Focal Point

The Newsletter from Southwest Precision Instruments

132 North Elster Drive • Tucson, AZ • Tel./Fax 520.546.4986 • swpinet.com

May, 2010

In This Issue

Update: Samuteb Hospital, Democratic Republic of Congo

The United States is undergoing some sweeping changes and spirited discussions about healthcare reform. No matter which side of the arguments you're on, things could be a *whole* lot worse. There are still places on our planet where basic healthcare is little more than a dream.

In the March issue we discussed how seemingly small things can make big differences in peoples' lives.

Our story centered around a dedicated OB/GYN physician from Colorado, Dr. Lee Jeffrey, and his upcoming medical mission to Samuteb Hospital, a remote outpost in Katanga Province of the Democratic Republic of Congo (DRC.)

Dr. Jeffrey brought with him what most of us would call a "student microscope." The microscope has an LED light source and a solar cell recharging system, which makes it ideal for use in remote locations with intermittent or no power.

Dr. Jeffrey is now back in the United States and the microscope is in the DRC, doing its job very nicely.

Dr. Jeffrey writes: "The microscope was a big WOW for Samuteb Hospital lab. The first slide we looked at was positive for tuberculosis."

Here are a few "verbal images" from the medical team's blog:

> **Young man too weak to walk, blind, skinny as a pole, wasted away. Diagnosis is diabetes, non-treatable in this region without refrigeration to keep insulin.
>
> **Infertility -- everyone wants more babies. (as too many die before age 5.)
>
> **Two children who were prevented from attending school due to daily seizures. Their epilepsy began with cerebral malaria at infancy that was untreated.
>
> **Young woman had fallen into the family cooking fire and severely burned her foot…. 4 months ago. Toes now blackened and falling off, some gangrene noted, surgery required (and done while team was there.)
>
> **Malnutrition everywhere...with devastating effects on the children, for instance... a 13 year old girl who looked the size of a 6-year old.
>
> **Heated but amicable discussions on gender equality, a new concept in this region (for men, at least).
>
> **A view of malnutrition: Distended bellies, skinny arms, puffy feet and faces, yellowing hair, too many children to count!
>
> **Impressions of 'bush surgery'…. Patient lying restrained on operating table, in a Ketamine stupor (no anesthesia), using worn-out instruments, operating under window-lighting.

Read and subscribe to the medical team's blog at: http://plumpynutscongo2010.blogspot.com

External links in this Newsletter were current as of the date of publication, but please remember:
The World Wide Web evolves and changes on a daily basis. Please contact us if you find a dead link.

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Microscope Conversion: from Halogen Lamphouse to Fiber Optic Illuminator

We love a good challenge, and recently one of our customers took us to task. We *do* advertise that we do upgrades for microscopes, so let's get right to it:

The customer had an Olympus BX60 compound microscope with transmitted light illumination, and he wanted to boost the amount of available light.

The Olympus microscope comes standard with a lamphouse that accepts a 12 Volt / 100 Watt halogen bulb.

A collector lens on the front of the lamphouse focuses the light and sends it into the base of the microscope, to a mirror, and ultimately into the substage condenser. This is a very common configuration for a transmitted light microscope.

Lamphouse with cover removed. 12 V 100 W bulb is on the right and collector lens assembly is on the left.

We "recycled" the collector lens assembly, as it plays such an important role in the illumination system.

Collector lens assembly after removal from the lamphouse. The lens surface at the lower right faces the bulb. The flange at the upper left mounts to the microscope.

The center of the collector lens coincides with the center of the optical axis of the entire microscope. Placing an alternative bulb or light source exactly where the 12 Volt 100 Watt bulb is normally located seemed to be the best approach.

This is a critical dimension in the Olympus lamphouse. The bulb is positioned 15 mm from the back surface of the lens, at its optical center. The new illumination source would have to be located at the same position.

We opted to use a fiber optic illuminator with a 21 Volt 150 Watt halogen reflector bulb, and to connect this high intensity source with a fairly large, ½ inch diameter fiber optic cable.

An adapter was made which slips over the back of the collector lens assembly and is held with 3 small hex screws. The center of the adapter clamps the end of the fiber optic cable and holds it on-center and exactly 15 mm from the collector lens.

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The collector lens assembly (black) is mounted on the microscope stand, and the fiber optic adapter (silver) mounts to the collector lens assembly.

Empirically, this system has an extremely bright output. We didn't measure the differences with a photometer or a light meter, but we note that the new illuminator running at about 30% of maximum puts out approximately the same illumination as the original 100 Watt lamphouse running at maximum intensity.

One could argue that the source (the new bulb) is about 36" from the microscope and runs through a fiber optic cable, so we'll lose some photons along the way.

That's true, but also remember: the original lamphouse did not have a mirror inside, so only the photons from the front of the bulb ever made it into the optical path of the microscope. The fiber optic illuminator uses an EKE bulb which has a built-in reflector behind the filament. This system appears to be much more efficient at collecting photons from the source (or filament).

The complete system: fiber optic illuminator, fiber optic cable and adapter.

Of course, this system isn't recommended for all applications, but it was requested by a customer who does a lot of high magnification phase contrast and darkfield microscopy, as well as experimental imaging. He's a happy camper, and so are we!

Scientists say: More than 60 percent of a conversation's meaning is transmitted nonverbally.

Emerging Technology: Cellular Nanosurgery and Non-Contact Dissection of Tissues and Materials

A spin-off from the Laser Center Hannover, one of Germany's largest laser institutes, is bringing new applications for ultra-short pulsed lasers to the biomedical and materials sciences.

Rowiak's CellSurgeon system on an inverted microscope. http://www.rowiak.de/en/produkte/cellsurgeon/beschreibung.php (8 May 2010)

Rowiak GmbH has developed CellSurgeon, a femtosecond near-infrared laser module which can be coupled to a microscope. This allows extremely high precision laser ablation inside the cell.

Some of the potential uses include optical perforation of the plasma membrane for transfection studies; nanosurgery of single cytoskeletal filaments; ablation of individual organelles without damage to surrounding structures; bleaching of labeled structures; and optical stimulation of cellular organelles.

A second instrument, TissueSurgeon, uses an ultra-short pulsed laser as a non-contact cutting tool. This technology has been used for high precision cutting of unfixed soft tissues (kidney, liver, skin, etc.) as well as hard tissues (bone and teeth.)

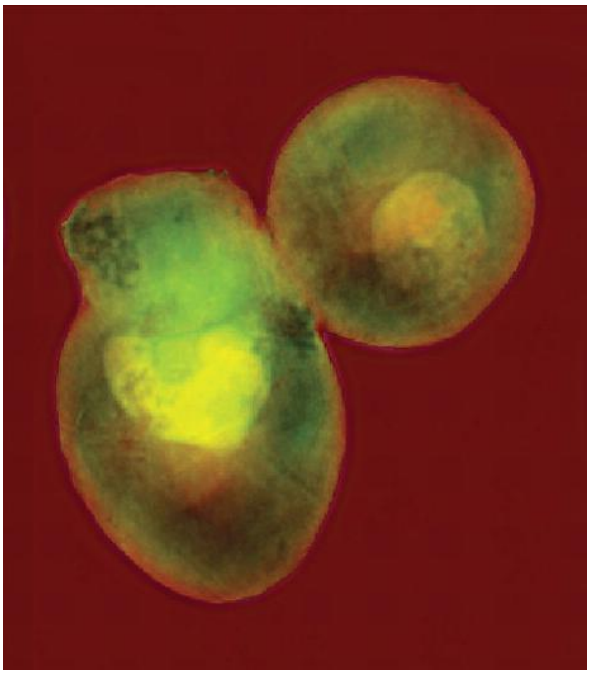
TissueSurgeon also has been used for microstructuring and sectioning materials such as Teflon, silicone and ceramic scaffolds.

Rowiak is in the process of expanding into the United States, and a dealer network is now being established.

To learn more about Rowiak and to download brochures, go to: http://www.rowiak.de/en/index.php

The only two industrialized nations that don't mandate paid maternity leave for new moms: Australia and the United States of America.

Lensless X-Ray Diffraction Yields High Resolution Images of Individual Cells



Coherent soft X-ray image of two yeast cells. Image courtesy of Department of Energy / Lawrence Berkeley National Laboratory (8 May 2010.)

A team of scientists working at beamline 9.0.1 of the Advanced Light Source (ALS) at the U.S. Department of Energy's Lawrence Berkeley National Laboratory has used x-ray diffraction microscopy to make images of whole yeast cells.

The researchers achieved the highest resolution -- 11 to 13 nanometers -- ever obtained with this method for biological specimens.

Their success indicates that full 3-D tomography of whole cells at equivalent resolution should soon be possible.

While x-rays have the ability to look deep into thick specimens, or right through them, imaging with a lens has its own problems. Even the best x-ray microscope lenses (concentric circles of metal known as Fresnel zone plates), can't focus x-rays with high efficiency, so to get an image means using such intense radiation that it more quickly damages biological specimens.

At the same time, the geometry of the highest-resolution zone plates makes for an extremely narrow depth of focus.

To get around these barriers, a research team led by Johanna Nelson, Xiaojing Huang, and Jan Steinbrener used lensless x-ray diffraction microscopy.

To produce a high-resolution diffraction pattern from noncrystalline structures like the membranes and organelles of a cell, the light has to be coherent, that is, laser-like, having all the same frequency and phase. Beamline 9.0.1 was built to supply this kind of light.

Read the complete news release at:
http://www.sciencedaily.com/releases/2010/04/100427171844.htm

Q: What did Alexander Graham Bell, Thomas Edison, Albert Einstein, John F. Kennedy and George Washington have in common?

A: They all suffered from dyslexia.

Penn State's Audible Assault: Science of Acoustics Helps Crank Up Home Field Crowd Noise

Somehow this just doesn't seem right. Rival college football teams and their fans are probably justified in calling this a misapplication of science.

Loud stadiums help win games, and Penn State's Beaver Stadium is one of the loudest in college football. When its crowd roars at a visiting quarterback, his calls can only be heard from a foot and a half away.

The university's athletic department will put into play a new strategy to make its field even louder thanks to a team of acoustic scientists. The goal is to send a deafening wall of sound at the opposing team's offensive line.

"We're not going to let visiting teams get comfortable, and if you can't get comfortable, you're probably not going to perform as well," said Guido D'Elia, director for communications and branding for Penn State football.

Computer modeling suggests that relocating the student seats could further boost the wall of sound on one side of the stadium by 50%.

Read more of Guido's comments and how acoustics is getting in the act at:
http://www.insidescience.org/research/penn_state_s_audible_assault

Gettin' High at Starbucks

The Starbucks at the highest elevation is located on Main Street in Breckenridge, Colorado, at 9,600 feet above sea level.

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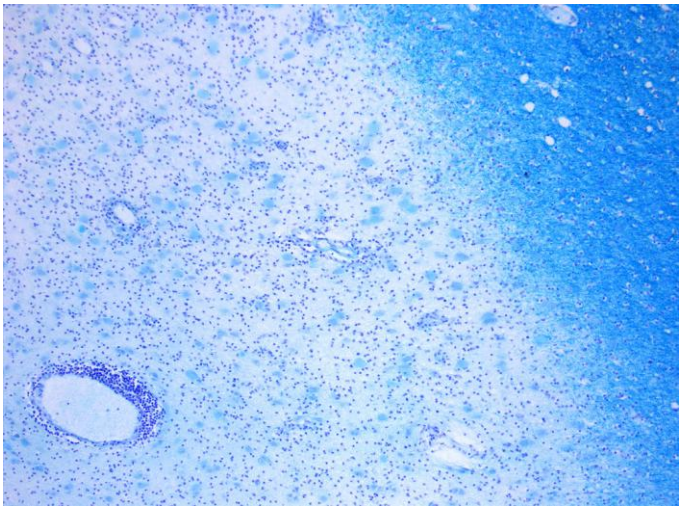
Twins Study Points to Environmental Cause for Multiple Sclerosis



Demyelination in multiple sclerosis. Note lack of coloration in area of lesion. Public domain image (Wikimedia). Published under GNU Free Documentation License.

Genetics can't seem to explain why one twin would have multiple sclerosis while an identical twin doesn't, a new study finds.

That leaves scientists still stumped as to what causes multiple sclerosis (MS), although it's clearer than ever that environmental factors play a major role.

"We found that these twins had a lot of genetic risk factors for MS and yet the twins were born on the same day in the same family, grew up together, ate the same food, went to the same schools and they [both] had that predisposition, that set of risk factors. But, one developed the disease and one didn't," said study senior author Dr. Stephen Kingsmore.

"This points to some environmental trigger that protected one of the twins or triggered the disease in one of the twin members," added Kingsmore, who is CEO of the National Center for Genome Resources in Santa Fe, NM.

The researchers set out to see if genetic differences accounted for the discrepancy, given that it's now known that not all identical twins are 100 percent identical.

Three different genetic analyses allowed them to look not only at the genes the twins were born with, but also at gene expression and what's known as imprinting or epigenetics.

Still, the authors failed to find any genetic explanation for the discrepancy between the twins.

"It's a big mystery," added Kingsmore. "There's an unknown or undiscovered environmental trigger that's really important."

Source:
http://news.yahoo.com/s/hsn/20100429/hl_hsn/twinsstudypointstoenvironmentalcauseforms

"Work like you don't need the money. Love like you've never been hurt. Dance like nobody's watching."

Satchel Paige

Scientifically Verified: Presence of Cat Reduces Mouse Allergens

Wilson et al. have finally nailed it down with absolute certainty. See *Environmental Research* 110(2):189-98:

"We pooled... data from nine asthma studies... to identify those housing conditions and occupant behaviors that were associated with clinically significant allergen levels.

RESULTS. ... mouse allergen was associated with rodent control or signs of rodents and inversely associated with presence of a cat."

Read the abstract at:
http://www.ncbi.nlm.nih.gov/pubmed/19939359