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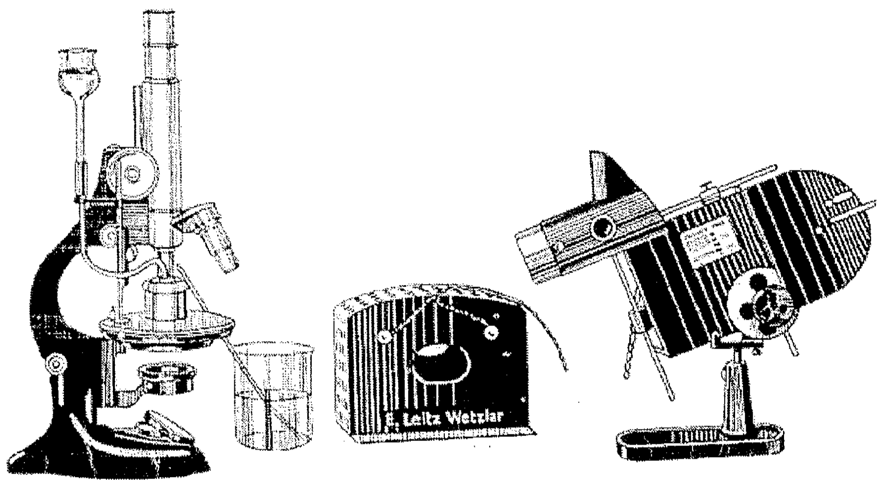
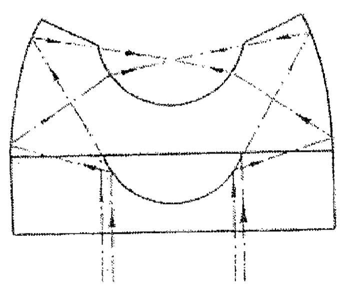
DARK-FIELD MICROSCOPY

James D. Solliday





Special stage mounted dark-field condenser used for the study of circulation and Brownian Movement

Definition:

Dark-field microscopy is the study of objects illuminated by the light which the objects themselves reflect into the lens of the microscope. The light source itself is prevented from passing through the image field as with bright-field illumination. All the rays lighting the object must be sufficiently oblique so that none of them can get directly into the lens. Only light which is reflected or scattered by the specimen can be taken in by the objective lens. The result is that the specimen appears self-luminous on a black background.

Limitations and Advantages:

In dark-field microscopy the subject material (specimen) must be spread across the slide, not densely packed or saturating the field of view. If there were no intervening empty spaces, the entire field would appear bright, thus obscuring details. Dark-field emphasizes edges, outlines and boundaries but does not do as well in showing the various internal details. Histology sections or other objects so large that they fill the whole field of view cannot be studied advantageously by the dark-field method. However, specimens that can be clearly seen by this technique are often live studies of microscopic organisms which have very little contrast of their own. This would include subjects that live in aquatic or plasma mediums such as bacteria, protozoa and diatoms. Subjects which might have medical significance would include liquids from the body such as blood, lymph, synovial, saliva, nervous system and other mucous fluids.

If you desire to study the behavior of microscopic organisms and your subject is very small or its refractive index is similar to its surrounding medium, dark-field microscopy is probably the most economical alternative to other contrast enhancing methods. This is especially true when fixing and staining are not possible. It has also been found to be useful in the counting and identification of particles. Even ultra fine particles are detectable with dark-field microscopy.

Description of Apparatus:

There are primarily three types of dark-field condensers available for the compound microscope. For the low power objectives, the Abbe condenser with a dark-field stop works quite well. For moderate to higher powers, the Paraboloid condenser works sufficiently. When working with the highest magnifications the Cardioid or bicentric type condensers provides the best results. Both the Paraboloid and the Cardioid types usually require homogeneous immersion contact between the condenser top and the underside of the glass slide. (Note: The Wenham Paraboloid type is rarely found in use today.)

In general terms, the Abbe condenser with the dark-field stop is the refraction-type, while the Paraboloid and Cardioid are the reflecting-type condensers. The most significant difference in the latter two types is that the Paraboloid has a single internal reflecting surface while the Cardioid has two internal reflecting surfaces.

Refracting dark-field condensers, Fig. 1:

When using a central stop with a common refracting condenser (Abbe), the stop must be large enough to exclude all rays from passing directly into the objective. It should also be small enough to allow those rays to pass through the outer margins of the condenser which has an aperture greater than that of the objective used. To determine the proper size of a central stop for a particular objective, you should remove the

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ocular and look down the tube of the microscope. Close the iris of the condenser until its edge can be seen around the margins of the back plane of the objective. Then, open the iris until the edge just disappears. You may now measure the diameter of the iris opening. This opening, which just fills the aperture of the objective, indicates how large a central stop is needed to exclude all transmitted light. Before beginning this operation you should focus the objective on a specimen and set the condenser properly under the specimen slide.

When using oil objectives with a high numerical aperture (above 0.85), the refracting condenser usually can not be made to produce adequate dark-field illumination. Oil-able condensers with the highest angle of aperture and the greatest degree of correction are best, however, the focus of the rays are not very sharp

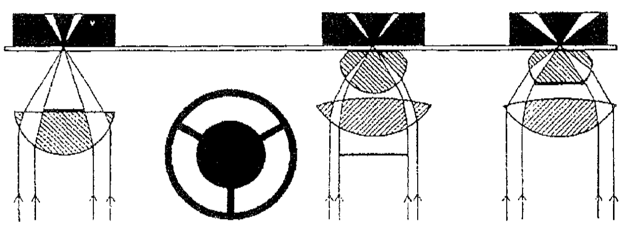


Fig. 1 Refracting dark-field condensers

A) A spot lens, the first reflection dark-field condenser was developed in England. Its best application was with low power objectives having an N.A. limit of 0.30.

B) Abbe Condenser, with a black stop held in the filter carrier. The diameter of the stop is determined by the Numerical Aperture of the objective, having a practical limit of 0.65. This is the simplest method for providing dark-field illumination while working with low to medium power objectives.

C) Abbe Condenser, using a dark-field element replacing the regular top lens. This element is threaded in place and is thus used in conjunction with the bottom lens of the condenser. Because the stop is inside the optical system, it is more efficient enabling it to be used with the higher powered objectives. This system is compatible with most objectives providing the N.A. does not exceed 0.85, and the top lens is immersed to the slide. Objectives with apertures above 0.85 will require a built-in iris, or a funnel stop.

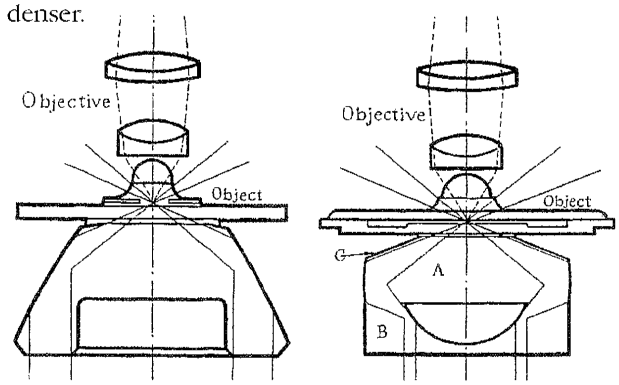
(Illustration from *The Practical Use of the Microscope* by Needham)

and even more serious, a central stop cannot easily be placed on the last element of the condenser. A small amount of scattered and refracted light will always remain to enter the objective and create a fog. In this case, a reflecting-type condenser is usually preferable to that of the standard refracting type.

Reflecting dark-field condensers (Fig. 2):

Between 1850 and 1856, there were several varieties of reflecting condensers designed specifically for dark-field use. It was discovered in the mid -19th Century that the refracting condensers were not well adapted for obtaining the best ring of light in high-powered dark-field work. One of the first reflecting types to be used was the silvered Paraboloid condenser (Fig. 2A). After the turn of the Century, the Cardioid condenser (Fig. 2B) was produced. The purpose of these condensers were to give a ring of light which would have the highest aperture and be as free of aberrations as possible. The result was the formation of a sharply focused hollow cone of light at the level where the specimen is situated. In all types of dark-field condensers, the central part of the light source is blocked and only a ring of light enters the condenser, eventually forming a narrowing cone (Fig. 3).

Another difficulty when using the highest powered objectives (high N.A.) is the inevitable law of refraction which prevents high angle rays from passing from the condenser through air and retaining that high angle. Once the rays pass from an air space and enter the slide they slow down and tend to straighten out in the direction towards the objective thus flooding it with stray light. There are two actions the microscopist can now take to overcome this difficulty. First the slide bearing the specimen should be in immersion contact with the top of the condenser thus eliminating the air space. Second, the collecting angle (N.A.) of the objective can be reduced by means of an iris or a funnel stop. The numerical aperture of the objective must be lower than that of the dark-field condenser.



A. Paraboloid Condenser **B. Cardiod Condenser**

Fig. 2 Reflecting type condensers

The reflecting angle or numerical aperture of the condenser must be greater than that of the objective. The central part of the cone of light equal to that of the aperture of the objective must be blocked out, leaving only a hollow cone of light whose rays are at a greater aperture (angle) than that of the objective. In practice it is difficult to achieve a good quality dark-field cone of light at a very high aperture. The reflecting condenser may produce its most oblique rays at an aperture of up to 1.30 to 1.40, but it may have for its least oblique rays an aperture of 0.90. The aperture reported on the side of the condenser should reflect

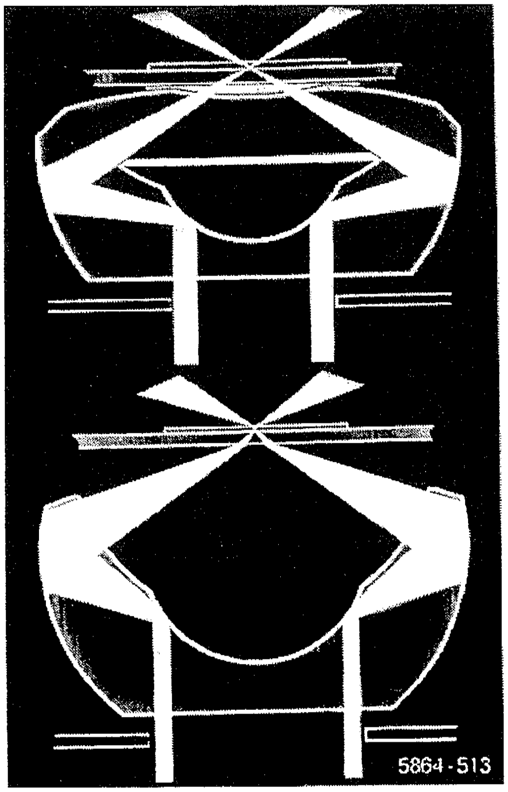


Fig. 3 Image of the light path of a Leitz Cardiod Condenser.

this lowest number as the true potential aperture of the device. The fact is the condenser would not produce proper dark-field illumination for objectives having an aperture greater than the least oblique rays of the condenser. As the oil immersion objectives have an aperture from 1.25 to 1.40 they cannot be used at their full advantage for dark-field observation. As mentioned above the solution to this problem is that the manufacturers provide an oil objective with an iris to reduce the aperture below that of the least oblique rays of the condenser. A second and more traditional means of achieving the same result with objectives without a built-in iris is to insert a funnel stop. For many years manufacturers produced specific funnel stops for their higher powered objectives. However, most modern objectives have additional elements that correct for flatness and provide for a wider field leaving no room to insert such stops. In today's market if one wished to purchase a high powered lens for dark-field work, they would have to buy an objective with a built-in iris.

Today, there are a few precision double-reflecting (Cardioid) immersion dark-field condensers with a true aperture of at least 1.20. This has extended the potential value for dark-field application, especially where the highest image quality is essential. The Cardioid type condensers also provide for a much greater efficiency in the use of the available light. When a refracting condenser is converted to dark-field by the use of a stop, about 80% to 90% of the light source is effectively blocked. The Cardioid type reflects a much higher percentage of light off an inner spherical surface that simultaneously acts as a stop. Instead of the light being absorbed by the stop, it is reflected to a second outer conical surface that, in turn, reflects it up through the plane of the specimen. Thus, we get the term Cardioid as it refers to a curved circle that wraps around the circumference of another similar circle.

When there is a need to study a slide which has been mounted in a permanent medium with a refractive index of higher than 1.45, dark-field condensers of the highest possible numerical aperture should be used. To solve this problem, there have been several double reflecting condensers of maximum aperture invented. The Cassegrain, introduced by Nelson (Fig. 4), and the Spot Ring, a double reflector similar to the Cardioid, are good examples. These condensers furnish an extremely oblique hollow cone of rays with a numerical aperture of up to 1.40. They will allow the use of a standard oil objective of up to N.A. 1.30. If you attempt to use this type of condenser with an aqueous mount of 1.33 (water) most of the rays will be reflected back to the condenser. All specimens must be mounted in a medium of 1.45 refractive index or higher and the slide must be in homogeneous immersion contact with the top element of the condenser. These types of devices are mentioned here primarily for the information of the reader as they are not generally available or regularly used by the amateur microscopist. It may also be useful to mention, that at the highest powers, it is difficult to obtain a clean dark background. To achieve a blacker field and reduce the glare, a blue daylight or green filter should be used.

The thickness of the slide should be between 0.9 and 1.1mm thick. If the slide is too thick, the rays will be focused inside the glass making it impossible to obtain a point of intense light necessary for a perfect dark-field. The thickness of the cover glass should be as near 0.17mm as possible. In most cases, the objective being used has been computed for this thickness. Any excess spherical aberrations tend to produce a hazy glow around an object. A thick cover glass may

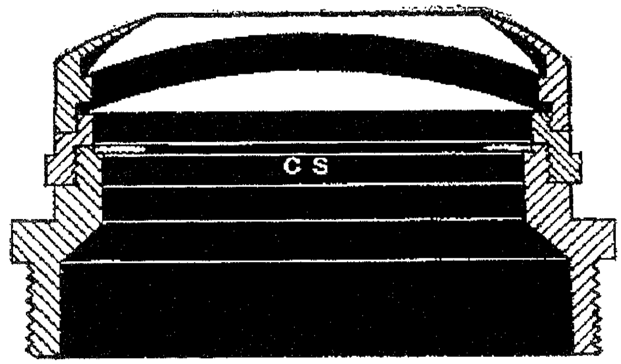


Fig. 4 Nelson's Cassegrain Condenser.

also tend to draw unwanted illumination rays into the objective. Bear in mind that the higher the N.A. of the dark-field condenser, the thinner the slide holding the specimen should be. If the slide is too thick and the angle of the condenser is very high, the focal-point, and consequently the working distance, will not be compatible with the slide. With dark-field condensers, the thickness of the slide chosen is determined by the fixed working distance of the condenser. Unless the slide is of the corresponding thickness, the object will be above or below the apex of the cone of light.

While centering the condenser is important in bright-field observation, it is far more important in dark-field application. Most condensers are provided with centering screws. This is important as quite often all the objectives on the nose piece are not parcentric (centered). It is advisable to center the condenser with the use of a lower power objective and eye piece. A ground glass slide serves as a good aid in centering the condenser.

Experiments:

One of the most interesting subjects to be studied by the dark-field technique is blood. After cleaning with alcohol, puncture the middle finger of the hand with a haemostast. Allow a drop of fresh blood to form and touch a cover to the top of the drop. Place the cover on a slide and allow the blood to spread out. There should be just enough blood to barely fill the cover. Some parts of the preparation should appear almost transparent, if it looks red all over, the blood layer is to thick. Seal portions of the cover with oil or Vaseline. Observation with the oil immersion lens can then begin. The red blood cells will be seen as rings and the white cells as bright globs. If you are fortunate, a white cell might be seen performing its amoebic function of phagocytosis.

Another interesting subject is Spirochaetes: This specimen can be taken from the mouth (Spirochaeta bucalis). For making a fresh preparation use a clean toothpick and collect a bit of material from around the base of the teeth and put it on a suitable slide. Add a drop of saliva and put on a cover glass and seal it with oil or Vaseline. The Spirochetes will have a string like spiral appearance with a cork-screw movement normally associated with this group of organisms. You should be using an oil immersion lens along with an immersion dark-field condenser.

History:

Probably the first description of dark-field illumination can be credited to that most remarkable scientist, Robert Hooke. Although he made no reference to it in his famous *Micrographia* of 1665, he later wrote, in 1678, a paper entitled *Microscopium*, perhaps as one of his Cutlerian lectures. He said that "if the candle were removed a little out of the axis of vision, all these little creatures appeared like so many small pearls or little bubbles of air, and the liquor in which they swimmed appeared dark" (Martin, 1980). As for the first published description of dark-field illumination, it should be mentioned that the Rev. J.B. Reade prepared a paper on this subject that was included in Pritchard's *Micrographia* (1837). A similar description was also published in Goring's *Microscopic Illustrations* (1838). The method described consisted primarily of a light source set aside from the axis of the instrument and directed at an oblique angle through the specimen by the aid of a bulls-eye condenser.

In the 1840's Nachet actually produced a prism (condenser) that provided oblique illumination from a single side of the condenser. However, the hollow cone of light that provides the dark-field that we see today was first invented by F.H Wenham in 1851. This was the brilliant silvered parabolic reflector that was displayed at the Great Exhibition and first manufactured by Smith and Beck. Within a very short time, Mr G. Shadbolt produced the same results with a glass annulus around a dark stop. Wenham soon combined Shadbolt's design with his silvered reflector and came up with the glass Paraboloid. This new device was much easier to manufacture and soon became the standard dark-field condenser for several decades. For most low power work, the paraboloid was eventually replaced by a simple dark-field stop when the Abbe type condensers became widely used (Martin, 1880). After Robert Tolles introduced homogenous immersion (1873), dark-field was able to be used at the higher magnifications and this led to fundamental changes in the design. By 1877 the Wenham glycerine immersion Paraboloid was available for high powered objictives. In 1909 Dr. Siedentopf designed the Cardioid ultracondenser with one spherical and one cardioidal reflecting surface. The immersion dark-field condensers made it possible to safely use ultra-violet radiation for the fluorescing of anti-bodies. Florescence microscopy became possible by the illumination of the specimen without flooding the field of view with harmful radiation. Today, all the major microscope makers provide a selection of dark-field condensers as an accessory to their line of instruments. The best advice would be to begin with a simple stop and low power objectives. At this point you can experiment with color filters alone with a variety of stops. In the mean time, you may wish to keep an eye open for the proper high magnification equipment needed for ultra dark-field microscopy.

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POCKET LENS PLANT LORE

BOOK REVIEW - by Fred Loxton, Editor Balsam Post

This little book is not one to be ordered, but one to be hunted for, and, I hope found eventually. It is a slim little volume, and my copy suggests that it was first published in 1931.There may have been later editions. Written by James Small and published by J & A Churchill, it is an unpretentious little volume, intended for the beginner or interested youngster and is easily overlooked on the bookshop shelves. There are 224 pages, and the author follows a month by month pattern with a selection of plant subjects for each month. The two page introduction to 'methods' is simple to the extreme, but the point is made regarding the necessity of a *good* pocket lens of x10. By following the suggestions, a fascinating introduction to plant construction results.A low power stereo microscope would be an asset to extend the study beyond the x10 magnification suggested.

Being now 66 years old, the book relies on line drawings for illustrations, but each month has a two page spread packed with these thumbnail sketches something in the manner of Tuffen West, but with less detail. There are over 700 individual drawings. These drawings are a marvellous introduction to the subject, and no one could fail to learn the details of construction of each plant described if they follow the suggestions, drawings and text supplied. 192 separate plants are covered starting with London Pride *Saxifraga umbrosa* in January, working through such diverse subjects as Groundsel, Lupin, Violet, Dandelion, Grasses, Knapweed and so on; with a brief diversion into seeds on the way and ending, appropriately, with Christmas Trees in December.

The named and described plants form an excellent basic guide and could be extended at the owners individual discretion; the combined text and drawings providing a basic guide to the way to investigate a plant in its entirety. The microscopist could extend the study to his/her heart's content, for the suggestions would provide enough material for slide mounting for years to come. I have found a pocket lens to be a useful and interesting pocket microscope which should be in the pocket at all times and I support the suggestion that a *good* one should be purchased and cared for by every microscopist. I would also suggest the addition of a secure chain for it is easy to lose one when out and about, as I know to my cost.

This book will not be expensive. The most difficult part will be in finding a copy, and especially one in good condition. It is, however, decently bound and well printed on substantial paper which will last well, if cared for. There may have been a dust jacket, but mine has long gone and now sports a wallpaper covering as some added protection. I promise that if you can find a copy you will not be disappointed. Certainly I have always been glad to have found my copy. It started life in a bookshop in Devon; once resided on a farm in Corfe Castle, Dorset, and eventually found its way to a good home on my shelves. It is a great pity that books are *silent* witnesses of their times, for they must have interesting lives.

Reprinted from The Balsam Post , Issue No. 35 April 1997 page 26. Courtesy Fred Loxton.

THE ONE THAT GOT AWAY

David L. Hirsch

Collecting microscopes is like l'amour; each 'event' ends in conquest, defeat or stalemate, accompanied by fond or not so fond memories. By comparison, every microscope that you acquire has a story to go with it. Was it a swap, an uneventful sale, heavy handed haggling, or a bequest? No matter the size of your collection, it is likely that there is a story to tell about each and every microscope. Therein lies a great source of satisfaction to the collector, but not all stories have a happy ending.

There you sit, snug and smug in your easy chair, surrounded by a kings ransom in microscopes. Every Marshall, Cuff, Jones, Powell and Lealand and Culpeper reposes in haughty grandeur, literally looking down their noses at lesser Zeiss and R.J. Beck instruments which stand in obeisance before the Masters.

You are a romantic, sentimental dude. Reminiscent of the "Vacant Chair" in that sad old Civil War ballad, you leave an empty space here and there among your collected pieces. Each vacant spot represents "the one that got away".
It could have been the repository for an instrument which, for some reason or other, you decided to get rid of, only to regret your action soon afterward. The space might have been left in rueful memory of that fine microscope you should have bought on the spot, but pondered far too long. Consequently, you try to limit the number of empty spaces on the shelves, lest you bestow upon yourself an inferiority complex.

Some spaces have a gold star in place. That is to remind you of the one that not only got away, but was lost forever, because, at the time, you had rashly overdosed on 'stupid pills'. Your blood pressure creeps upward as an example comes to mind. There you are, at Lipka's Arcade in Portobello Road, London, gazing in wide eyed fascination at a pristine Nachet Prismatic Dissecting microscope, circa 1850. Gradually, you ease into a "Gotta have it" purchasing mode. Before you take out your travellers checks, you sense the presence of a macabre looking gentleman. He points a bony finger at the Nachet and in sepulchral tones utters a single word: "Rubbish!" He points out things which you had apparently overlooked in your zeal to buy, such as: seemingly mismatched parts, replaced screws and other things which could indicate an instrument of low quality. Your wallet never leaves your pocket, and feeling a bit dejected, you exit the arcade and resume your scientific safari. Soon, your gut begins to growl, signalling that lunchtime is nigh, so you step into the closest pub for a Plowman's lunch and a pint of bitters. At a nearby table sits a familiar looking fellow; the ghoulish gent who bad mouthed that Nachet stand back in Lipka's Arcade. You are about to hail him, when you spot something on his table which causes your blood to boil.

There it is; HIS new acquisition, an object which will never grace your instrument room. You guessed it; he sits there, lovingly admiring that 1850 Nachet prismatic dissecting microscope; the one he so artfully did you out of. My man, you've been had. How many collectors such as yourself, fell for that same sleazy 'strategic debasement' trick?

Another ploy that you should be aware of, involves an object that you are examining in a shop or elsewhere. A stranger comes up to you and says, "It's been sold", when actually, it wasn't. Most people would utter an apologetic "Oh, sorry" and walk away without asking the dealer if it was indeed, sold. It takes a lot of chutzpah (Gaelic, for nerve), for someone to pull the "it's been sold" trick, but some people are that way.

Do you recall the Bausch & Lomb 'jug handle' microscope that you spotted on a Friday afternoon in, of all places, a Salvation Army thrift shop? The stand is being offered at a ridiculously low price, but you don't buy it. That evening, you have second thoughts, so early Saturday morning, you return to the shop. You didn't get to the shop early enough because once more, Murphy's Law goes into effect. A scholarly looking gent got there first, and is giving YOUR microscope a thorough examination. Very discreetly, you maintain your distance and casually rummage through a pile of junk as the man paws, pokes, unscrews, sniffs and twists just about every part of the instrument. He chucks his chin several times, a thought promoting process perhaps, but he has still not made up his mind. THEN, he makes a big mistake.

He places the microscope on the counter and strolls away, deep in thought. One would assume that he is about to spend a million bucks, rather than the paltry 45 dollars asking price. You have him under close surveillance, and when he reaches the end of the aisle, you pounce, pick up the microscope (with a case and accessories, of course) and head for the cashier. Being a noble person, you do not cackle with glee. Mission accomplished! You leave the thrift shop and dash home with your treasure. For a change, somebody else will be telling about "the one that got away".

Have you ever encountered a shill? He or she is a person who acts as a decoy. You are examining a Society of Arts microscope at a Boston antique show and soon, are aware that you have an audience of one; somebody who is taking more than an ordinary interest in the microscope which you are holding. You let your hand brush lightly against the pocket containing your wallet, not being sure what this fellow has in mind. He initiates the conversation, saying: "That's a nice looking microscope that you're holding. If you don't want it, I will buy it". The competitor for that instrument

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MUTE WITNESS

The Evolution of Locard's Exchange Principle

Edwin L. Jones, Jr.

Edmond Locard, From Soderman, H. *Modern Criminal Investigation*, 5th ed. 1962.

Hans Gross, From Soderman, H. *Modern Criminal Investigation*, 5th ed. 1962.

Right in the middle of the "Trial of the Century" FBI agent Doug Deedrick explained to the O.J. Simpson jury that, "When two objects come into contact, physical contact, there is going to be an exchange of materials." He went on to say that the origins of this principle were with Locard's work in France. But in reality, the origins of the so-called "Exchange Principle" are not all that clear. In fact, the principle has been stated in several different ways by a number of authors over the decades. I wanted to do a little detective work of my own and see if I could uncover exactly how Locard himself had phrased it.

As early as 1930, Locard authored a three-part article, *The Analysis of Dust Traces*, which appeared in the *American Journal of Police Science*. No mention of any exchange principle was made. The nearest expression was, "For the microscope debris that cover our clothes and bodies are the mute witnesses, sure and faithful of all our movements and of all our encounters." He gives priority to work on dust as possible evidence to Hans Gross and Conan Doyle. Gross authored the 1893 work *Manual for Examining Magistrates* which was subsequently translated to English in 1907 under the title *Criminal Investigation*. Doyle is, of course, best remembered as the creator of the master detective, Sherlock Holmes. With regard to dust as evidence, Locard further stated, "The main idea, which was embryonic for a long time has been hatched in many places simultaneously, and no one can frankly attribute its paternity to himself." Since Locard refuses to claim the "Exchange Principle", to whom should the honor go?

In Saferstein's *Criminalistics* (3rd Ed., 1987) it is noted that "It was Locard's belief that when a criminal came into contact with an object or person, a cross-transfer of evidence occurs (Locard's Exchange Principle)". In *Techniques of Crime Scene Investigation* by Svennson, Wendel and Fisher (1981), the idea is presented thus, "When an individual comes into contact with a person or location, certain small seemingly insignificant changes occur. Small items such a s fibers, hairs and assorted microscopic debris may be left by the person or picked up by that person from contact with the environment or another individual. In short, it is not possible to come into contact with an environment without changing it in some small way, whether by adding to it or taking something away. This concept of change is the so-called Locard Exchange Principle, and is the basis for the study of trace evidence." H.J. Walls was more succinct in his book, *Forensic Science* (1968), when he wrote, "Edmond Locard laid it down as a guiding principle that "every contact leaves a trace." The term Locard Exchange Principle was not even mentioned. Travelling back to 1962, we find L.C. Nickolls, in his work, *Methods of Forensic Science, Vol. 1* wrote:

> **Locard's Exchange Principle.** During the years 1926 through 1928, Professor Locard of Lyons was describing in his many writings, his exchange principle. This may be briefly summarized as follows. When any two objects come in contact, there is always a transfer of material from each object to the other. Often this transfer is obvious, at least in one direction, but even when the amount of material transferred or its nature is such that nothing is visible, there is always some transfer; it is the duty of the forensic scientist to identify the material if at all possible.

Staff of the Lyons Police Laboratory, 1928. Locard is seated third form the left in the front row. His secretary, Maggie Guiral is just behind him. From Soderman, H. *Policeman's Lot*, 1957.

But six years earlier, in what may be the very first mention of the term, L.C. Nickolls had written in *The Scientific Investigation of Crime* (1956), under bold type:
"**LOCARD'S EXCHANGE PRINCIPLE**: The basis of this reconstruction and of contact traces was laid down by Locard (1928), who stated that when any two objects come into contact there is always a transference of material from each object on to the other."

Edmond Locard was born in 1877, retired in 1951 and died in 1966. A prolific writer, he published works from 1902 until 1957. Educated in both medicine and law, he trained under Lacassagne and Bertillon. Alexander Lacassagne was the Professor of Pathology and Forensic Medicine at the University of Lyons and Bertillion was the first person to use science in the form of anthropometry (measurements of the human) to identify criminals for the Paris police. Before starting the police laboratory in Lyons in 1910, he traveled to Berlin, Rome, Vienna, New Your and Chicago to observe police methodology.

In addition to studying dust, Locard was the inventor and discoverer of Poroscopy, which individualizes fingerprints based upon the pores in the ridges themselves. He performed painful experiments on his own skin, burning it with hot oil and irons, to show that fingerprints were permanent and heal with the same individual points of identity.

His salary as lab director was small, but he was allowed to charge a fee for any questioned document case he processed. Thus, he became the most famous and possibly the best Questioned Document examiner in France. Author-scientist Harry Soderman, himself a student of Locard from 1926 through 1929, said that Locard was "an exciting man to work for." Soderman was no stranger to academic excellence, having studied organic chemistry with Grignard. In 1940, Locard finished the seventh volume of his treatise on criminalistics-no doubt the most comprehensive treatment of the subject.

Excerpt from *The Scientific Investigation of Crime*, by L.C. Nickolls.

A typical case of this type was one of larceny of bronze filter plates from a factory making hydrated manganese dioxide for use in dry batteries. The plates, when they were stolen, were contaminated with this substance. The Police officer investigating the case noticed black stains in a motor car and on certain garments and boots; he sent these for laboratory examination. The various articles were extracted and the extracted dust was analyzed. The dusts all contained manganese dioxide which, calculated as hydrated manganese dioxide, amounted to from 40 to 80 % of the total weight of the different extracted dusts. This evidence directly associated the samples examined with a source of manganese dioxide and, since manganese dioxide is a substance of very limited use, raised a very strong presumption that the source of the manganese dioxide was the stolen filter plates.

It can be accepted that it is established that any contact between the criminal and the crime will leave a trace. Whether this trace is identifiable will depend partly on the amount of the trace which has been transferred and partly on the nature of the material transferred. In addition Locard showed that trades and professions leave traces in the fingernails, ears and skin folds of a person, as well as on their clothing, which will serve to identify them with their occupations. These are called occupational dusts. It is expected that a sweep will be black with soot, or a miller white with flour. Locard went further than this and showed that all occupations which produce any finely divided material in the course of the occupation will leave recognizable traces of the occupation on the person or clothing of the individual. It is the duty of the scientist to find these traces. Examples are fragments of leather and wax on a shoemaker, leather and paper fibers on a bookbinder, talcum and soap dust on a hairdresser or drugs on a pharmaceutical chemist.

MEMBER PROFILE

John J. deHaas

Fig. 1 My brother and I at the 1939 World's Fair

Fig. 2 New York Microscopical Society Trip 1948

Fig. 3 John de Haas April 1997

My twin brother and I were born on February 6, 1919 in Strasbourg, Alsace Lorain, France. I had French as my first language. My parents left France at the end of the first world war to go to Hamburg in Germany. My father was a banker and both my parents' parents were from Germany. My father was a heavy smoker and he died of lung and larynx cancer at the young age of 35. My Grandmother took my mother, brother and me in to live with her in Magdeburg when my father died. My Grandmother had been educated at an excellent girl's school in England, so English became another of my languages. I went to primary and grammar schools in Magdeburg. In the Real Gymnasium in Magdeburg, we studied science, Latin, Greek, the classics and philosophy. The education was so complete that if one completed the gymnasium exam one could go directly into a university to study a special field of interest without taking any other ancillary courses.

My mother had been a surgical nurse in World War I. She was a remarkable woman who encouraged my interest in science. Once, when I was in high school, she went without a winter coat for a year to buy me my first microscope. In 1935, I left the gymnasium and in 1939 my brother and I just escaped Nazi Germany on the last ship out to the U.S. under the French quota. The quota for fleeing Germans was heavily overfilled. I found later that my whole family remaining in Germany were killed in Auswitz. We came to New York to stay with one of my mother's brothers. I knew cabinet making so made a living at that. I loved science and made friends with people at the Natural History Museum in New York. In 1942, I was drafted into the US army and sent to Fort Knox, Kentucky to the 4th Armored Division. I had been a champion gymnast in Germany and became the physical instructor for my company and then for the regiment. Among other things, I taught Judo. The company commander picked me for officer's school, but the school was disbanded and I was sent to England with a transportation outfit. I had a great time in England. I loved the friendly English, made many friends and won the epee championship for the US Army.

Then I landed on Omaha Beach on June 6th in the Normandy invasion. I saw one member of the company stupidly put his head up during a lull in firing and have it blown off. We had a terrible time as all the German guns were sighted in on our landing. I survived the day and was not wounded until two weeks later when I got a piece of shrapnel in my leg. I fished it out myself and got patched up and still have the scar today.

Our outfit was part of the supply for Patton's army and, therefore, we were in all the worst places, the Meuse and the terrible winter in the Ardennes. I was lucky there in not having to serve guard duty as they were afraid that with my accent and no knowledge of American sports scores, I would be shot as an infiltrator by one of our own men.

After the war ended, because of my language skills, I was picked to work at an army center for displaced persons in Bamburg. One of the first sad duties was to care for a group of concentration camp survivors.

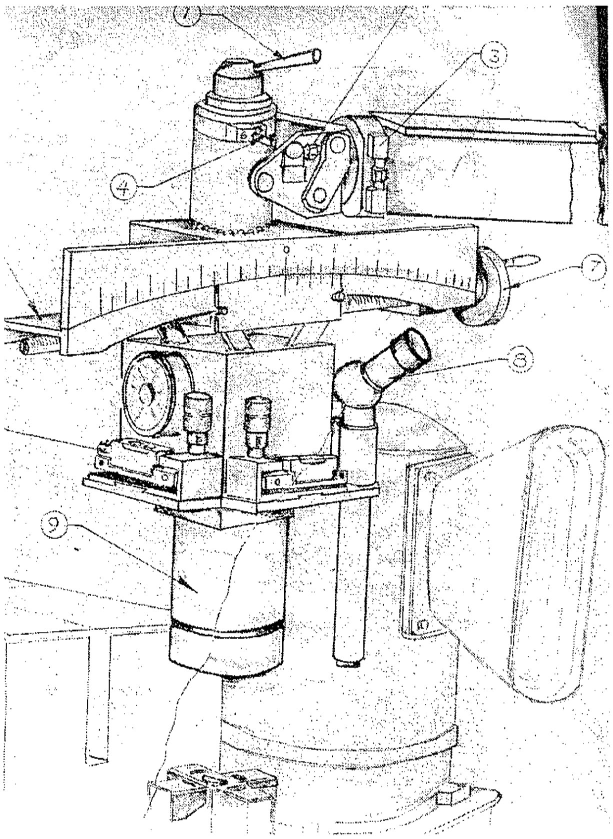

Fig. 4 My sketch for the Solar Simulator - Hughes 11-20-66

Unfortunately, they were so far gone that almost all died. Shortly thereafter, a French captain, who had known me before, said that I had medical knowledge that should be better used. I was sent to Koburg in Saxony to the army displaced persons center there. It was the work that I did there that is the accomplishment of my life of which I am most proud. When I arrived, conditions were those of the middle ages. Women in labor gave birth on piles of straw. I was able to establish a medical center, and to get the whole place cleaned up with an entire floor set aside for a hospital. I delivered around 100 babies while I was there. There was one ex-Luftwaffe doctor who volunteered to help and who worked very hard. We also had two Estonian nurses. I was able to trade supplies that I could get, such as cigarettes, for medical supplies from German companies. There are many sad stories from this time as well as a few that were amusing.

I came back to New York after the war and worked at the Kollsman Instrument Company. I had met my wife, Lee, over a water fountain at a YMCA and we had been married on April 4, 1943, before I went overseas. The owner of the Keystone Camera Company suggested that there were excellent positions available on the West Coast. Our son, Alan, had delicate health which gave us a reason to look for a warmer climate.

I came to Hughes in Culver City in 1957, and knew the minute that I walked into the company that this was the place that suited me. I did some microscopic studies of magnetic tape anomalies and then was able to set up and equip a splendid project optics lab.

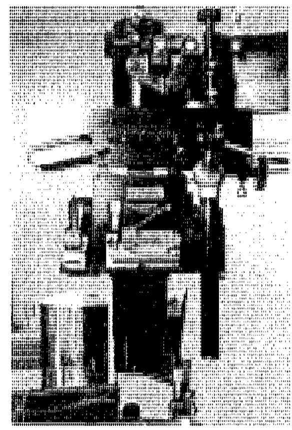

Fig. 5 Completed Solar Simulator.

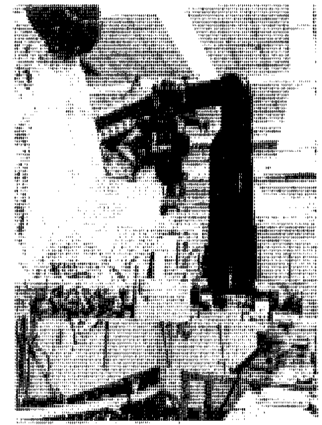

Fig. 6 Solar Simulator - Test with actual Surveyor Spacecraft.

Hughes paid for further schooling at UCLA while paying full salary. With a project downturn in 1960, I left Hughes for Lockheed for a year and a half, but returned to Hughes for the Surveyor Spacecraft Program. I was assigned to design and make a prototype of the Solar and Canopus sensor including a simulator that had the spectral characteristics of the Sun. Fig 4 shows my initial sketch of the device. Fig 5 shows it finished, and Fig 7 shows it attached to the real spacecraft for test. My 17 years with Hughes were some of the most pleasant of my life. I was called on by Dr. Adler to serve as interpreter several times when they had important German and French guests at Hughes. I thus got to attend many fancy dinners and other functions and to meet the top Hughes management. Another fascinating project that I worked on was the lunar laser ranger. The laser beam leaving the telescope was 62 inches in diameter, but spread to 1.6 kilometers at the moon. Although we received very few photons reflected back into the telescope, we were able to resolve the distance to the moon to within 2 inches. These programs involved many trips, some to Cape Canaveral and some to the De Kueper telescope in Arizona. I always kept a bag packed so that I could hop on a plane at a moment's notice. I remember having breakfast alongside Walter Cronkite before one of the launches. Another interesting project was to design a laser trimmer for semiconductor fabrication. After leaving Hughes in 1970, I taught microscopy and micro-techniques at the University of Southern California. I also started a business adjusting and repairing microscopes. I gave numerous lectures and courses at crime labs such as to the Los Angeles Sheriff's Department and Parker Police Center Scientific Investigation Bureau.

In 1971, my son, Alan, and I with some friends rejuvinated the Southern California Microscopical Society which was founded in 1938, but which had become essentially defunct. The name was later changed to the Los Angeles Microscopical Society and, in August, 1996, to the Microscopical Society of Southern California. I am now active again in the Society advising on microscopy and microtechniques and related matters such as microscope history and restoration.

BASIC PRIMER FOR CLEANING AND SERVICING LIGHT MICROSCOPES

Ron Morris

Many people don't know that I began my technical career as an instrument repair technician.After a long and tedious apprenticeship, I was allowed to venture forth and repair precision optical instruments on my own. What follows here are many tips and tricks I picked up along the road to the "school of hard knocks".

First of all, know one's limitations. Before initiating the cleaning and servicing of a microscope, first identify exactly what the problems are, and proceed forward with these in mind. Remember,at one time,your instrument did leave the factory in pristine condition and fully functional.A skilled technician assembled it with care. It is important that the root cause of the malfunction is clearly identified,and corrected,and to ensure that the problem does not reappear. With a precision instrument such as a microscope, there is no excuse for making shoddy repairs.

If you are careful and methodical, you should be able to clean and repair a microscope to the same degree of mechanical and optical condition that it was in when it originally left the factory.

It can't be emphasized enough that cleanliness and being careful to the attention to details is just as important as technical expertise. When you disassemble and clean your microscope, it must be done in a clean, well lighted area so that you can see what you are doing, and to keep the optical and mechanical parts spotless after they have been cleaned. Disposable surgical-type lab gloves can be worn to keep dust and fingerprints off of lenses and prisms. Keep in mind that a microscope is a high-powered magnifying instrument,and a tiny speck of dust will look like a boulder when magnified, and will have a detrimental effect on the final image quality.

Along with being clean, technical knowledge is also important. Don't attempt a repair of your microscope unless you are aware of the procedures involved. Don't be afraid to ask questions. I suggest trying some of the following methods on a "junker" scope first, to build up your confidence level.

Preparing Your Workplace

Clear a suitable area that is well lighted and has adequate ventilation. A kitchen table, desktop, or benchtop will do. Avoid drafty places, work where the air is fairly settled. A Luxo lamp or Dazor lamp is handy for even illumination.The work surface should be covered in a light-colored material to enable you to see the small parts that occasionally get dropped. If you have a portable vacuum cleaner such as a Black and Decker "Dustbuster"; then put a clean filter in it, and have it ready. It is an easy way to pick up loose screws, washers, etc. under the table or on the floor.

I like to use the green material that draftsmen use on their drafting tables as a ideal bench top material. It is a nice easy color to the eyes, will not glare light back at you, and is easy to keep clean. A white or light blue towel that has been well- washed will also work, or just a sheet of brown or white "butcher's paper" will serve well also.

A supply of small boxes, baby food jars, cigar boxes, egg cartons make ideal places to put the parts that you disassemble into to keep organized. Remember to keep groups of parts together that belong together. If, for example, you are taking the stage apart, then keep all the screws together in one box for that section. Another trick is to tape a piece of paper to a sheet of 1/2 inch styrofoam, and poke the screws and parts into the foam in the order removed. If you follow this procedure, then re-assembly will be much easier since there will be no doubt as to where the similar sized screws and washers will go.

When working on the microscope head, don't remove the eyepieces unless absolutely necessary. They can be loosely taped to the tubes to keep them from falling out.The same advice holds for the objectives- don't remove them all at once, but rather one at a time. The manufacturer often shims the objectives to the nosepiece to ensure that the scope is parfocal.These shims are easy to lose, so be careful.The objectives should be placed in the nosepiece in clockwise ascending order of magnification as you look down at the nosepiece from above the instrument.

When cleaning objectives, use only lens cleaner paper wet with Kodak lens cleaning fluid. Never use solvents such as acetone, alcohol, etc. Xylene can be used in sparing amounts if there is a buildup of dried immersion oil on the higher power lenses. Most solvents will attack the coatings and the cement that holds the objectives together. A small camel's hair brush, or canned air from camera stores can be used to blow dust off the lens.

Basic Repair - Checking for Parfocality

Set the drawtube on your microscope to the recommended length if it adjustable, such as 160mm, or 170 mm. This will be normally marked on the side of the objectives. Place a specimen slide on the stage and swing the lowest power objective into place. Bring the specimen slide into sharp focus using the fine focus knob. Now swing each higher power objective into place, and see whether or not the image is still in sharp focus. With a "perfect" microscope, the specimen slide would stay in perfect focus regardless of which objective was used, without having to re-focus. Since this is seldom the case, a slight readjustment of the fine focus knob will be required. If this adjustment is more than 1/4 to 1/2 of a revolution of the fine focussing knob, then some shims will probably be needed between the objectives and the nosepiece.

First, check that the objectives are in the proper rotation order. Some scope makers put numbers on the nosepiece locations, i.e.: 1, 2, 3, 4, 5. The lowest power objective should go into #1, the next higher powered one into #2, and so forth. Recheck the parfocality as above. If they are still not right then proceed as follows. Make a note as to which objective is in each hole in the nosepiece. You can put small gummed sticker colored dots, etc. to mark each objective and it's corresponding hole. Also note whether the objectives already have shims under them, and please keep them with the proper objective. Next, determine which objective has the most parfocal problem as compared with the fine focus point of the lowest power objective. Select an adjacent objective to the one that is the most out of parfocal, and sharply focus the specimen slide. Then slightly loosen the "worst" objective and swing it back into place over the slide. Without touching the microscope focussing knobs, gently turn the loosened objective either looser, or tighter, and see what effect it has on the focus of the specimen slide. If unscrewing the "worst" objective brings the slide into better focus, then a shim the same thickness as the amount the objective has been unscrewed must be placed between the objective and the nosepiece, i.e. between the mount and the seat. If unscrewing the objective makes the focus of the specimen slide worse, then the adjacent objective needs to be shimmed. This procedure is mainly a trial and error process. Make sure that the objectives are seated tightly on the nosepiece, and use a minimum number of shim washers. You can get the shim washers yourself from most microscope dealers that have a repair shop, or you can make your own from shim stock.

Some of the lowest power objectives that are used for "scanning" slides such as 2.5x, 3x, 3.5x, etc. don't need to be shimmed, but rather have their projecting tube rotated after loosening the lock screws. The lock screws are re-tightened after the proper focus is achieved.

Tools

One of the quickest ways to ruin a microscope is by using the wrong type or size of tools. Here are some tips on getting the right tools for the job:

Screwdrivers

To get the right amount of turning power (torque) with minimal damage, the screwdriver blades must fit the slot of the screw head exactly. If by chance the screwdriver blade is too big, it will damage the screw slot by not "seating" properly; if it is too small, it will slip out of the slot, damaging both the screw and the driver in the process.

Make sure that both the screwdriver blade thickness and width match the screw slot perfectly. I have found the easiest way to achieve this is by using "hollow ground" screwdriver blades. These are often sold as Gunsmith Screwdrivers, and are available from Jensen Tools, and Techni-Tool. For smaller size screws, the Wiha brand screwdrivers are superb. They are built like a large Jeweler's screwdriver, but with a larger handle with a red rotating cupped tip for your finger to rest on. These screwdrivers are made in Germany, and are marketed here in the U.S. by Bondhus, the same guys that make the balldriver type allen wrenches.

Another good screwdriver set is the jeweler's set made by Niwa of Japan. If you look carefully on the barrel of the screwdriver under the rotating top, you will see their name stamped on it. These sets are often packaged in a clear and blue plastic box and generally sell for less than $10.00 U.S. Be careful, because there are other similar sets that look the same but are made in Taiwan, etc. that aren't as good quality. Niwa also makes a removable blade screwdriver with many of the small hard to find Phillips and crosspoint type screwdriver blades that are needed for the very small and delicate camerabody type screws. Fargo Enterprises at (800) 359-2878 is a good source for these and other precision tools.

Other Miscellanous Tools

Soft-Jaw Optical type wrenches (also known as A-N type connector pliers) are indispensable for removing stuck lenses. Mine are by Utica Tool, part # 529. A spanner wrench set is handy for lens and eyepiece disassembly. The Fargo #1054 is a good size for microscopy.
Flexi-Clamps are great for removing stuck lenses, eyepiece tubes, etc. They are available in a variety of sizes, from 5/16" up to 2".
For a dust blower, you can use the desoldering bulbs available from electronic stores.
The Clauss white workmat is a good surface to work on making it easy to see small parts. Fargo #14X22

Lubricants

Almost all lubrication on a microscope can be done with just a few lubricants. One of my favorites for "sliding type" surfaces such as dovetails is Dow #3 Medium Grease. Also NYE brand NYOGEL #795A light helical damping grease is great. These lubricants are good for light focussing mounts. Do not use oil on racks or pinions or dovetails because it will just dry out and will leave a sticky surface that makes the parts hard to move and attracts dirt and grime that can cause eventual damage. Examples of the dovetail and rack and pinion are; the focussing mount on the drawtube, and the condenser rack system.

Before putting any grease on the microscope parts, make sure that all of the old lubricant has been removed with solvent (TricChlor, lighter fluid-butane, or Naptha). All surfaces must be de-greased. Also be careful and do not contaminate the cleaned surfaces with sweat or oils from your fingers. Use a cotton applicator stick to apply new grease to the dovetails and sliding surfaces. Use a clean, lintless cotton cloth to remove any excess grease. Excess grease will cake up and attract dust and dirt. Do not grease the rack or pinion as they are usually meant to run dry.

When you lubricate a shaft or bearing, or any similar type of assembly, do not try to work the lubricant in from the outside. Disassemble the part first, then coat the shaft and reassemble.

The Condenser iris diaphragm blades are also designed to work dry, so never put any lubricant on them. Any oil or grease put on them will eventually cause the blades to bind and pop out or break when the diaphragm is used. Do not touch the blades with your bare fingers because that will destroy the factory protective coating on the blades.

Recommended Lubricants

For ball and plain bearings, use a good grade of purple lithium grease, or Nyogel #701 medium.

For eyepiece draw tubes, use Lubriplate #210, or Nye Rheolube # 728J

For worm-type gears, use Lubriplate #310, or Nyogel # 795A, or Dupont Krytox Fluorinated grease.

For binocular head axes, use Lubriplate #320, or Nye rheolube # 728J

For pivots of the microscope arm and base, use a good grade of clock oil, such as Nye's.

In a pinch, you can make your own homemade greases. For eyepiece draw-tubes, heat and mix equal parts of softened white paraffin wax with vaseline.

For a medium, general purpose grease: heat and mix 4 parts beeswax, 2 parts rosin, and 1 part vaseline.

On the newer microscopes with plastic gears, it is best to use the grease recommended by the manufacturer. Synthetic lubricants are used such as Permantex Super-Lube.

Notes on the author:

Ron Morris has worked at the journeyman repair technician level on a variety of optical instruments such as microscopes, telescopes, submarine periscopes, artillery gunsights, binoculars, night-vision scopes, IR-amplifying tank turret targeting systems, laser alignment and measuring systems, optical alignment tooling, and surveyor instruments such as theodolites, transit levels, and distance measuring equipment. Also with aircraft instruments, gyros, accelerometers, autopilot pitch, roll, and yaw, air data computers, and engineering development flight simulators. He has been factory trained on a number of brands such as Wild-Heerbrug, Leitz, Nikon, Brunson, Berger and White instruments.

In his engineering career he has worked for a number of major companies including Hughes, McDonnell-Douglas, Rockwell International, Parker-Bertea and Bendix Aerospace. He is currently a member of the technical staff in the research & development department of Silicon Systems, Inc, a subsidiary of Texas Instruments.

WORKSHOP of the Microscopical Society of Southern California

George G. Vitt, Jr.

Date: **Saturday, 12 April 1997**

Location: **Steve Craig's Lab**, 23 persons attended.

We welcomed **Charles Payne** as a visitor to the workshop, who signed up as a member of MSSC before the meeting ended.

We are pleased to announce that member **Alan de Haas** has donated to MSSC an excellent small color video camera which he and **Steve Craig** demonstrated in Steve's lab. The unit is available to members who wish to make video recordings of their investigations through the microscope. Alan, you have our sincere thanks!

1. **George Vitt** displayed a 1927 Leitz monocular 3-objective microscope., describing the design and usefulness of its centerable and rotatable substage diaphragm assembly. He described its use for oblique and azimuth-adjustable darkfield illumination and in recent experiments in resolving detail of Pleurosigma angulatum diatoms using oblique lighting at various magnifications. George passed around the following items of information: Catalog of optical abrasives and polishing compounds of **Universal Photonics**, Inc. (Hicksville, NY, 800-645-7173); catalog of light bulbs of every description of **Bulb Direct** (Pittsford, NY, 800-772-5267); spec. sheets on an integrated circuit (DIP) containing a silicon diode light detector and transimpedance amplifier by Burr-Brown, suitable for photometric use in photomicrography; color reproductions of colored SEM imagery by **David Scharf**, who had been a speaker at MSSC; and the recent issue of the PMS *Balsam Post*, to illustrate the value of being a member of PMS. George also asked for ideas on possible **Science Fair** projects for 5th grade level students. Pete Teti came through with an excellent input!

2. **Richard Jefts** showed a copy of the Winter 1933 edition of *Mechanics & Handicraft* magazine containing an article on the highly then controversial microscope constructed by Dr. Royal R. Rife of San Diego, for which the maker gave claims which are now adjudged as fraudulent, but which created quite a stir at the time. In one issue of the bulletin of the Historical Microscopical Soc. of Canada, Richard showed a copy of *Beauchamp or Pasteur*, by E. Douglas Hume, The C.W. Daniel Co. Ltd., Ashingdon, Rochford, Essex, 1963. In it, Pasteur is described as quite a politician who had preempted ideas of others and, therefore, is not deserving of the degree of praise he had traditionally been receiving. Richard also passed out business cards of **Tim Hironimus**, 709 Marin Ave., Modesto, CA 95358, (209) 538-8661, who has a microscope repair service.

3. **Leo Milan** distributed 10 groups of paleo-botanical microslides of coal-ball peeled replicas recently donated to MSSC by member **Herbert Layfield**. Some 40 slides were thus signed out. Leo then showed an album of his excellent photomicrographs, and the large format book *Artforms in Nature*, which he highly recommended.

4. **Dave Hirsch** displayed a Swift c.1908 Petrological microscope. in a mahogany case of his own construction. The microscope. features 2 objectives; substage condenser, diaphragm and swingable mirror; centerable rotating stage; Bertrand lens, insertable retardation plates; polarizer and analyzer.

5. **Gary Legel**, who has been fishing since the ripe old age of 5 years and who, therefore, knows the proper way to scale a fish, made a correction to some recently given instructions on the preparation of fish scale microslides: he stated unequivocally, "The fish must be scaled from the tail end to the head end!" The writer, who has fished since the age of 7, fully concurs.

6. **Jim Clark** showed a Liechtenstein-made "coffee grinder" type of cylindrical calculator. He had a Wild M-20 microscope. and a Sherline miniature lathe for sale. Jim reported that he is building a 3-axis digital computer control for his Sherline miniature milling machine and that he should be able to bring this completed project for demonstration at the next Workshop. He displayed a small gear and a 3-spoke wheel that he had made with this new apparatus, using a 0.028" end mill, using his computer and programs he had written to do the job. Jim then displayed a Leitz Mod. 2 Photo Micro Camera and control unit which meters the light and controls the electric shutter. **Jerry Bernstein** said he has information on this unit, which he called the "Orthomat".

7. **Izzy Lieberman** told a hilarious story about tests the British had run to test the strength of locomotive windshields against the high velocity impact of birds. Having read that the FAA had used defunct chickens in such tests, they aimed and propelled one such at about 200 mph at the intended target. The late chicken not only went through the windshield but demolished the whole interior of the locomotive. The FAA later commented that they should first have thawed out their projectile!

8. **Ken Gregory**, our inveterate collector, specially for this April Workshop, exhibited the most unusual, complex and inexplicable apparatus seen in many years - incorporating electro-mechanical, metal, glass, thermal and pressure measuring sensors and screw driven micrometric scales and verniers, topped with a vintage microscope of venerable heritage but unmarked resolution. Amazed onlookers asked many obvious ques-

tions that immediately came to mind, such as: "Could this apparatus be the rare micro-manometric thermo-active psychrometrically actuated gaussmeter which had been exhibited briefly in a remote village 40 mi. S.E. of Bombay in 1908, and mentioned in their annual sanskrit Journal? Could it be the very instrument used for dengue fever research in Banjarmasin? Was it used for research in the Pasteurization of yak milk in Srednekolymsk? Did he get it from Sotheby's or Rick Blankenhorn?" With Ken, no possibility can (or should) be ruled out. Since there was no reply to these simple questions, and no coherent explanation seemed to be forthcoming at this time, we can only hope that with patience and a large dose of cajoling, we may yet know the secret!

9. **Jim Solliday** exhibited a Camille S. Nachet (1799-1891) drawtube microscope. with central pillar screw fine focus. Jim recounted the history of the Nachets and their developments: the chemical microscope., the binocular microscope., their 200 microscope./year production. Jim reported that, in 1929, Albert Nachet published the Nachet Collection Catalog - which showed the largest collection of early French and European instruments.

10. **Stuart Warter** displayed a French c.1852 microscope., with the tube inscribed, "G. Oberhaeuser made for McAllister & Co., Philadelphia". It has a swingable bullseye lens, an American-made case, an objective wood case bearing the Serial No. 2233, swingable substage mirror, drawtube coarse focus with typical continental "top of column" fine focus. Stu then showed a 'Columnar Drum microscope.' with tiltable single column support and a solid plate foot and also a McAllister & Co. drum type microscope. Stu emphasized that the substage polarizer and nosepiece analyzer of the McAllisters' was one of the first implementations of such polarization capability. He then recounted the history of the McAllister microscope enterprise, stating that they had made some 1800 microscope. by 1850 and 3000 by 1857.

11. **Don Battle** described the proper way of processing T-MAX film, stressing that vigorous agitation MUST be used for uniform development. Don also brought a Mamiya 6x7 SLR for sale.

12. **John de Haas** displayed a large heavy stand by Gundlach (Manhattan Optical Co.) c.1890-5. It has 3 objectives, centerable substage, a lead-weighted foot for added stability, and a dovetailed X-Y stage. John commented on the poor quality of the Gundlach brass of that period, stating that the excessive zinc content caused a newly polished instrument to tarnish very quickly! John also announced that he would like to guide a field trip to Mt.Baldy to search for ruby crystals for mineral micro-mounting. John later said that we may well be the recipients of a rotary microtome from the same company that donated a quantity of dyes to MSSC.

13. **Gaylord Moss**, with pardonable pride, exhibited his LOMO MBS-10 Stereo Microscope. (Russian) in a recently made clear acrylic exhibition case made especially for him by **Alan Levy** of Venus Displays who had exhibited at the Feb.1997 scientific instrument show at the Helms facility in Los Angeles. He then reported that he had received, from sources in Japan, samples of sand used for ballast in the 'Bomb Balloons' sent via jet stream by Japan to the USA. (See a previous issue of the MSSC Bulletin for this article by Leo Milan). It was suggested that samples be sent to **Douglas Richardson**, a UK member of the PMS who is a sand expert and a correspondent with several MSSC members. Gaylord presented a detailed spread-sheet analysis of the cost of our publication, and its implication on our dues. He will distribute copies at our regular April meeting, so that an informed vote can be cast at the May meeting. There was a general discussion of costs of quality publication and the state of our FY 96 treasury.

14. **Larry Albright** described the subject and the speaker to be featured at our April meeting. He then showed a 1" diameter solid glass cylinder, overcoated with a lower refractive index glass, that is used for drawing optical fibers. The 34" length piece he showed could fabricate kilometers of fiber!

15. **Alan de Haas** presented a highly justified and appropriate criticism of 'fraudulent scientific information' that has been and is being disseminated by the media to the scientifically naive public. This is especially reprehensible if it is meant to sway opinion and the vote. As an example, he gave the totally false and misleading newspaper hoopla that was lavished years ago on the so-called 'Rife Microscope' touted as a breakthrough in cancer research. It was credited with a 'cascaded magnification' that exceeded the theoretical limits by **orders of magnitude** - and that no one at the time had raised a protest over this hoax! **Richard Jefts** has a copy of contemporary article on this device (see above).

16. **Ed Jones** reported that his forensics lab now has a new SEM installed and he showed a fine SEM photo of a large Okinawan foraminifera. He then passed around the book *Stereoscopic Atlas of the Human Cervix*, which also contained a foldable stereo viewer to view color stereo slides of this subject. Ed brought many 'freebies' such as plastic film containers and glass micro-capillary tubes. Ed showed the *Encyclopedia Science Supplement* for 1980 which has an article on hobby microscopy written by the New York Microscope. Society, which used the term *Micromaniacs* to describe our microscopical brethren! Ed also mentioned the existence of 'Sand Collectors' groups in the USA and So.Africa.

17. **Leon Stabinsky** brought a new model Canon ELPH camera which uses the new format 'APS' film.

Continued on Page 98 Workshop

MINUTES OF THE MEETING OF 16 APRIL 1997

David L. Hirsch

THE EYE OF THE BEHOLDER. Although we might look upon decaying flesh as an abomination, decomposition is a part of the cycle of life. The speaker of the evening, Orange County Vector Entomologist James P. Webb, PhD., presented a detailed account on the application of forensic entomology in criminal investigation relating to crimes of violence. The attentive audience was told beforehand that many of the slides shown would be graphic in nature, relating to the decay of human tissue. Forensic medicine, which deals in part with the previously mentioned condition, is instrumental in helping bring criminals to justice. People like DR. WEBB and our ED JONES, a Criminalist, perform a valuable public service in support of the American legal system.

Dr. Webb had many interesting stories regarding his experiences in the solution of crimes or other problems by the inspection of entomological evidence. One was a murder case in which a key was chigger bites on the murderer which were related to a chigger infestation that was localized to the field in Ventura where the victim was found.

In another instance, an ophthalmologist consulted Dr. Webb about a patient with a painful eye problem in which he had noticed a mite on the eye. Fortunately, Dr. Webb is a particular expert on mites and was able to identify the critter as a rare species that is found only in the nasal passages of walruses. Questioning the patient, it was then found that he had first noticed the pain in his eye during a visit to Sea World where he had watched the walruses blowing water on the visitors.

In another bizarre case, Dr. Webb was able to defend a fast food chain which was being sued by a person who claimed to have found a cochroach fried inside a chicken leg. In a scientific examination involving obtaining and frying cockroaches at the prescribed fast food temperature, Dr. Webb was able to show by spectral analysis of the remains that the purported "chicken cockroach" had not been fried, and had thus been put into the chicken after the preparation.

After the refreshment break, Dr. Webb spoke on the subject of insect dementia, whereby persons perceive the 'presence' of vermin infesting various parts of their bodies. Although foreign organisms may not be present, they can be quite real to the person so 'infested'. He showed great sensitivity in describing how to deal with these cases in which there are no real insects involved, and yet the persons afflicted need real help.

It is noted, that the stereo-binocular microscope and other types of stands are used extensively in the course of investigations by forensic technologists.

FISCAL ISSUES. VP GAYLORD MOSS distributed spread sheets outlining cost estimates for publication of the MSSC BULLETIN. As previously mentioned in the April, 1997 bulletin, an increase in membership fees is mandated to cover the costs incurred in the publication of a bulletin of high quality. MSSC expensesfall into two main categories; publication costs and general costs. The latter include refreshments, supplies and miscellaneous expenses. We welcome all comments on the subject from Regular and Corresponding members, alike.

To cover the costs of refreshments served at meetings and workshops, Regular members would pay a higher membership fee than Corresponding Members. After all pertinent factors have been considered, actual fees, starting with the 1997-1998 fiscal year will be established after the May, 1997 meeting and will be announced in the June, 1997 MSSC Bulletin.

SEMANTICALLY SPEAKING. Is the MSSC publication a 'bulletin' or a journal'? Some members would like to see the name changed to "Journal." Sheets were distributed giving definitions of both, allowing the membership to judge for themselves. At the next meeting a vote should put the matter to rest.

SCANNING ELECTRON MICROSCOPE. SECRETARY RON MORRIS reported the availability of a 1985 Cambridge SEM declared surplus by the company where he is employed. The instrument will be sold to the highest bidder. Several possibilities were discussed, including helping the Crossroads School to obtain it for student programs, with the provision that our members could also share it for their own studies. Crossroads, where we hold our regular monthly meetings has a particularly good science curriculum and this SEM is a later, more modern instrument than the vacuum tube, older instrument that our Society donated to them previously.

SHOW AND TELL. PRES GEORGE VITT called upon those members who brought items for display at the meeting. It should be mentioned that the Show and Tell portion occurs at both regular meetings and at the workshops, and the response is very favorable in both instances.

Barry Sobel showed a gimbal mounted monocular microscope signed on the front of the body tube: E. Hartnack/Oberhauser, Place Dauphine 21 Paris. The mid 19th century stand has a rectangular, black enamelled cast iron base to which is attached two brass pillars supporting the body of the instrument, and secured to the body by a knurled nut at each pillar. Mounted under the stage, is a disc with holes of varying diameters, arranged radially, serving as stops. A lyre shaped stage clip mounts on top of the rectangular stage. Course focus is by means of a rack and pinion assembled in back of the arm. There is no provision for fine focus. Other features include button type objectives and a substage mirror with plane and a concave reflecting surfaces.

VP GAYLORD MOSS displayed his LOMO Russian stereo-binocular microscope of the type owned by five other MSSC members. The microscope was encased in a custom made clear acrylic (Plexiglass) case which both protects and dramatically displays the fine microscope. The clear case allows the microscope to be kept on a desk by a window; protected from dust, without blocking the light from the window.

DON BATTLE, who is listed along with STEVE CRAIG AND MORRIS GREESON as MSSC experts in photographic matters, showed a camera equipped with a 180mm focal length, f:2.8 Zeiss lens that was made in Jena during the Russian occupation. It is signed:" Jena, Made in Occupied Germany". Don mentioned that the lens is nicknamed the Olympic Sonnar, as it was supposedly designed for the 1936 Olympics where it was used by EVA BRAUN, a 'friend' of Hitler, to photograph athletic events.

Pres GEORGE VITT showed his Ernst Leitz monocular microscope, circa 1927. It features a rotatable, centerable substage condenser mount. The stand came with a grey leatherette covered case of a later vintage.

LASTLY. But by no means leastly, KEN GREGORY favored us with two pristine, top of the line, 'jug handle' type microscopes, which would make collectors' mouths water, if they had a taste for brass and glass, that is. His newest find is a well equipped Zeiss Jena monocular microscope, circa 1918, with many features including a full rack and pinion adjustable substage. Kens' second offering was a Bausch and Lomb, Grand Model, also designated as their model BB. The circa 1906 monocular stand has a nosepiece equipped with four objectives. The fine adjustment wheel is graduated and mounted vertically on the post. A mechanical stage was intergral with the rotatable stage. Both instruments came with their original wood cases in excellent condition.

A word of praise to all MSSC members and the members of other societies with whom we are corresponding; We thank all of you for your fine response to the request by VP GAYLORD MOSS, the editor and publisher of the MSSC Bulletin, for the articles which you submitted for publication.

THE NORTH FORTY. About 2 PM on Saturday, April 19, I received a call from MYRON WRIGHT, our Corresponding Member in Anchorage, Alaska. They are having a heat wave up yonder, with the temperature hovering in the mid-forties. Myron is interested in panoramic cameras and related equipment. I mentioned our 'Expert List' shown on page 80 of the April, 1997 MSSC Bulletin. Myron welcomes direct correspondance with the MSSC membership. He can be reached at: 13720 Karen Street, Anchorage, Alaska 99515. His phone number is: (907)345-6014.

WORKSHOP of the Microscopical Society of Southern California - Continued from Page 96

This very miniature (pack of cigarettes sized) metal cased precision camera is a masterpiece of compact design: 2:1 zoom, viewfinder switchable from panoramic, to closeup to group photos; LCD status display; electronic autofocus and exposure; date and message imprint on film, the six different messages (such as 'Happy Birthday') displayable in 7 languages!; red-eye flash elimination; and auto load and rewind. All this in an 8 oz. package! Leon stated that the processed film remains in the APS cartridge and one gets from the processor a proof sheet and prints. Several 1 hour. processing labs exist in L.A. The cost is $239 from SMILES (or B&H Photo) in NYC. Leon took some photos at the Workshop and we hope to see them in the near future.

18. **Ernie Meadows** gave a short but eloquent expression of "...your good influence on me." We all thank you, Ernie, but remember that since it works both ways, we are the richer.

19. **Ron Morris** reported that his company will surplus an all-solid-state c.1985 SEM, the Cambridge Stereoscan 240, with magnification up to 100,000X. It originally cost about $250,000. Ron gave us all the technical details and specs. on the SEM and the possibility of acquiring this unit. There was a general discussion on the operating and maintenance costs and other aspects of ownership. The disposition of the unit will be decided at, or shortly after, our April regular meeting.

After the Workshop a group of 12 adjourned to Coco's for more conversation.

We extend our thanks and appreciation to **Steve and Millie Craig** for their boundless hospitality and patience, as well as the tasty goodies and coffee served at our Workshops.

appears to be breathing down your neck, so a quick decision is in order. Hesitate, and you could lose a good microscope. "OK, I will take it", you say to the dealer. Your decision to buy was hastened by an assumption on your part that the other person wanted that microscope. Actually, he and the dealer are partners,working as a team. You were influenced by a shill. Luckily, that microscope turned out to be a good buy

As a parting shot, here is a poignant story about the microscope which didn't get away, but should have. Picture a dusty little shop on one of Brighton's back streets. The blob of a proprietress with orange hair, extols the myriad virtues of a 'genuine' Culpeper in an obelisk shaped wooden case. Bone slides, a fishplate, forceps and several other accessories complete the ensemble. The microscope and case look old and dusty, and the latter day temptress quotes a ridiculously low price for the package. You figure that pricewise, she made a mistake. Then, the larceny that resides in the best of us to some degree, takes effect. You ask for, and get, the "price to the trade". You pay the agreed on price of three hundred and fifty pounds for your new toy and beat a hasty departure from her shop, clutching your treasure.

You display your Culpeper for 'show and tell' at the next Microscopical Society meeting. Eagerly, you wait for the ooh's, ah's and sundry kudos from your fellow members, while savoring the thought of telling how you outfoxed the shopkeeper. After the meeting, one of the members who had examined the instrument, takes you aside and says: "I'm sorry to disillusion you, but your 'Culpeper' is a reproduction that's being made in large quantities along with many other fake scientific instruments in home shops in many Third World countries. It's true that in todays market, an original is worth several thousands of dollars, but your microscope would sell for a whole lot less than a hundred bucks". Your heart sinks when you think of the healthy bundle of cash you parted with. In the meantime, back in Brighton, the fiery haired lady takes a drag on her fag and unpacks another 'Culpeper'. She places it in her shop window, where sunlight, dust and flyspecks gradually convert the crudely made fake into a 'genuine' antique, baited to trap another gullible collector.

To be an astute collector, you must make an ongoing study of microscopes and become cognizant with the provenance of instruments. Provenance deals with the origin or source of something. As with so many artifacts, the origin of most microscopes may, or may not be properly documented. In addition, the history of the microscope, once it leaves the shop of the instrument maker, is often sketchy and poorly documented. Unless original, authenticated paperwork comes with the instrument, don't expect to get a comprehensive rundown on that 'strange looking' microscope you picked up in the flea market.

Once you develop a proper 'microscopical attitude', you will be less apt to let a good buy in microscopes slip through your fingers. Conversely, your ability to ascertain the value of an instrument will be enhanced. The advantages of belonging to a microscopical society become apparent. Among your fellow members are those concerned with, and well versed in, the provenance and other historical aspects of microscopes and microscopy. You got questions, we got answers! Pose your questions to the attention of the MSSC membership at meetings, workshops, through our bulletin, or via the Internet. Good hunting, and don't take any wooden 'nicols'!

IMPORTANT - MAY MEETING NOTICE:
CHANGE OF DAY
THE MEETING WILL BE ON MONDAY MAY 12
FEATURING - JEREMY COLLINS OF CHRISTIE'S

The next meeting should be a most interesting one. Jeremy Collins, the Scientific Instrument Coordinator for Christie's Auction House in London will visit us on his way to New Zealand. He has prepared a slide show of a variety of microscopes and accessories, some rare, but all different and interesting. Christie's, of course, has a long and glorious history of handling some of the most rare and precious items in the world. It should be an exciting and historical event.

In order to coincide with Mr. Collins' travel schedule, the May meeting will be held one week and two days earlier than usual, on Monday the 12th of May at 7 PM at the Crossroads School located at 1714 21st Street in Santa Monica. Don't miss what is sure to be a memorable evening.

Errata - Omitted from last member list.

James D. Clark, Jr. 11518 Valle Vista Rd. Lakeside, CA 92040. 619-443-6154 e-mail jjclark@cts.com.

New Members:

Daniel W. Christensen PO Box 68, Clifford, VA 24533 (804) 277-8738. FAX (804) 277-8045.
Stuart Ziff 1045 24th St, Santa Monica, CA 90403 (310) - 829-5116. e-mail kndm67@prodigy.com

Additions to Expert List - Ron Morris

Books and Literature - Jim Solliday.
Wild-Heerbrugg Instruments- Peter Fischer.
Diatoms - Leo Milan.
Photography - Ed Jones, Leo Milan.
Slide Making - Ed Jones.
Foraminifera - Ed Jones.
Polarizing Microscopy, Crystals - Leo Milan, Jim Solliday, Ed Jones.
Precision Instrument Repair - Ron Morris.
Electronics Repair - Ron Morris.
To add your name to the expert list, contact Ron Morris.

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Regular	56	1680	2240	2800
Corresp.	36	720	1080	1440
Total Income		2400	3320	4240

BULLETIN COSTS AND DUES INCOME - The Need To Increase Our Yearly Dues.

The cost to print and mail the bulletin is $2576.40 per year. Adding on the cost of printing an extra 25 copies per month for file, contributers and new members brings the total yearly publishing cost to $2942.40 per year.

For the current dues of $30 regular and $20 corresponding, there is a shortfall of $542.40 per year for publication alone.

If the dues were raised $10 per year to $40 regular and $30 corresponding, then there would be a remainder from the bulletin publication of $377.60. ($3320 minus 2942.40) for all other expenses. This is marginal, as it must cover the cost of any special mailings, such as special meeting notices, bulletins mailed to non-member editorial contributers and refreshments at the regular and workshop meetings. If we assume that special mailings will average $10 per month, that leaves only $21.46 each month for refreshments and other expenses.

If the dues were raised by $20 per year ($1.67 per month), there would be a remainder, after publishing the bulletin, of $1297.60, or $108.13 per month. This should provide sufficient funds for special mailings, refreshments, occasional honorariams for guest speakers (that we might not be able to get otherwise) and a cushion against the expected increased postage costs next year. It might even allow us to build up a small reserve for unforseen emergencies and to eventually pay the legal fees to achieve non profit organizational status that would allow us to reduce our mailing costs and to receive tax free gifts from sponsors who would be able to write off their donations against taxes.
Please think about the pros and cons of possible changes to the dues structure before the next meeting. Since our fiscal year starts at the end of June, we will need to vote on dues changes for 1997-1998 at the May Meeting on the 12th.

Gaylord E. Moss VP & Editor