Bulletin of

THE MICROSCOPICAL SOCIETY OF SOUTHERN CALIFORNIA

Volume 2 Number 4 April 1997

Book Review

PHILLIPO BONANNI : OBSERVATIONES CIRCA VIVENTIA

Norman H. Blitch

Fig. 1 Frontispiece, several optical devices being used.

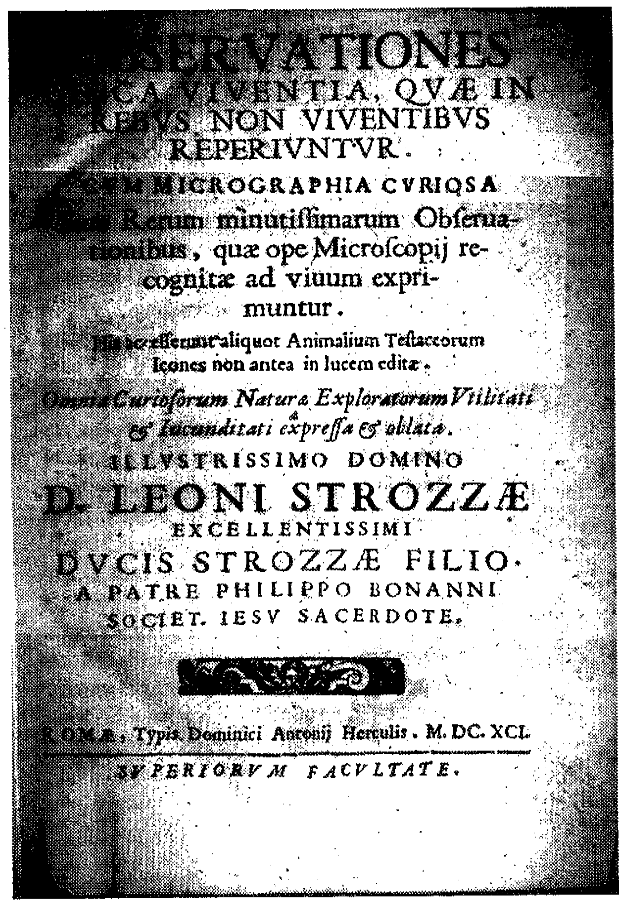
SERVATIONES
CA VIVENTIA, QVÆ IN
REBVS NON VIVENTIBVS
REPERIVNTVR.
MICROGRAPHIA CVRIOSA
Rerum minutissimarum Obseruationibus, quæ ope Microscopij recognitæ ad viuum exprimuntur.
aliquot Animalium Testaceorum Icones non antea in lucem editæ.
Curiosorum Naturæ Exploratorum Vtilitati & Iucunditati expressa & oblata.
ILLVSTRISSIMO DOMINO
D. LEONI STROZZÆ
EXCELLENTISSIMI
DVCIS STROZZÆ FILIO.
A PATRE PHILIPPO BONANNI
SOCIET. IESV SACERDOTE.
ROMÆ, Typis Dominici Antonij Herculis. M. DC. XCI.
SVPERIORVM FACVLTATE.

Fig. 2 Title page, Observationes.

Born in Rome in 1638, Phillipo Bonanni became an outstanding and loyal student of Athanasius Kircher and, like Kircher, a Jesuit priest. In 1680 he succeeded Kircher as Professor of Mathematics at the Collegium Romanum, and in 1698 was named Curator of the Kircherian Museum. Bonanni was a scholar of wide-ranging erudition, as well as an enthusiastic, inventive microscopist.

In this book, published in 1691 (see Figs 1 and 2 for the elaborate optics-oriented frontispiece and the title page), Bonanni summarized his work toward an improved taxonomy of mollusks and set forth his innovative ideas about the design and employment of microscopes. But also, he came down squarely on the wrong side in the debate among scientists and phi-

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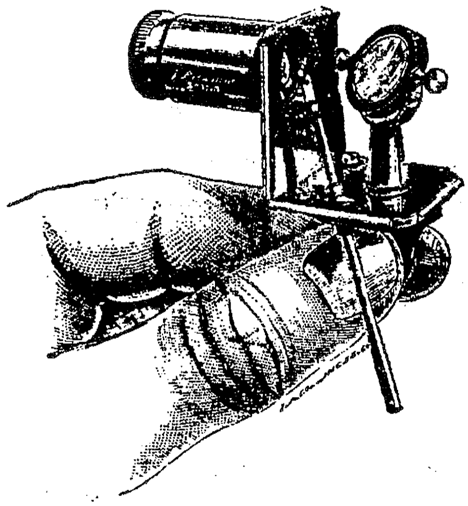
BROWNING'S MICROSCOPES.



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MSSC BULLETIN
Volume 2 Number 4 April 1997

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PHILLIPO BONANNI - Continued from page 61.

losophers over the Aristotelian belief in " spontaneous generation" of living things.The idea was destined to cause heated debate and controversy, lasting even into the 19th Century, and perhaps persisting here and there even today. Supporting Aristotle's dictum flew in the face of Francisco Redi's *Esperienze intorno alla generazione degli insetti*. Redi had provided, using microscopical studies and experimental findings, experimental proof that insects did not arise from some natural force, but from the direct intervention of other insects. In spite of Marcello Malpighi's confirmation in 1679 of Redi's findings, and Swammerdam's detailed studies of insect anatomy, Bonanni remained stubbornly unconvinced, faithful to Kircher.

Redi derided Bonanni's attempts to prove that insects are spontaneously created from hyacinth flowers, or that certain rotten leaves and flowers generate certain specific insects without the intervention of biological processes. In *Observationes*, Bonanni responded to Redi's ridicule in defense of his own beliefs and those of Kircher.

In spite of his stubborn disagreements, Bonanni in his book expounded real advances, in the pre-Linnean taxonomy of snails and other mollusks and in innovative microscope design. Although not up to the standards of, say, Robert Hooke or Jan Swammerdam, his depictions of some of his work were interesting, and generally accurate, particularly when, as has been noted before, he copied the work of others (See page 64 for the Bonanni flea, Fig 3, from Hooke).

Probably under the influence of Kircher, Bonanni became interested in microscopy and constructed a microscope of his own design for use in his studies of mollusks. His design was based on the screw barrel concept that had been invented and first applied by the Italian Tortona. Tortona's screw barrel focus, after some changes and improvements, was eventually to evolve into what is commonly known as the Wilson Screw Barrel Microscope. Tortona has been overlooked except as a minor footnote in microscopical history. Bonanni's application of the screw barrel, in 1691, is illustrated in Fig 7. Campani also produced a version of Tortona's design idea, in about 1668 (Disney suggests the first screw barrel by Campani became known between 1660 and 1665). The first published description of the Campani microscope appeared in an earlier version of Bonanni's *Micrographia Curiosa*, published in 1687. (With some changes, *Micrographia Curiosa* is appended to *Observationes*.)

Among Bonanni's innovations was his spring stage, which heavily influenced microscope stage design well into the 19th Century. The spring stage was applied to his screw barrel microscope, Fig 7, which he probably used for most of his observations. It is also seen in Fig 8, as part of his horizontal microscope.

The large horizontal microscope (Fig 8, appearing on page 28 of *Observationes*) may have been Bonanni's crowning achievement. This plate has been reproduced repeatedly in many modern accounts of the history of microscopy, because of its portrayal of early design ideas and mechanical innovations. It should be remembered that, crude as the Bonanni microscope may appear, its special design characteristics were conceived more that three hundred years ago and have influenced microscope design to the present day.

No example of the Bonanni horizontal microscope is known to exist today. Some authors have expressed doubt that it was ever actually built. There is a reference, however, in Bonanni's own words, to the effect that he had disassembled and reassembled the large instrument with great ease. This lends credence to the assumption that Bonanni actually constructed at least one instrument to his own design.

Another innovation depicted in Fig. 8 is the slider. One modern author refers to it as "the first slider, 1691." However, another author disagrees, pointing out that the slider was shown in an Italian work at least five years earlier. At least there is strong doubt about Bonanni's primacy in this case.

But, there are other design developments that can be credited directly to Bonanni without question, and that are easily verified by the text and by careful examination of the drawing in Fig 8. First and foremost is the two-lens sub-stage condenser, which is capable of being focused independently to achieve optimal illumination of the field. The second is the employment of a rack and pinion device for gross focussing. Fine focussing is still by moving the draw tube. The horizontal mounting of the microscope was also depicted here for the first time.

The ultimate purpose of Phillipo Bonanni's pioneering work in microscope design was, of course, to facilitate his observations of the life around him. In addition to those already mentioned, three of his drawings that are representative of his natural sciences interests are reproduced in this review in Figs. 4 through 6. In the work, there are a total of 64 plates plus the frontispiece and a few figures in the text.

Fig. 3 The Flea, Plate 56, copied from Hooke.

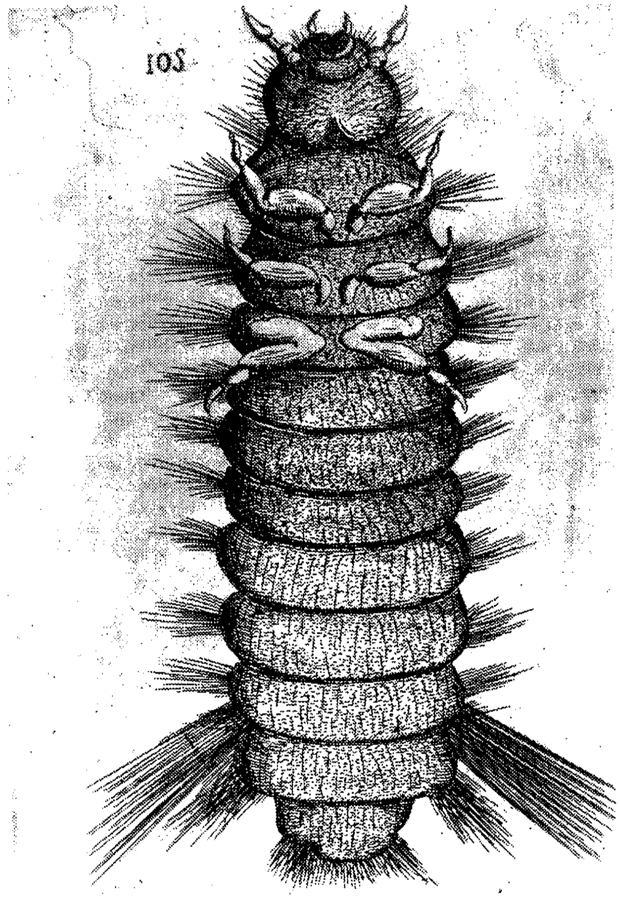

Fig. 4 Caterpillar

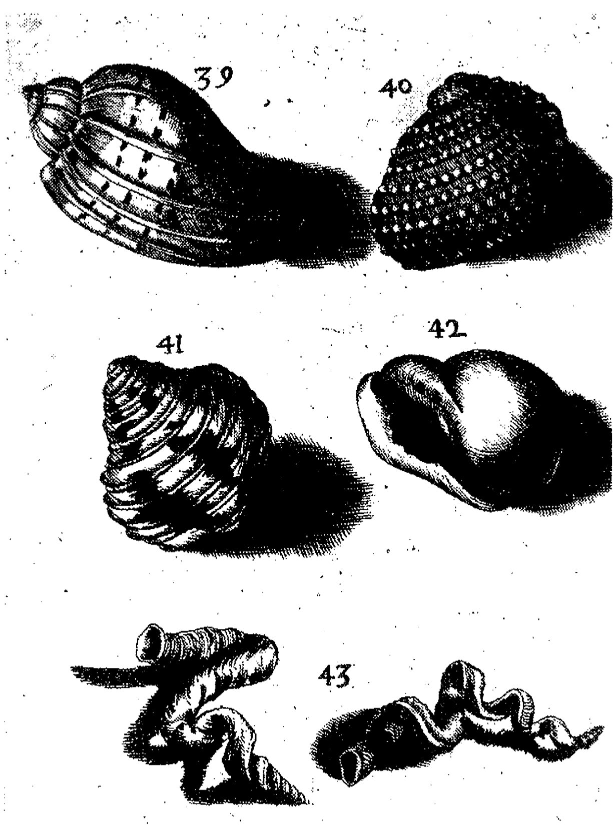

Fig. 5 Studies of Mollusk Shells

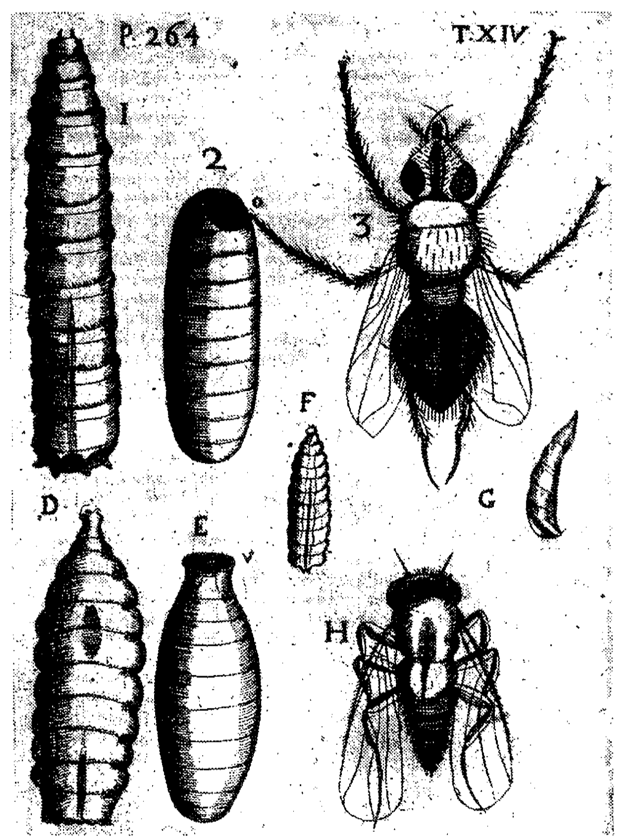

Fig. 6 Stages of a Fly

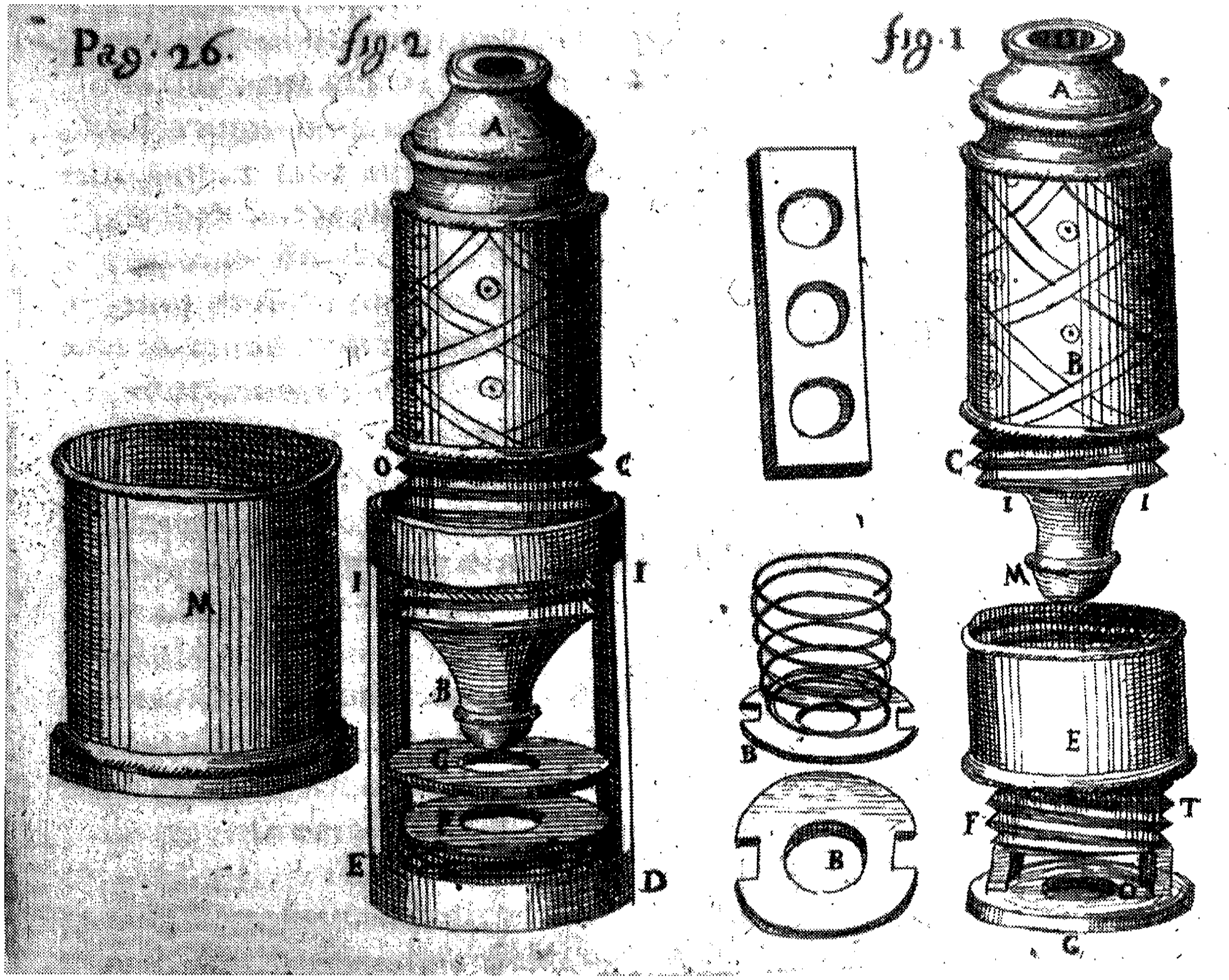

Fig. 7 Bonanni's Spring Stage

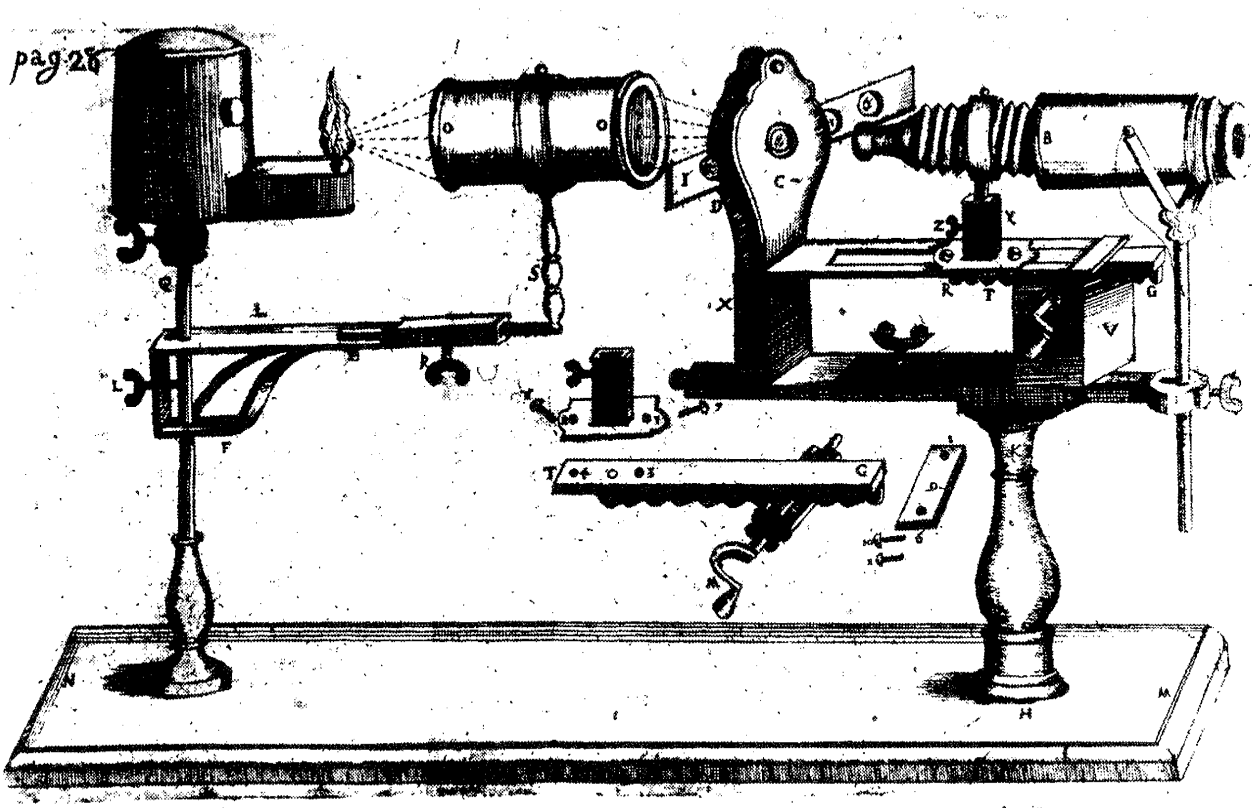

Fig. 8 Bonanni's Large Horizontal Microscope

MINUTES FOR THE MEETING OF 19 MARCH 1997

David L. Hirsch

31 members and 1 guest were present for the MSSC regular meeting held on 19 March, 1997. FRANK BARTA brought his 60x binoculars which he shared with several members to observe the Hale-Bopp comet. At seven o'clock that evening, the comet appeared in the northern sky at an elevation of about 25 degrees, with the head of the comet seemingly moving in a westerly direction.Astronomers tell us that we needn't fear a collision with Earth, even though the comet appears to be heading toward Malibu.

SCAM BUSTERS. Most Americans are honest citizens who pay their way and do not abuse the System. Regrettably, there are others of dubious intregrity, who are ever on the lookout for ways to cheat the government and ultimately, tax-paying citizens. One type of chicanery involves seeking payment for medical treatment or other services which were never offered or received, resulting in an annual multimillion dollar loss to the taxpayer.

The SignaScan Company, founded by JOHN F. CERLANEK, has developed state of the art technology which successfully puts down the scam artist and other parasites by the use of microscopic and macroscopic analysis, infra red and ultra violet radiation, and computer graphics. The methods of analysis discussed ; by John Cerlanek, were predicated on the use of the ball point pen, which was given in-depth treatment by IZZY LIEBERMAN in his talk of 17 February, 1997. Signascan techniques, using microstriation analysis, are far more positive and efficient when compared to the output of so-called "handwriting experts".

CHOW TIME! Nut laden Brownies, peanut butter cookies, cream frosted white cake, and other delicious comestibles loaded down the refreshment table. Thank you, MILLIE CRAIG, MEG MITANI and other equally gracious though unnamed donors who supplied food for the body which is in total harmony with 'food for the mind', so ably and generously distributed by speakers and MSSC members.

DUES (AND DON,TS) MSSC is on a roll and proceeding nicely, thanks to a dedicated membership and staff. The cumbersome and unnecessary 5 level dues structure rampant in our past life will be eliminated. A majority of members favored a single membership dues of $30 covering all members, regular and corresponding members alike, since the primary expense covered by the dues is the publishing of the Bulletin which is now more than doubled in size, doubling the mailing cost. The publishing cost is less than doubled due to adoption of more efficient publishing methods. Since several members have objected to the fact that there was not a pre announcement of the dues issue discussion, nor a clear expense plan for the next year, the matter will be re-evaluated at the April meeting at which time any changes for the July 1, 1997 to June 30 1998 dues should be resolved. The bulletin for the June meeting will include your dues statement, and an updated application form for our files, to be returned to your Treasurer.

THE BULLETIN, The superiority in every way, of the MSSC BULLETIN over any previous offerings cannot be denied, thanks to the herculean efforts of VP GAYLORD MOSS and the volume of pertinent articles submitted by MSSC members and courtesy submissions exchanged with other Microscopical Societies, world wide.

WE SHOWED AND WE TOLD. As usual, the membership was treated to several interesting offerings. PRES GEORGE VITT led the exhibitors with several large prints showing the latest advances in color printing techniques. The samples, in striking color, represented two processes: Laser color scan and CIBA Chrome.

An English made compound monocular microscope, known as the Sea-Side Pocket Microscope, sold by Murray & Heath, late of Jermyn Street, London, was shown by BARRY SOBEL, The sliding focus instrument featured folding tripod legs and separable button objectives. The magnifying power of the microscope is changed by removing or adding button lenses. If you could be transported in time to that period in English history, you could purchase the Sea-side microscope for 2 pounds, 15 shillings or roughly three and one-half bucks. Barry showed two books;"Notes on Modern Microscopes", by Brian Bracegirdle, the prolific British author who wrote the classic volume on Microtechnique. His second book was "The Single Lens", by Brian Ford. According to LARRY ALBRIGHT, Mr. Ford will be our guest speaker at our coming November or December meeting.

Now that KEN GREGORY has built up an impressive collection of microscopes, he has boldly ventured forth where few men have dared to tread (or something like that). Ken is forging ahead in the exotic area of restoring and refinishing some of his finds, which may have needed sprucing up. He uses Brasso for polishing metal surfaces and clear polyurethane, carefully applied, to produce a uniform coating finish. He displayed three microscopes which were brought up to show room condition. Ken also restores wooden microscope cases, adding wood parts which had broken away, and otherwise bringing the cases up to like-new condition. Restoration of scientific instruments will be discussed at length in future meetings and workshops. Look forward to a future article pitting the 'Bermondsey Burnishers and the "Blue Rinse Brigade" against the "Marblehead Moralists.To polish or not to polish, that is the question.

I'm sure that we all enjoyed STUART WARTER'S front page article in the March, 1997 issue of our bulletin, discussing "Laban Heath's Invention". By some strange coincidence, I was rummaging through a drawer containing assorted rubbish, such as a punctured poo-poo cushion, half a yo-yo, my old Buck Rogers zapping gun

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MUSCAE VOLITANTES

Roy Winsby - Manchester Microscopical Society

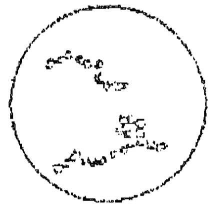

Fig. 1 View of "Floaters"

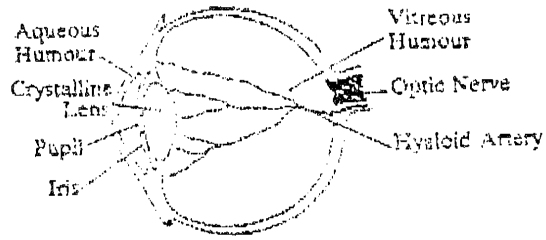

Fig. 2. Section of eye of human foetus.

Ignore and do not be alarmed if odd chains of tiny cells float across your field of view whilst looking through the microscope. They are called Muscae Volitantes, often referred to as "floaters". (Fig. 1).

They are not a sign of eyestrain or any other eye defect, nor have you caused them by any use of the microscope. They are harmless, always present and everyone has them but they are not always noticed. Sometimes they are seen when the head is moved rapidly and there is a change of view involving a contrast, particularly when looking into the light at say, a window, a light coloured wall, a television screen, etc. They are often noticed when looking through a microscope, for here the head has been moved to look down the eyepiece and the contrast is provided by the light source seen through the microscope.

The eye is very much like a camera, with a front lens and a backplate to receive the image, The image we see passes through the pupil, the circular opening in the iris, the flat coloured membrane in the aqueous humour in the front part of the eye, passing through the lens and then on through the vitreous humour to focus on the retina, the plate at the back of the eye sensitive to light that receives the image. Muscae volitantes float in the vitreous humour, the fully transparent albuminous fluid with the consistency of thin jelly through which an image passes on its way to the retina, and we see them in the field of view.

During the development of a baby in the womb of its mother, the front part of the baby's eyes is supplied with blood through fine blood vessels as shown in Fig.2. If these vessels were to remain in the eye they would impair vision and by the wonder of nature these thin blood vessels lose their connection with the hyaloid artery and begin to atrophy; by eight and a half months, the atrophy is almost complete. A few remnants remain which break up and fall in short lengths to the bottom of the eye where they lie ever after. Any quick movement of the head throws them up in the vitreous humour in the same direction in a quick phase of movement lasting a fraction of a second. Here they form out-of- focus images, seemingly floating in the viscous gel, sometimes for a second, sometimes for quite a few seconds, before beginning their descent to the bottom of the eye where they rest until another sharp movement of the head throws them up again. The condition is not abnormal and is not a cause for any worry unless large numbers suddenly appear.

Reprinted from the Manchester Microscopical Society Newsletter, No 5. August 1986 by the kind permission of R. Winsby.

Minutes of Meeting of 19 March 1997 - Continued

and other relics of early childhood, when I came across a small mahogany case containing a 3 draw, 30X telescope with a mahogany barrel, and the lower secton of a drum microscope. When assembled as a microscope, the instrument could be used at 40X to 150X. The compendium, of French origin from the 1870's, closely resembled the Laban Heath ensemble described in Stuarts' article.

In addition to the previously mentioned parts, the 7.63" long x 4.25" wide x 2.25" deep mahogany box included the forementioned pieces, plus a solar eyepiece, six prepared slides, 2 live boxes, an objective and a pair of forceps. Sometime in the past, a previous owner lost the key; a not uncommon happening. The case was pried open, breaking a part of the lock. Restoration will take place "when I get around to it".

I don't mean to be a spoil sport, but the compendium was purchased for 30 pounds in Oxford England, in 1985. For solace, review the article on: "How Much is that Microscope Worth", by JIM SOLLIDAY, in the previous issue of the MSSC Bulletin.

The video cassette showing the magnificent collection of a Portland Oregon physician didn't play on the video setup used at our meeting, so I will bring it to the next workshop for viewing. MSSC has a growing video cassette library containing subjects of microscopical interest. STEVE CRAIG is our video library curator.

THE STORY OF ZEISS

Roy Winsby - Manchester Microscopical Society

This is a most extraordinary story.

In 1846, Carl Zeiss, at the age of 30, set up his business in Jena, Germany, to design, make and repair microscopes and optical systems of all kinds. He had previously served an apprenticeship and studied at the University of Jena and the University became his first customer by engaging him to maintain their microscopes. Within a few years Zeiss was not satisfied with the optical performance of his microscopes made under trial and error methods and realised that the optical systems needed to be computed according to mathematical and scientific principles, but he himself did not have this ability. In 1866, by which time the Zeiss workshop was using treadle lathes had in its first 20 years produced 1,000 microscopes. Zeiss invited Ernst Abbe, a mathematician and a professor of physics who was then at the age of 26, a lecturer at Jena University, to join him in an endeavour to improve microscopic images by using scientific mathematical calculations to compute new lenses.

Abbe had come from a poor family, but although his parents could not afford to pay for him to have a better education , he won scholarships and went on to secondary school. He received a doctorate at age 21, and became a professor two years later. In 1875, Zeiss made Abbe a partner and the business prospered. Optical glass, however, was lacking in quality and Abbe, on becoming dissatisfied with the lenses they were producing, approached various glass manufacturers asking them to experiment in improving glass used for optical purposes, but could not find one prepared to do so. In 1879, he met Dr. Otto Schott, a glass chemist, and in 1882, Zeiss, Abbe and Zeiss's son, Dr. Roderich Zeiss, formed a partnership with Schott to establish a factory for manufacturing high grade optical glass. The factory became known as the Schott and Genossen glassworks (from now on in this article referred to as the Schott works and was responsible for improving microscope lenses, Schott providing new formulae for improvements in the quality of the glass.

Zeiss died in 1888 at the age of 72 and his half share of the business passed to his son, Roderich. By this time, the workforce had grown to 300. As a result of his poor upbringing in his early years, Abbe held strong socialist views and the ideology of operatives run by and for the benefit of the workers. In 1889, he formed the Zeiss business and his share of the Schott glassworks into a co-operative which he called the Carl Zeiss Stiftung (foundation). Roderich did not agree with Abbe's ideals and in 1891 sold out his share of the Zeiss and Schott business to Abbe for a generous settlement. In contrast with his humble beginnings, Abbe was at this time an extremely wealthy man and after putting all his personal fortune into the business, he introduced profit sharing and pension schemes for all employees, as well as an eight hour working day. The same year, Otto Schott transferred his share of the Schott works to the Foundation which thereby became the sole owner of all Zeiss and Schott enterprises.

Abbe was a genius at inventing things, and in an endeavour to ensure that the quality of lenses made in their workshops did not vary from the prototypes he had computed, he devised many measuring and checking instruments for workers to use n their work. In 1870, he invented the apertometer to determine the numerical aperture of objective lenses. He is particularly well known for his Abbe condenser found on countless numbers of microscopes, and on the 25th July 1879, he was elected an honorary member of the Quekett Microscopical Club, London. In 1889, he developed apochromatic objective lenses with corresponding compensating eyepieces, followed by many other optical inventions.

Professor Kohler joined the Foundation in 1893, and his name was given to the high intensity illumination method used for photomicrography, phase contrast techniques etc. By 1900, more and larger lathes were in use in the Zeiss factories, belt driven from overhead shafts and from the early 1900's, they were making giant telescopes. Abbe died in 1905 at the age of 65. The Foundation continued throughout two world wars, though many off its factories were destroyed or heavily damaged in Anglo/American air raids during the 1939-1945 war, but an even worse set-back was to fall on the Foundation at the ending of hostilities in 1945. Arrangements between the Allied countries were that on the ending of hostilities the victorious powers would be entitled to claim reparations from the areas occupied by their respective forces.

In April 1945, American troops entered and occupied the town of Jena. This occupation, however, was to last for only ten weeks because at the historic Yalta Meeting, when the split up of Germany was determined, it was decided that the eastern part of Germany, in which part Jena was situated, would be administered by Russia. Winston Churchill objected to Jena being in the Russian Zone because this was against the general rule previously agreed that a territory would be administered by that of the three powers whose troops had occupied the area, but he was overruled by America's President Roosevelt and Russia's Joseph Stalin.

During their short time in Jena, the Americans examined the operations of the Zeiss and Schott factories that were remaining after the ravages of the air raids and they questioned the directors and management as well as many of the scientists. They had planned to take away to the Western zone some 4,000 Zeiss and Schott directors, managers, scientists, technicians and skilled operatives and their families, along with a corresponding quantity of machinery, equipment, materials and technical documents. The book *FEV Carl Zeiss Jena* published in East Germany, confirms that units of the American Army with economic experts occupied the Zeiss premises on the 13th of April 1945.

The Americans had to hurry, since they knew the region was about to become part of the Soviet occupation zone and when they realised that time was too short for (according to *FEV Carl Zeiss Jena*), their large scale theft, Colonel Sempke of the American Army said, "We will take the brain along with whatever else we can manage". Dr. Kuppender, manager of the Zeiss concern, made up for Colonel Sempke a list containing some 80 names of top scientists, engineers and senior technicians making up the "Brain" who wished to leave with the Americans before Jena was occupied by the Soviet forces.

So, along with the Americans went the "Brain", i.e. the directors and management, scientists, engineers, technicians and other skilled workers, a total of some 125 key men from the Zeiss and Schott works, accompanied by their families. Trucks were loaded with hundreds of packing cases containing production data, charts, schedules, specifications, countless drawings, scientific and technological data, laboratory equipment, tools and instrument and the long convoy of trucks moved into Western Germany, not knowing where they would end up. The Americans stopped the convoy in Heidenheim, where the Zeiss evacuees were directed to some abandoned ex-German Army huts which were to be their accommodation until the families could find other housing accommodation in the town. There was no workshop accommodation for them, but, in any case they had to depart Jena quickly and had not been able to bring any proper machinery with them. Neither did they have any money to buy any in their new surroundings, but even if they had, machinery for purchase was extremely scarce and the highly sophisticated and specialised machinery they were used to was not available.

They had immense pride in the Foundation and were determined to build it up again. They managed to obtain a disused armaments factory in nearby Oberkochen and also some machinery recovered from bombed factories in various parts of Western Germany. By now, many towns in Western Germany could visualise the rebirth of the famous Zeiss business and made presentations to the Zeiss people in Oberkochen, who had approaching 200 personnel when they opened up in the newly acquired property on the 1st August 1946 under the name of Opton GmbH, but they decided to stay in Oberkochen. In the following year, they changed the name to Zeiss Opton Their numbers swelled by refugees coming to join them from Jena, and, in much smaller numbers, returning Zeiss people who had been resident in Britain in 1939 and who had been interned for the duration of the war. By 1950, they had 2,000 employees, and by 1957 the number had grown to 6,000.

As, according to the boundaries designated at the Yalta Conference, Jena was to be part of the Soviet administration zone, the Soviets maintained that the American way of dealing with the Zeiss works constituted a breach of agreements between the Allied Forces, and they accused the Americans of large scale theft, conveniently overlooking the fact that the Americans were the first to occupy Jena and had in fact been there for ten weeks before it was decreed that Jena would come within the Soviet occupation zone.

As soon as the Americans had departed over the weekend of 24th and 25th June 1945, the Russians occupied Jena and on the 5th July 1945 a conference was held between the civil authorities and Soviet representatives. At the conference it was decided, inter alia, that the resumption of production should take place in what remained of the Zeiss and Schott organizations, although at the time it seemed that it would be impossible to replace the "brain" as well as the immense quantity of documents representing nearly a century of research and invention "stolen" by the Americans. Another important decision of the conference was that the University of Jena be re-opened.

Before their hurried departure with the Americans, the departing directors had appointed a deputy management consisting of three of the senior men who would be remaining in Jena. The temporary management tried to keep together the workshops and remaining workforce in some sort of semblance of a manufacturing organisation. The Soviet occupation authority asked the temporary management if they were able to continue, could they develop a new "brain", had they any materials and would they endeavour to resume manufacturing immediately, which they did.

The remaining Zeiss and Schott workers in Jena working under the new management were delighted on hearing the announcement that the Russians wanted the respective factories to keep operating, but their pleasure did not last long because soon came the first of the bad news - all the output of the Zeiss and Schott factories was in future to be despatched to Russia.

The rest of the bad news followed not all that long after, on 22nd October 1946, and it was catastrophic. Early that morning the management were wakened at their homes to be told that the Zeiss and Schott operations in Jena were to be closed down immediately and moved with all the machines, tools, equipment, scientists, technicians and the higher skilled operatives, as war reparations to Russia, and that during the night Russian troops had been rounding up from their homes nearly 3 scientists and key operatives and their families and belongings for transport to the railway station bound for Russia. Troops moved in to the factories and began loading everything movable into trucks. The Zeiss and Schott works were so extensive that it took five months, until the end of March 1947, to complete the devastation. Casting one's memory back to the end of the war and putting things in their right perspective, you have to remember that the Germans were the defeated enemy in a long and bitter war in which the Russians had lost many millions of men and suffered great hardships. As the saying goes, to the victors go the spoils of war.

There were some 4,000 employees in the Zeiss and Schott enterprises in Jena who were thrown out of work by the dismantling of the biggest optical plant in the world. After prolonged councils, etc. the Russians did permit a token 6% of the machines and equipment to remain whilst many of the workers were forced to help with the dismantling and packing of the equipment for removal, as factories were abandoned, other workers were cleaning them up ready for when they could be re-equipped, whilst other operatives were endeavouring to resume production with what few machines and equipment the Russians had permitted them to retain. But they had a serious problem, one that they had experienced not all that long before. They had to develop yet another new "brain".

The Zeiss workers in Jena had been looking forward to celebrating their firm's centenary in 1946, but this was at the very time the works were being almost destroyed by the Russians and in any event, the Russians forbade celebrations. So, in their despair, the management and devoted members of the staff gathered in the cemetery and held services at the graves of the founders of their empire, Carl Zeiss, Ernst Abbe and Otto Schott.

Following the Russians moving most of the remaining Zeiss and Schott operations from Jena to Russia, the evacuated Zeiss management in Heidenheim claimed that as all the directors, senior management, legal and company registration documents had left Jena, the Foundation that was the business had gone too. and was now based in Heidenheim. They sought a ruling in the West German Federal Court that they were the legal owners of the Carl Zeiss Foundation and as such were entitled to the use of the name Zeiss and the trademarks, and the ruling was granted by the Court in 1949.

The book *FEV Carl Zeiss Jena* published in East Germany does not, as can be expected, mention that in 1945 all the output from the Zeiss and Schott factories in Jena was sent to Russia, followed in 1946 by the moving of practically all the Zeiss and Schott operations from Jena to incorporate into and help develop Russia's optical industry. It does, however, as again can be expected, state that with the aid of the West German State, the old managers succeeded in establishing in Western Germany a sham Carl Zeiss Stiftung and that with the aid of the West German authorities, they usurped the titles to the Zeiss name and trademarks.

The East Germans sought to prevent the Foundation in Oberkochen from using the name Zeiss and the trademarks and at colossal cost they brought Court actions in countries all over the world to establish who had the right to use the name Zeiss. The West German Federal Court decided that as the directors, management, scientists and company documents of the Carl Zeiss Foundation had moved to Heidenheim prior to the Russians entering Jena, then Heidenheim, or wherever the Foundation moved to from Heidenheim, was the seat of the Foundation. In particular, the Foundation, as the legal owner of the Zeiss trademarks, did not cease to be the owner on moving from Jena. For the Courts in other countries, the problem was more difficult in deciding who had the right to the trademarks, but they appear to have solved the problem by supporting East-West prejudices because Courts in all the iron curtain countries found in favour of the East Germans, whilst Courts in the western countries invariably ruled that the Foundation in Oberkochen was the legal and rightful owner of the Zeiss name and trademarks. In two countries, Britain and Switzerland, the Courts took a different view and decided that both the Foundation in Oberkochen and the East Germans in Jena were entitled to use the name Zeiss and the trademarks, but that if any goods were exported to Britain or Switzerland bearing the name Zeiss, then that name must be followed by the word Jena or Oberkochen or the country according to where the goods had been made.

It is to the credit of both Zeiss Oberkochen and Zeiss Jena that the name Zeiss still reigns supreme in the optical world, both firms carrying on research and development of which Dr. Carl Zeiss and Professor Ernst Abbe would have been proud, and maintaining that high degree of quality with which the name Zeiss has always been associated.

Both firms devote a fair proportion of their manufacture to biological microscopes and in addition they both make astronomical telescopes and planetaria, surgery microscopes, electron microscopes, laboratory optical instruments and numerous other high quality products for scientific and technical purposes.

High quality invariably means high price and accordingly the products of Zeiss Oberkochen and Zeiss Jena are expensive. But which are the best? The two organisations cannot be compared as anything like equals other than the fact that they both have the name Zeiss. As you have read in this article, Zeiss Oberkochen took practically all the original "brain", i.e., the expertise developed over practically a century with them when they moved out of Jena in 1945, but they started off with no proper premises and no machinery. Zeiss Jena on the other hand, started off with those of their buildings still remaining at the end of the war with what undamaged machinery remained therein, but they no longer had the documents, technical drawings, formulas and also most of the managerial, scientific and technical skill had gone with the Americans, they being left with only the remnants of the original "brain". So they had to develop a new "brain". Then they had the same problem in 1947 when practically all of the organisation then remaining and which had tried to build itself up again in Jena was forcibly moved to Russia without compensation and it was only after protests good luck that they were left with a 6% remnant of their organisation, which they had to build up a second time and develop yet another new "brain".

It is therefore not at all surprising that the Oberkochen products are by far the best so far as optical and mechanical quality is concerned. Their products have much more finesse and consequently they are the much more expensive. What of course has an important economic influence on the pricing, apart from the difference in quality, is that Zeiss Oberkochen are in Western Germany, which has a strong currency, whilst Zeiss Jena are in East Germany which, like all the iron curtain countries, is always in need of the stronger currencies such as the pound, the dollar, the franc, etc. and they often sell their products to the west at cost or only a little over cost to obtain such currencies.

Stereoscopic microscopy had its beginnings around 1851 and in 1897 the Zeiss workshops made stereoscopic microscopes based on a design suggested by the American, H.S. Greenough, another name recorded in the annals of microscopy. For nonmicroscopists reading this article, orthodox biological microscopes have a very short working distance between the bottom of the objective lens and the slide, so the object under examination must be either flat or minuscule. Orthodox binocular microscopes do not give stereoscopic vision. Stereoscopic microscopes have a separate optical system for each eye and each eye sees a slightly different image, the combined image being seen the right way up in stereoscopic (three dimensional)relief. Because they are confined to the low overall magnification range of 3x to 125x, stereoscopic microscopes have a large working distance and are ideal for examining solid, larger and irregular shaped objects.

In 1944, Zeiss made what has proved to be an important refinement to their stereo microscopes, e.g. the ability to change the magnification without the need to refocus, keeping the same large working distance. As a result, specialized versions of suspended stereoscopic microscopes with binocular viewing heads either side for two surgeons working together have been developed. These are a boon to surgeons performing plastic surgery and transplant operations and what the newspapers describe as micro surgery, the putting back of severed limbs. Two surgeons sit facing across the patient, working along together with infinite skill and patience, both seeing the same stereoscopic image through their respective binocular eyepieces. One surgeon might be working on rejoining the tiny nerves, the other working on rejoining the tiny blood vessels. Strictly, though, any operation where the surgeon needs to use a surgical microscope is micro-surgery.

If Dr. Carl Zeiss and Professor Ernst Abbe were alive today, no honour would be good enough to signify the thanks and appreciation due to them from the whole world for the service they have done for both the science of microscopy and the good of humanity as a result of their starting off and building up the Zeiss enterprise.

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Comment by Roy Winsby, the author of the article above.

The above article was written in 1987. Since then, radical changes have taken place as regards the two Zeiss organisations, occasioned by the momentous coming together of West and East Germany.

In late 1989, early 1990 representatives of Zeiss Oberkochen and Zeiss Jena, which in 1945 had been separated into two distinct entities, and who had in fact, been rivals for nearly half a century, had talks to explore the possibilities for co-operation and to see how they could collaborate in the future. The problems against merger were that Zeiss Oberkochen was a Foundation, an unusual type of private organisation not having any shareholders and which provided its own capital for maintaining its formidable position in the field of microscope manufacture and technology. whereas Zeiss Jena was an East German state owned company receiving state subsidies. By this time Zeiss Oberkochen had risen from its humble rebirth in 1945 to the world's largest manufacturer of precision microscopes and other technological instruments.

The East German state owned Zeiss Jena had been operating under the name of Jenoptic GmbH. Zeiss Oberkochen took a 51% controlling interest in the newly formed Carl Zeiss Jena GmbH, the East German company Jenoptic GmbH retaining a 49% interest.

I do not know the exact date, but by early 1992, Dr. Skoludak, Chairman of Zeiss Oberkochen, is reported to have stated, "There is now only one Zeiss world-wide. Carl Zeiss Jena is now part of us and no longer a competitor." It was also stated that the Zeiss Jena products would henceforth complement the Oberkochen range, which would be marketed through Zeiss Oberkochen. The February 1992 issue of the publication *Optical World* said that the uniting of the two operations would involve a unified workforce of over 17,000 employees.

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MEMBER PROFILE

Jerry Bernstein

In the Marines - March 1961

Jerry Bernstein

Most people are surprised that I am that rarity, a native Californian. Born in 1943, a "war baby", many crossroads bring me to say "I love my California! I always have ... perhaps I always will."

When my brother took an autobiography class at a local city college (he already had a Ph.D. in physics) I found interesting the instructor's suggestion to those who said, "well, what do I write about? His suggestion was to write about "the cars in my life" or "the houses in my life" or something similar.

I can't easily write about "the microscopes in my life" as well as some of you who have been into microscopy most of your lives. However, I can say that I have always had a love for all kinds of technical things; optics, cameras and telescopes included.

Not coming from a wealthy family, I had no hope to buy new things so I learned early how to shop around for things second hand. I always looked at ALL the technical details I could find with cameras, short wave radios and the like, just to know how close I could get to the best for what I could afford.

If I ever become a wealthy man, I still wouldn't be able to pass up a garage sale. There is something related to this in our MSSC meetings, mostly from the people you meet there and the stories you share as well as the "stuff" you might find.

Poor study habits brought me to quit high school and join the Marines at seventeen. I'm grateful for the things that came easy to me over the years because every time I got fired, or quit a job, something better happened to come along.

I have always had a complex about education and being a school dropout. But in looking back, I still managed to go on and do something.

I think one special opportunity was getting into a "guaranteed aviation program" with the United States Marine Corps, right from the recruiters office. After boot camp and infantry training, I got into aviation electronics (Navy training in Memphis, Tennessee) and then spent my last two years at the El Toro Marine air station; truly a "Disneyland Marine" about forty miles from home. I worked mostly with the, then new, F-4 Phantom fighter aircraft.

This was followed by eight months with Pacific Bell as a telephone installer; then four months with Trans World Airlines working on the autopilot, radios, com-pass, navigation instruments, and radar (...I got fired for starting a fire while trying to clean a live radar antenna with methyl ethyl ketone.

Then I went over to the Flying Tigers, Where I did the same aircraft instrumentation work. I stayed there for thirteen years from 1966 to 1979. In 1967 at the age of twenty three, I spent two months in Japan where I was responsible for Avionics repair work, covering three air fields. In 1968, I was sent to Israel for eight months with an extra B707 that El Al Airlines needed on lease for a heavy holiday period.

There, I met and married a pretty young Army lieutenant named Ruth. We have two boys, Michael who lives in Las Vegas doing computer graphics, and David who lives in Israel managing special upholstery work in a small company.

I left the Flying Tigers to live and work in Israel for Bedek Aviation in 1980. I had three positions there until I left in a voluntary layoff program in 1988. I first worked in flight testing of the Israeli made Astra business jet. I then went into Reliability/Maintainability Engineering, and lastly into quite a nice position as a Contract Administrator where our efforts were to secure maintenance and engineering work with the U.S. Government from the European theater.

This last job normally requires a Masters degree or a legal degree, however, I got the job because they needed someone with an extensive aircraft background and a mother language of "American" English.

What does this have to do with microscopes? Nothing much, except that in the two years in which I was "rootless" between two countries, I wanted to get a nice microscope and, true-to-form went looking for the best second hand stuff I could find. That took me to several microscope dealers where I bought, sold, traded and ended up with two nice Zeiss instruments and a lot of accessories. Soon I had eight; then I had twenty.

Finally, in 1990, I had to find a job or start my own business with second hand microscopes. Well, guess what I did with more guts than brains?

I'm now into my seventh year with this business, and I think it really has turned into a case of being able to play with my toys while having it as a means of livelihood. It also became a wonderful blessing by providing something to do as a challenge during my recovery from very extensive back surgery. Thank you God for the gift of recovery and to all of you for your encouragement.

I will never forget your get well card with fifty signatures at that tough time and your continuing friendship. Thanks!

An interesting ring light advertised in "Biophotonics" January /February 1997.

The Microscope - Fundamentals

Alan G. deHaas

Whether one works with a 100 year old or modern instrument, an inverted, continental or "L" style stand, the main parts of a microscope are the same, the goals of the designer are the same and the science and art of using the microscope are the same. It is to these basics that I direct the following discussion.

THE STAND

The user of the microscope usually does not disassemble the instrument to see what is inside; so let us perform a dissection. The mechanical design of a microscope starts with the requirement for a stable structure to both support the specimen and optics, and allow for the accurate repeatable small motions required of a system moving shallow depth of focus lenses.

The stand sans eyepieces, objectives, condenser, any relay or tube length correcting optics, and without a lamp or its associated lenses, is basically a vertically oriented non-deflecting pier with cantilevered components. The foot of the microscope should be large enough to resist tipping and for modern stands, have some provision for the mounting or containment of an in-base, that is substage, illuminator. A bare stand may be either a one piece casting or a screwed together assembly of structural components. The quality and thickness of the metal should be selected so as not to allow deflection under normal loads; cameras, photometers, special specimen holders et cetera.

The condenser setting although critical, need be controlled only by a rack and pinion motion. If for a condenser one wishes to use a microscope objective, this rack and pinion system should have a comfortable "feel" to permit fine motions. For this purpose some stands from the 1930s and 40's still incorporated both coarse and fine adjustments for condenser height control. In some of the less expensive stands, euphemistically called "student" models, the condenser is mounted in a helically slotted sleeve and is displaced vertically by rotation of the condenser. This is fine for minor adjustments but does not allow for the intentional decentering or necessary centering of the condenser, or for full control of the illuminant. A microscope permitting condenser interchangeability will have either a sleeve mount with a clamping screw, a front entry dovetail slide or fork, or a pin-detent holder in which the condenser is snapped onto a ring. This latter form is very good for smooth controlled centering.

A few decades ago, vertical motion of the condenser was obtained from the rotation of a nut in the form of a knurled headed sleeve, with the condenser mount resting on a single round guide rod - very effective, smooth and easily controllable. Today's rack-and-pinion motions do not give one the same feel or have the sensitivity, but certainly suffice. The condenser support mechanism, depending on manufacturer and model, is suspended either from the underside of the stage or is attached directly to the vertical member rising from the foot of the microscope. This vertical member is frequently part of the foot casting.

Just above the condenser mount is the stage. The stage need only be a flat rigid plate with a hole on the optic axis to permit illumination of the specimen. It is usually mounted to the stand by means of two to four screws passing through a protrusion from the limb of the microscope. Modifications and attachments to the stage are available for both ease of specimen manipulation and for measurement of optical characteristics. The most common of these attachments is the mechanical stage; a device with an x-axis and y-axis rack-and-pinion or screw drive, actuated by knobs either on individual shafts or on one set of coaxial shafts. This drive may be above the stage or below, left or right handed, and can usually be selected to suit the user. On smaller instruments of the "L" stand variety, below the stage x-y controls can interfere with access to one or more of the focus control knobs. (the term "L" stand refers to the zeiss microscopes of the 1930s, the first in which the limb of the microscope could be positioned away from, and the stage toward, the user).

The rapid specimen scanning required of pathologists causes many to remove this mechanical device or the specimen holder, and position the slide directly by hand. With experience this becomes quite easy even with a 40x objective.

The mechanical x-y stage is often built in to the stage plate itself. Attached to the microscope is a supporting member on which is mounted, on ball or cross roller slides, or solid metal ways, a rack-and pinion driven plate for the y-axis motion. The x-axis motion of the specimen is produced by means of a gear driven embedded dovetail slide. There are more variants to this stage design and construction than manufacturers, with a price range just as wide; from a few hundred dollars to over two thousand. If one wishes to also rotate the specimen, as is necessary in petrology, this figure can rapidly climb to over three thousand. The rotating stage is also useful in photomicrography for proper specimen orientation. Special stages for the inspection of semiconductor wafers can have motions exceeding 10 by 10 inches.

Above the stage, the microscope will have some form of support for the optics cluster. This may be a tube mounted on a gear driven dovetail or a rigid horizontal limb. In the first case, all focussing is accomplished by moving the eyepiece and objective assembly on the optic axis of the instrument. In the second case, the optics remain fixed and it is the specimen which is caused to move along the "z-axis". In some older stands the entire optics support limb was raised and lowered. For early stands and some less expensive instruments, focus was achieved by manually sliding the tube in a sleeve.

The fine adjustment is much more complicated. Most fine adjustment knobs are graduated in 1 or 2 micron increments.That is a minimum expectable control sensitivity. One actually requires a smooth, jitter free vertical translation ability of one tenth of a micron or better.

This motion may be produced by a superimposed fine rotation of the coarse adjustment pinion, or by bearing against a separate block traveling in its own dovetail slide and carrying either the entire tube and coarse adjustment assembly or the stage.

A fine adjustment system can be anything from a simple screw driven lever supporting the body tube, to a cardioid shaped cam supporting a ball bearing follower. One common and good system is the relaying of fine adjustment shaft rotation to a coaxial coarse adjustment by means of a set of planetary balls: that is, the hollow coarse adjustment outer shaft contains a set of balls, usually three, in a plane perpendicular to the shaft axis. A smaller fine adjustment shaft passes through the central open space between the balls. A large angular displacement of the fine focus control will then produce a small angular motion of the coarse adjustment.

In the Series-10 American Optical microscope the coarse focus was accomplished by rotating a large helically grooved cylinder with a lever follower transmitting motion directly to the nosepiece.The coaxial fine adjustment screw caused a slow linear translation of the cylinder.

The simplest parts of the microscope and the ones usually not given any attention, are the drive knobs and centering screws. Much of the comfort of using a good microscope is the ease of access to the controls. Properly knurled screw heads of suitable diameter and focusing knobs of metal, with a solid feel and ease of handling, are a nicety unfortunately overlooked by many manufacturers.

The heart of the microscope, the optics, must be carried by a stable, durable and easy to manipulate structure. In its basic form this is a tube of known fixed length (or adjustable length in older instruments), accepting the eyepiece at one end and an objective at the other. Should one wish the system to have more than one objective readily at hand, as is usual with most microscopes, the distal end of the tube can be outfitted with a nosepiece. This is sometimes called a revolving nosepiece or revolver. In microscopes designed or adapted for petrological work the objectives are mounted in either single interchangeable centering mounts or on a nosepiece in which each objective is individually center-able. A nosepiece may have a capacity of 1 to 7 objectives.

The most important steps in the manufacture of any objective changing device are an attention to accuracy and quality control. If one wishes to observe a specimen detail at greater magnification, it should be possible to move a different objective into place without having to reposition the specimen.This characteristic is called parcentration. Even in the most expensive systems it is sometimes necessary to "walk" the objectives around the nosepiece to find the locations in which the errors in manufacture of the objective's mounting thread and sleeve best compensate the errors in the nosepiece. Even with this effort, it is common to find an error in parcentration on the order of a quarter of the visual field. That this problem can be eliminated is shown by a currently manufactured film analysis device in which the parcentration is held to no worse than 1 micron.

For modern microscopes equipped with objectives of like brand and series, the changing of objectives should not necessitate refocussing by more than 1/8 of a turn of the fine adjustment (my estimate and my preference). Parfocallity can be assured by using shimming washers. These are available in a wide range of thicknesses starting at less than 0.001 inch. The older Bausch & Lomb objectives had adjustable sleeves allowing the user to set the position of the optic and then lock it in place. By this means parfocallity of all the objectives on the instrument was assured.

Proper manufacturing processes also, of course, must extend to the eyepieces. In some less expensive modern binocular microscopes, it is possible to observe that the field centration is not the same in both eyepieces. I am not speaking here of misaligned prisms or eyepiece tube displacement. By rotating one or both eyepieces there eventually will be a place where the fields are identical. This means that there is a lack of concentricity between the stop in the eyepiece and the optic axis or between the shell of the eyepiece and the axis. In older microscopes this was a common problem easy to observe in monocular instruments. If you have one, rotate the eyepiece and observe the field perimeter.

It should be obvious from these statements that, as with almost everything else, the quality of the microscope is directly related to the manufacturer's desire to maintain a certain reputation and market share, and hence, is directly related to cost. Some manufacturers produce good optics and very poor mechanical parts, not just from the standpoint of material selection, but starting with the basic concept of what is right and proper in a scientific instrument. Yes, nylon gears do make for a smooth motion, but why should the user be forced to replace worn or terminally fatigued parts when an initial dollar more would have obviated that need? Why select a soft aluminum alloy not capable of being threaded properly when it is just as easy to cast a stronger aluminum alloy? Most models of one popular microscope brand that comes immediately to mind, will bear no more than two servicings, after which a retightening of the screws will strip the threads out of the stand. This same manufacturer is known for a common peculiarity in their binocular heads. The prisms are held in such a manner that a strain is produced in the glass thereby generating a rather severe astigmatism. The image's vertical and horizontal axes do not come into focus in the same plane. The astigmatism of a system is easy to check with a hemacytometer slide.

With all the parts placed back on the, one assumes, decent microscope you have selected, you are ready to prepare the instrument for use. It is hoped that the optics are clean because that subject alone can easily take up more space than the entire society bulletin. One basic warning about tissue used for cleaning lenses; do not use paper towels, laboratory wipes or any other glass fiber strengthened material. As the manufacturers of good lens tissue generally have rather large minimum order requirements, the best alternatives are either a well washed and rinsed 100% cotton handkerchief or plain white toilet paper. Remember that whenever a lens surface is too dirty to be cleaned by blowing a stream of air over the surface, that some moisture must be present to act as a vehicle to carry away the contaminants without scratching the lens. The water vapor condensed on the lens surface from exhaling on it is often sufficient. Just breathe well upon the lens and wipe carefully.

LIGHTING

There are two common methods for specimen illumination. The modern microscope with built-in illuminator incorporates a Koehler style system in which the illuminant is imaged in the plane of the condenser's aperture iris. The benefits this system offers have caused many to forget the Nelson, also called critical, illumination system. The word "critical", as applied to illumination, has been greatly misused. There is only one method correctly referred to as critical illumination; the source must be imaged in the specimen plane. For the best photomicrographs, Nelson, or critical illumination is still unsurpassed. When one questions how the 19th and early 20th century photomicrographer was able to achieve such high contrast and resolution, critical illumination is the answer. The source for this method must be of uniform intensity and planar. Since we no longer use oil lamps or incandescing magnesium oxide blocks, this requirement is filled by ribbon filament lamps.

When using Koehler illumination, the lamp's filament structure is not as important, for one is generally working from a secondary source, a ground glass filter. This light homogenizing method is perfectly satisfactory for routine observation. With or without a filter, one is always illuminating the specimen with whatever falls in the plane of the field iris. Zeiss even went so far as to place, in a less expensive microscope, an equivalent to an opal glass directly beneath the specimen. This "lucigen" condenser, although yielding a lower contrast, does provide uniformity. It also does not suffer from one of the major problems of Koehler illumination in which the slightest bit of dust can be made visible if that dust is sitting in a plane image-able by the condenser. In true critical illumination, it is the image of the source, usually clean and free of defects, that falls in the specimen plane.

SETTING UP THE INSTRUMENT

With a specimen on the stage of the microscope, one initially needs only to know that a sufficient amount of light is passing through the system to be able to focus on the object. Centering and other adjustments come later. If the specimen is in focus the position of the objective is known, correct and should be left as is for the following adjustments. If you are using a microscope with built-in Koehler illumination, stop down the field aperture iris all the way and move the condenser so as to bring the edge of the field iris into focus. Open the iris to almost fill the field. You can now observe whether or not the condenser is centered. If necessary, manipulate the adjustment screws on the condenser mount to properly center the image of the iris. Open the field stop to just outside the perimeter of the field.

We now arrive at an often disputed point. Some will say that when the field iris is in focus, the condenser is in the proper position. But, since by small vertical motions of the substage, the chromatism of even the best condenser is observeable, that chromatism is also useable. Raise the condenser so that the blue focus falls in the specimen plane. This slight shift in condenser position is not detrimental, does not go against theory, and in fact can produce a higher contrast and resolution.

The usual next instructions are to remove the eyepiece, observe the rear of the objective and reduce the aperture iris to nine tenths of the diameter of the luminous area (according to some authors, seven tenths). These steps are both unnecessary and misleading. A specific aperture observed at the back of the objective does not always indicate that the best image will be produced. The design and quality of the objective determine how much of the aperture may be used for the creation of the image. With the eyepiece(s) in place, carefully observe the specimen and begin to close the aperture iris. There will be a best position which is not necessarily .9 or .7 of the diameter. Some poor 100x oil-immersion objectives cannot be used at even .6 of their full aperture whereas a few good 25x 0.75n.a. oil immersion lenses can be used with the aperture iris all the way open.

Do not be put off by theory or constrained by what is written in some of the manufacturers' literature on microscope use. The best achievable image, the best trade off between contrast and resolution, is determined by the microscopist starting from the basic setup and modifying and manipulating the light to bring out the details and characteristics of the specimen.

THE BINOCULAR HEAD

In order to use a binocular instrument comfortably, the interpupillary distance and the individual focus must be set to produce, as nearly as possible, a condition of muscular rest - no strain. Do not squint while adjusting the focus , for this will produce a strain in the other eye. For a binocular head with one eyepiece tube fixed and one of variable length, keep both eyes open, hold a card over the adjustable eyepiece and focus the microscope upon a specific detail in the specimen. Without touching the focus, move the card to the other side and adjust only the variable eyepiece tube until the best focus of that same detail is achieved. Observing with both eyes, adjust the interpupillary distance to produce one uniform field. At this point, a slight readjustment of focus may be needed. Binocular heads with two variable eyepiece tubes are to be first set for the user's inter-pupillary distance in mm on each tube or, if so graduated, to -0-. Then regarding one as the independent and the other as the dependent tube, proceed as above.

Once one starts using a microscope, hours may go by without the perception of their passing. So, although it has nothing to do with the microscope itself but much to do with its operation - sit comfortably without inducing a strain in the neck or other body parts. The light level should also be adjusted for comfort. It may be controlled either by varying the voltage applied to the lamp or by the insertion of neutral density filters. If one is not concerned with color photomicrography the former is preferable. Have available some filters for the control of image contrast; blue filters for red stained specimens, et cetera. Slight filtration will sometimes make viewing easier by enhancing detail and reducing eye strain. ***

Near-Field Optical Microscopy: A Breakthrough in Resolution

Sid Ragona and Phil Haydon, Laboratory of Cellular Signalling, Department of Zoology and Genetics, Iowa State University.

Excerpted from Topometrix (TM) Applications Newsletter, Summer 1996, Volume 96-1

Unlike conventional optical microscopy, in which the resolution is limited by the wavelength of light used, the resolution of a Nearfield Scanning Optical Microscope (NSOM) is primarily dependent upon the size of a sub-wavelength aperture that is brought within a few nanometers of the surface.

The data presented here demonstrates this remarkable improvement in resolution. The test sample used for this experiment is the interband region of a polytene chromosome.

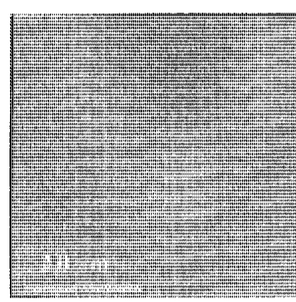

Fig 1. Far field - probe separation is 1.8 microns

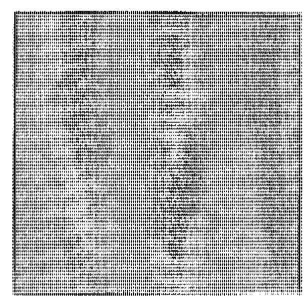

Fig 2. Near field - probe separation is 2-5 nm.

Using a TopoMetrix Aurora (TM) NSOM, a small area (5 x 5 microns) was imaged with a probe which had an aperture of approximately 25 nm. When the tip-sample separation is 1.8 microns, providing far-field illumination, the resolution is about 700 nm, (Fig 1).

A dramatic improvement is shown when the same area is imaged with a separation of only 2-5 nm, which is obtained when shear force feedback is used to position the aperture (Fig 2).

Line profiles (Fig 3) across the images clearly demonstrate the increase in resolution.

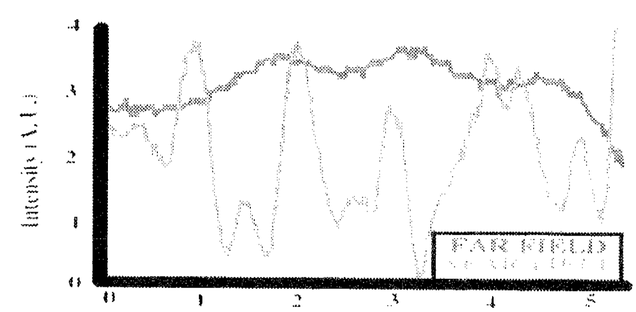

Fig 3. Comparison between far and near field resolution.

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Future Programs

Our program chairman, Larry Albright has been doing a wonderful job getting interesting speakers for our monthly meetings held at the Crossroads School, 1714 21st Street at 7 PM on the third Wednesday of each month. Visitors are invited to attend.

At the April meeting on Wednesday the 16th, Orange County Vector Entomologist, James P. Webb, Phd. will speak on two subjects. First will be his exciting illustrated lecture on forensic entomology. Those of us who have heard Dr. Webb speak at the Lorquin Society look forward to his enthusiastic presentation and fascinating material which gives a new appreciation for entomology in criminology. His second topic will be insect dementia, or the perception of insects that are not there. This will be a dynamic and interesting program, not to be missed.

In May, Larry is arranging for Jeremy Collins of Christie's auction house in London to stop by on a trip to Australia to give us an illustrated lecture on scientific antiques. Aside from speaking about his work with Christie's, Mr. Collins can draw from his extensive personal collection of scientific antiques to enrich another exciting evening. In order to fit with Mr. Collins' travel schedule, it is likely that the May meeting will have to be held on the Tuesday the 13th, rather than on Wednesday, our regular day. Special notices will be sent out as soon as the plans are definite.

Further on, sometime in the fall, Brian Ford, the author of "The Single Lens" will be our featured speaker. On another memorable evening, those of us who own his book will have a chance to have it autographed by the author.

Thanks are in order from the whole group for the splendid work that Larry has done in obtaining such distinguished speakers.

EXPERT LIST - The following is a resource list of members who have offered to share their particular expertise in various subjects to answer questions from other members. To get answers, please contact the person on the list directly. To add your name and particular talent to the list, contact our Secretary Ron Morris who had the idea for, and will maintain the list.

Antique microscopes, identification and history - Jim Solliday, Stewart Warter.
Books and literature - Norm Blitch, Rick Blankenhorn
Botany - Leo Milan
Chemistry- - Bill Hudson, Izzy Lieberman, Leo Milan
Diatoms - Jim Solliday
Electronics - Chris Brunt, George Vitt, Al Herman, Ron Morris, Steve Craig
Forensic Microscopy - Ed Jones
General Optics, Optical design - Alan deHaas, Gaylord Moss, George Vitt
Histology - John deHaas
History (Leitz) John Field, Peter Fischer.
Integrated Circuits and Microelectronics - Ron Morris
Metallography - Bill Hudson, Annalese Grohs.
Metalworking lathe and machine tools-Jim Clark, Ernie Meadows
Microscope techniques, illumination, adjustment - Alan deHaas, John deHaas
Modern microscopes, microscope selection - Jerry Bernstein, John deHaas, Alan deHaas
PC Macintosh, Internet - Larry Albright, Gaylord Moss.
PC with windows 3.1 Internet - John A. Busey
Petrography, Thin sections - Bill Hudson
Photography - Don Battle, Steve Craig, Morris Greeson
Photoshop - Al Herman
Restoration - John deHaas, Jim Solliday, Dave Hirsch
Slide making - John deHaas, Jim Solliday
Spectroscopy - Bill Hudson
Video/cinema micrography - Steve Craig.
Woodworking and microscope box construction - Dave Hirsch, Ernie Meadows.

Editor's Notes

Once again, thanks to those members who continue to contribute the articles that make the Bulletin possible. The outstanding collections of instruments, books and knowledge among the group are wonderful resources to share.

We continue to owe a great debt to the members of our corresponding societies who allow us to republish their articles in a cooperative exchange. In this issue, we can all enjoy the magnificent Zeiss Story by Roy Winsby of the Manchester Microscopical Society as well as his article on "floaters". In previous issues we were fortunate to be able to republish several fine articles from the Balsam Post.

One item that we lack are very short articles from the members. How about some brief, even quarter page, descriptions of some interesting thing or technique that you have discovered. Please do not feel that every contribution has to be a long scholarly article.

Gaylord Moss