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Newsletter

Of the

New York Microscopical Society

1 Prospect Village Plaza
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Clifton, New Jersey 07013-1918
GPS: Latitude 40.8648N, Longitude 74.1540W

September 2012 **N.Y.M.S. (973) 470-8733** **Volume 6 (26) Number 7**

General Meeting – 2pm Sunday, Sept 30, 2012 – At NYMS Clifton Headquarters

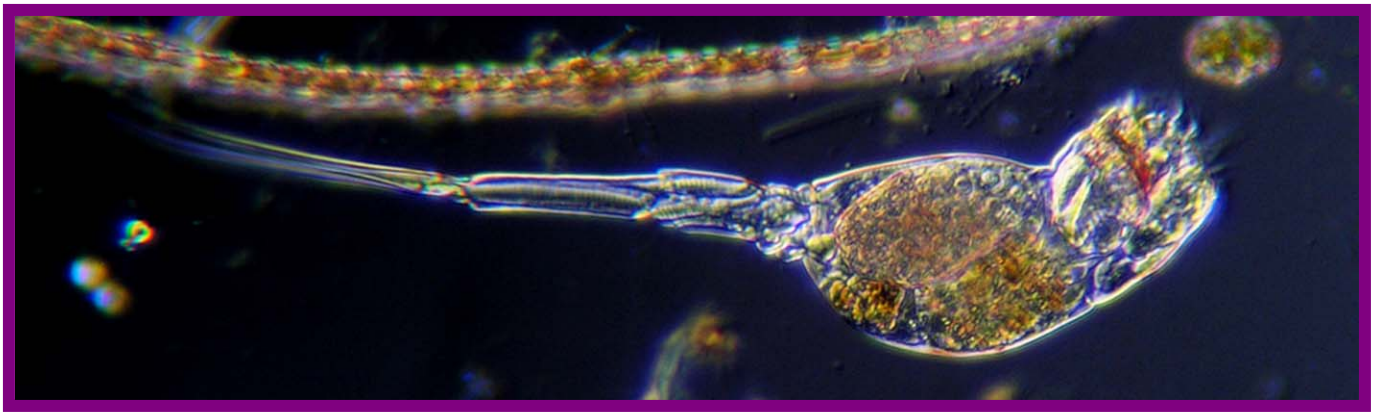
Talk Title: Confocal imaging and atomic force microscopy in the analysis of spermatogenesis and sperm morphology

Speaker: Dr. Angela Klaus, Ph.D

Spermatogenesis is a complex process where spherical cells transform into motile elongate sperm cells. In fruit flies, as in mammals, spermatogenesis takes place within the context of the testes. The cellular transformations that occur in mammals during spermatogenesis are closely mimicking in fruit flies, thus making flies an excellent model for studying spermatogenesis. Dr. Angela Klaus of the Department of Biological Sciences at Seton Hall University will present results of current work looking at spermatogenesis in the fruit fly Drosophila pseudoobscura using confocal microscopy. She will also present some preliminary AFM analyses of sperm morphology in the white-tailed deer.

Doors will be open at Noon. Refreshments will be available. Those attending can have a tour of our facility and also see our member-accessible microscopy lab and library. For additional information please contact Mel Pollinger (pollingmel@optonline.net) or (201)791-9826 before the day of the meeting, or by cell= (201) 314-1354 no later than 2 PM (meeting day only).

Rotifer image by Mel Pollinger (see page 3 for details)



Save a Tree: Get The Extended Newsletter: By Email Only

Board of Managers (updated)

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Pollinger, Mel, pollingmel@optonline.net; (201) 791-9826, ... Expy June 2014, ...Treasurer, Editor, Librarian

Klaus, Angela, Ph.D., klausang@shu.edu; ..... Expy June 2015, ...Secretary, Education Chair

O'Leary, Don, dkoleary@verizon.net; (201) 368-8849, ...Expy June 2013, ...Curator, Facilities Manager

Reffner, John A., Ph.D., jareffner@cs.com; (203) 348-8098, Expy June 2014,.....Awards Chair, Past President

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Scal, Roland, Ph.D., rscal@qcc.cuny.edu; (718) 631-6071, ...ExpyJune 2013, ...Webmaster

Dues and Addresses
Please remember to mail in your Dues to:
Mary McCann,
Membership Chair
McCann Imaging
161 Claflin Street
Belmont, MA 02478

Junior (under age 18) $10 Annually
Regular $30
Student (age 18 or above) $20 Annually
Supporting $60 Annually
Corporate (includes one advertisement in NYMS News) $175 Annually
Life $300 (payable within the year)
To avoid missing notices:
Notify Mary McCann and Mel Pollinger if you have changed your address, phone or email.

Awards Given by the New York Microscopical Society
The New York microscopical Society takes great pleasure in recognizing and rewarding individuals who have contributed to either the activities of the society or to furthering microscopy. These awards are described in our website and in a pdf file for our email newsletter recipients. All members are eligible to nominate individuals for these various awards, and are encouraged to do so.
John A. Reffner, Awards Committee Chairperson

Awards Committee
Chair: John A. Reffner
Members
Jan Hinsch
Don O'Leary
Mel Pollinger

Mel Pollinger, Editor
18-04 Hillery St.
Fair Lawn, NJ 07410-5207

To Order Your NYMS Lapel Pins
Send a check in the amount of $12.00 per pin to:
New York Microscopical Society
c/o Mel Pollinger, 18-04 Hillery Street, Fair Lawn, NJ 07410. To avoid shipping & handling charges, pins may be purchased directly at any NYMS meeting for $10.00.

The Mission of the New York Microscopical Society is the promotion of theoretical and applied microscopy and the promotion of education and interest in all phases of microscopy.

Alternate Meeting Notifications
Please note that due to time constraints in publishing, some meeting notices may be available by calling Mel Pollinger at 201-791-9826, or by visiting the NYMS website, or emailing: pollingmel@optonline.net

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Dues for 2012 is past due!

Buy and Read a Good Book on Microscopy.

From page1:Rotifer image by Mel Pollinger
Living specimen taken from Barbour Pond in Wayne, New Jersey. Nomarski D.I.C. image made with an Olympus C5060 digital camera on an Olympus BH2-BHT microscope. Original magnification was 40x. Contrast and image size adjusted with Adobe Photoshop.

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Robert H. Sherwood Has Died

Robert H. Sherwood, a long-time Life member of New York Microscopical Society, who resided in Boise, Idaho, Passed away in May 2012. Additional information about Mr. Sherwood is expected to follow.
Information received from his surviving spouse Sharon Goltry:

Sharon.goltry@gmail.com
(208) 337-4801

Hi NYMS friends.

I am a member of the National Parks Conservation Association, and in their current magazine they have an article about a biodiversity inventory that is being conducted in the Great Smoky Mountains. The report focuses on the tardigrades. 81 species in the Park so far, and 13 new species! Amazing!

They have produced a key that runs in your web browser:
http://www.warren-wilson.edu/~pbartels/E-Guide/Read_First!.html

And in the inventory's main web site they have a short section about the tardigrades:
http://www.dlia.org/phylum-tardigrada

Jay Holmes
Department of Education
American Museum of Natural History

YouthCaN: http://www.youthcanworld.org
Jay's site: http://www.cryptolithus.com

From Bill Isecke
Especially the Dolphins "playing" with them.
http://www.youtube.com/watch?feature=player_embedded&v=mHyTOcfF99o

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Visit Our New Website

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In Memory of a Friend

Mitchell A. Sieminski

Hearing of Mitch Sieminski's passing was a bitter-sweet experience for me. I first met Mitch in the early 1960s at an Inter-Micro meeting in Chicago. At that time he was leader of microscopy research at Celanese Corporation in Summit NJ. He had attended every Inter-Micro since that series of meetings started in the early 1950's. Mitch studied textile science at MIT with Edward R. Schwarz. In the microscopy world, Mitch was widely recognized as a leader. He was a very active member of the New York Microscopical Society until he retired from Celanese.
Mitch and Ann loved the opera and ballet, traveling regularly to the City from their home in Bedminster, NJ to enjoy performances.

Mitch proposed that the New York Microscopical Society establish an award to recognize significant contributions to the development and application of microscopy. This became the Society's Ernst Abby Memorial Award. Without Mitch's foresight and love of microscopy this award may never have happened. He also contributed to the Yearbook. His SEM micrograph of a split hair made the cover.

My friendship with Mitch was renewed when I joined the New York Microscopical Society in the late 60s. Working with Mitch on *Dialogs in Microscopy* and workshops was great fun. Above all, Mitch was the perfect gentleman. I've never heard him raise his voice in anger; he was a quiet spoken and persuasive advocate for microscopy and human dignity. One of my fondest recollections is our sharing a quart of Johnny Walker Black label and solving all the world's problems in one night in Chicago.

Mitch Sieminski is synonymous with double entendre. He always had a pun and he enjoyed the telling. He always remembered birthdays. He was always the counselor you needed, whenever you needed assistance or cheering up. I have missed Mitch ever since he retired and this void will continue.

John A. Reffner

Please note: Board member term expiration dates have been updated

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NYMS website The new NYMS website went live on July 17th 2012!

NYMS Welcomes Visitors

Although most NYMS events and meetings are held in Clifton, New Jersey on Sundays, the building may be opened for visitors at other times providing an appointment is made with Don O'Leary or Mel Pollinger at least two days prior to the desired appointment time. NYMS Headquarters at Clifton, NJ will be open by appointment only to members from 8:00pm to 10:00 pm most Tuesday evenings.

Those members wishing to visit must call Don O'Leary or Mel Pollinger to confirm. Don's cell-phone number is (201) 519-2176 or email: dkoleary@verizon.net. Mel's Home phone number is (201) 791-9826 or email: pollingmel@optonline.net

***From The Editor*… if you have email:** Getting the newsletter by email means you receive an **extended pdf version** that cannot be sent by "snail mail." Even if you continue your USPS delivery of the newsletter, NYMS needs your email address for reporting priority events and special news. Being able to contact you by email means better communication between us■■ Mel

Dues for 2012 is Past due!

Need to use a Microscope?

The various microscopes that are presently set up on the main floor of the New York Microscopical Society building in Clifton, N.J. are there for the use of its members.

Microscope Cleaning Kit

A complete set of tools and accessories to keep your microscope in optimum operating condition. The kit is put together by our Curator/Educational Chairman and available directly from NYMS for only $35.00 plus shipping & handling, or may be purchased at a meeting. Call or email Mel Pollinger or Don O'Leary for details (see page two for contact numbers).

Also: Slide boxes 100 capacity, used: $5.00 while they last

Answer to Mystery Photo forSummer2012

Deer tick mouth parts (proboscis) imaged by Arthur Coates through a stereo microscope. Correctly identified by Michael Reese Much, RMS, EMS.

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Mystery Photo for September 2012

Want to take a guess? Send it to me by email or call me: pollingmel@optonline.net, (201) 791-9826

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Additional Historical NYMS Supplements Email Newsletter recipients will also be getting copies of NYMS Newsletter pdf back-Issues from 2007. Copies of older newsletters will be sent as I convert them.

Got something you want to sell, trade or publish in the Newsletter and/or on the website? Write, call or send an email message to:
201-791-9826 or pollingmel@optonline.net (images ok)
or
Mel Pollinger, Editor
NYMS Newsletter
18-04 Hillery Street
Fair Lawn, NJ 07410

Supporting Member

NYMS Newsletter Extended Section, September 2012

In This Section: Directions to NYMS

Directions to NYMS Headquarters

One Prospect Village Plaza
(66F Mount Prospect Avenue)
Clifton, NJ 07013

GPS: Intersection of Colfax & Mt. Prospect: Latitude 40.8656 N, Longitude 74.1531W,
GPS: Our building: Latitude 40.8648 N, Longitude 74.1540 W

From George Washington Bridge:
Take Interstate Route 80 west to Exit 57A, Route 19 South. Take Route 19 to Broad Street and continue two lights to Van Houten Avenue. Turn Left. Go to second light, Mount Prospect Avenue and turn left. Building 66F is on the left side , one and a half blocks from Van Houton.

From Lincoln Tunnel:
Follow exit road to NJ route three west. Continue to Bloomfield Avenue exit. Turn right to Circle and go three quarters to Allwood Road West. Mount Prospect Avenue is a few blocks on the right (a small street) Turn right and go to first light (Van Houton) continue. Building 66F is on the left side , one and a half blocks from Van Houton.

From North:
Take Garden state Parkway South to Route 46 Clifton Exit. On 46 Make second exit to Van Houton Ave. Continue to third light Mount Prospect Avenue and turn left. Building 66F is on the left side , one and a half blocks from Van Houton.

From Route 46 coming from west:
Take Broad Street Exit in Clifton and follow Directions above from GW Bridge.

From route 46 coming from East: Take Paulson Avenue Exit in Clifton and follow to Second light, Clifton Ave turn right. Go to next light, Colfax, turn left, go three blocks and turn right on Mount ProspectAve.. Building 66F is half block on right.

Public transportation from NY:
Take NJ Transit train from Penn Station to Secaucus Transfer Station. Change trains to Bergen Line to Clifton (call NJ Transit for schedules). From Clifton Station cross under tracks to first street and go left one block to Mount
Prospect Street, turn right and Building 66F is one half block on Right.

If you plan to come by bus or train, please copy the links below into your browser:
http://www.njtransit.com/sf/sf_servlet.srv?hdnPageAction=TripPlannerItineraryTo
http://www.njtransit.com/sf/sf_servlet.srv?hdnPageAction=BusSchedulesP2PTo
http://www.njtransit.com/sf/sf_servlet.srv?hdnPageAction=TrainTo

Stereo Microscopes

Part 1: Introduction and Background
3rd Edition

R. Jordan Kreindler (USA)

Figure 1. Spider spinneret, stereo zoom microscope 45x

Introduction

Although not as widely recognized as standard biological compound microscopes, stereo microscopes are widely used. In addition to their real world uses, some discussed in this paper, they are often seen in television shows and movies, particularly those containing elements of forensic science.

For example, the American Optical (AO) Cycloptic® microscope with its unique appearance (discussed in more detail in Part 3), and distinctive Galilean drum markings has been used in various US TV shows. This includes, possibly the most popular TV drama series of its time, *CSI* (Crime Scene Investigation) where it was used by Supervisor Dr. Gil Grissom, Ph.D. Olympus SZ series stereo microscopes are seen on *CSI:NY* (Crime Scene Investigation: New York). On *Bones*, an Olympus SZX7 is used by one of the show's continuing characters, entomologist Dr. Jack Hodgins, Ph.D. On *Body of Proof* the American TV series starring Dana Delaney as Dr. Megan Hunt, MD, Dr. Hunt is often seen using a stereo microscope.

A Leica MZ series stereo microscope appears on the BBC's *Sherlock* (c. 2010). *Sherlock* is a modern dramatization of Sir Arthur Conan Doyle's famous detective, and a Leica stereo microscope is often used by the title character, Sherlock Holmes. In this series the images, which appear to be seen through the MZ microscope, are often created using 'artistic license' and can be computer simulations or scanning electron microscope (SEM) photographs.

It's likely camera distributors pay for product placement and display on these shows, as camera names are often prominently visible. However, although they are relatively ubiquitous in forensic dramas, these shows rarely display the names of the stereo microscopes used, and if present the names and logos are often blurred or otherwise obscured.

Background: The Compound Microscope

In this paper the term "compound microscope" is restricted to mean a standard "non-stereoscopic" monocular or binocular microscope, although stereo microscopes are also compound microscopes.

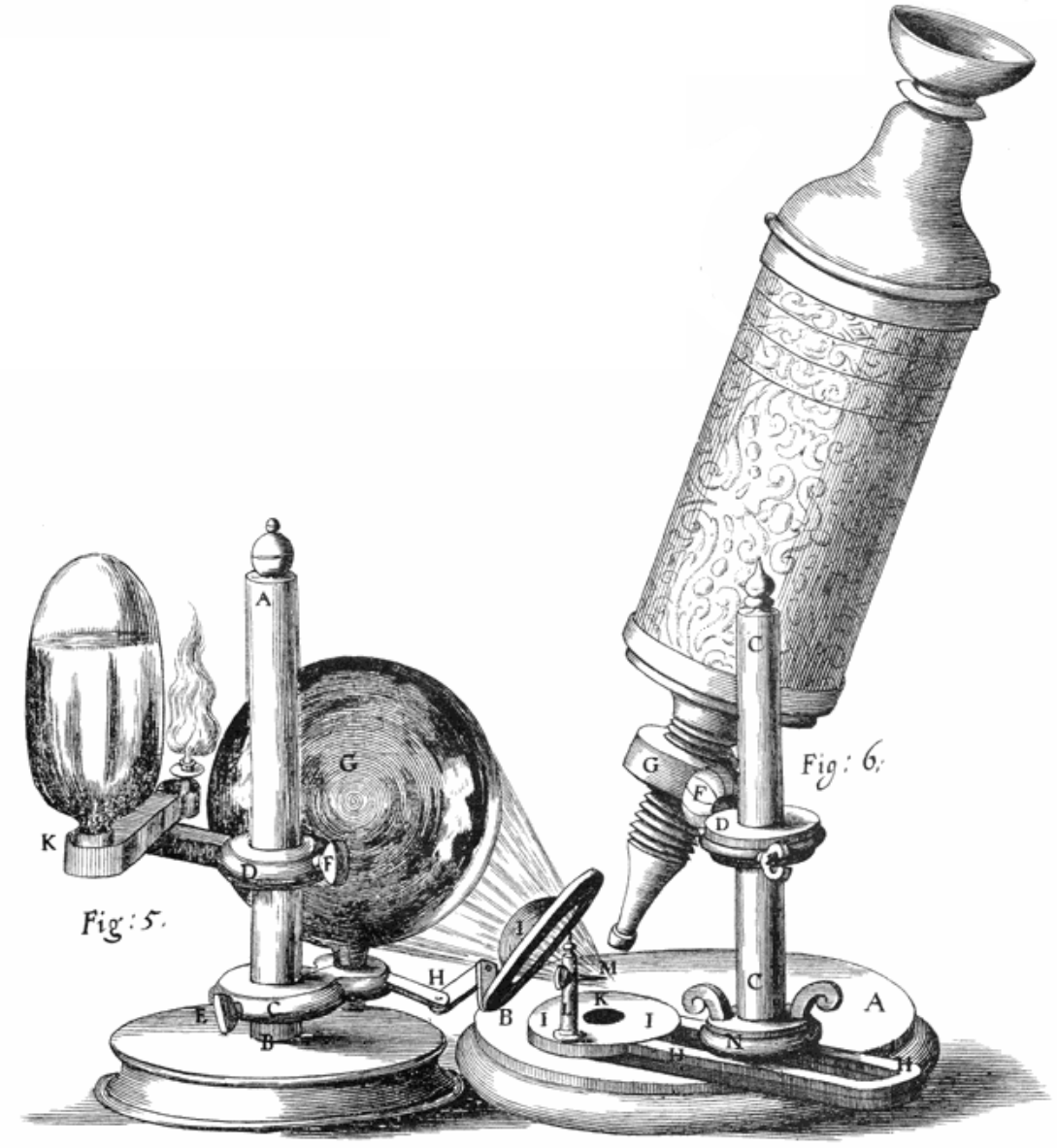

Figure 2. Robert Hooke Microscope c. 1665 used reflected rather than transmitted light

Most compound microscopes, metallurgical microscopes being an exception, use objectives designed for specimens mounted on slides and enclosed under cover slips. Objects are commonly flattened or cut into thin sections so they can be viewed with transmitted light, which passes through the subject before it enters the objective. Conversely, stereo microscopes view most objects using incident light. That is, light is reflected from the object before entering the lens. Early compound microscope were an exception. For example, Hooke's microscope of 1665 used reflected light, Fig. 2.

Figure 3. AO high N.A. 0.95 APO Objective

Later compound microscopes usually used transmitted light. For high resolution imaging it's critical to correct for coverslip thickness. In the recent past, top quality, and expensive, apochromatic (APO) lenses, e.g., Fig. 3, had correction collars. This allowed for the optical adjustments required on high quality, high numerical aperture lenses to account for variations in coverslip thickness. The Royal Microscopical Society (RMS) standardized coverslip thickness at 0.17mm (the current standard for No. 1.5 coverslips). This standardization significantly diminished the need for correction collars on objectives to be used in examining modern slides. However, owing to coverslip manufacturing variations, high magnification, high N.A. objectives can still benefit from the presence of correction collars which may be needed to adjust for potential optical aberrations.

Most stereo microscopes, and comparison microscopes (described in the section to follow), have dual objectives designed for viewing without cover slips. They're designed to view objects at relatively low magnifications, typically 10x - 40x.

For most stereo microscopes, working distance (the distance from the bottom of an objective to the in-focus area of an object) and depth of field are relatively large. Resolution and working distance typically have an inverse relationship. Stereo microscopes provide microscopic views of the world without the need for complex object preparation. Because of their large field of view they can give us "in context" views of objects that would otherwise be impossible to obtain.

As M.C. Cooke said, and quoted in Kreindler (Kreindler, May 2011), " ... we may be permitted to recommend the novice always commence the examination with the lowest power of his microscope ... the greatest satisfaction will always be derived from a great practical use of low powers". Although this was said for compound microscopes, it's clearly applicable to stereo microscopes.

Background: The Comparison Microscope

In 1911 W. & H. Seibert marketed the first comparison microscope, designed by chemist W. Thörner for food quality control. It was followed shortly by comparison microscope models from other German makers, such as Leitz, and U.S. manufacturers (Mappes, 2005). Pictures of a Seibert comparison microscope can be seen on-line at the *Museum optischer Instrumente* (Mappes, 2005-2006).

Seibert's comparison microscope used two substage mirrors. Similar dual mirrors had already been used by Riddell (Fig. 12) in his stereo microscope c. 1853.

Figure 4. Bausch and Lomb Comparison microscope. c. 1929 front View

Although neither a stereo or standard compound microscope, the comparison microscope can be considered an intermediate instrument between the typical biological compound microscope and Greenough stereo microscopes (Greenough's design is discussed in Part 2).

Similar to a compound monocular microscope, a comparison microscope provides a single image of each object viewed, while like a Greenough stereo microscope it has two objectives. However, unlike either microscope, it looks at two different objects at the same time. As its name implies, it is used to compare objects.

Figure 5. Bausch and Lomb Comparison microscope right-side view

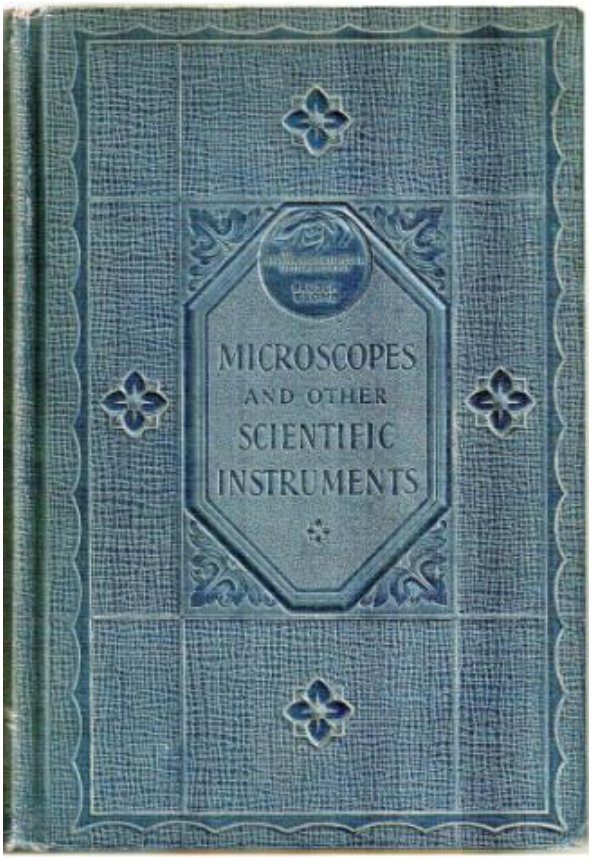

Figure 6. Bausch and Lomb's 1929 hardcover catalog

Perhaps this extract from Bausch and Lomb's (B&L's) 1929 *Microscopes and Other Scientific Instruments* book, Fig. 6, best describes this instrument.

The Comparison Microscope makes possible the comparison of any two objects that can be brought within its field, which are seen in juxtaposition through a single eyepiece. It is particularly useful to the technical expert who seeks to compare under the microscope substances, surfaces or colors. Affording, as it does, a means of accurate investigation and of ocular demonstration before courts or jury, it is of great assistance to the examiner of disputed or suspect documents.

It is especially adapted for the examination of inks, colors, erasures, changes, interlineations, and overwriting, and for the comparison of disturbed and undisturbed paper surfaces, pen, and pencil points, the tint, texture, and condition of paper surfaces, the texture and quality of typewriter ribbons, written and printed characters, and type faces.

-- (Bausch and Lomb, 1929).

In 1929 the comparison microscope shown in Figs. 4 and 5, with 2x objectives and 10x Ramsden eyepieces sold for USD $80.00. Other paired objectives were available for $11 and $17 respectively.

Many modern examples of comparison microscopes are often purpose-built for specific functions. A modern example is shown, in Fig. 7.

The Yuken Hydraulics "Microscopic Inspection Device" (Hagan, 2011) is a comparison microscope used to measure "pollution" of hydraulic fluids. Hydraulic fluid samples are soaked up and dispersed by a membrane filter under one of the lenses. The contamination of the dispersed fluid is compared to a standard contamination disc placed under the other objective. To provide portability, this device has built in illumination useable with either an AC or DC power source. This is a relatively heavy instrument weighing about 10 pounds.

Figure 7. A Modern Comparison Microscope

Background: The Stereo Microscope

One can be excused for believing that the first stereo microscope was designed quite recently. This is true for the first practical instrument for scientific purposes. However, over three hundred years ago, the first "stereo" microscope, was designed by a monk in the Orders of Capuchin Friars Minor (O.F.M. Cap), also known as the Capuchin Franciscans, a Catholic Order deriving from the Franciscans.

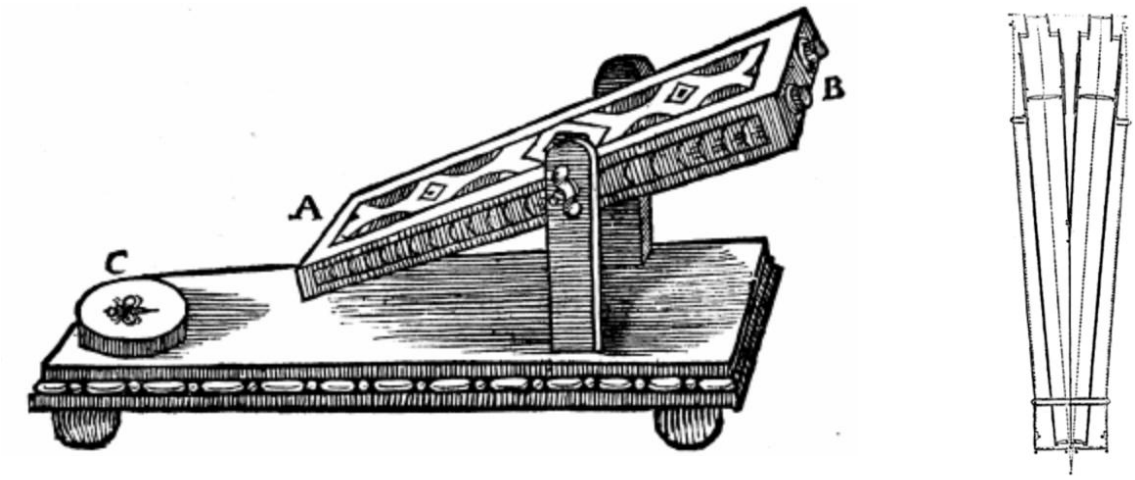

Figure 8. Père d'Orleans binocular microscope (pseudoscope) [Ref. Journal of the Society of Arts 1886]

Father (Père) Cherubin d'Orléans (Francois Lassere) designed his binocular "stereo" microscope, Fig. 8, c. 1670s, (Journal, Nov. 1886), (Cherbun, 1677). This microscope was constructed not only with dual eyepieces, but also with dual objectives, with the images to each eye reversed.

Stereo above is in quotes as this is a pseudoscopic rather than a true stereoscopic microscope (Wade, 1998), (Encyclopaedia Britannica, 1910). In a pseudoscope images appear inverted in the vertical direction, that is high points appear low and low points high. So that object points closest to the objective appear farther away and points farthest from the objective appear closer. Thus, a toothpick viewed through Père d'Orleans microscope would appear as a mold to make copies of the toothpick.

Normally right images go to the right eye and left images to the left eye to provide stereoscopic images. However, if the images sent to each eye are reversed this is no longer true. As Dr. Kurt Schwidefsky, former head of the Photogrammetry Department of Carl Zeiss Oberkochen, notes in his book (Schwidefksy, 1950), " ... if left and right images are exchanged the orthoscopic *[author: stereoscopic]* effect changes into a pseudoscopic one.

The same effect occurs if the images which are observed are rotated by 180 degrees. This 180 degree image rotation is the typical case for both standard compound monocular and binocular microscopes. This can be easily seen by writing "abc" in very small letters, and looking at these letters under a compound microscope using the lowest magnification available. The original and its view through a compound microscope are shown below.

abc Original text
ɔqɐ As seen through a compound microscope

This reversal is always seen using a standard compound microscope. It's the reason when we move a slide right the image moves left, and when we move a slide downward the image moves upward. Compound microscope images are not seen in three dimensions, and spatial orientation is usually unimportant, so this effect is not normally detrimental to subject investigations.

The instrument shown in Fig. 8 was not the only binocular microscope designed by Père d'Orléans. He also designed a binocular microscope made of two monocular-style microscopes and held in a housing similar to a cylindrical Withering microscope c. 1678. As Wise, Ockenden, and Sartory (Wise, 1950) note, although the

> *... principles of stereoscopic vision were not fully understood at the time. Nevertheless, the remarkable fact remains that the author [Père d'Orleans], in his books, had expressly recommended systems giving erect images for the monocular compound microscope. Had he used [author: any of these] his ... instrument would have rendered [author: stereoscopic images].*

D'Orleans' microscope was developed before the invention of achromatic microscope lenses, and at a time when simple microscopes provided better images than their compound relatives.

Perhaps, because of the negative implications of this for serious scientific use, only modest development of the stereo microscope took place over the next 150 years. The next major advance was achieved by Prof. Riddell in the U.S., c. 1850s, see below, who used prisms above the objective to divide the circle of rays coming from an objective into binocular eyepieces. (Ferraglio, 2008).

However, that development would first require a greater understanding of 3D vision.

Understanding Stereoscopic Vision

As mentioned earlier, the first "stereo" microscopes were pseudoscopes, e.g., the microscope built by Cherubin d'Orleans, rather than true stereoscopic instruments. An understanding of optical principles gradually evolved, due initially to the work of English Scientist Sir Charles Wheatstone c. 1833, and was documented in his *Contributions to the Physiology of Vision, (Wheatstone, 1838).* [Wheatstone is perhaps best known to electrical engineers for the Wheatstone bridge (which was not his invention), to communications engineers for his work on the telegraph, and to cryptographers for his Playfair cipher. He was, in the best Victorian tradition, a "man for all seasons".] However, he's rarely identified for his invention of the stereoscope.

Wheatstone's initial work on the stereoscope was later improved by Sir David Brewster c. 1849. Wheatstone's and Brewster's stereoscopes were devices for viewing two not quite identical images to produce a 3D view. Fig. 9 shows an example of a Brewster style stereo viewer.

Wheatstone's original interest in stereoscopic vision related to the development of the stereoscope, but his optical investigations were important for their understanding and explanation of 3D perception. Wheatstone's stereoscope was developed before the widespread use of chemical photography. Thus, it was necessary for him to commission artists to draw images he felt would be viewed as three dimensional. His papers were key to the later development of the modern stereo microscope.

It was Queen Victoria's interest in the Brewster stereoscope, seen at the London Exhibition of 1851, that generated widespread public awareness and interest.

Later in the United States, Oliver Wendell Holmes (the son of the Associate Justice of the Supreme Court of the United States, whose life is documented in the 1950 movie *The Magnificent Yankee*, and grandson of the medical doctor and writer of the same name) developed an American stereoscopic viewer.

Figure 9. Brewster-style stereoscope. Courtesy, and with permission of Rainer Maertin, www.photoarsenal.com

This development combined with the growth of photography led to growing popularity and sales of stereo viewers. The Holmes Stereo Viewer was popular for almost 60 years, starting in the latter 19th century.

Brewster-style stereo viewers, primarily made of wood, are today relatively expensive antiques, but are still often found for sale. After changes and simplification the Brewster stereoscope evolved to become the parlor stereo viewer popular in the early 20th century, Fig. 10. These modern viewers are unmistakably similar to the Brewster stereo viewer. As a major contributor to the Encyclopaedia Britannica editions of 1842 and 1860, Brewster was able to document his work for a larger audience.

Inexpensive stereoscopes made of wood and metal were common sights in many middle and upper class households in the 20th century, and remained popular for about 60 years, diminishing gradually with the rise of radio and movies.

Figure 10. 20th century (Holmes-Bates) stereoscope. The Monarch. Keystone View Company.

The ubiquitous stereoscopes, also known as stereo viewers or stereopticons, were open viewers of Holmes' design, improved by Joseph L. Bates, and often referred to as Holmes-Bates stereo viewers.

The most widespread viewers and views, at the start of the 20th century, were those made by the USA's Keystone View Company, although other companies, e.g., Underwood and Underwood, H.C. White, and Sears also produced these instruments. Stereo viewers were, in their time, often the primary device that brought the distant world to local living rooms.

Waldsmith (Waldsmith, 1991) provides a more detailed discussion on the history of stereo viewers and views.

The popularity of stereo viewers led in the 1930s to the development of the *Tru-Vue* stereo viewer which used 35mm film strips with over a dozen stereo images per strip.

Tru-Vue was eventually acquired by View-Master, the makers of the *Sawyer View-Master,* designed by William Gruber. Many readers of this paper may have used a *Sawyer View-Master* as children. View-Masters are still sold today by Fisher-Price, usually for about USD $9.00, and are marketed primarily to pre-teens.

Stereo camera and viewers are still available. Fig. 11. shows an inexpensive digital 3D camera currently available, c. 2012. Other stereo digital camera and accessory manufacturers include SVP, Fujifilm, Loreo, etc. Many TVs are now 3D capable.

Figure 11. Digital 3D camera and viewer, c. 2012

It was the evolution of understanding of 3D vision, following on the work of Sir Charles Wheatstone in the 1830s and his intellectual descendants, that led to the development of modern stereo devices and the stereo microscope (see below).

Designs of Prof. John Leonard Riddell of New Orleans, USA

Wheatsone's publication (Wheatsone, 1838) and his subsequent work influenced researchers in England and the US to explore further development of stereoscopic devices. The first functional stereo microscope was made in the U.S. by J(ulius) & W(illiam) Grunow according to Prof. J. L. Riddell's design, c. 1853. Riddell had likely been influenced, directly or indirectly, by Wheatsone's work.

The two Grunows were brothers, and were joined briefly by a third brother Charles. The formal designation "Grunow Bros." was used only briefly as the company name. (Over time, the brothers went their separate ways.) The Grunows were known for the quality of their instruments, which compared favorably to those of British manufacture. The Riddell microscope, and the design of its prisms, is shown in Figs. 12 and 13. An example of Riddell's microscope can be found in the Billings collection, Fig. 257 (Purtle, 1987).

The description in Billings states that the Riddell microscope in their collection is 16 inches tall, and it includes the inscription *"Invented by Prof. J. L. Riddell, University of Louisiana, Made by the Grunow Broths. New Haven, Conn*"

One of the seminal features of the original Riddell microscope is the use of two substage mirrors, i.e., two light sources to independently illuminate each of the microscopes. This dual illumination feature would continue to be used in more recent times. For example, it is used in conjunction with the Bausch & Lomb Stereo 240 microscope designed for photo interpretation, and discussed later in Part 2 of this paper.

Note the prisms atop each eyepiece in Fig. 12. These not only negate the need to look directly down into the eyepiece tubes but, perhaps more importantly, they're also used to produce a normal orientation of the image, i.e., erecting vertically the images which were corrected horizontally by the lower set of prisms. The final result, for the user, are images where movements at the stage are shown correctly, not inverted, i.e., movement to the right is shown as movement to the right, and movement upward is shown as movement upward. (Ferraglio, 2008).

The Riddell microscope in Fig 12 uses two independent light paths through a common relatively small objective with prisms above the objective to divide the circle of rays coming through the objective into two eyepieces.

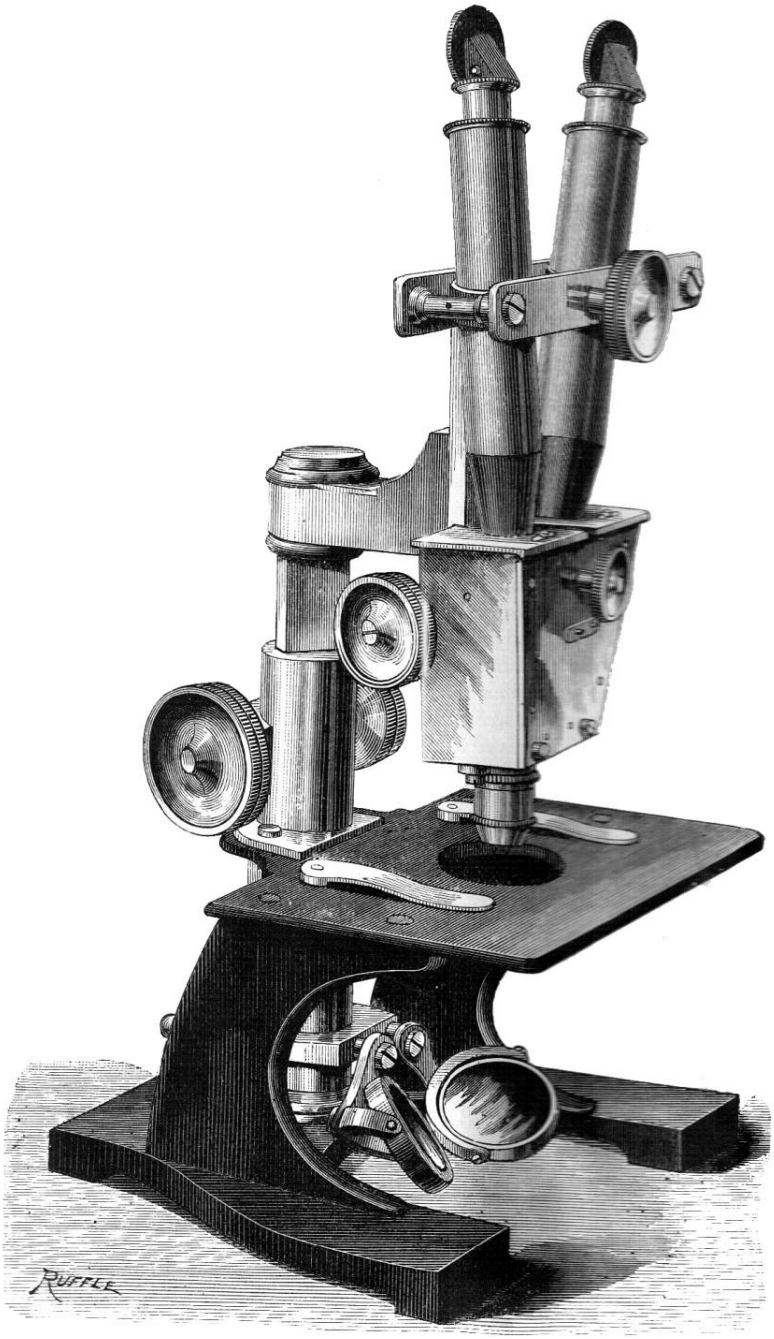

Figure 12. A representation of Riddell's original microscope, slightly software enhanced, by the author (Carpenter, 1901)

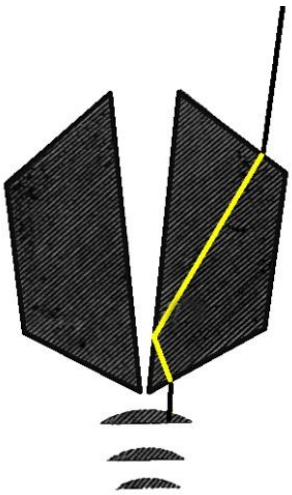

Figure 13. Riddell's Trapezoidal Prisms (Carpenter, 1901) Modified here for illustration

As can be seen in Fig. 13, both light paths go through a common objective. The use of a common objective would evolve in the 20th century into the Common Main Objective (CMO) stereo microscope discussed in more detail in Part 3 of this paper.

As Ferraglio notes,

Despite its useful features, novelty, and production by America's premier microscope maker of the time. Riddell's binocular microscope seems to have failed in the marketplace. Only one example survives: Riddell's own microscope ... It seems demand for such a microscope was very low during these early years of microscopy in America.

-- (Ferraglio, 2008).

Stephenson Stereo Microscopes

Fortuitously, the basic design of Prof. Riddell's microscope was discovered independently, several decades later, by John Ware Stephenson, R.M.S., F.R.A.S of England. Stephenson was elected to the Council of the Royal Microscopical Society and was its Treasurer c. 1880s. He was also a major contributor to the Encyclopaedia Britannica edition of 1842.

One of Stephenson's modifications used Riddell-style prisms (possibly made by Browning), that were much smaller, and were mounted inside a small tube that projected from the microscope and extended into the objective housing in close proximity to the back element of a lens. That is, the prism and its housing stayed with the microscope and not with the objectives. The Riddell-Stephenson design, with various modifications, was used in some 19th and early 20th century British binocular microscopes. These microscopes were produced by various British makers, including Ross (although these are rarely found), John Browning, Charles Baker of London, and James Swift & Son of London. Swift is the maker most commonly seen, (Ferraglio, 2008).

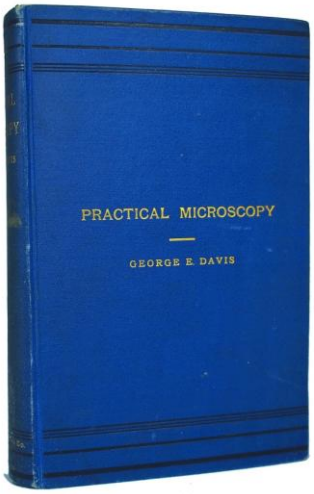

Figure 14. George E. Davis. *Practical Microscopy,* 1882

See, Kreindler and Goren (Kreindler, March 2011) for the differences between the unrelated Swift companies in England and the US.

A picture of a Stevenson style binocular microscope, made by Swift, can be found in the Truman G. Blocker, Jr. History of Medicine Collections, *Fig. 1.020,* (Blocker 2012), as well as in the article, *Introduction to Stereomicroscopy* (*Fig. 1.)*, at NikonU (NikonU, undated)

As will be discussed in a later section, the Riddell-Stephenson design can be considered the precursor of the modern common main objective (CMO) stereo microscope.

A picture of a Riddell-Stephenson-Browning binocular along with a brief discussion is given in Davis (Davis, 1882). Figs. 15 and 16, taken from Davis, show this microscope and its prisms.

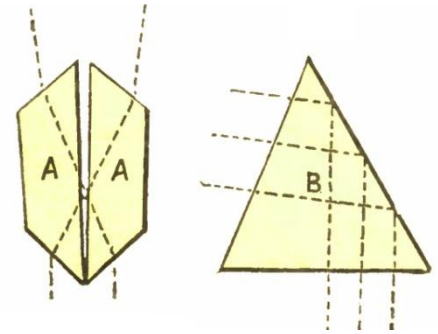

Figure 16. Prism designs for Stephenson Stereo Binocular shown at left. *Modified and colored from Davis (Davis, 1882)*

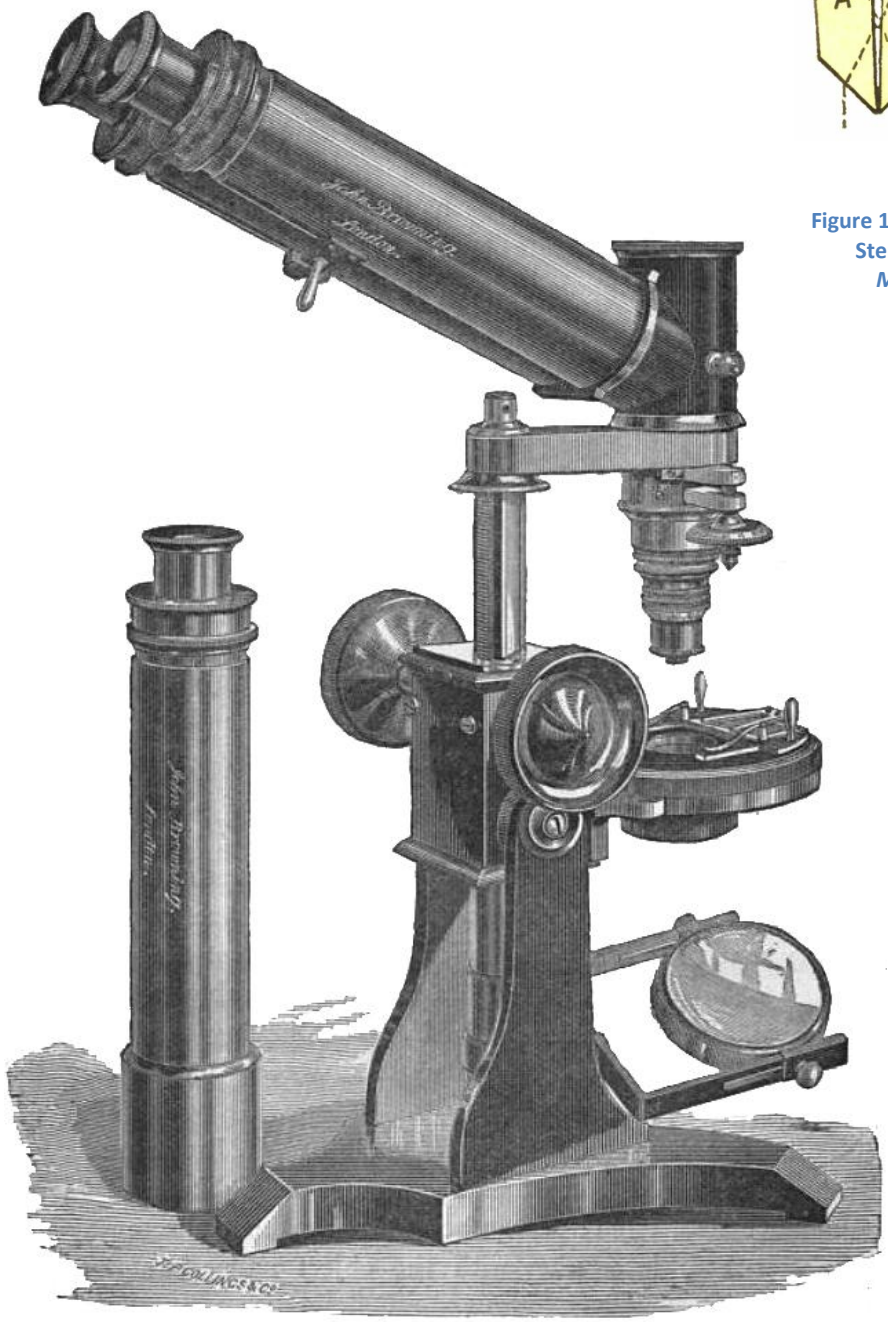

Figure 15. Riddell-Stephenson stereo binocular microscope made by Browning. (Davis, 1882)

Wenham Stereo Microscopes

However, it was the development of the Wenham binocular, Figs. 17 through 19, that led to the rapid distribution of stereo microscopes.

As can be seen in Fig. 17, Wenham used a single prism, different from that used in Riddell's microscope, to reflect half the semicircle of light entering the objective into an angled tube. The remaining half of the semicircle of light passed unobstructed and without reflection by Wenham's prism into the other eyepiece tube.

As the images from the objective are reversed, as in a normal microscope, to obtain a stereoscopic effect the image from the right-side of the objective must be sent to the left eye, and the image from the left-side of the objective to the right eye. If these images had not been crossed, to go to opposite eyes, the resultant image would have been pseudoscopic, as in the binocular microscope of Père d'Orleans, Fig. 8.

The use of Wenham binoculars for stereoscopic examination has a number of difficulties. In addition to the reduced image illumination obtained with a single small aperture objective, relief is limited due to a number of factors, including (1) most objects are cut into thin sections, so relief is naturally reduced, (2) the short working distances mean that many objects cannot be placed whole under the objective, (3) cover slips may, in some circumstances, further depress potential relief, (4) the spatial separation of images is relatively small and effects relief, and (5) depth of field is quite shallow with higher magnification.

Due to the small diameter of the back lens of high power objectives, compared to the size of the Wenham prism, images are somewhat distorted by the edge of the prism at high powers, and the relief seen at low powers is significantly diminished, if present at all, when high powers are used.

Wenham binocular microscopes have prisms that can be slid outside the optical path, Fig. 18b, to allow more light to the eye when high magnification objectives are used. However, when this is done the binocular microscope becomes a non-stereo monocular microscope, with a prism-free image path, with all the light from the objective going into a single body tube. That is, the image is 'flat'.

At low powers, Wenham binocular microscopes show relief, but not as significantly as modern stereo microscopes, and their working distances are insufficient to accommodate larger whole specimens. Also, as the light paths are not similar, the illumination variations to the left and right eyepieces make these microscopes more fatiguing for some to use.

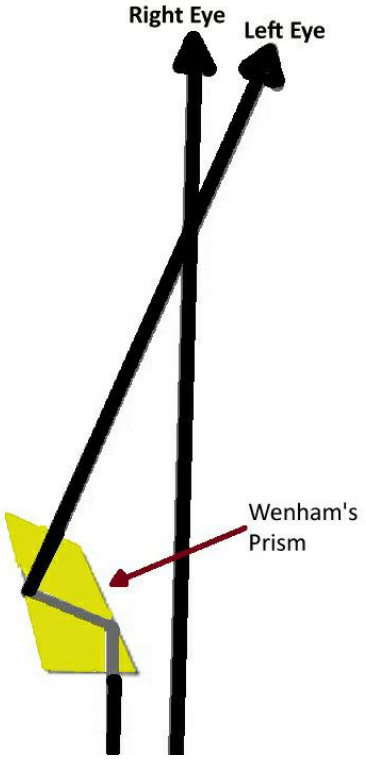

Figure 17. Wenham binocular light path

Figure 18 - Crouch Wenham Binocular

a. Left: Complete view

b. Above: Close-up with Wenham prism moved out of light path

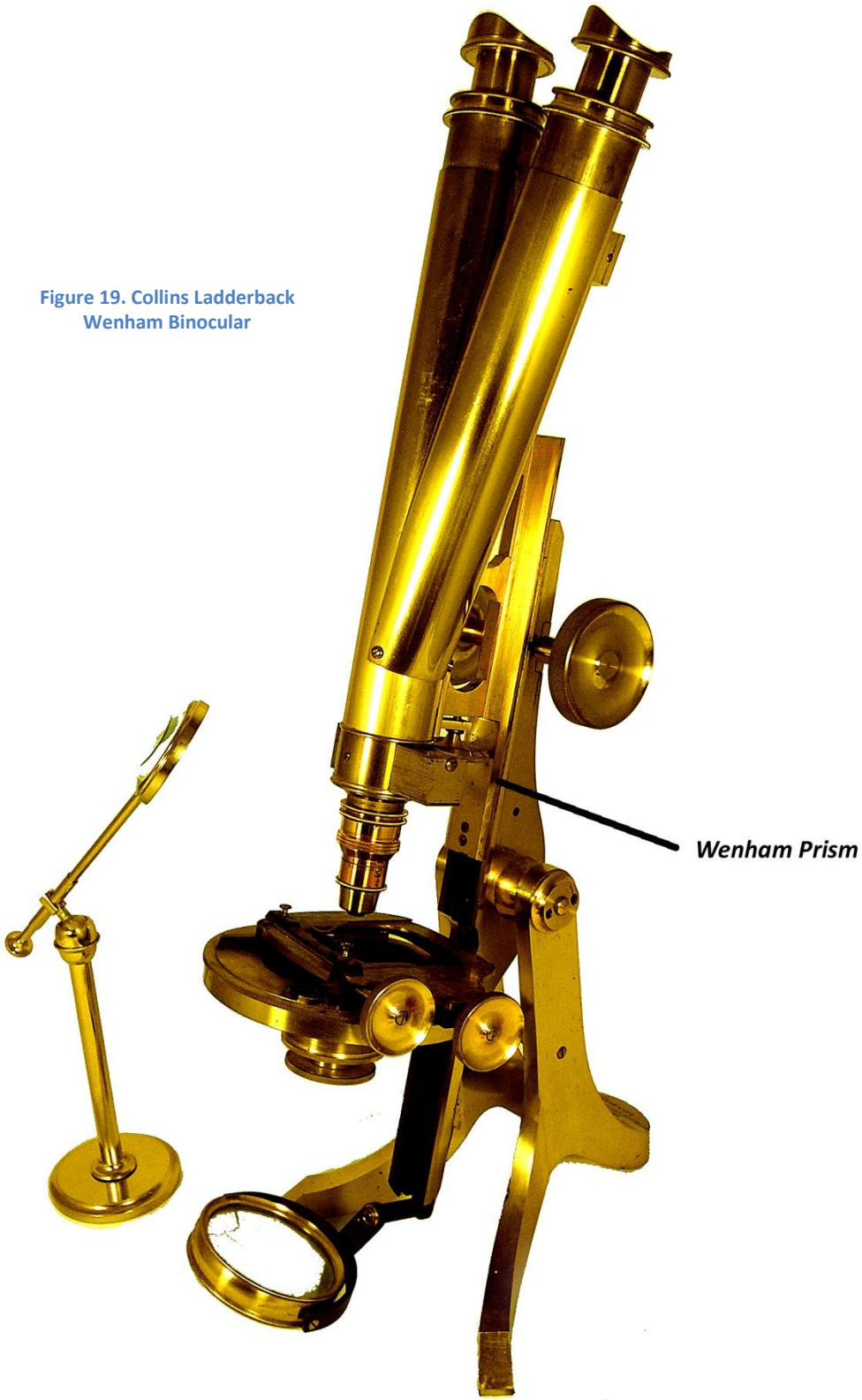

Figure 19. Collins Ladderback Wenham Binocular

Nonetheless, the Wenham binocular microscope, in various versions, dominated the production of British, and American, binocular microscopes in the 19th century. Wenham English binocular microscopes are easily identified by their one "straight" and one angled tube, Figs. 18 and 19. Wenham's binocular microscopes were suited to the longer English tube length of 10 inches. However, this prism design did not work well for continental microscopes with their shorter tube lengths, slightly over six inches.

The wide acceptance of the Wenham's binocular design may not have been due to its stereoscopic capabilities but its being a binocular, instead of a monocular, microscope. Using both eyes, as occurs in a binocular microscope, is usually more comfortable for users.

The stereoscopic limitations of Wenham binocular microscopes were, in part, the motivation for the development of the modern low power stereo microscope, where whole objects can easily be seen in outstanding (some would say spectacular) three-dimensional relief. Most objects can be quickly (i.e., without thin section preparation or staining) placed under a stereo microscope for examination. An object's image is not reversed by a stereo microscope. That is, moving an object to the left moves its image to the left, and moving an object downward moves its image downward. Thus, "abc" seen under a stereo microscope appears as "abc".

The Wenham binocular presents dissimilar light paths to each eye. Light not going through the prism provides relatively greater intensity to its eyepiece than light traveling through the prism does to its eyepiece. Thus, it is the Riddell-Stephenson design, rather than the Wenham design, that should be considered the direct predecessor to the Common Main Objective (CMO). A discussion of CMOs is given in Part 3 of this paper.

As Wenham's prism design proved inappropriate for continental instruments, other style stereo microscopes were developed in Europe, initially by the French firm Nachet, (Moe, 2004).

The author welcomes, and appreciates, any suggestions for corrections or improvement.
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Although this was a landmark in American stereomicroscopes, the common objective concept was first used by Riddell in 1850s, and a common large objective was later implemented by Zeiss in their Citoplast,, considerably before the Cycloptic® was introduced.

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Code	~ One-Day Courses ~ Wednesday 8:30am - 5:00pm (Holiday Inn)	Instructor(s)
E12-29	Development, Validation, Verification and Transfer of Analytical Methods: A Lifecycle Approach of Analytical Methods	Mr. Gregory Martin, Complectors Consulting
E12-32	Quality-by-Design (QbD): A New Paradigm for the Analytical Laboratory I: QbD Fundamentals for Analytical Chemists	Dr. Zenaida Otero Gephardt, Rowan University
E12-33	Practical Applications of Laser-Induced Breakdown Spectroscopy	Dr. Lydia Breckenridge, Bristol-Myers Squibb
E12-34	Practical Headspace Gas Chromatography	Dr. Mary Ellen P. McNally, DuPont Dr. Thomas A. Brettell, Cedar Crest College
E12-35	Extractables and Leachables Studies for Biologicals and Other 'High Risk' Dosage Forms	Dr. Thomas Feinberg, Catalent Pharma Solutions
E12-36	Practical Knowledge and Recent Advances in Developing Supercritical Fluid Chromatography (SFC) Applications	Dr. Yingru Zhang, Bristol-Myers Squibb

Code	~ One-Day Courses ~ Thursday 8:30am - 5:00pm (Holiday Inn)	Instructor(s)
E12-38	Quality-by-Design (QbD): A New Paradigm for the Analytical Laboratory II: Design of Experiments (DOE) for Analytical Chemists	Dr. Zenaida Otero Gephardt, Rowan University
E12-39	The Chemistry of Drug Degradation	Dr. Christopher Foti, Pfizer
E12-40	Dissolution: A Rational Approach to Developing and Validating Methods for a Variety of Purposes	Mr. Gregory Martin, Complectors Consulting
E12-41	Impurities in Pharmaceuticals - A Survey Course	Dr. Bernard A. Olsen, Olsen Pharmaceutical Consulting
E12-42	Quantitative Analysis for Managers, Auditors and Data Reviewers	Dr. Nicholas Snow, Seton Hall University Dr. Gregory Slack, Clarkson University
E12-43	Practical Introduction to Raman Spectroscopy	Dr. Frederick H. Long, Spectroscopic Solutions

2012 EAS
Conferences-in-Miniature

ART CONSERVATION

Technical Sessions

- Current Applications of Mass Spectrometry in Heritage Studies, I (11/12 AM) *invited*
- Current Applications of Mass Spectrometry in Heritage Studies, II (11/12 PM) *invited*
- Cleaning of Modern Paint, I (11/13 AM) *invited*
- Cleaning of Modern Paint, II (11/13 PM) *invited*
- Diverse Industrial and Cultural Applications (11/13 PM) *contributed*

Short Course

- The Modular Cleaning Program – An Accelerated Course for Conservators (11/14-11/15)

BIOANALYSIS

Technical Sessions

- Analytical Solutions for Characterization of Biologics and Quantification in Biological Matrices (11/12 PM) *contributed*
- Poster Session: Analytical Solutions for Characterization of Biologics and Quantification in Biological Matrices (11/12)
- Dried Blood Spot Analysis (11/13 AM) *invited*
- EAS Award for Outstanding Achievements in Mass Spectrometry, Honoring Dr. Fred McLafferty (11/14 AM) *invited*

Short Courses

- Essentials of Modern HPLC/UHPLC I and II (11/11-11/12)
- Essentials of Modern HPLC/UHPLC I: Fundamentals and Applications (11/11)
- Essentials of Modern HPLC/UHPLC II: Practice, Operation, Trouble-shooting and Method Development (11/12)
- The Analysis and Characterization of Protein Therapeutic Drugs (11/13 - 11/14)
- The Role of Chromatography in the Analysis and Characterization of Protein Therapeutic Drugs (11/13)

CHEMOMETRICS

Technical Sessions

- EAS Award for Outstanding Achievements in Chemometrics, Honoring Lutgarde Buydens (11/12 AM) *invited*
- Modeling and Classification with Chemometrics (11/12 PM) *invited*

Short Courses

- Chemometrics Without Equations I & II (11/11-11/12)
- Introduction to Chemometrics Without Equations (11/11)
- Intermediate Chemometrics Without Equations (11/12)

CHROMATOGRAPHY

Technical Sessions

Liquid Chromatography

- American Microchemical Society Benedetti-Pichler Award, Honoring Luis Colon (11/12 AM) *invited*
- HPLC Technologies and Pharmaceutical Applications (11/12 AM) *contributed*
- Pharmaceutical Analyses: Is your Column Equivalent? (11/12 AM) *contributed*
- EAS Award for Outstanding Achievements in Separation Science, Honoring Robert Kennedy (11/12 PM) *invited*
- Poster Session: High Pressure Liquid Chromatography Technologies and Pharmaceutical Applications (11/12)
- Poster Session: Novel Applications of LC/MS and GC/MS (11/12)
- Poster Session: Novel Liquid Chromatography Phases and Instruments (11/12)
- Successful Applications of Fast Liquid Chromatography in Various Industries (11/13 AM) *invited*
- Poster Session: Separation Anxiety from Capillaries to Columns (11/13)
- Counter(feit) Attack- Strategies and Technologies to Fight Counterfeits (11/14 AM) *invited*

CHROMATOGRAPHY *continued*

Supercritical Fluid Chromatography

- Supercritical Fluid Chromatography: Advances and Applications in Pharmaceutical Analysis I (11/14 AM) *invited*
- Supercritical Fluid Chromatography: Advances and Applications in Pharmaceutical Analysis II (11/14 PM) *invited*
- Poster Session: Gas Chromatography Intro, Assay and Detection (11/14)

Gas Chromatography

- Gas Chromatography Intro, Assay and Detection (11/15 AM) *contributed*
- Separation Anxiety from Capillaries to Columns (11/15 AM) *contributed*
- Novel Liquid Chromatography Phases and Instruments (11/15 AM) *contributed*
- Novel Applications of LC/MS and GC/MS (11/15 PM) *contributed*

Short Courses

Liquid Chromatography

- Anatomy of Modern Reversed-Phase Columns: Understanding Their Role in HPLC (11/11)
- LC/MS: Theory, Instruments, and Applications (11/12-11/13)
- How to Develop Validated HPLC Methods: Rational Design with Practical Statistics and Troubleshooting (11/12-11/13)
- Essentials of Modern HPLC/UHPLC I and II (11/12-11/13)
- Essentials of Modern HPLC/UHPLC I: Fundamentals & Applications (11/12)
- Essentials of Modern HPLC/UHPLC II: Practice, Operation, Trouble-shooting and Method Development (11/13)

Supercritical Fluid Chromatography

- Practical Knowledge and Recent Advances in Developing Supercritical Fluid Chromatography (SFC) Applications (11/14)

Gas Chromatography

- Practical Gas Chromatography (11/11 - 11/12)
- Practical Headspace Gas Chromatography (11/14)

General

- Sample Preparation: The Chemistry Behind the Techniques (11/13)
- Critical cGMP and ICH Guidances for Analytical Laboratories (11/13)

CONSUMER PRODUCTS

Technical Sessions

- Poster Session: Product Analysis of Us and Our World (11/13) *contributed*
- Counter(feit) Attack- Strategies and Technologies to Fight Counterfeits (11/14 AM) *invited*
- Product Analysis of Us and Our World (11/14 AM) *contributed*

DATA ANALYSIS

Technical Sessions

- Spectral Analysis from Pharmaceutical Process to Production (11/12 PM) *contributed*
- Poster Session: Pharmaceutical Analysis of Quality-by-Design and Automation (11/12)
- Poster Session: Spectral Analysis from Pharmaceutical Process to Production (11/12)
- Pharmaceutical Analysis of Quality-by-Design and Automation (11/13 PM) *contributed*

Short Courses

- Introduction to Chemometrics Without Equations I (11/11)
- Intermediate Chemometrics Without Equations (11/12)
- Chemometrics Without Equations (I & II) (11/11-11/12)
- Laboratory Data Analysis Using EXCEL©: New Uses for a Familiar Tool (11/13)
- Hands-on FTIR, NIR and Data Analysis – What is the Right Tool to Solve Your Problem (11/14-11/15)
- Quality-by-Design: A New Paradigm for the Analytical Laboratory I & II (11/14-11/15)
- Quality-by-Design Fundamentals for Analytical Chemist I (11/14)
- Quality-by-Design: Design of Experiments for Analytical Chemist II (11/15)

EDUCATION

Technical Sessions

- Insights into Grants and Funding (11/14 PM) *invited*

Seminars

- Kitchen Chemistry (11/11 PM)
- Chemical Identity via Mass Spectrometry (11/12 AM)
- What Does an Analytical Chemist Do in Industry (11/13 AM)
- Analytical Chemistry and Forensic Science (11/14 AM)

ENVIRONMENTAL

Technical Sessions

- Analysis for a Greener World (11/14 AM) *contributed*
- Poster Session: Analysis for a Greener World (11/14)

Short Course

- Sample Preparation: The Chemistry Behind the Techniques (11/13)

FOOD ANALYSIS

Technical Sessions

- Poster Session: Product Analysis of Us and Our World (11/13 PM)
- Product Analysis of Us and Our World (11/14 AM) *contributed*

FORENSIC ANALYSIS

Technical Sessions

- Advances in Forensic Toxicology (11/12 AM) *invited*
- Dried Blood Spot Analysis (11/12 AM) *invited*
- Novel Approaches to Forensic Spectroscopy (11/12 PM) *contributed*
- Designer Drugs: 2012 (11/13 AM) *invited*
- Drugs and Counterfeiting: 2012 (11/13 PM) *invited*
- Counter(feit) Attack- Strategies and Technologies to Fight Counterfeits (11/14 AM) *invited*
- Forensic Microscopy VI "What is it? Who does it?" (11/14 PM) *invited*

GAS CHROMATOGRAPHY

Technical Sessions

- Poster Session: Novel Applications of LC/MS and GC/MS (11/12)
- Poster Session: Gas Chromatography Intro, Assay and Detection (11/14 PM)
- Gas Chromatography Intro, Assay and Detection (11/15 AM) *contributed*
- Novel Applications of LC/MS and GC/MS (11/15 PM) *contributed*

Short Course

- Practical Gas Chromatography (11/11 - 11/12)
- Sample Preparation: The Chemistry Behind the Techniques (11/13)
- Practical Headspace Gas Chromatography (11/14)

INFRARED SPECTROSCOPY

Technical Sessions

- EAS Award for Outstanding Achievements in NIR, Honoring Joseph Hodges (11/13 AM) *invited*
- Poster Session: The Full Spectrum of Infrared Spectroscopic Techniques (11/13)
- The Full Spectrum of Infrared Spectroscopic Techniques (11/15 PM) *contributed*

Short Courses

- Infrared Spectral (IR) Interpretation I and II (11/12-11/13)
- Infrared Spectral (IR) Interpretation I (11/12)
- Infrared Spectral (IR) Interpretation II (11/13)
- Introduction to Near-Infrared Spectroscopy: Applications in the Pharmaceutical and Biotech Industries (11/13)
- Hands-on FTIR, NIR and Data Analysis – What is the Right Tool to Solve Your Problem (11/14-11/15)

LABORATORY MANAGEMENT

Technical Sessions

- Outsourcing: Perspectives from Sponsors and CROs (11/13 AM) *invited*
- Innovation and Creativity in Management (11/14 PM) *invited*
- Poster Session: Innovation and Creativity in Management (11/14)

Short Courses

- Critical cGMP and ICH Guidances for Analytical Laboratories (11/13)
- Fundamentals of Laboratory Management for New Managers (11/13-11/14)
- Quantitative Analysis for Managers, Auditors and Data Reviewers (11/15)

LIQUID CHROMATOGRAPHY

Technical Sessions

- HPLC Technologies and Pharmaceutical Applications (11/12 AM)
- Pharmaceutical Analyses: Is your Column Equivalent? (11/12 AM)
- EAS Award for Outstanding Achievements in Separation Science, Honoring Robert Kennedy (11/12 PM)
- Poster Session: HPLC Technologies and Pharmaceutical Applications (11/12)
- Poster: Novel Applications of LC/MS and GC/MS (11/12)
- Poster Session: Novel LC Phases and Instruments (11/12)
- Successful Applications of Fast LC in Various Industries (11/13 AM)
- Poster Session: Separation Anxiety from Capillaries to Columns (11/13)
- Counter(feit) Attack- Strategies and Technologies to Fight Counterfeits (11/14 AM)
- Separation Anxiety from Capillaries to Columns (11/15 AM)
- Novel LC Phases and Instruments (11/15 AM)
- Novel Applications of LC/MS and GC/MS (11/15 PM)

Short Courses

- Anatomy of Modern Reversed-Phase Columns: Understanding Their Role in HPLC (11/11)
- LC/MS: Theory, Instruments, and Applications (11/12-11/13)
- How to Develop Validated HPLC Methods: Rational Design with Practical Statistics and Troubleshooting (11/12-11/13)
- Essentials of Modern HPLC/UHPLC I and II (11/12-11/13)
- Essentials of Modern HPLC/UHPLC I: Fundamentals and Applications (11/12)
- Essentials of Modern HPLC/UHPLC II: Practice, Operation, Trouble-shooting and Method Development (11/13)
- Critical cGMP and ICH Guidances for Analytical Laboratories (11/13)

MASS SPECTROMETRY

Technical Sessions

- American Microchemical Society Benedetti-Pichler Award, Honoring Luis Colon (11/12 AM) *invited*
- Dry Blood Spot Analysis (11/12 AM) *invited*
- Poster Session: Novel Applications of LC/MS and GC/MS (11/12)
- Analytical Solutions for Characterization of Biologics and Quantification in Biological Matrices (11/12 PM) *contributed*
- EAS Award for Outstanding Achievements in the Fields of Analytical Chemistry, Honoring Mary Wirth (11/13 AM) *invited*
- MS of Large and Biomolecules Session I (11/13 AM) *invited*
- MS of Large and Biomolecules Session II (11/13 PM) *invited*
- EAS Award for Outstanding Achievements in Mass Spectrometry, Honoring Fred McLafferty (11/14 AM) *invited*
- Real or Imaginary? Demystifying Artifactual Peaks in HPLC Analysis of Pharmaceutical Products (11/14 PM) *invited*
- Solving Chemical Structure: Structure Elucidation Answers (11/14 PM) *invited*
- Structure Elucidation In Mass Spectrometry (11/14 PM) *invited*
- Novel Applications of LC/MS and GC/MS (11/15 PM) *contributed*

Short Courses

- Impurities and Degradants Identification: Strategies for Structure Elucidation via Chromatography, MS and NMR (11/11)
- LC/MS: Theory, Instruments, and Applications (11/11-11/12)
- Interpretation of Mass Spectra with Practical Solutions to Problems (11/13)
- The Chemistry of Drug Degradation (11/15)

MICROSCOPY

Technical Sessions

- New York Microscopical Society Ernst Abbe Award, Honoring Skip Palenik (11/14 AM) *invited*
- Forensic Microscopy VI "What is it? Who does it?" (11/14 PM) *invited*
- Industrial Microscopy (11/14 PM) *invited*

NMR SPECTROSCOPY

Technical Sessions

- New York Section of the Society for Applied Spectroscopy Gold Medal Award, Honoring Richard Mendelsohn (11/12 PM) *invited*
- EAS NMR New Faculty Award (11/13 PM) *invited*
- NMR Techniques for Metabolite ID (11/14 AM) *invited*
- NMR Analysis of Biological Systems and Materials: Structure (11/14 PM) *invited/contributed*
- EAS Award for Outstanding Achievements in Magnetic Resonance, Honoring Jeffrey Reimer (11/15 AM) *invited*
- NMR Analysis of Biological Systems and Materials: Dynamics (11/15 PM) *invited/contributed*
- Frontiers in EPR Spectroscopy (11/15 PM) *invited/contributed*

Short Course

- Impurities and Degradants Identification: Strategies for Structure Elucidation via Chromatography, MS and NMR (11/11)

PHARMACEUTICAL ANALYSIS

Technical Sessions

- Dry Blood Spot Analysis (11/12 AM) *invited*
- Quality-by-Design in Pharmaceutical Analysis I (11/12 AM) *invited*
- Pharmaceutical Analyses: Is your Column Equivalent? (11/12 AM) *invited*
- Poster Session: Spectral Analysis from Pharmaceutical Process to Production (11/12)
- Poster Session: Pharmaceutical Analysis of Quality-by-Design and Automation (11/12)
- Quality-by-Design in Pharmaceutical Development II (11/12 PM) *invited*
- Spectral Analysis from Pharmaceutical Process to Production (11/12 PM) *invited*
- Applications of Microdose Strategy in Preclinical and Clinical Studies (11/12 PM) *invited*
- Analysis of Consumer Products (11/13 AM) *invited*
- Outsourcing: Perspectives from Sponsors and CROs (11/13 AM) *invited*
- Applications and New Instrumentation for Process Analyzers and PAT (11/13 PM) *invited*
- Product Analysis of Us and Our World (11/13 PM) *contributed*
- Pharmaceutical Analysis of Quality-by-Design and Automation (11/13 PM) *contributed*
- Poster Session: Separation Science Cures in Pharmaceutical Analysis (11/13)
- Counter(feit) Attack- Strategies and Technologies to Fight Counterfeits (11/14 AM) *invited*
- Real or Imaginary? Demystifying Artifactual Peaks in HPLC Analysis of Pharmaceutical Products (11/14 PM) *invited*
- Separation Science Cures in Pharmaceutical Analysis (11/15 PM) *contributed*

Short Courses

(Please also see MS and LC listings for additional courses)

- Impurities and Degradants Identification: Strategies for Structure Elucidation via Chromatography, MS and NMR (11/11)
- Physical Characterization and Analytical Test of Pharmaceutical Solids I & II: Essential Knowledge & Advanced Applications (11/11-11/12)
- Physical Characterization and Analytical Test of Pharmaceutical Solids I: Essential Knowledge (11/11)
- Physical Characterization and Analytical Test of Pharmaceutical Solids II: Advanced Applications (11/12)
- Critical cGMP and ICH Guidances for Analytical Laboratories (11/13)
- Introduction to Drug Discovery and Development Processes for Analytical Scientists (11/13)
- The Role of Chromatography in the Analysis and Characterization of Protein Therapeutic Drugs (11/13)
- The Analysis and Characterization of Protein Therapeutic Drugs (11/13-11/14)
- Development, Validation, Verification and Transfer of Analytical Methods: A Lifecycle Approach of Analytical Methods (11/14)

PHARMACEUTICAL ANALYSIS *continued*

- Extractables and Leachables Studies for Biologicals and Other 'High Risk' Dosage Forms (11/14)
- Hands-on FTIR, NIR and Data Analysis – What is the Right Tool to Solve Your Problem (11/14-11/15)
- Impurities in Pharmaceuticals - A Survey Course (11/15)
- Dissolution: A Rational Approach to Developing and Validating Methods for a Variety of Purposes (11/15)
- The Chemistry of Drug Degradation (11/15)

POLYMERS

Technical Sessions

- Real or Imaginary? Demystifying Artifactual Peaks in HPLC Analysis of Pharmaceutical Products (11/14 PM) *invited*

Short Course

- Polymers: An Introduction and Characterization Techniques (11/11)

RAMAN SPECTROSCOPY

Technical Sessions

- Poster Session: The Full Spectrum of Infrared Spectroscopic Techniques (11/13)
- Applications of Surface-Enhanced Raman Spectroscopy (11/15 AM) *invited*

Short Course

- Practical Introduction to Raman Spectroscopy (11/15)

SAMPLE PREPARATION

Technical Sessions

- Novel Sample Preparation Techniques (11/14 AM) *contributed*
- Poster Session: Novel Sample Preparation Techniques (11/14)

Short Course

- Sample Preparation: The Chemistry Behind the Techniques (11/13)

SPECTROSCOPY

Technical Sessions

Infrared Spectroscopy

- EAS Award for Outstanding Achievements in NIR, Honoring Joseph Hodges (11/13 AM) *invited*
- Poster Session: The Full Spectrum of Infrared Spectroscopic Techniques (11/13)
- The Full Spectrum of Infrared Spectroscopic Techniques (11/15 PM) *contributed*

Raman Spectroscopy

- Poster Session: The Full Spectrum of Infrared Spectroscopic Techniques (11/13)
- Applications of Surface-Enhanced Raman Spectroscopy (11/15 AM) *invited*

Spectroscopy

- Bringing Home the Bacon - Vibrational Spectroscopy gets the Job Done (11/12 AM) *invited*
- Poster Session: Spectral Analysis from Pharmaceutical Process to Production (11/12)
- Spectral Analysis from Pharmaceutical Process to Production (11/12 PM) *invited*
- Spectroscopy in the Palm of your Hand (11/13 AM) *invited*
- The Role of Spectroscopy for Enabling Quality-by-Design and RTR (11/13 AM) *invited*
- Applications and New Instrumentation for Process Analyzers and PAT (11/13 PM)
- Counter(feit) Attack- Strategies and Technologies to Fight Counterfeits (11/14 AM) *invited*
- Advances in Vibrational Spectroscopy: Instrumentation and Applications I (11/14 AM) *invited*
- Advances in Vibrational Spectroscopy: Instrumentation and Applications II (11/14 PM) *invited*

SPECTROSCOPY *continued*

Short Courses

Infrared Spectroscopy

- Infrared Spectral (IR) Interpretation I and II (11/12-11/13)
- Infrared Spectral (IR) Interpretation I (11/12)
- Infrared Spectral (IR) Interpretation II (11/13)
- Introduction to Near-Infrared Spectroscopy: Applications in the Pharmaceutical and Biotech Industries (11/13)
- Hands-on FTIR, NIR and Data Analysis – What is the Right Tool to Solve Your Problem (11/14-11/15)

Raman Spectroscopy

- Practical Introduction to Raman Spectroscopy (11/15)

Spectroscopy

- Practical Applications of Laser-Induced Breakdown Spectroscopy (11/14)

SUPERCRITICAL FLUID CHROMATOGRAPHY

Technical Sessions

- EAS Award for Outstanding Achievements in Separation Science, Honoring Robert Kennedy (11/12 PM)
- Supercritical Fluid Chromatography: Advances and Applications in Pharmaceutical Analysis I (11/14 AM)
- Supercritical Fluid Chromatography: Advances and Applications in Pharmaceutical Analysis II (11/14 PM)

Short Courses

- Practical Knowledge and Recent Advances in Developing Supercritical Fluid Chromatography (SFC) Applications (11/14)

SURFACE ANALYSIS

Technical Sessions

- Real or Imaginary? Demystifying Artifactual Peaks in HPLC Analysis of Pharmaceutical Products (11/14 PM) *invited*
- Soft Surfaces and Interfaces (11/14 PM) *invited/contributed*
- Environmental Surface Chemistry (11/15 AM) *invited/contributed*
- Surface Spectroscopy (11/15 PM) *invited/contributed*

EASTERN ANALYTICAL SYMPOSIUM & EXPOSITION

Aspen Leaves in Fall – November 2004 – Wayne, N.J.
(Leaf110304cc) Image by Mel Pollinger

(P1061317) (P1061321)

Diphenoxybenzene, 50x, Polarized light
Photomicrographs by Mel Pollinger