing at the back focus of the objectives with the eyepieces removed.As a space conservation measure, the small 20W halogen bulb was mounted at the centre of a 2 1/2" hole sawn through the 1 1/4" base material.A polished Al strip reflector was mounted behind it and bent to illuminate the apertures.

The lamp filament to object distance came out to 88mm and it was then a simple matter to design the darkfield illuminator to fit. For the elliptical reflector I purchased a connector for 2" PVC plumbing tube.This had a thick wall and an ID of about 60mm. I therefore needed to turn the inner surface to a central minor axis band of an ellipse with 88mm between foci and a minor axis of a little over 60mm.

A gauging tool for this surface was cut from a scrap of thin sheet brass after generating the necessary curve by the well known 'string and pins' method (see for example World Book Encyclopedia under 'ellipse').The connector was turned to give a light tight fit to the gauge using a hand held tool ground from an old file.

A sleeve of heavy duty kitchen Al foil pressed into intimate contact with the turned surface and joined by a thin strip of transparent adhesive tape completed the reflector. The slightly wrinkled surface of the foil spreads the focus to give very uniform illumination over the whole field rather than the small filament image that would be given by a perfect optical surface.

For the benefit of those who might find making an elliptical reflector somewhat daunting I would mention that I tried straight cylindrical reflectors and they work almost as well, Burrells, 1961.2. They are' easy to make either by bending and riveting thin Al sheet (roof flashing) or even cutting from an Al soft drink or beer can and polishing the inner surface. However the elliptical reflector gives a brighter image since it focuses in the vertical as well as the radial plane, Fig.2.

A useful test method, which can identify defects in the surface or maladjustment of the reflector, is to place an opaque card with a large pinhole on stage as the object. The pinhole acts like a pinhole camera and projects an image of those parts of the reflector delivering light to it.This image is viewed by holding a piece of ground glass or tracing paper above the pinhole, when dead spots are readily identified. The whole of the object area can be explored by scanning across it with the pinhole.

RESULTS

The images given by the brightfield system contain no surprises.They are exactly what you would expect from any microscope with a correctly adjusted condenser. It should be mentioned that the apertures were sized to give about a 70% cone at the top end of the zoom range. Theoretically they should have been reduced in diameter as the microscope was zoomed to lower powers (and lower NA) but this would have added considerable mechanical complexity. In practical tests it was found that the advantages of reducing the apertures was barely noticeable and certainly not worth the hassle.

The darkfield system did hold some surprises. I had for some time enjoyed the use of a 150W fibre optic darkfield illuminator ('Lumina' by Chiu Technical Corp.) which gave beautiful brilliant images. Much to my surprise, the first time I tried my system it seemed to be equally brilliant. I am always suspicious of subjective impressions so I made a crude comparative measurement. With my system running at its full 12V I took a reading with a CdS photocell mounted above the exit pupil. Then I placed the Chiu illuminator on the stage of the same microscope with the same object and adjusted the (uncalibrated) power supply to give the same reading. Several repeats confirmed that it occurred at about 3/4 of full scale, which was about the setting I was normally in the habit of using. Not strictly scientific but quite a satisfying result for a 20W bulb and a strip of kitchen foil!

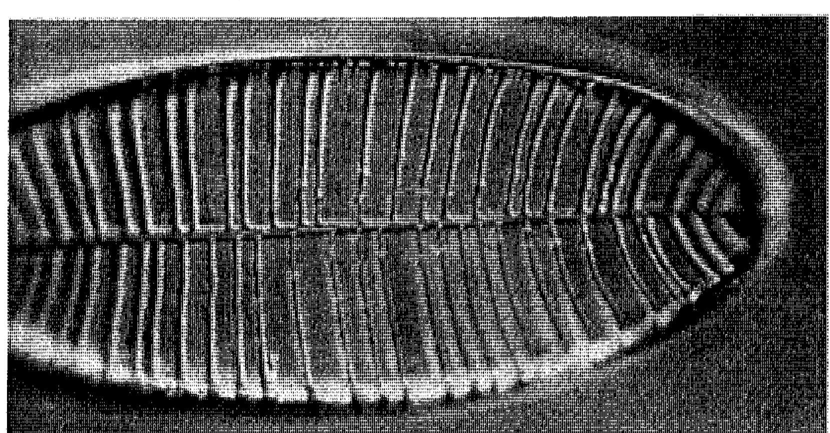
REFERENCES

1. Loro, A. (1996). Transmitted light and the stereobinocular microscope. Quekett J. Microscopy,37,pt7,575-579.

2. Burrells, W. (1961). Microscope Technique,359. Halsted Press, New York.

Correction to the October MSSC Journal

In the lead article by Ron Morris, "Using the Diatom Test Plate..." , there is a printing error in that Fig. 14 and 15 show the same image of a Navicula diatom. Fig. 15 and the caption are correct. However, the correct Fig. 14 is the Surirella image shown at right.



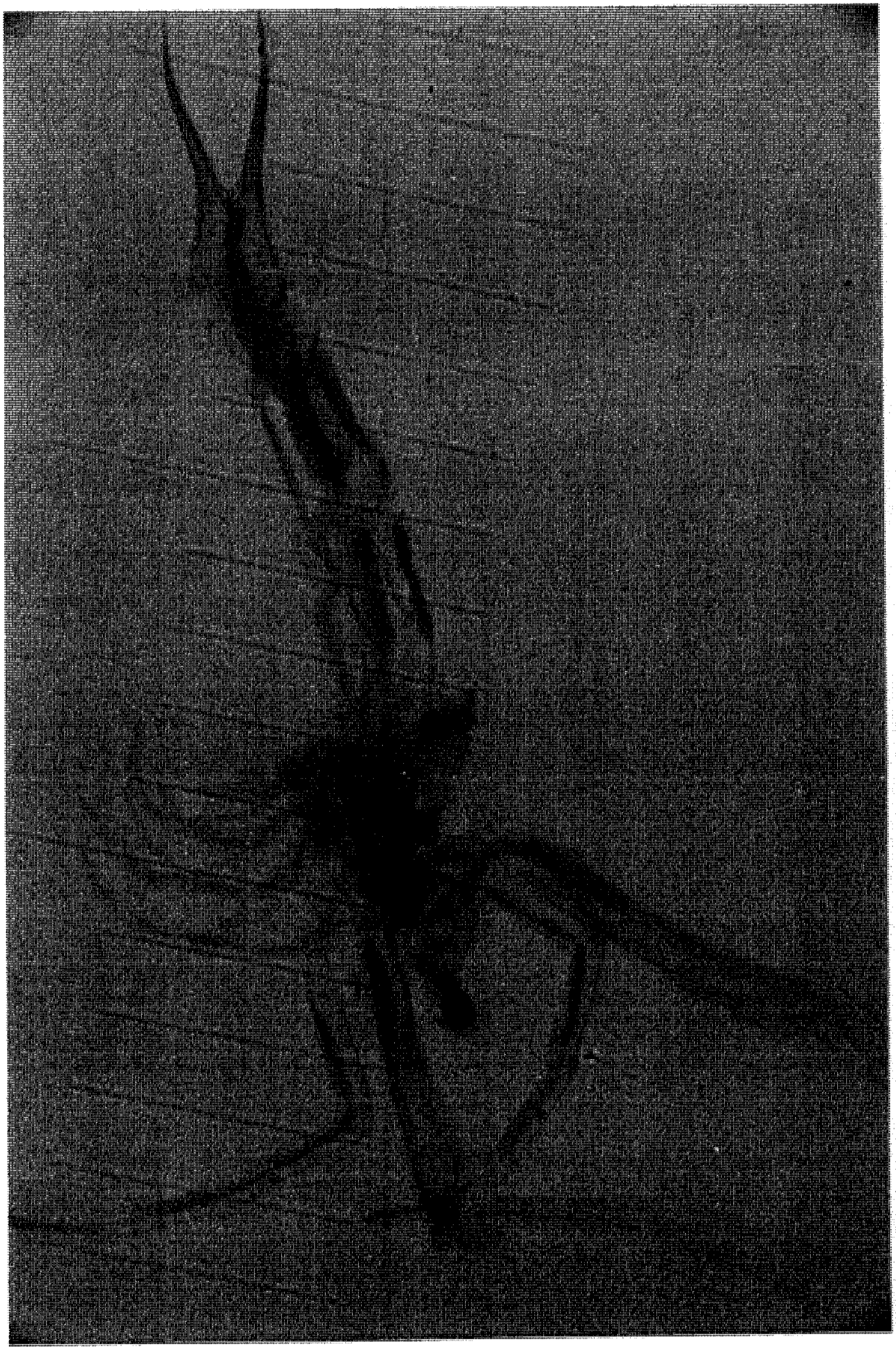


Fig. 6 The giant water flea, Leptodora kindti in glycerin. Photographed with a diffusing disc illuminator in the stage aperture. Despite appearances to the contrary, this micrograph is at the best focus.

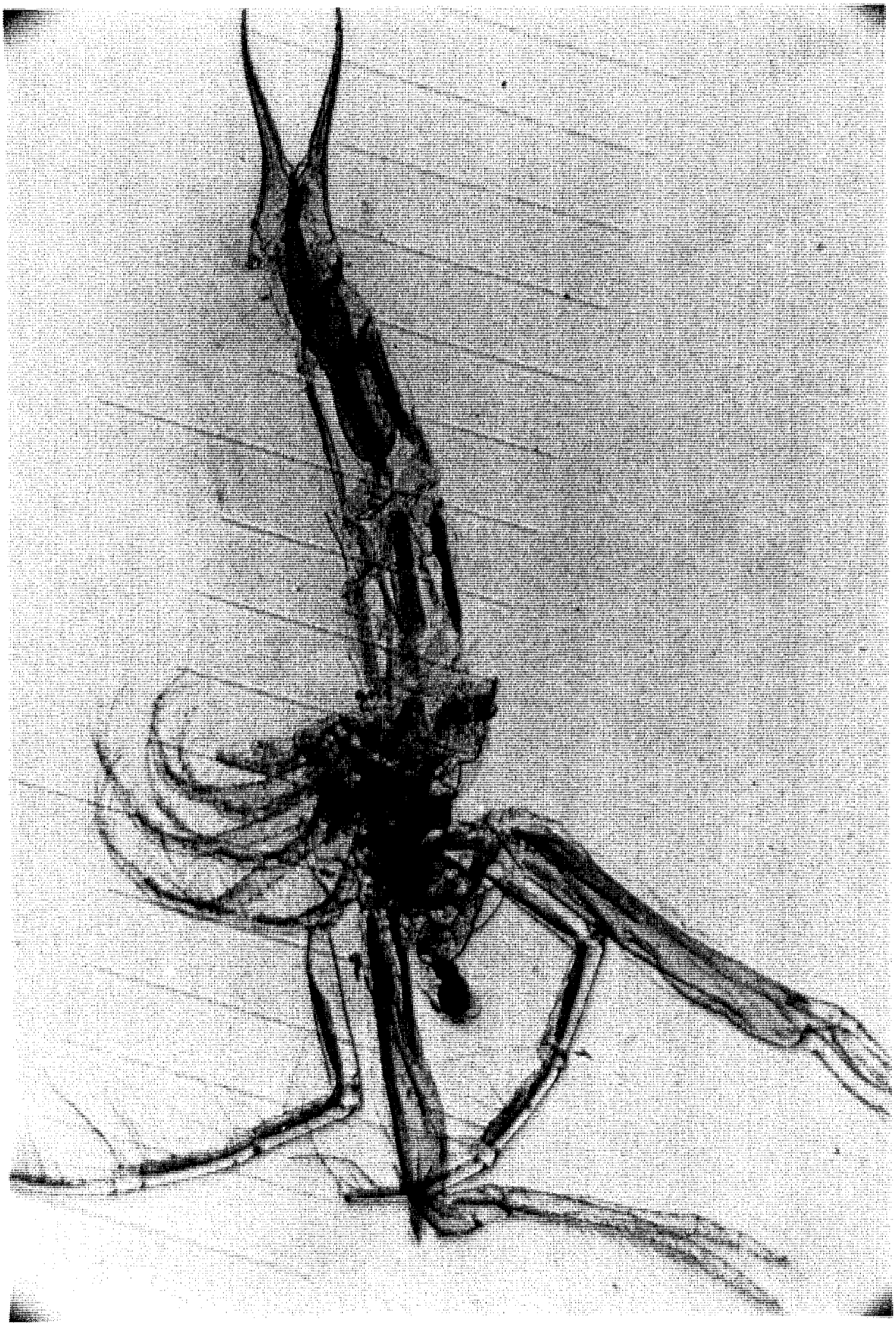


Fig. 7 Subject as Fig. 6 photographed with double aperture brightfield illuminator.

Fig. 8 Subject as Figs. 6 and 7 photographed with the darkfield illuminator.

The MSSC Meeting of 19 November 1999

David L. Hirsch

The eagerly awaited exhibition of MSSC member accomplishments came into full bloom at this meeting. Seventeen members set up their exhibits which were highly impressive., to say the least. Lets walk around the room and see what was shown by whom.

ALAN DeHAAS set up his Leitz Metalloplan with all the "bells and whistles"; a very impressive microscope, indeed.

STEVE CRAIG brought in a number of turn-of-the-century prepared slides. If you are interested in purchasing his slides, call Steve at: (310)397-8245.

JOHN deHAAS set up a Beck binocular stand with a Wenham prism which provides stereoscopic capability. The microscope was carefully restored and refinished by a man whose middle name is 'perfection'. John showed a microcrystalline specimen of cyanotrichite from his impressive mineral collection.

BARRY SOBEL set up a table laden with a variety of carefully selected scientific instruments. KEN GREGORY showed his vintage Bausch and Lomb microscope and other interesting pieces. STUART WARTER has built up an impressive collection of small 19th century monocular microscopes, of which some American and English stands were shown.

JIM SOLLIDAY has achieved his goal of assembling a complete series of 19th and early 20th century Bausch and Lomb monocular microscopes. At least two of the instruments were set up with illuminators to show slide mounted specimens. RON MORRIS set up the ne plus ultra display which justifiably copped First Prize! Ron occupies an important technical position with a well known manufacturer of integrated circuits devices. He went full bore in creating a magnificent portrayal of how these state-of-the-art products are developed and manufactured, and the role microscopes play in the overall effort.

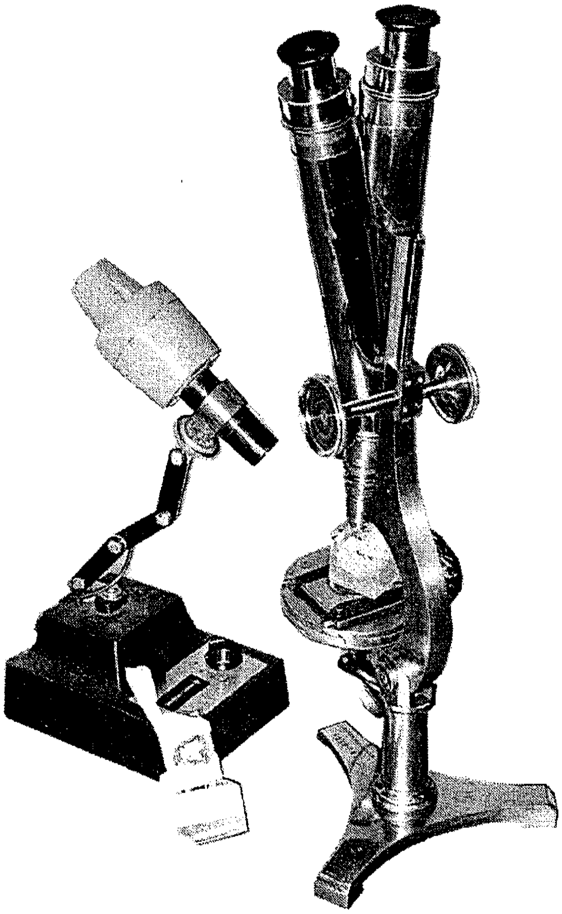
PETER FISCHER showed a Leitz Orthoplan Pol and explained its function. DAVE HIRSCH (thats me), has been alluded to, by my wife as (among other things), someone who would have been at home in the 18th century. By a liberal stretch of imagination, I showed a number of my 'scientific instruments'; from the whimsical to the practical, as I assumed they would have been produced in the days of Priestly, Volta, Napier, et.al. The exhibit took second prize. The prizes, incidentally, consisted of two KLAUS KEMP slides with geometric arrangements of butterfly scales and diatoms. Both Ron and I thank you, fellow members, for your approvals.

Hey, stick around - I'm not through, yet. GARY LEGEL displayed samples of lathe turnings taken from rare tropical woods, as seen under the microscope. IZZY LIEBERMAN set up a polarizing microscope to show the effect of polarized light on a variety of crystal substances. GAYLORD MOSS showed phase contrast on his Zetopan and also used an arc lamp to show the reflected image from a Chinese "magic mirror", a bronze mirror that reflects from the front surface an image cast on the back. PETETETI posted several prints which gave a historical representation of the beginnings of photography. TOM BOULGER displayed a 'closed circuit' video system with microscopical specimens. KATE McDONALD produced up a microscopical exhibit showing several types of molds and seeds. Over the years, ED JONES has developed high proficiency in the arrangement of microscopic sized shells, seeds, etc. We saw some new samples of Ed's' handiwork. My sincere apologies to those exhibitors whom I may have overlooked. The members will agree that the exhibit was a great success and shows the notable effort put forth by all of the exhibitors to make this a memorable evening.

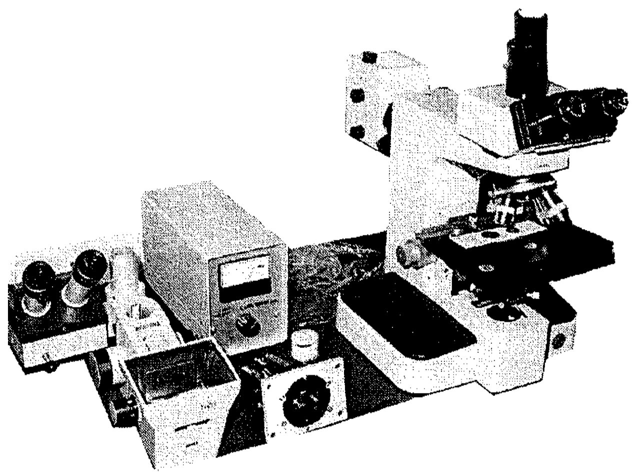
Let's give a hearty MSSC welcome to CURT DECKERT who just joined our happy family. Curt is the head of Curt Deckert Associates, Inc., of Santa Ana California, a firm specializing in the application of optical technology. Welcome aboard, Curt!

ERNIE MEADOWS has offered to give instruction in wood and metal working to MSSC members. We will be discussing the modus operandi in future meetings. Now, for the commercial. January 1, anno domini 2000, will be the start of our 2000-2001 fiscal year. Your Treasurer will not be pressing for dues until then. The dues structure will be announced in the next issue of the Journal..

The following pages show a selection of photographs taken at the meeting by our esteemed president: George Vitt.

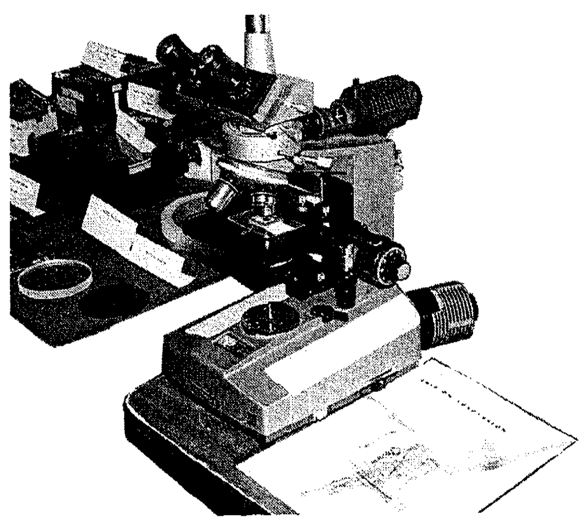


Walter Coulson's beautiful Smith Beck and Beck

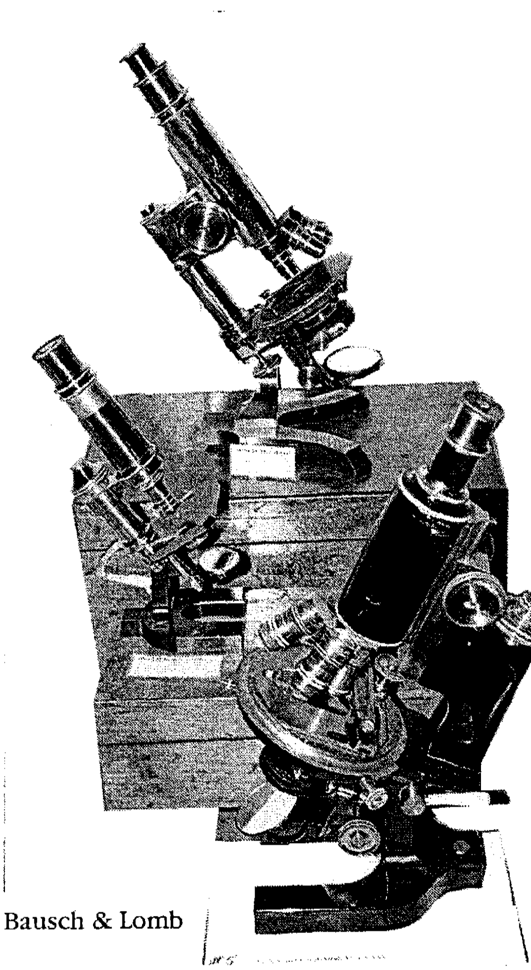


Alan deHaas's Orthoplan, incident and transmitted.

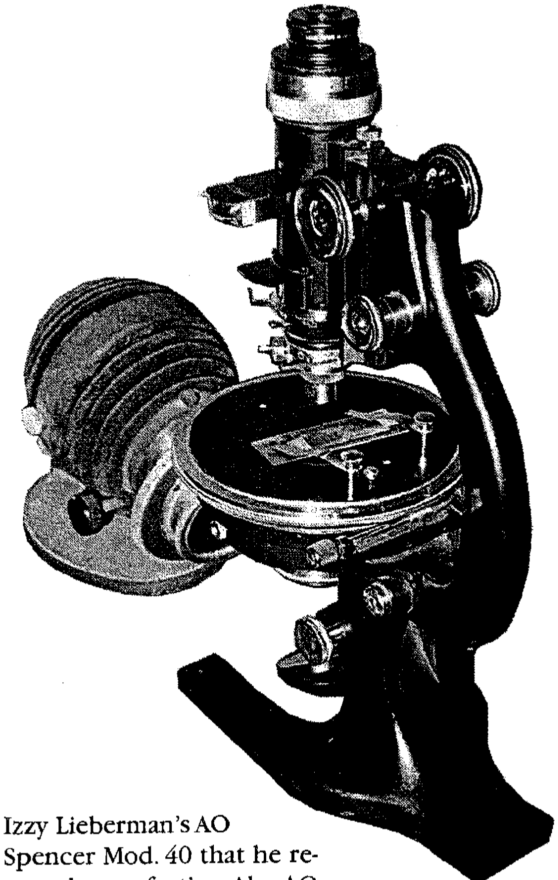
Ed Jones showed and described interference colors using quartz wedges and a Michel-Levy chart. Shown with some of his micro arrangements.



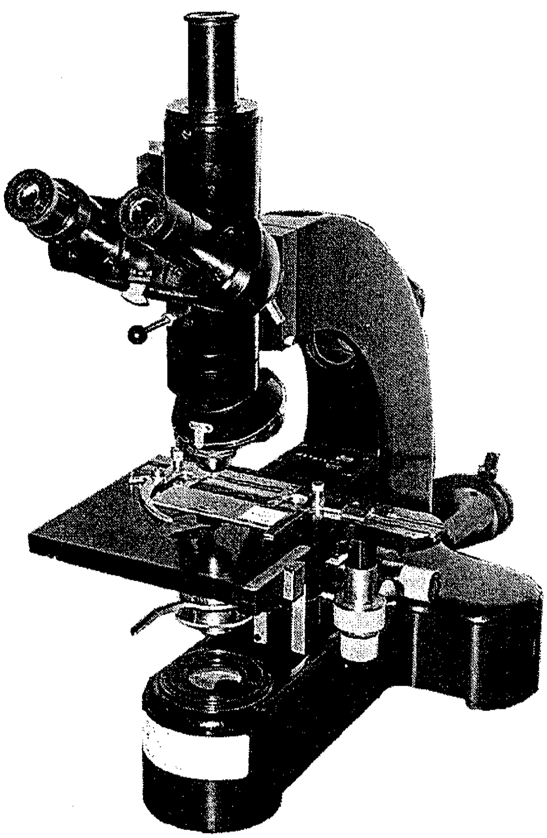
Ron Morris's Olympus BHA



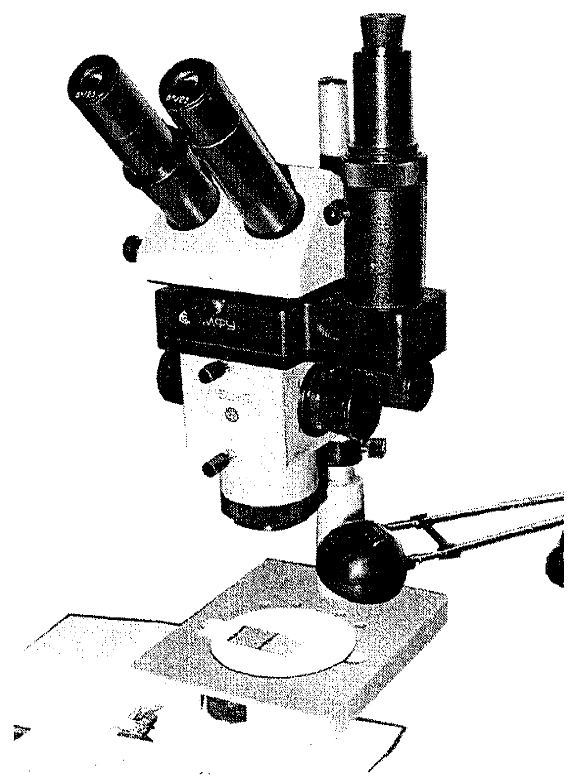
Bausch & Lomb



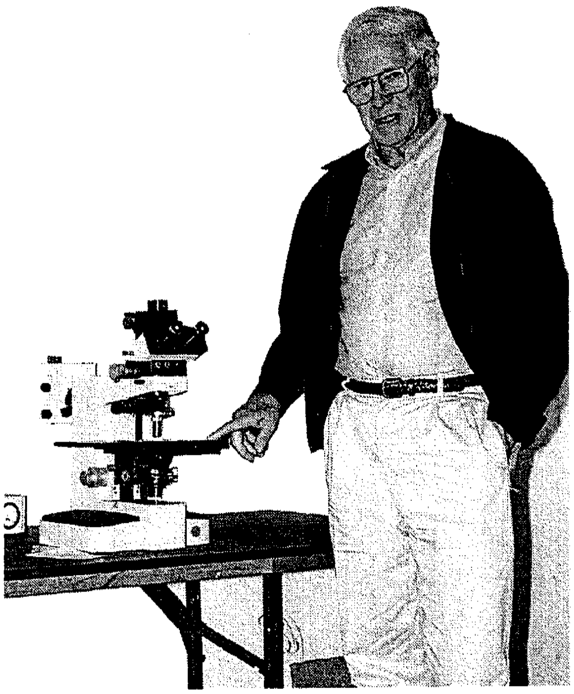
Izzy Lieberman's AO Spencer Mod. 40 that he restored to perfection. Also AO Mod. 735 illuminator.



Gary Legel's Leitz Ortholux



One of the several Lomo stereos in the MSSC

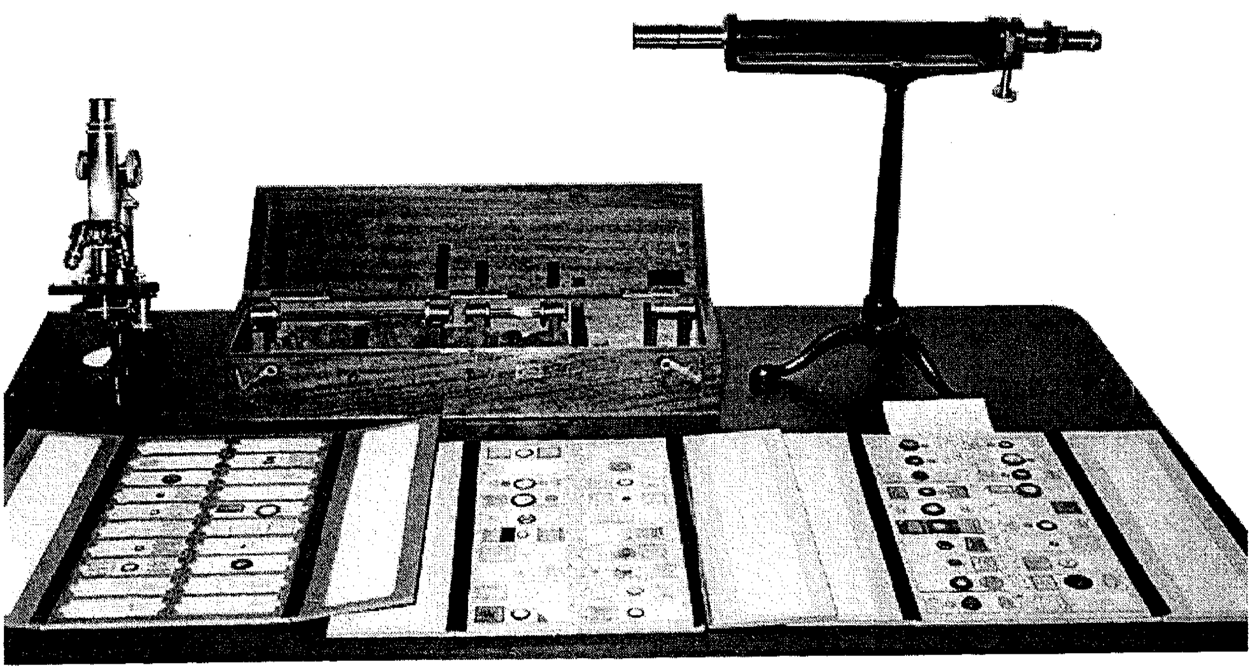


Peter Fischer with his Leitz Orthoplan Pol, equipped with a Leitz long working distance Pol objective, examining a CD disk in reflected light.

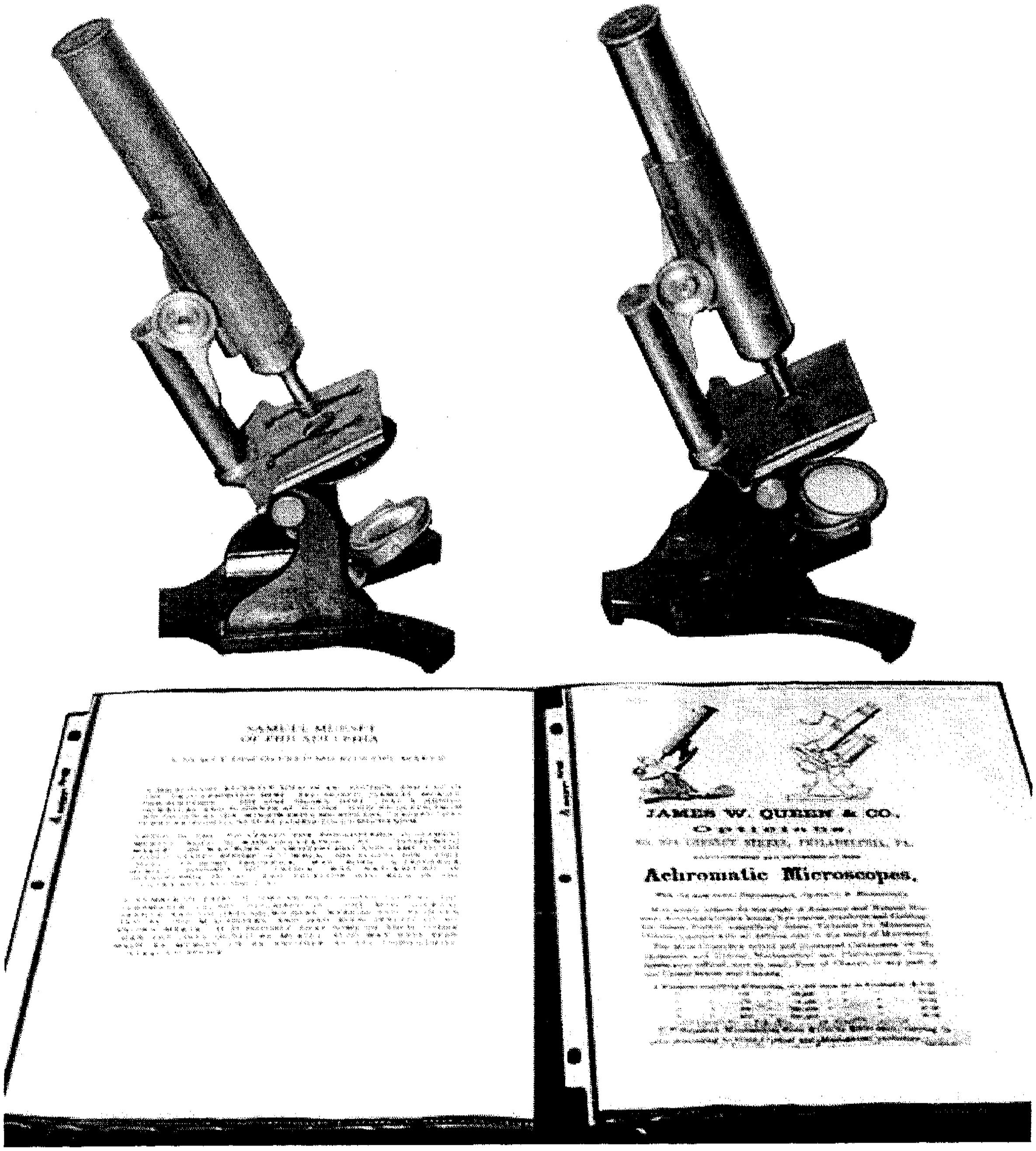
The instrument was first manufactured in 1967 and available for 25 years, until 1982.
It is a first rate research polarized light instrument with a large array of accessories. It may be the last instrument equipped with calcite prism as standard polarizer.Two 100 watt illuminators, one for reflected light, the other for transmitted light were the standard, in addition, a 150 and a 450 watt xenon lamp were available.The later was useful for projecting the image via the projection eyepiece and projection mirror.The most fascinating accessory is the universal rotating stage, a marvel of precision engineering.

In the foreground are trays of superb slides shown by Steve Craig. These were by some of the best English makers and were collected by a Los Angeles biology teacher who used them in classroom demonstrations as well as for his own interest. The remarkable and elegant "stalked-eye fly" that Steve showed in the Palos Verdes art exhibit was from this collection.

Below on the stand and in the wooden box is Herb Gold's Riechert Saccharinimeter, a specialized type of polarimeter used to measure the polar rotation of sugar solutions.



Saccharimimeter



Stuart Warter showed two microscopes by a previously undocumented maker, Samuel Murset of Philadelphia. The instrument on the right is signed underneath the stage.The one on the left is unsigned. Note that the bases are slightly different.The advertisement below is from Queen in 1858 and the microscope on the left is called "Dr.Woodward's microscope. It was undoubtedly made by Murset and sold by Queen. It is simpler than the ones illustrated above in that it has only a sliding, rather than a rack-and-pinion coarse focus mechanism.The base is the same as the Murset on the right.

Jim Solliday facing the group, climbing wall in the background.

Alan de Haas with his Orthoplan and Zeiss SV8 stereo.

WORKSHOP of the Microscopical Society of Southern California

George G. Vitt, Jr.

Date: Saturday, 6 November 1999
Location: Ernie Meadows' residence - 29 persons attended

1. **George Vitt** announced that the annual MSSC Christmas Party will be held on 12 December, starting at around 4PM. **Ernie Meadows** very graciously offered his home as the setting for this festive occasion. George reminded all those wishing to attend, to send a check for $14.00, made out to **Beverly Black**, to **Steve Craig's** address: 3455 Meier Street, Santa Monica, CA 90066. Beverly, who is Steve's daughter, will do her usual excellent catering. Members were urged to bring desserts and, those wishing to imbibe, to bring a beverage of their choice.

George then passed around several color prints which he had produced digitally in the course of testing various printing papers. There was a lively general discussion on ink-jet printers and papers, and means of achieving good visual dynamic range and tonal and color fidelity. George then showed a pair of field glasses which were identified by Stuart Warter as having been made in France c.1890 -1900.

2. John de Haas announced that he plans to give lectures on microtome techniques.

3. **Stuart Warter** showed a c.1890 mic. by Leopold Schrauer. This excellent, cased instrument was a presentation piece given to a graduating physician in 1894, and had been so engraved on the body tube. This was one of the last examples of hand-made American microscopes. Stuart then showed an unsigned (Gundlach?) microscope, c.1880, with its distinctive Gundlach foot, draw-tube coarse focus and Continental style fine-focus. Under the unusually small square stage is the swinging mirror to provide either transmitted or incident illumination.

4. **Jim Solliday** spoke of the Crossroads School upcoming Centennial Exhibition, scheduled to begin the day of our 17 November meeting. There will also be a 'permanent' exhibit, lasting 4-5 months, Members who had their photomicrographs at the Palos Verdes exhibit, were urged to provide these images for exhibition at the School, and those wishing to help in setting-up should be there at 9AM on the 17th. Jim then displayed a 'mystery' microscope, probably English, identified only by a stamped trademark representing the human eye. (Parkes & Son of Birmingham used such a trademark). It featured a folding foot and divisible objectives. The unusual feature of this instrument is that it has a 30-200X zoom capability enabled by an erecting lens system situated in the body tube! The eyepiece focuses on the aerial image created by the objective/erector. Alan de Haas interestingly pointed out that this feature may have been incorporated not so much to provide zoom, but to correct eyepiece aberrations.

5. **Barry Sobel** showed a very rare Soleil (French) hand-held microscope which had been found in a N.Carolina antique shop, and had there been identified as a 'Bullock microscope" It is one of two known to exist. Soleil only made instruments for scientific use. He then showed several other mics.:
a) Seibert No.2, s/n 6563, which had been obtained at an auction in Uruguay. It features polarizer and analyzer and an achromatic condenser.
b) A non-recorded cased Watson with a Wells limb, analyzer/polarizer, and Watson objective.
c) Swift Advanced Students' Petrological microscope, c.1890, cased, rotating calibrated stage, with all accessories, A marvelous instrument in absolutely mint condition, including the Nicol prisms.
d) A cased, fusee drive microscope by W. Ladd, Chancery Lane, London.
e) A cased French-made double-tube colorimeter, brass, made by the inventor of this type of colorimeter. Perfect condition.
f) A small Wollensak microscope In a cased kit.

6. **Pete Teti** showed an article on a Video Microscope (10-200X), made by the US toymaker, Mattel, selling for $99. It is connectable to a computer.

7. **Dave Hirsch** told of his consulting work at Mattel and then described and demonstrated an electroforming technique being used there for the manufacture of elastomer doll's faces. Dave showed an actual electroformed mold illustrating the process. He then showed a cased collapsible Ross microscope, resembling the Zeiss microscopes. made c.1900. It featured a swing-out separable condenser with filter holder.

8. Richard Jefts described the problem he has been

having with power line voltage variations and their adverse effect on photomicrographic exposure. Several solution were suggested. He then showed a publication by the Lunar Society which showed an illustration of the microscope used by Lavoissier. Richard also showed his set of excellent mounted color enlargements of photomicrographs that he had taken of fossilized turitella in mineral matrix.

9. **Steve Craig** showed a cased Watson interferometer, in mint condition. This small instrument attaches to the objective end of a microscope and is used to examine surfaces via. interference fringes. A horizontal light beam is directed into the device, and the beam is directed downward onto the specimen by a beam splitter. The light reflected from the surface re-enters the instrument upward, beats with the prime beam, and passes upward through the beam splitter to be observed as the familiar interference pattern, formed by fringes of max. and min. interference. In principle, it is not unlike a Michelson interferometer. Both Chris Brunt and George Vitt had used such a Watson in years past. Chris described the principles of its operation.

10. **John Fedel** reported that the Eastman Kodak Web page has information on the proper settings necessary to produce good color fidelity on a large variety of ink-jet printers. John also showed some excellent color prints of various subjects and color patch charts that he had produced in conducting printer setup experiments. These prints were made on Kodak paper especially formulated for use with ink-jet printers.

11. **Larry Albright** described the use of electroformed shells for use as precision masks in airbrushing/spray painting of manufactured parts.

12. **Jack Levy** showed the 31 Oct 99 Butterfield & Butterfield auction catalog featuring gems, meteorites, sculptures, fossils and the largest fossil snake (38") ever offered for public sale. Jack then showed some interesting books on natural history that he had gotten at the local book fairs: "On the Origin of Species", Huxley, 1853; "Elements of Geology", Charles Lyell, 1871; "History of Entomology", E.O. Essit.

13. **Gaylord Moss** recounted his visit to the Monterey CA aquarium and his observations of small ciliated jellyfish. He then showed a marvelous new computer keyboard, developed by a local friend of his, which folds and fits in one's pocket and meant to be used primarily with the versatile new 'pocketable' computers. When unfolded, it becomes a full-size keyboard of substantial construction and elegant appearance with black keys and white alpha-numerics. The key action is identical in quality to that of the standard IBM keyboard. Gaylord is 'beta testing' it for the inventor.

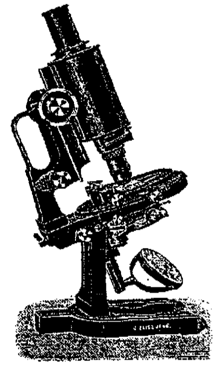
14. **Ed Jones** told of his experience in trying to see, via microscope, the names of the States engraved on the $5 bill. Apparently, not all States had been included.

15. **Alan de Haas** offered for sale a good number of high precision miniature ball-bearing linear slides. The units are rectangular in cross section and about 2" long. The play in the raceways is adjustable by means of several screws situated on one side, along its length. At $5/pair this was a real bargain!

16. **Jerry Bernstein** reported that he had obtained a piece of the Ajende meteorite at a recent auction and is seeking information on this meteorite.

The Workshop adjourned at noon and 19 members went to Coco's for lunch and more conversation. We wish to thank Mr. & Mrs. Meadows for their fine hospitality in hosting our Workshops at their home.

A note to workshop participants: Happily, our Workshops have expanded in size and scope, and the number of items displayed and described has increased substantially. To assure that everything displayed is included and properly identified in these Workshop notes, I urge all participants to supply the writer with succinct hardcopy descriptions of their 'goodies'. This can be accomplished either during the Workshop or via email. Thanks.



Bausch and Lomb and Carl Zeiss Connections

Allen Bishop

It has been general knowledge for some time that there was a commercial link between Bausch & Lomb and the Carl Zeiss organizations.The full story has unfolded in the Journal of the Zeiss Historica Society in an unconnected series of three articles in that publication, two of which date back to 1987.The rediscovery of he 1944 book, *Cartels, Challenge to the Free World* by Wendell Berge brings to light what may be considered as much of the story as will ever be known.The anti-German sentiment in the USA was somewhat offset by our state of war with Japan. Had Japan not been at war with us in 1944, we can almost assume that an atmosphere similar to 1917-18 would have prevailed, and Bausch & Lomb (nice Germanic names!) would have been in severe trouble with the Federal Government. It is not known to me whether they were victims of the almost hysteric anti-German feelings of World War I.

Note that in the short chronology published in 1987 as well as the Nedinsco story, the extent of B&L's connection with Zeiss was not fully understood; the Nedinsco article never even mentions Bausch & Lomb, yet they were major players in this diversionary scheme. I wonder how this story would have unfolded in today's internationalized world?

Though the Allies pounded Nazi industry via round-the-clock bombing, it was evident by late 1944 that the end was in sight for Hitler and his war machine. The prevailing idea shifted to attempting to save at least the high-tech sectors of German industry to use against Japan.* Only a select few knew about the development of atomic weapons, and even they could only estimate their potential power.

In conclusion, I would like to thank Larry Gubas, editor of the Zeiss Historica Journal for permission to reprint these articles.

Allen Bishop

* The Zeiss works were never heavily bombed; there was a light raid against the Dresden plant in early 1945 and at least one or two others. Several Allied leaders were not pleased with the British firebombing of Dresden. It was considered a needless act of revenge for the Blitz of 1940 that could have annihilated Zeiss-Dresden.

Zeiss, Bausch & Lomb Chronology

Nicholas Grossman, Rockville, Maryland

Reprinted from *Zeiss Historica*, Journal of the Zeiss Historical Society. Vol. 9 No. 1 Spring 1987.

Jacob J. Bausch was born in 1830 in Gross Sussen, Wuerttemberg, Germany. The economic and political situation that prevailed in Europe convinced him to emigrate to the United States in 1849. He settled in Rochester, N.Y. where he worked as a wood turner. Henry Lomb was born in Hesse-Kassel, Germany in 1928. He also came to the U.S. in 1849 and settled in Rochester. By trade Lomb was a cabinet maker.

The two men became business associates and founded various enterprises without much success. Then around 1861 they had an idea: make eyeglass frames out of a hard rubber type of material. This proved to be a commercial success. At about the same time Bausch invented and patented a power-driven spectacle lens grinding machine. In 1866 the partnership incorporated under the "Vulcanite Optical Instrument Company" name.

J. J. Bausch's first child, Edward, was born in 1854. After graduating from Cornell University in 1874 Edward joined the Vulcanite Company. It was in this same year that the company produced its first microscope based on its own design.They also changed the name of the firm to Bausch & Lamb Optical Company (B&L).

In response to the ever-growing demand for medium priced microscopes and other less expensive, but reliable optical instruments, Bausch & Lomb concentrated on mass production techniques to offer products at competitive prices.This goal was steadily pursued and numerous patents were acquired to enhance the value of the products.

By the end of the nineteenth century Bausch & Lomb, Optical Company had become the leading optical manufacturing firm in the United States.

During the same time period, Carl Zeiss, Ernst Abbe and Otto Schott in Jena established their scientific and technical foundation for the design and fabrication Of Optical instruments.Their new approach replaced the art of trial and error. Image formation theory was postulated and put into practice. Optical glasses were produced that met design specifications.

The desire to combine production know-how with theoretical advance, activated Zeiss and B&L to form a cooperative exchange agreement for the benefit of both parties.A brief chronology of this association with major milestones follows.

1891. Carl Zeiss Works and Bausch & Lomb form an assocation. Zeiss licensed B&L to fabricate the patented Zeiss lenses. In exchange, B&L provided Zeiss with manufacturing techniques and equipment. (It is interesting for the modern reader to put this period in perspective. This was the year when B&L installed electric lights in their shops - the electricity probably came from the Niagara Falls hydroelectric generating facility

1893. Edward Bausch travelled to Jena to make arrangements to enable B&L to fabricate the Zeiss product line in Rochester. In all probability, Bausch brought back to Rochester a fairly complete line of Zeiss instruments, in addition to drawings and specifications.

1894. B&L started marketing Zaiss-designed binoculars, telescopes, filar micrometer eyepieces, and other new optical instruments. B&L won prizes at the World Columbian Exposition held in Chicago in that year.

1905. B&L had been providing optical components to George N. Saegmuller a Washington, D.C. establishment specializing in surveying and ordnance instruments to Saegmuller specifications. (Some of the. beautifully crafted Saegmuller instruments are on display today at the Smithsonian Institution's "Centennial Building" in Washington.) In 1895 B&L and Saegmuller formed a joint enterprise. Its products bore a new marking: a stylized triangle with the B&L, Zeiss, and Saegmuller names.

1907. The B&L/Saegmuller affiliation was dissolved. In subsequent years, B&L fabricated numerous instruments developed by Zeiss, among them the Greenough type stereo microscope, the Abbe comparison microscope, and a wide range of opthalmic devices.

1915. The Zaiss/B&L agreement was suspended.

1921. In April the Zeiss/B&L link was reestablished.

1933. In February B&L paid Zeiss a substantial sum of money to settle a claim by Zeiss. Zeiss requested the payment to compensate it for the 1915-1921 period when B&L supplied the U.S. government with military and other optical devices incorporating Zeiss patents and other Zeiss trade information. This payment was particularly significant because Germany was eagerly seeking foreign currency, especially U.S. dollars.

1941. The outbreak of hostilities terminated the Zeiss/B&L cooperative agreements. This ended an association that spanned a fifty year period, except for the gap caused by the First World War.

Zeiss In The Netherlands

Nicholas Grossman, Rockville, Maryland

Reprinted from *Zeiss Historica*, Journal of the Zeiss Historical Society. Vol. 9 No. 1 Spring 1987.

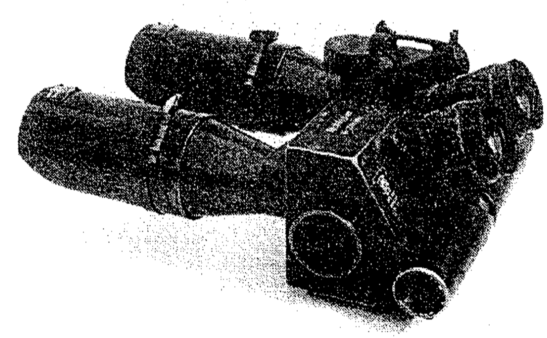
November 8. 1918. Near Compiegne, France, Marshall Foch received the German Armistice Commission in a railway coach. The conditions presented in the Germans were harsh: Germany was to evacuate all occupied territories (note: at this date German troops, far from being defeated, were in command of various strategic locations outside of Germany). The German homeland west of the Rhine would be occupied by Allied forces. Germany was to surrender 5000 locomotives, 150,000 freight cars, and 5000 trucks. In addition, 160 submarines and most of the German surface navy (though not defeated) were to be surrendered and turned over to the Allies.

November 11, 1918. At Compiegne forest at Rethondes two railway trains waited in the misty dawn. At 11 o'clock in the morning in a teakwood panelled Wagons-Lits dining car, Germany had no alternative but to sign the terms of the Armistice. The human losses to Germany amounted to 1,808,000 dead, 4.247,000 wounded, and 618,000 prisoners of war.

January 18, 1919. The Peace Conference convened in Paris with 70 representatives from 27 victorious nations. Germany was excluded from this Conference. Germany requested that the "Fourteen Points" postulated and widely publicized by President Wilson of the U.S. and upon which the Armistice document was signed should be incorporated into the Peace Treaty. This was ignored by the French.

June 21, 1919, The German navy was assembled at Britain's Scapa Flow to be turned over to the Allies. France was scheming to obtain most of the German ships gathered at Scapa Flow. Then while the English watched helplessly, the German crews scuttled the undefeated ships rather than surrender them,

June 28, 1919. In the Hall of Mirrors in the Palace of Versailles, outside of Paris, the German Peace Treaty was signed. Besides major territorial concessions by Germany, Article 231 made Germany solely responsible for causing the War. (Note: Archduke Franz Ferdinand of Austro-Hungary was visiting the Bosnian town of Sarajevo on June 28, 1914 when he was assassinated by Serbian extremists. Most impartial students of history consider this event and the subsequent reluctance by the Serbs to take corrective measures as the cause of the conflagration.)



7x50 naval binocular: a product of Nedinsco. Instrument is made of heavy bronze to avoid magnetic disturbances on shipboard. Serial number is 123318.

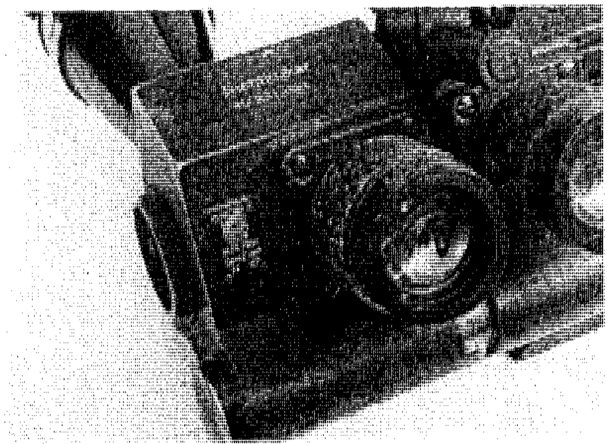
Other provisions of the Treaty limited the German Army to no more than 100,000 men equipped only with small caliber guns. The Navy was limited to six warships but no submarines - and no German military aircraft. In addition to heavy financial compensation imposed upon Germany (the final bill was indeterminate in other words a black check) Germany was to hand over most of her merchant and fishing fleet. Germany was also directed to build 200,000 tons of ships for a five year period for the Allies, to provide large quantities of coal to various countries for the next ten years, and pay for the cost of the occupying armies. A further stipulation was that Germany had to sell all German property in the Allied countries.

July 7, 1919. The German Government ratified the Treaty.

November 19, 1919. A move to ratify the Treaty in the U.S. Senate was defeated. The United States never ratified the Treaty.

Defiance

The terms of he Treaty made it nearly impossible for an industrialized nation to recover from the ravages of



Closeup of eyepiece. "Richtkijker Nr. 23 Links" gives the location of the binocular on the ship: position 23 on the left (port) side.

the War and reestablish a viable economy. The Zeiss Foundation and its affiliated companies were profoundly affected by the various restrictions forced upon German industry. Prior to the War numerous optical products, such is, binoculars, were used both by the general public and by the military forces of various nations. Other optical goods, such as range finders, were specifically developed and marketed for the military.

Zeiss was looking for a way out of this crippling situation. At stake was not merely the volume of goods to be produced, which was made more pressing when Zeiss started to re-employ the returning war veterans, but also the need to keep up with the fundamental Zeiss tradition of staying in the forefront of new optical developments.

On January 12, 1921 the "N.V. Nederlandsche Instrumenten Compagnie" (The Dutch Instruments Company, Ltd.) was formed by a notarial act in Den Haag.The Netherlands. Initial capitalization was 200,000 Dutch guilders.

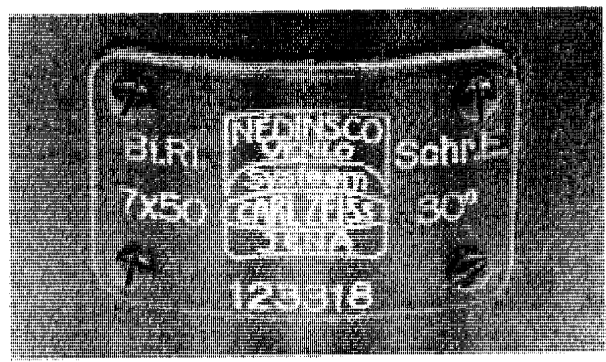
"Officially" this company came into existence because the Dutch East-Indies Company (Hollandsch Indische Compagnie) terminated operations in Amsterdam. In reality this was a wholly owned subsidiary of Carl Zeiss Foundation. The funds came from Zeiss Jena through various banks in The Netherlands and Switzerland.

Rather than using its full, but lengthy name, the firm adopted its telegraphic routing symbol "Nedinsco". Production facilities were set up in the small town of Venlo, only a walking distance from the German border. Zeiss provided all the necessary machinery and equipment and shipped it to Venlo.

(The spotlight was briefly on Venlo in the early days of World War II. The British Intelligence Service tried to establish clandestine contacts within Germany. Two British MI-6 officers travelled to Venlo on November 9, 1939 to meet with "German underground" representatives at the Cafe Bacchus.

They ran into a trap set up by the Gestapo. While technically The Netherlands was then a neutral country, the Germans in three Mercedes Benzes came crashing through the border barriers, held the Dutch border guards at bay, then abducted the two MI-6 officers to Germany. For details refer to "Bodyguard of Lies" by Anthony Cave Brown, Bantam Books, 1975, chapter 11-7 "The Venlo Incident".)

In order to effectively cover up the Zeiss-Nedinsco link, Zeiss set up a financial holding company in the Netherlands in January 1924, called "N.V. Finantieele Maatschappij Nederland".



Closeup of Nedinsco markings on binocular sunshade. 30⁰ marking means that eyepieces are set 30 degrees from the horizontal to provide more comfortable viewing. "Bi.Ri." indicates that this is a binocular

This holding company then could handle financial and commercial transactions, especially in international trade, thus circumventing the restrictions of the Treaty. With Nedinsco in operation Zeiss could retain the profits rather than turn them over to the Allies as reparations as stipulated in the Treaty.

In a significant parallel development the German Admiralty encouraged the Dutch government to establish a "Submarine Development Bureau" in Den Haag. The German Admirality helped finance the operations and provide facilities and German personnel to the Bureau.

To cover up this German-Dutch connection the Bureau was officially named "Ingenieurkantoor voor Scheepsbuow" (Ship Design and Construction Bureau) in July 1922 and posed as an ordinary commercial shipbuilding firm. It was this firm that developed and built the "schnorkels" that played such a decisive role in the early part of World War 11. Whether these actions were coordinated on a much higher level is subject to speculation. It is a fact that this Dutch firm built U-boats for various nations to the designs supplied by the German Navy. (For example this Dutch firm delivered three submarines to the Finnish Navy in 1930-31).

Thus a very effective mechanism was put in place in the Netherlands that permitted Zeiss to utilize Nedinsco and the German Navy's coven operation to supply various advanced military optical goods and get the benefit of experience through the Dutch connection.

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Payoff

March 16, 1935. Ile leader of Germany, Adolph Hider, denounced the Treaty of Versailles as a "scrap of paper" and initiated the re-armament of Germany.

Zeiss no longer had to hide the Dutch connection. The Venlo plant came out with a new Zeiss logo: Nedinsco Venlo Systeem - Carl Zeiss Jena. It was fashioned around the classic Zeiss Jena logo.

According to the best estimate of the present Directorate of the Netherlands Naval and Electronics Establishment the binoculars shown in this article were fabricated in 1938. Probably the instrument was one of the binocular gunsights and was mounted on the weapon director of one of the two 12 cm. guns of the "Hr, Ms. Willem van der Zaan", a Dutch Naval minelayer. The left gunsight was used for elevation control and the right one for azimuth control.

The ship was put in service on August 21, 1939. In 1953 she was converted to a frigate. In 1961 she was converted into a maintenance ship at which time the guns and gunsights were removed. Ile optical instruments were sold by the Royal Netherlands Navy at that time. The ship was wrapped in 1970.

In addition to this Nedinsco instrument, the author has obtained photographs - alas no history - of identical Nedinsco binoculars, serial number 123373, marked "Richtkijker Nr. 5 Rechts" whose meaning should be obvious from the above text.

Starting in 1940, when the German expectation of "a quick victory" evaporated, most military hardware, including optical goods, ceased to carry a manufacturer's label, but utilized randomly selected, mostly three letter codes. Code letters "aaa" to "azz" were assigned in November 1940. Nedinsco was assigned the code "jux". The "jaa" through "jzz" batch was allocated in September 1941. After that date the Zeiss Nedinsco, Venlo trade emblem ceased to be used.

Epilogue

Should you visit Venlo, you can find the B.V. Nederlandse Instrumenten Compagnie (Nedinsco) doing business at Molensingel 17, 5912 AC Venlo, Ile Netherlands.

MSSC March Meeting

Wednesday, March 15 at 7 PM

Crossroads School, 1714 21st Street

Santa Monica, CA

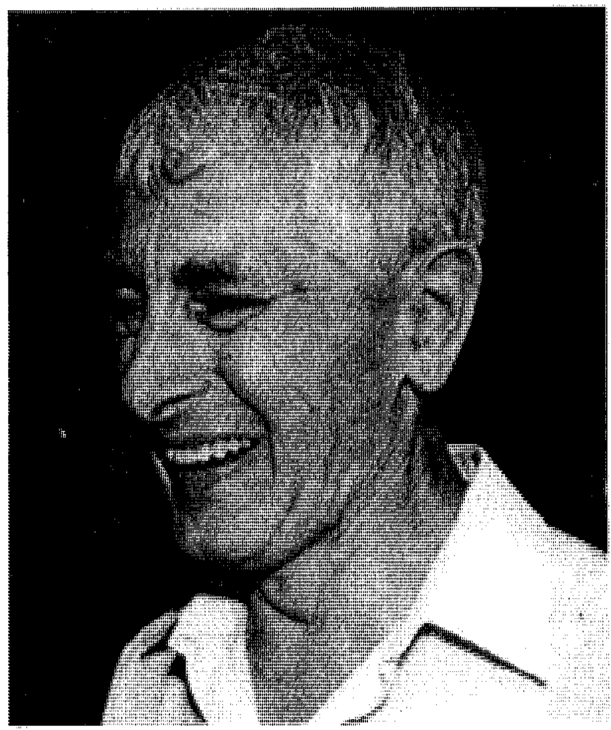
Cells That Went To Live Inside Cells

John Coates

Living organisms can be divided into bacteria or prokaryotes, without cell nuclei enclosed by membranes, and the rest of us, eukaryotes with membranes round our cell nuclei. Some bacteria have gone to live inside cells of other organisms, not merely between them, and present-day examples show that after living together for a short time neither can live separately. Such an intimate association beneficial to all partners is called symbiosis.

Some particulate structures (organelles) present in nearly all nucleated cells resemble bacteria and seem to be derived from bacteria which entered into symbiotic associations with unicellular eukaryotes about 2,500 million years ago and became permanent residents. They are mitochondria, which complete the breakdown of carbohydrates with oxygen in both plants and animals, and plastids (chloroplasts) in which algae and plants use chlorophyll to synthesise sugars from water and carbon dioxide. Thus essential parts of the cells of all animals and plants were established a long time ago and nearly all of their genes have been transferred to the cell nucleus.

It is also possible, but no more, that motility structures -cilia, flagella and nuclear spindles which pull chromosomes apart when cells have lost all their genes to host cells and preserve little more than their distinctive proteins. Our knowledge of the subject is nearly all based on work during the last thirty years or so. The talk will summarise the evidence for our present understanding and discuss how the symbioses came about and their consequences for the history of life on Earth. It will refer to some familiar microscopical objects and little-known ones. Much of it will be about objects at the resolution limit of light microscopy or beyond but will draw on discoveries made by electron microscopy, cell surgery and other techniques.
It will be illustrated and should interest practical microscopists, whether they already know something of the subject or not.



About the Speaker

John Coates trained as a zoologist, taking a PhD in agricultural sciences. He taught chemistry to university entrance level, then went into the pharmaceutical industry. From information support to a research team, he moved to export and transfer of technology to developing countries.

Finally he worked in a government sponsored body for simplifying international trade documentation. His business career culminated in international payment procedures. In retirement he has been catching up with developments in biology."

Saturday Workshops March 11 and April 1, 2000

The next workshops will be held on March 11 and April 1 at 9 AM at the home of Marj and Ernie Meadows. 707 Greentree Rd. Pacific Palisades, CA 90292. Tel. 310-459-4788.

Editor's Note - My apologies to the membership for the disparity between the date of publication of this issue and the issue date. A combination of computer breakdown, bus;y schedule, lack of material and general ineptness has led to my falling behind in publication. More back issues are in the works and I hope to catch up soon. In addition, one of the most popular items, the personal profiles, have been missing because no contributions have been forthcoming. I plead for members to send in their profiles for publication.

Gaylord Moss Ed.