



Microbe Hunter

Microscopy Magazine

ISSN 2220-4962 (Print)
ISSN 2220-4970 (Online)

Volume 1, Number 5
May 2011

The Magazine for the
Enthusiast Microscopist

<http://www.microbehunter.com>

*The Novitiate's
Odyssey Episode*

*Of the Edge of a
Razor*

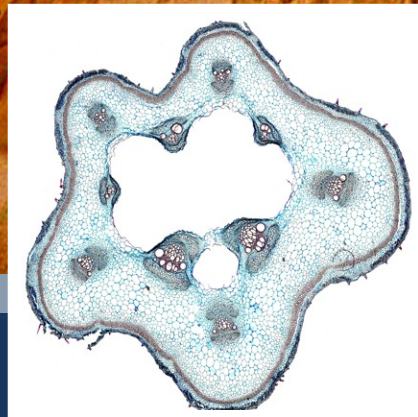
*Some advice for
making good
micrographs*

*Making Zoomable
Images*

*Buying
Microscopes for
Kids*



*The Novitiate's
Odyssey*



*Making good
Micrographs*



*Making a remote
control*

MicrobeHunter Microscopy Magazine

The magazine for the enthusiast microscopist
MicrobeHunter Magazine is a non-commercial project.

Volume 1, Number 5, May 2011 (revision 0)

ISSN 2220-4962 (Print)
ISSN 2220-4970 (Online)

Download: MicrobeHunter Microscopy Magazine can be downloaded at: <http://www.microbehunter.com>

Print version: The printed version can be ordered at: <http://microbehunter.magcloud.com>

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Front Cover:

large image: Oliver Kim (Wing of a butterfly)
Left image: Joseph Wilhelm;
Middle: Oliver Kim
Right: Yogeshkumar T. Patel

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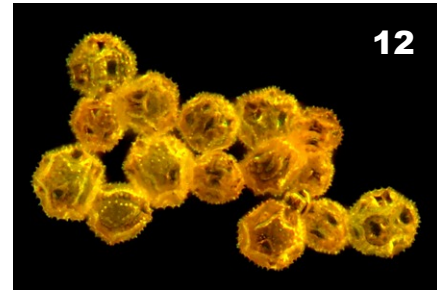
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Before submitting anything, please read the submissions page on the website: www.microbehunter.com/submissions.

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Answer to the puzzle (back cover):
Cross section through the tongue of a rabbit.

EDITORIAL

In this issue, we continue Joseph Wilhelm's Novitiate's Odyssey (p. 4) There is also a step by step guide in how to construct a cable release for a webcam (p. 18). I myself wrote a FAQ on how to buy a microscope for children (p. 24). As I am personally interested also in historical articles, I published an excerpt from Robert Hooks book

Micrographia obtained from Project Gutenberg (p. 10).

Now some words about the printed version of the magazine, which can be obtained from <http://microbehunter.magcloud.com> The cost of the magazine is entirely for the printing and mailing, I make no profit.

At this point I would like to encourage the readers to write com-

ments and letters. I will then publish them in a letters to the editor section. I have to admit that I am still struggling a bit with filling the pages. You do not have to be an expert in microscopy to contribute! Simply share your pictures, experiences and thoughts!

Mingling with organized humanity, specimen gathering and other forms of microscopy Zen

This article was originally published in the May 2010 issue of Micscape Magazine and is now republished here with the permission of the author and of Micscape Magazine.

In Episode Four, the author continues his thoughts and musings on microscopy. Here he has a closer look at a mosquito, from a historical slide.

**By G. Joseph Wilhelm
Florida Keys USA**

Due to the odd nature of my sociability, it is not often I am given the opportunity to engage in unsupervised fraternal interaction with the cultured haut monde that so pervades this Conch Republic in which I reside (at most gatherings I attend, I immediately corner the host and advise them to be nice to me or I would stay). However, sometimes the stars do align and I was presented with just such a fortuitous circumstance as to allow myself the chance to occasion the Boondocks Pub, which is an easy saunter from my castle of about ten minutes along lightly trafficked back roads.

It was a Saturday morning and my lovely wife was leaving for Miami on a business-buying trip and would not be back until Sunday morning. She left me with a to-do list, an admonition to “Behave,” and “remember what happened last time.” After her departure I promptly rang up Chauncey and he indicated he would be glad to go “honky tonkin” that night. So in eager anticipation for an evening of mental stimulation I polished my best boots, accomplished the to-do list in record time and left myself a note to remove the laundry from the washer early Sunday.

At the agreed hour just before sunset, Chauncey arrived astride his Harley Davidson (his full name is Chauncey Tubbs and prefers the abbreviated moniker of “CT”) and once he had his steed properly stabled we commenced our soiree.

CT, bedecked in steel-toed shoes, shorts T-shirt, Bubba Gump fishing hat and I, festooned in boots, vest, Stetson, and carved African mahogany walking stick set about.

The pace was leisurely and we promptly began engaging in the night’s conversation about microscopy. I had previously shown him some pictures of crystallized beer viewed thru crossed polarization and he was eager to see what his homemade moonshine would look like in the hopes of achieving bragging rights that it not only tasted good but was pretty too. I conveyed that some glitches had arisen with getting my ZEUS microscope system (see Episode 3) on line. There were some clearance issues with the condenser to stage fit and the coarse focus would not rack down far enough to bring objects into view using JIS objectives. Solutions were on the horizon but for the present, we would have to satisfy ourselves with debate on what indigenous specimens, other than his bootleg concoction, would establish a collection of slides that was truly representative of the Florida Keys.

As we walked, I gestured to the wetland areas that would be excellent possibilities for local diatoms. I made the mistake of mentioning that some people would pay for samples from the Keys. Nothing lights up CT as much as the possibility of a moneymaking scheme (his current one is selling painted gravel as a landscaping item). He

pointed and exclaimed “Yew mean people pay fer thet stuff?” I immediately had visions of him in a roadside stand on US-1 selling jars of muck and slime under a banner proclaiming “DIATOMS-Two fer a dollar. Git em while they last.” After assuring him it was probably not a viable monetary enterprise we continued on.

We spoke of beach sand as a possibility; many different types abound here. We passed myriad flora examples for consideration. CT suggested bird feathers, easily obtained from the local wildlife rescue centers, which I thought to be a grand idea as my home parrots had provided beautiful viewing under the Spencer Stereo-Scope. I indicated a mound of fire ants and the excellent whole mounts they would provide. I estimated several hundred unique slide specimens could easily be obtained within a short distance for the collection I envisioned.

“How d’ya make em? The slides I mean.” he inquired. I replied that I had no level of practical expertise as yet but I did want to develop the late Victorian elegantly papered and ringed techniques. This of course would require acquisition of period apparatus such as a ringing table, instruments, suitable apothecary and cabinet etc. (Oh joy and rapture! Another collection!), as well as a design or two to have my own paper printed. I will share that a little further on. I name-dropped a few of the famous slide preparation specialists I wished to emulate i.e. W. Watson, Charles Morgan Topping, Amos Topping, Wheeler, J. T. Norman and of course, Fred Enock. I wanted to create an amalgam of individual aspects of these and others for my slides; paper style from one, labeling style, ringing, and so on from others.



Fig. 1 - Fred Enock slide showing a mosquito

As we continued, our evening constitutional to the pub was extended somewhat due to my insistence on lingering to observe certain objects. Such as the medium sized Iguana slowly emerging from the bush by the road. He was bright green and about five feet from nose to tip of the tail. These odious creatures worked their way here from South America some time ago and are found everywhere now. CT claims to have seen them up to eight feet. A group of these beasties can and have devastated some of my wife's very expensive landscaping jobs in short order. They carry salmonella bacteria in their mouths and have been officially declared a "pest" in Monroe County, which means they can be dispatched humanely by property owners. There are other nuisance critters that are plentiful here. Burmese pythons, released into the wild by irresponsible owners when they get too big are proliferating nicely. They have organized hunting parties to capture them in the Everglades and Keys. Nine were pulled from under the boardwalk at the Bahia Honda state park in one afternoon. The largest so far was found on Big Pine Key. It was an 18ft, 200 lb specimen lounging on the patio of a very distraught mobile home owner. There are also large nasty raccoons that when cornered prove more than a match for any animal twice their size. Rattlesnakes and alligators while not considered pests, round out

the list of the more dangerous wildlife to avoid when walking about. All of this, coupled with my palaverous commentary on everything we perceived allowed the sun to set and the very short-lived twilight to expire before reaching our destination. We picked up the pace a bit and filled the remaining moments with a mutual pondering of the great mysteries of the universe; the meaning of life, Quantum Physics and whether or not it was actually possible to neatly fold fitted sheets.

Our destination finally achieved, we climbed the short stairway and entered the tiki hut structure. Upon our ingress thru the main portal, the assemblage therein greeted this dashing duo with an overwhelming display of ambivalence and we retired to a corner seat with a wall to our backs and a clear view of the door (force of habit from my years in the Virgin Islands).

After ordering, we resumed our discussion on specimen collecting while waiting for the usual impotent aqua vitae and bland comestibles that seem to be the standard for these excursionist-catering establishments. As our confabulation progressed, CT caught the eye of a young girl seated close by. She wore high heels, tight jeans, a leather bustier with spiked dog collar and stiff finned hairstyle that bore a striking resemblance to the posterior portion of a 1957 Chevrolet. With the prolific and prominent piercing ornamentation of

her ears nose and lips I daresay she could have made a living as a fishing lure. Chauncey, obviously intrigued, gave her his broad country grin that exposed the conspicuous gap between his two front teeth and turned on the charm with a smooth rapid banter of "Hi, come here often? What's yer sign? You ski? Luv yer nails. How d'ya like me so far? Yer hot." Completely taken in by his beguiling blandishments, she accepted his invitation to join our table.

Having overheard part of our conversation, and curiosity evidently piqued, she inquired "What are you talking about?" I immediately launched what I believed to be an enthralling discourse on the Gordian facets of specimen collecting and slide preparation. Shortly thereafter the eyes of this young waif began to glaze over and I could see her enthusiasm waning. She slipped CT a piece of paper, whispered in his ear and left the table in obvious disappointment after learning that "flagellates" were not a medieval sect of masochistic monks with whips and "mounting rotifers" did not reference an attempt to ride some large breed of dog. Upon inquiry about the note and whispered message CT replied "she wants me to call her sometime when I'm alone."

The Boondocks activities for the evening were ramping up. The "Teeny Weenie hot dog eating contest" and live band set up were complete before we finished our repast. Observable declines

in the ability of the patrons to exhibit ambulatory dexterity were appearing at this point. While the theory of mini black holes has yet to be validated, there was one individual who conclusively proved that extremely localized gravity storms were a reality. I then asked CT, a little too loudly, if he knew the difference between an Iguana and a Florida Keys tourist. To his negative response I replied, "One is an invasive, non-indigenous, environmentally destructive, disease carrying species with an infectious bite and the other is a reptile." This and other vocal comments on what I viewed as the largely subaltern clientele came to the attention of the bouncer. The very fact that this pub had an employee dedicated to throwing out the riff-raff gives you an idea of the class of cortege they expect to entertain. (Not one of the finer five star establishments that have requested my departure has had a bouncer.) This Neanderthal approached our table and pointedly demanded I surrender my walking stick/cane as it could possibly be used as a weapon. "BALDERDASH young man" was my stern reply, quickly followed by a loud diatribe on denying a man with an infirmity his means of assistance. His polite reply was having an infirmity didn't seem to be my problem.

At this juncture CT and I decided that a retreat back to my personal pub under my stilted domicile was the most reasonable course of action to conclude the evening. We set about once again on the homeward path. We reached the driveway to the TropicalBri's Estate and as we proceeded past the "Private Property" sign at the foot of the drive and the "No Trespassing" sign a little further on and finally the "Beware of Dog!" warning at the main building I made sure they were all lit properly by their solar charged lights. I am rather zealous about my privacy you see. It's not that I am inhospitable, my wife and I have hosted many celebratory events, pig roasts and music fests on our property. I simply abhor interruptions and unsolicited visitors. My better half did persuade me to remove the banner over the ground level entrance foyer that stated "Abandon hope all ye who enter

here." It was just "Not good form" she said. We entered and soon thereafter, after deciding we were not burglars or a threat to the property my silver Doberman, Gracie, came out of hiding for pets and coddling.

TropicalBri's is the name of the property (Named after my wife, Bri Montgomery) and is carved from the surrounding dense foliage. My shops and pub occupy most of the area beneath the raised main structure. No neighbors for a thousand feet on the right almost the same on the left and none in back, very secure and private. No access except the palm lined driveway. It is here, sitting at the bar in this fortress of solitude that CT and I had our final microscopy specimen gathering exchange. I was determined to have the evening culminate with a solution to my vexing problem of acquiring an undamaged example of a local mosquito. It was the Fred Enock slide (Figs 1 and 2) that was my inspiration.

I have tried and tried but up to this point I have been frustrated in my attempt to capture a mosquito without the end result resembling a very bad train wreck. Mr. Enock's specimen looks as if it were plucked in flight from the air directly to the slide. All of the delicate antennae, legs, proboscis etc. are perfectly intact. I would manage to mangle my specimens removing them from a mosquito net, a bug zapper would burn them, insecticides would bring them down but I could never find them after that, traps, sticky paper, all these techniques were unsatisfactory.

Undeterred and with dedicated chutzpah CT and I deliberated, researched, experimented until we were satisfactorily requited with the achievement of developing the soon-to-be-patented Wilhelm-Chauncey Mangle Free Method for Mosquito Collection or the WILCHAMAFMETFOMCOL system for short. Has a nice ring to it, doesn't it?

Exhausted but secure in the knowledge we had done a great service to science, I tossed the guest accommodation keys to CT and retired upstairs to rest before tomorrow's validation of the technique.

The WILCHAMAFMETFOMCOL System and Application

My wake up call was the sound of CT departing on his unmuffled conveyance at 7:30 Sunday morning. I grabbed my notes from the previous night to make sure they still made sense in the light of day. So far, so good. After two large helpings of caffeine I was ready to assemble all the necessary mosquito collection apparatus on the list.

Item #1: A shotgun. I chose a nice 1920s era Parker top break side-by-side 12 gauge with mule ear hammers and Damascus barrels.

Item #2: An approximately one gallon stoneware crock jug of moonshine with large 2 inch high letters spelling XXX on the side and a corn cob stopper. CT provided this and although the actual potency of the contents is irrelevant to our purposes here it is noteworthy to mention that CT's brew is about 150 proof.

Item #3: A small table. There was one already in the gathering area, which was to be the ground level foyer.

Item #4: A roll of 36" wide white medium to heavy grade wrapping paper.

Item #5: A roll of duct tape.

Item #6: Hat with brim.

Item #7: Surgical gloves

Item #8: A 36" square of mosquito netting.

Item #9: One dozen (or more) specimen containers. I chose 6" test tubes with rubber stoppers

Item #10: A full can of OFF insect repellent.

Item #11: A 3" x 5" piece of typing paper.

I first, placed the table in the foyer against the East middle pillar. Then the jug is positioned on the table with the three X marks facing the gate. The Parker is leaned on the pillar next to the table. Then the white wrapping paper is placed on the floor, overlapping as necessary to cover an approximately 5ft by 5ft area. Secure with duct tape.

Wear clothing that completely covers the upper torso to the neck and the arms down to the wrist. The lower torso should be covered but the legs exposed between the knees and ankles. This is



Fig. 2 - Mosquito under the microscope

the bait. Drape the mosquito netting over brimmed hat, gather around the neck and secure with tape. Make sure your specimen containers are handy, (I have a safari hunters vest with twelve cartridge loops that were the perfect size for my test tubes and would offer immediate access during the specimen collecting session). Don the surgical gloves.

Now to harass some mosquitoes!

I ran along the East side of the house with a garden hose sprinkling the orchid garden and quickly retreated to the foyer. I didn't have long to wait, the disturbed throng quickly gathered at the nearest shade, which was the foyer. I positioned myself in the center of the wrapping paper square, with the can of Off held waist high pointing down. The

little beasties soon gathered around me, the netting and then my bare exposed shins and calves. As about twenty were swarming on my exposed extremities I let loose with a burst of the off and was immediately rewarded with the agonized screams of a dozen stricken individuals who were easily found writhing about in contrast on the wrapping paper. Grasping a test tube and removing the stopper I dropped to my knees and covered the still twitching specimen with the open end of the test tube and slid the 3" x 5' typing paper underneath, upending the tube. Reinserting the stopper and thus capturing an alive and physically undamaged specimen. I was able to capture two more before the Off effects wore away and had to repeat the exercise. YES it was working!

I was in my third repetition of this scenario hollering "GOTCHA YOU

LITTLE BLOOD SUCKING DEMON" when I noticed I had company.

There, peering over the gate to the foyer, were three young individuals, two male, one female. The two males were sporting ties and one was carrying a bible, I surmised they were Jehovah's Witnesses.

Now realizing that my antics will occasionally present an irresistible curiosity or, as my lawyer puts it "an attractive nuisance" to the general public, my current state of dress (emerald green bathrobe terminating at the knees, pith helmet covered with mosquito netting, tan shooting vest with test tubes for cartridges, surgical gloves and rubber shoes) should not have given anyone who knows me pause. Given this group's slack jaw expression after viewing the entire scene before them, there was obviously some quandary over exactly what approach to take with



Fig 3 - The Anole lizard, a darling ubiquitous creature in the Keys. About three to five inches long. When captured and tapped on the nose they open their tiny mouth and will close it upon anything that is placed therein. Some of the local native girls will use them as live earrings. They hold on for quite some time until you pass something else they would rather be attached to.
Image credit: Paul Hirst (Phirst) CC-BY-SA-2.5

regards to my salvation. Being slightly miffed by their total disregard for the posted signage, and their attention being somewhat distracted by the sight of the Parker and moonshine in close proximity, I took advantage of their hesitation. With as much of a guttural snarl as I could muster, while at the same time stepping towards and reaching for the Parker, I loudly pronounced the monosyllable “GIT!!”

The desired flight response was achieved, and I was afforded the display of some very inventive physical gyrations in their attempt to remove themselves as quickly as possible from my line of sight. What fun! I watched them complete their hurly-burly scramble to the street and disappear from view. If I'd had known this was how entertaining some aspects of microscopy could be, I would have started this hobby much earlier.

Privacy restored, I resumed the collecting but was now beset by a dozen or more of the local small Anole lizards (See fig 3) having been attracted by and

scavenging for the mosquitoes now thrashing about on the wrapping paper. They approached from all sides and it became a race to be first to get to the downed prey. Sort of a living mini version of Jurassic Park as it were. Over the next fifteen minutes I applied a rigorous repetitious regimen of waiting, spraying, dropping to the knees, shooing away Anole, covering and capturing. It worked! A dozen perfectly intact mosquitoes were now in the specimen tubes. I was hot, I was tired, I had a sense of accomplishment, I had satisfaction and I had company..., again.

Standing at my gate was Burt, a uniformed Monroe county Sheriff's deputy. He had left his cruiser out on the road and silently walked the driveway. He was familiar to me from last month's visitation so I greeted him with a cheery salutation of “Yo Burt, whaz-zup?”

“Mr. Wilhelm” he began formally. “I've received a report that you threatened some people with a firearm,” he said, indicating the Parker. “So please

stand over there,” he pointed to the opposite wall “while I come inside and we talk.”

I complied with a slight bow and uttered “Entrez-vous m'sieur.” while realizing my cell phone with the speed dial connection to my lawyer was upstairs.

There are several ways to deal with authority in a case like this. Total denial was probably out of the question. Also, any pleonastically stated contentions in support of my innocence to this allegation such as “Do I look that foolish?” would be severely mitigated given my current attire. So I decided to keep my answers brief, concise and respectful. Our conversation went something like this:

“So, did you threaten anyone with that shotgun?” he asked.

I came to attention, clicked my rubber heels together and stated “Nein mein Herr!”

“Are you sure?”

“Ach mon, aye dinna tuch it!”

“Is it loaded?”

"Nyet comrade!"

"I'm just going to check it anyway." He pronounced as he picked up the Parker.

"Yumpin' yiminey, yah, shure you betcha!"

He paused and asked, "Are you mocking me Mr. Wilhelm?"

Raising my palms and eyes to the heavens I exclaimed, "Lordy Burt, the Jehovah's Witnesses are making me speak in tongues," then I lowered my gaze to the Deputy and asked "Er ye sartin t'was meself they be wailin' about?"

Burt gave me a sidelong up and down look, then slowly nodded and said, "Yes, their ah, description was quite accurate."

He opened the action on the Parker to reveal the welded metal plugs blocking the breeches of both barrels. Turning it over he looked into the muzzles and could see welded plugs also blocked them. This, combined with the fully adjustable comb and cheek piece and the barrels open under the adjustable forearm showed him this was just a gunsmith's device to take a shooter's personal measurements for a custom gunstock. The only way I could hurt someone with this contrivance was to hit them with it. Burt spoke into his radio to cancel the backup Deputy. He

replaced the Parker, picked up the triple X jug, removed the stopper and took a sniff. His nose wrinkled, he grimaced and squinted as his eyes began to water.

"What the (explicative deleted) IS this?" he wheezed.

"Decanted Courvoisier Erte 3" I deadpanned.

"Yeah, my aunt's fanny it is."

Burt, at this point realizing I had broken no laws and my posted signs were ample warning that trespassers would be violated, took one more look around and asked, "What are you doing anyway?"

"Ketchin' bugs."

"What for?"

"To look at 'em."

Since no further elaboration was forthcoming on my part, this intrepid Deputy sighed and left shaking his head but not without one last turn to me with a wagging finger saying "You behave, remember what happened last time." I watched his departure all the way out the palm lined drive and as he opened the door to his cruiser, my wife turned into the driveway. They spoke for a moment, probably exchanging mutual condolences on having to deal with me. I was in trouble now. I hadn't removed yesterday's laundry from the washer.

Conclusion

Since this specimen-gathering concept has now been proven (I'm sure this is how Fred Enock did it.), I offer its use free of charge to all. Please, there is no need to thank me, I insist. You may feel free to customize its application as you see fit. For instance, the shotgun and jug could probably be replaced to achieve the same result with say, a chainsaw and a half dozen empty Budweiser cans.

A few days later the parts I had ordered to complete the ZEUS had arrived. I bit the bullet and acquired a Zeiss circular, revolving stage, a set of six new aftermarket Plan Achromat lenses and a new aftermarket trinocular head. Hope to have a review of this setup by next month.

So another episode of my sedentary existence comes to a close. As always, comments, questions and advice from both of my fans are encouraged. I'll leave you with CT's last question to me, "If a man in the forest speaks and there is no woman there to hear him, is he still wrong?" ■

CHERRY BLOSSOM - ANTHOR

Spring time is here, and the Japanese cherry tree in front of my apartment is full of flowers. The micrograph shows an anther of a cherry blossom in dark field. The anther was mounted in water and air bubbles are therefore visible. The large oval circle on the top left is also an air bubble, which I could not remove. What surprised me a little, was the absence of pollen. The image was stitched together from three separate images. (ed.)



Observ. II. Of the Edge of a Razor

Micrographia was first published in 1665. It was not only a best-seller, but also created a wide interest in microscopy. Published before the invention of photography, it contains numerous drawings by Robert Hooke himself.

The excerpt (which is in public domain) was obtained from Project Gutenberg (www.gutenberg.org).

By Robert Hooke FRS

The sharpest Edge hath the same kind of affinity to the sharpest Point in Physicks, as a line hath to a point in Mathematicks; and therefore the Treaty concerning this, may very properly be annexed to the former. A Razor doth appear to

be a Body of a very neat and curious aspect, till more closely viewed by the Microscope, and there we may observe its very Edge to be of all kind of shapes, except what it should be. For examining that of a very sharp one, I could not find that any part of it had any thing of sharpness in it; but it appeared a rough surface of a very considerable breadth from side to side, the narrowest part not seeming thinner then the back of a pretty thick Knife. Nor is't likely that it should appear any otherwise, since as we just now shew'd that a point appear'd a circle, 'tis rational a line should be a parallelogram.

Now for the drawing this second Figure (which represents a part of the Edge about half a quarter of an inch long of a Razor well set) I so plac'd it between the

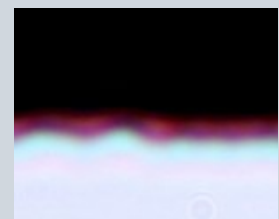
Object-glass & the light, that there appear'd a reflection from the very Edge, represented by the white line abcdef. In which you may perceive it to be somewhat sharper then elsewhere about d, to be indented or pitted about b, to be broader and thicker about c, and unequal and rugged about e, and pretty even between ab and ef. Nor was that part of the Edge ghik so smooth as one would imagine so smooth bodies as a Hone and Oyl should leave it; for besides those multitudes of scratches, which appear to have raz'd the surface ghik, and to cross each other every way which are not half of them express in the Figure, there were several great and deep scratches, or furrows, such as gh and ik, which made the surface yet more rugged, caus'd perhaps by some small

EDGE OF A RAZOR - REVISITED

The picture below shows the edges of two razors, a brand new one (top) and an old one (bottom). The image was taken with a 40x objective, so the magnification is quite high. As expect-

ed, the old razor blade shows a highly irregular pattern. Enlarging parts of the micrograph (right) revealed a blue and a red discoloration of the razor's edges. This is chromatic aberration of the

objectives. Could this also be a method of testing the optical quality of objectives? I do not have apochromatic objectives for comparison. These should have a much lower chromatic aberration.

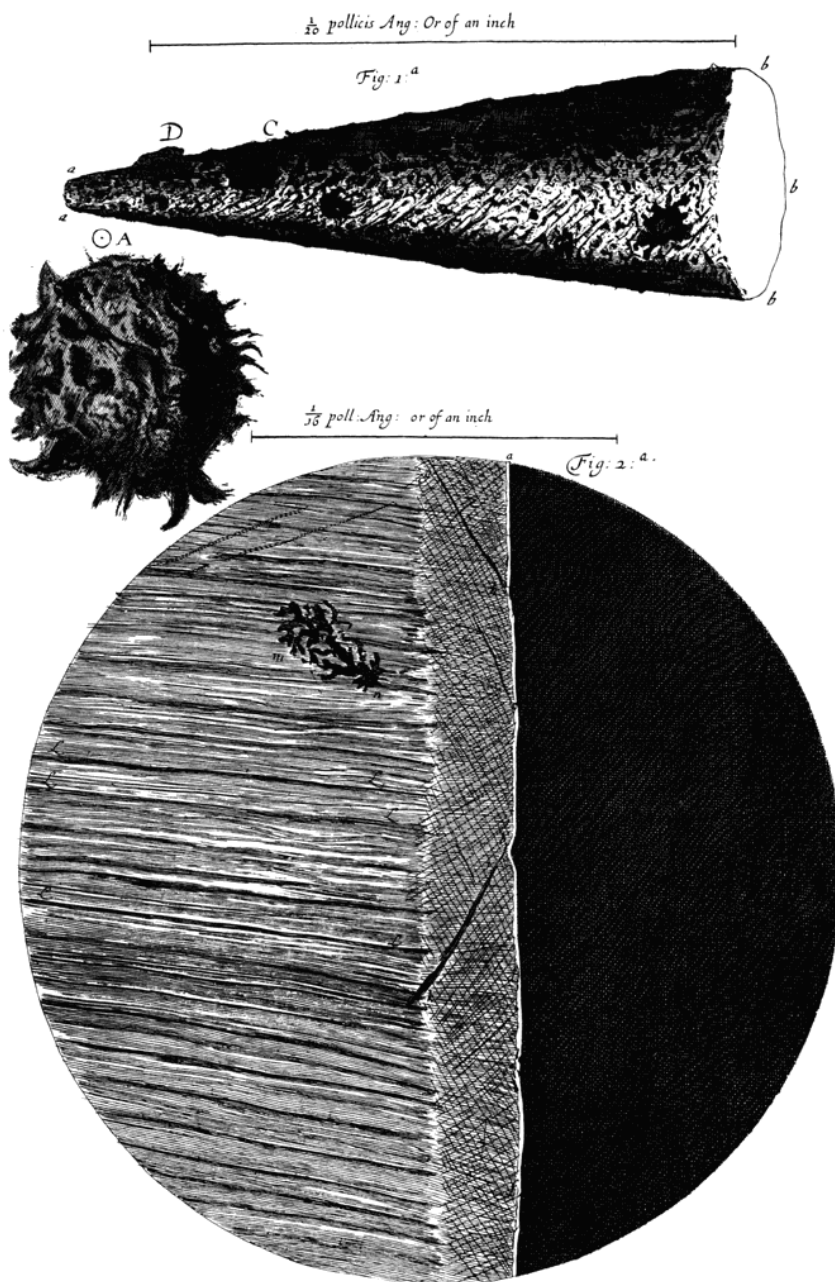


Top: Discoloration at the edges indicate the presence of lens error.

Dust casually falling on the Hone, or some harder or more flinty part of the Hone it self. The other part of the Razor II, which is polish'd on a grinding-stone, appear'd much rougher then the other, looking almost like a plow'd field, with many parallels, ridges, and furrows, and a cloddy, as 'twere, or an uneven surface: nor shall we wonder at the

roughnesses of those surfaces, since even in the most curious wrought Glasses for Microscopes, and other Optical uses, I have, when the Sun has shone well on them, discover'd their surface to be variously raz'd or scratched, and to consist of an infinite of small broken surfaces, which reflect the light of very various and differing colours.

And indeed it seems impossible by Art to cut the surface of any hard and brittle body smooth, since Putte, or even the most curious Powder that can be made use of, to polish such a body, must consist of little hard rough particles, and each of them must cut its way, and consequently leave some kind of gutter or furrow behind it. And though Nature does seem to do it very readily in all kinds of fluid bodies, yet perhaps future observers may discover even these also rugged; it being very probable, as I elsewhere shew, that fluid bodies are made up of small solid particles variously and strongly mov'd, and may find reason to think there is scarce a surface in rerum naturâ perfectly smooth. The black spot mn, I gness to be some small speck of rust, for that I have oft observ'd to be the manner of the working of Corrosive Juyces. To conclude, this Edge and piece of a Razor, if it had been really such as it appear'd through the Microscope, would scarcely have serv'd to cleave wood, much less to have cut off the hair of beards, unless it were after the manner that Lucian merrily relates Charon to have made use of, when with a Carpenters Axe he chop'd off the beard of a sage Philosopher, whose gravity he very cautiously fear'd would indanger the oversetting of his Wherry. ■



Some advice for making good micrographs

In this article I collected some thoughts and suggestions on how to improve photomicrographs.

By Oliver Kim

Maybe you have seen the micrographs of Nikon's Small World photo contest and would like to make pictures of comparable quality. First the good news: Making reasonably nice pictures with a microscope is not difficult, provided that you follow a few basic guidelines (and provided you have the appropriate equipment). Now the bad news: If you want to make really good pictures, then following a few points may not be enough. It requires experience in preparing and staining the specimens and you may also have to invest a bit into some of the better microscopic and photographic hardware. For winning a contest, a fair amount of originality is also necessary, and this originality can not be obtained by taking pictures of "standard" specimens found in the slide box of every school laboratory.

Even if you do not have top equipment and sample preparation experience, following the

guidelines below may dramatically improve your results.

What's a good light micrograph?

Let's start at the basics. What is a "good" light micrograph? It's easy to get philosophical about this and the standards and expectations of different people will differ. Nikon's Small World contest judges the micrographs based on originality, visual impact, technical proficiency and information content. It are these points that I would like to address in greater detail.

Good micrographs show technical proficiency

This includes correct exposure time, sufficient resolution, no camera shake, no motion blur (of moving organisms), correct white balance and correct focusing. Microscopy-specific criteria include: no visible dust, proper use of the Koehler illumination to minimize stray light and reflections, proper setting of the condenser diaphragm to achieve the optimum contrast and resolution. Proper exposure is also important. Both highlights and shadows should reveal details.

Good micrographs give a visual impact

This addresses the artistic aspect. The micrograph should have a center of interest and the eye of the viewer should not move restlessly around the picture. Look for clear shapes and patterns. Simplicity and regularity is key. Many images with impact are of surprising simplicity. Even those pictures that show many different lines and patterns, will not have these details arranged randomly. An overall shape and structure is still visible.

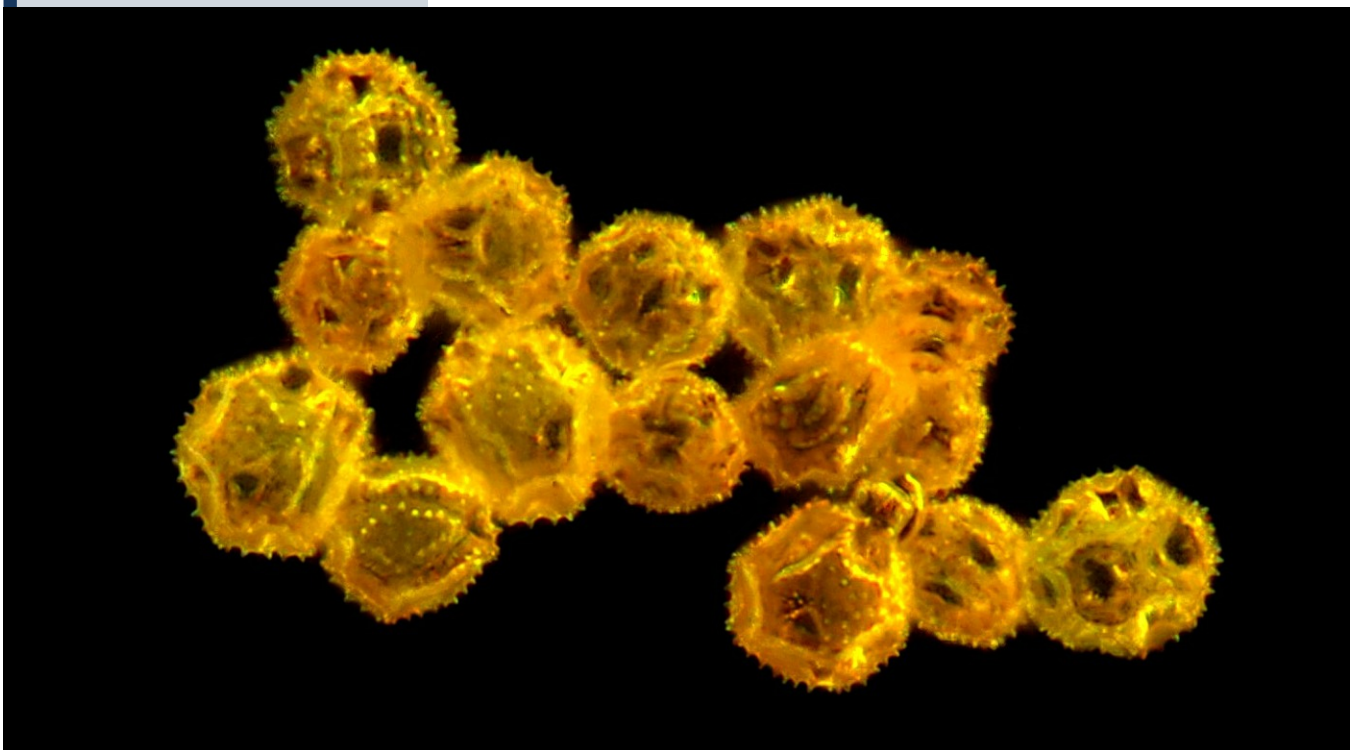
Good micrographs are informative

OK, you can be flexible about this aspect. There are many micrographs around that simply look good, but have a low information content. A typical example would be the pictures of Vitamin C that I made. They look great, but the information content is nil. Highly informative light micrographs can still be considered "great", even if they do not adhere to the rules of composition, simply because they illustrate a point well.

Careful specimen selection and preparation

Now let's talk about some of the things that one can improve, regardless of the the type of equipment that one has. If you want to make great photomicrographs, then you should spend some time selecting an appropriate specimen. Often the microscopist will not have much choice: it simply depends on the area of research that one is engaged in. And some specimens simply are more difficult to photograph than others. It may, however, well be, that you simply need a nice picture to hang up on the living room wall and in this case you have more choice of selecting a

Dark-field photograph of pollen grains of the dandelion (*Taraxacum*). Several images were stacked to increase the depth of field.



specimen. One thing should not be forgotten: If the specimen is of low quality, then the image will reflect this (unless you do some image editing in PhotoShop, which will be more or less successful). Start out with a good specimen in the first place.

The specimen should not move

Moving specimens may require you to chase the organism across the slide and when you push the release button of the camera, the image may be blurred (unless you use a really short exposure time or micro-flashing). Moving specimens also have another significant drawback: it is not possible to take several pictures of the object with different focus settings. Therefore you can not use software to do focus stacking (the combining of the sharp areas of

the different pictures into one final image). A moving specimen will also make composing the image more difficult.

Sufficient Details

The specimen should show details to make it sufficiently interesting. Not every specimen is interesting to look at. They may lack color contrast or richness in details. You may need to stain the specimen first. Some specimens simply lack color contrast or be too "blurry". They lack aesthetics. If your specimen lacks contrast and you are unable to stain it with chemicals, then the only alternative is to use optical contrast enhancement techniques, such as phase contrast, differential interference contrast, dark field or Rheinberg illumination.

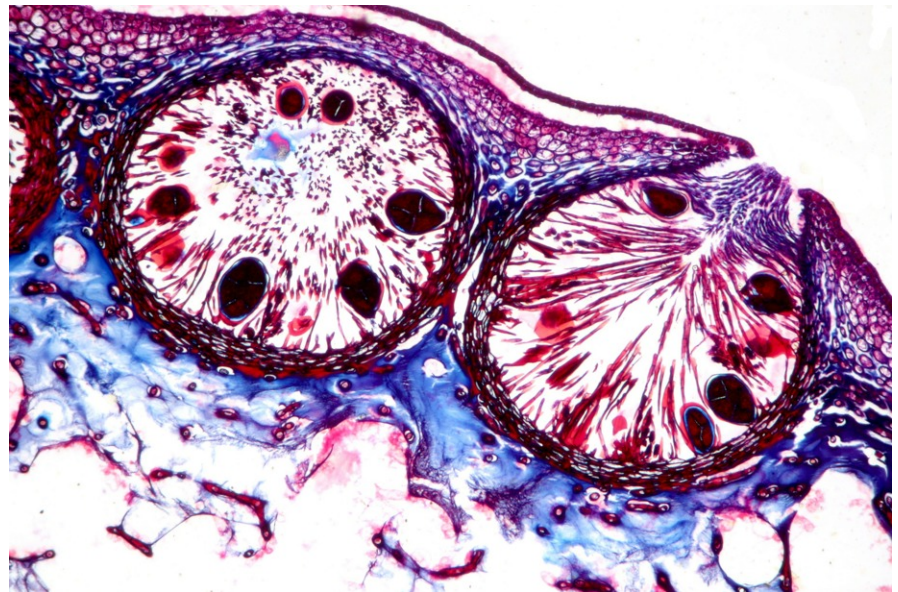
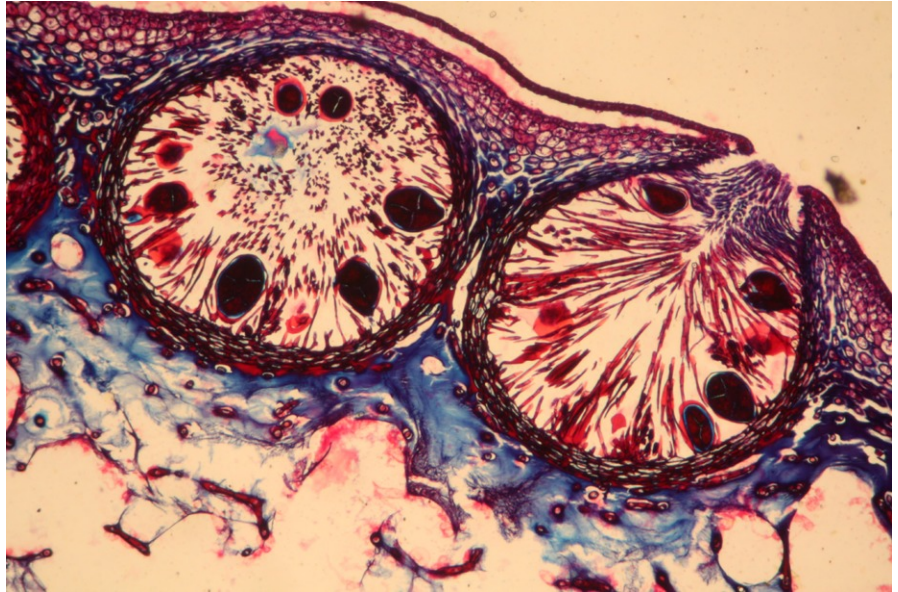
Color correcting images can do miracles to improve image quality. The bottom image was white balanced and contrast adjusted. Additionally disturbing dust (right side on top image) was removed. The image shows the seaweed *Fucus*.

Proper mounting

The specimens should be properly mounted in a mounting medium which enhances the structures of interest. This means that for phase contrast work, the refractive index of the mounting medium should be different than the structure being observed. The medium should be compatible with the stains and free of bubbles. Permanent mounting also immobilizes the specimen and makes it much easier to take several images that can be combined together.

Go for quantity

Mount several specimens in the hope that a few of them will be suitable for photography. This is where an element of luck is also necessary. I once mounted over ten small flies only to discover at the end that none of them had their wings and legs in a natural position. A picture of an insect with twisted and bent wings and legs simply does not look good, in my opinion. Some of them even lost some parts during the mounting process... Also take several images of the same specimen using different exposure times, filters and light settings. Then select the best images



at the end. Quantity means quality.

Proper Thickness

Specimens that are too thick often do not look good. The structures cover each other and details may not be visible. If there are several cell layers on top of each other, then the nice patterns of the individual cell layers can be obscured by the blurry cells above or below this layer.

This decreases aesthetic appeal. Insects are also often too thick to reveal much detail. The exoskeleton of the insect first needs to be brightened by placing the insect either in to lactic acid or Potassium hydroxide (KOH, be careful!) solution.

Low Magnification

The higher the magnification, the lower the depth of field and the lower the sharpness of the

image. Choose specimens that can be photographed at low magnifications. They are easier to deal with. Again, have a look at Nikon's Small World photomicrography contest. Most of the images were photographed at low magnifications.

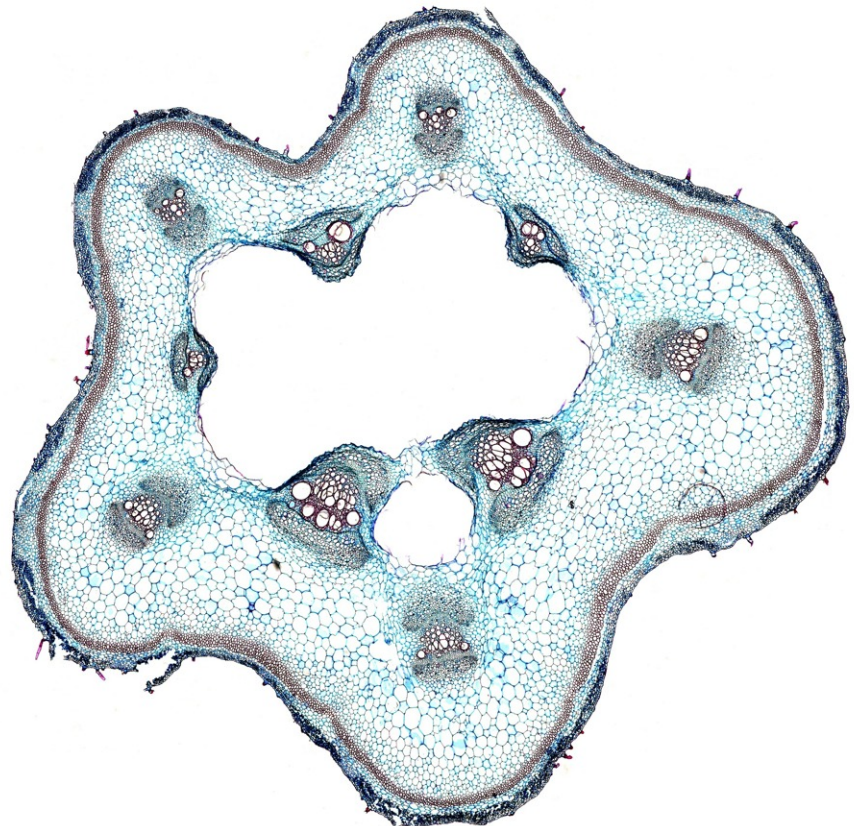
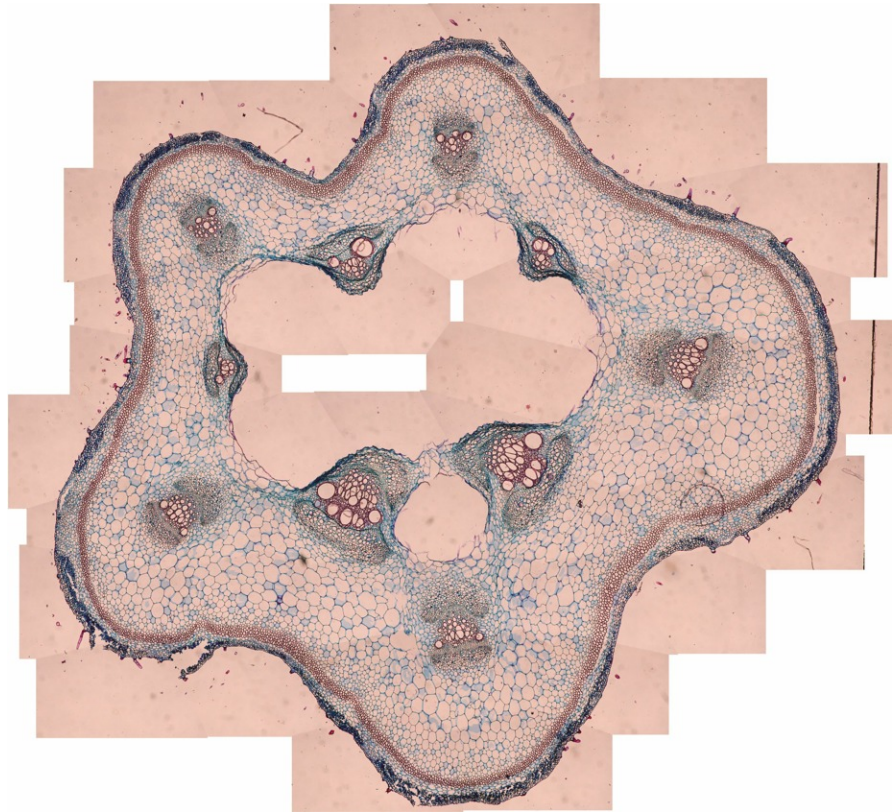
Whole organism

Take pictures of the whole organism and stitch several images together (using panorama software) if the whole organism does not fit on one single image. The shape of the whole organism gives the viewer orientation and often also adds to the visual impact of the picture.

Concluding thoughts

Beginners should probably start out with ready-made permanent slides and then take it on from there. First get the photographic equipment set up and optimized. Find the correct exposure time (for minimum vibration). When you have satisfactory results and feel comfortable using the equipment, I would move on and start preparing my own slides. It's just a suggestion to avoid too many parameters and unknowns at the beginning. ■

55 separate images were assembled to a final 100 megapixel image. The stitched original image (top) was then white balanced and color corrected to produce a more pleasing final picture. Working with large images like these requires much computer memory and patience.



Making Zoomable Images with Zoomify Express

The free program Zoomify Express allows for an easy way to make zoomable images. These images can be displayed in a web browser both for online and offline viewing.

By Oliver Kim

Large photomicrographs have a disadvantage. It is not possible to see both the details as well as the bog picture. A zoomable image combines the benefits of both extremes. In this article I would like to show you how to make these mages using the free program Zoomify Express. It can be downloaded from the site www.zomomify.com.

Step 1: In the first step you have to take the pictures. Take the pictures with sufficient overlap, about 20-30%, so that it is easier to stitch them together with panorama software. Also make sure that the images show interesting details as this magnification. There is little point in making a zoomable image if the resolution is so low that one does not see sufficient details when zoomed. Give the viewer something to discover!

Step 2: Use panorama software, such as the free software Hugin, to com-

bine the images into a large micrograph. Different types of panorama software work differently, so I can not give general instructions right now. Be aware that many kinds of panorama software only allow the stitching together of images in one dimension. You need software that is able to combine pictures both horizontally and vertically, If you quickly want to try out Zoomify, just to see how it works, then you do not need to stitch the images together, just use a non-stitched smaller image for test purposes.

Step 3: Download Zoomify Express from www.zoomify.com and unpack the folder. You will get several files.

Step 4: Drag and drop the original micrograph on the Zoomify Converter icon. The computer may ask if you want to start the program, and you can confirm. the program will now start and will convert the original file into tiles. This can take several minutes depending on the size of the original image. The tiles will be stored in a newly created folder, which has the same name as the original image. do not modify the contents of this folder. You can rename the folder, however.

Step 5: open the file TemplateWebPage with a regular text editor. Find the two lines which contain:
ZoomifyImagePath=
ZoomifyImageExample

Replace `ZoomifyImageExample` with the name of the newly created folder. Then save the file with an htm extension.

Step 6: We are now ready to view the zoomable image. Click the file, the web browser will open and display the zoomable image. Alternatively you can open the file with the open menu point of the browser. Operate the horizontal slider beneath the image to zoom in and out. Drag the small blue square in the navigation window on the top left to slew horizontally and vertically. You can also move by dragging the main image window.

You can also change the size of the display by changing the values of width and height in the htm file. Be aware that you have to do this on two different places in the file. There are two codes, one for the Internet Explorer and one for all other web browsers. Also make sure that the swf file is stored somewhere accessible and that the path to the swf file is set correctly. The default is that the swf file is stored in the same folder, but this is not a requirement. Be aware that the zoomable images do not display on an iPad, because the iPad does not support Flash. You must have a Flash player installed in order for Zoomify to work but most computers have one installed already.

Unpacking the ZIP file results produces 5 files and one folder. The Zoomify Converter processes the original picture. The result is stored in a newly formed folder. The TemplateWebPage displays the zoomable picture, the ZoomifyViewer is needed for this. The file `zoomifyConvertPrefs` can be edited to for different settings.



ZoomifyImageExample



TemplateWebPage
Firefox Document
2 KB



zoomifyConvertPrefs
ASP-Datei
2 KB



Quick Start
Firefox Document
27 KB



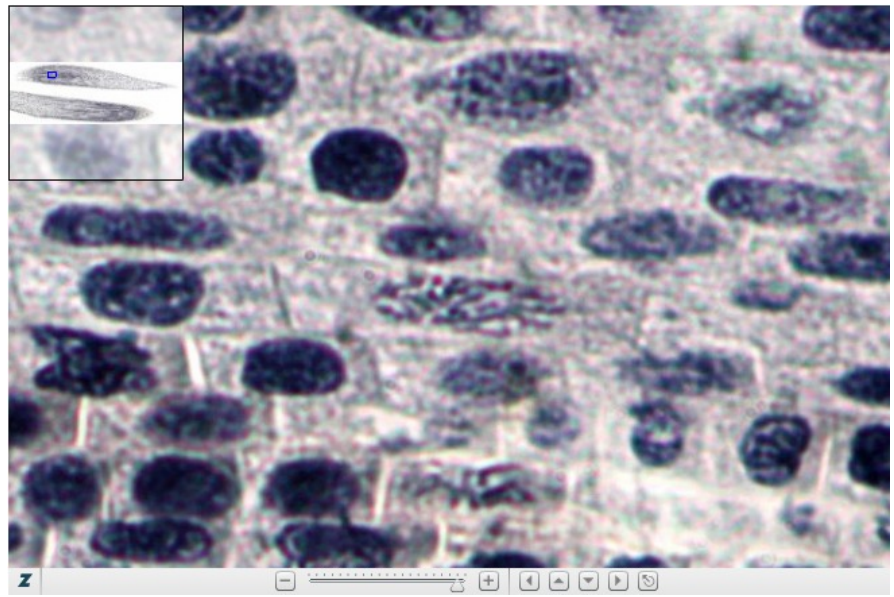
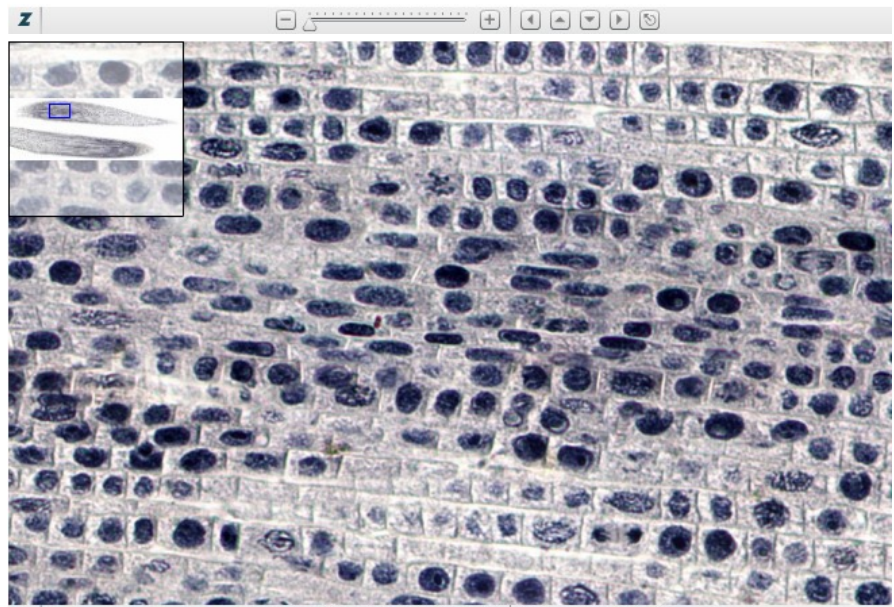
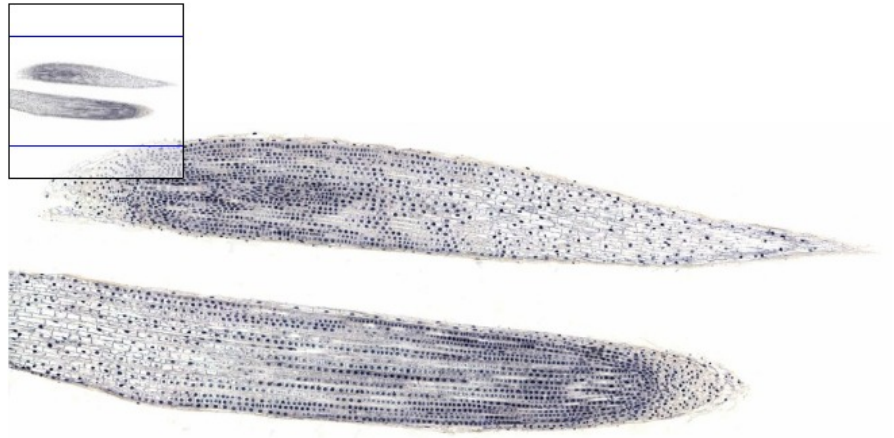
Zoomify Converter
Zoomify Converter v3.0
Zoomify Inc.



ZoomifyViewer
Shockwave Flash Object
49 KB

The free version of zoomify requires a single starting image. It is up to you to first stitch several images together. This I found to be the most difficult part, because computation time can be quite long for very large images. Some stitched images can be several hundred megapixels large and the filesize can go into the gigabytes. Simply loading a picture which is 20000 by 20000 pixels large can take quite a bit of time and memory. On several occasions my computer crashed due to the large memory and hard disk requirements. The question is, if this high resolution is needed in the first place, sometimes there is also some empty magnification involved and it is possible to reduce the size of the image. This is not a problem of Zoomify, however. The converter processes the files relatively quickly and once the original image has been processed, Zoomify is able to display it without performance problems. This is because the converter breaks the large image into individual tiles which can be loaded very quickly.

Commercial versions of the software are much more powerful. They also allow for an annotation of the zoomed image. It is also possible to define hotspots. They quickly help you find a particular structure over a dropdown menu. I can image many useful educational applications of this program and encourage you to try it out. ■



The picture on the right shows the root tip of an onion. The currently displayed part is indicated by a blue box in the navigation area on the top left. Operating the slider at the bottom of the picture zooms in and out, the arrows move the image horizontally and vertically. The last button resets the image to the start position.

A guide to adding a remote control to a webcam for vibrationless photography

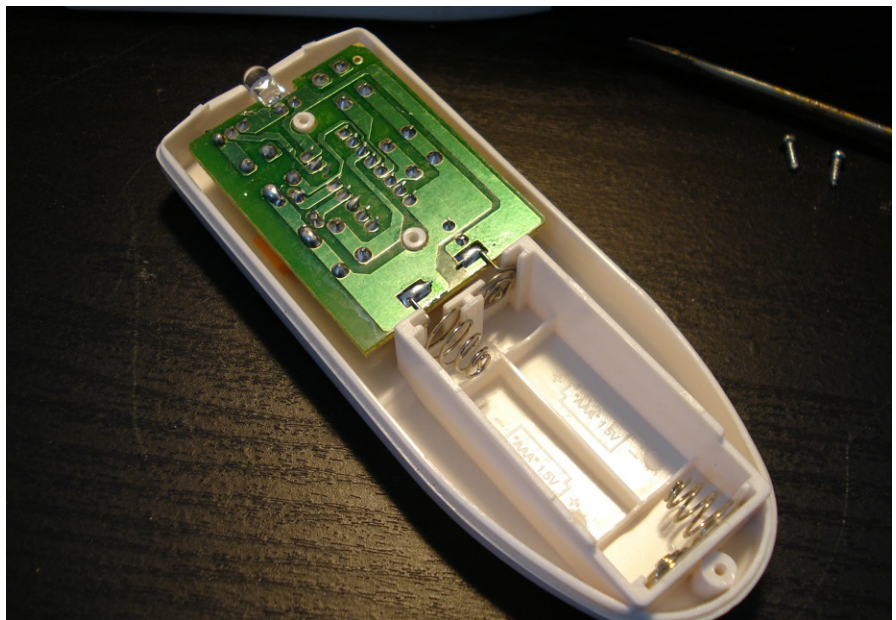
Many webcams have a shutter release button for taking pictures. Pressing this button can introduce vibration and result in a blurry image. This guide shows how to convert a remote control for a fan to a shutter release for a webcam.

By Yogeshkumar T. Patel

Here is a step-by-step version of adding a remote control to a webcam which has a microphone built into it. In my project I have used an oscillating fan remote control, but any remote with micro-switches can be used. The Webcam that I am using is a no name generic, but the concept is more or less the same. The next project will be to completely replace the original housing of the camera with something that will fit directly over the microscope trinocular eyepiece. ■



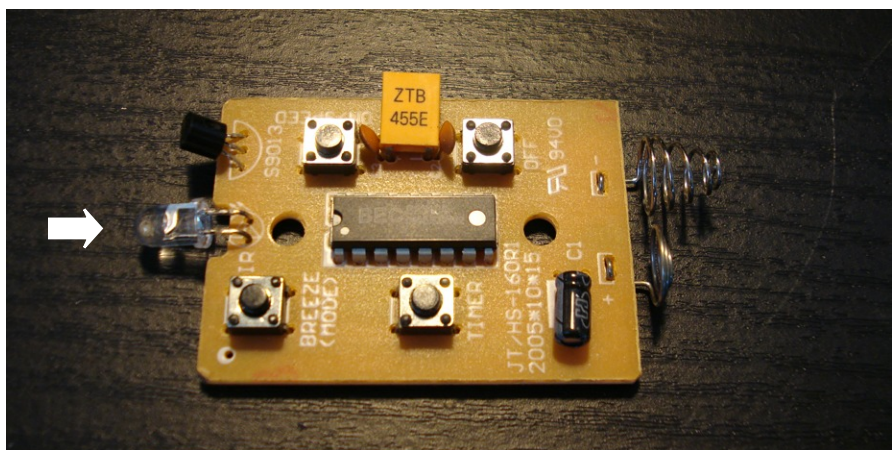
1 A remote control for an oscillating fan.

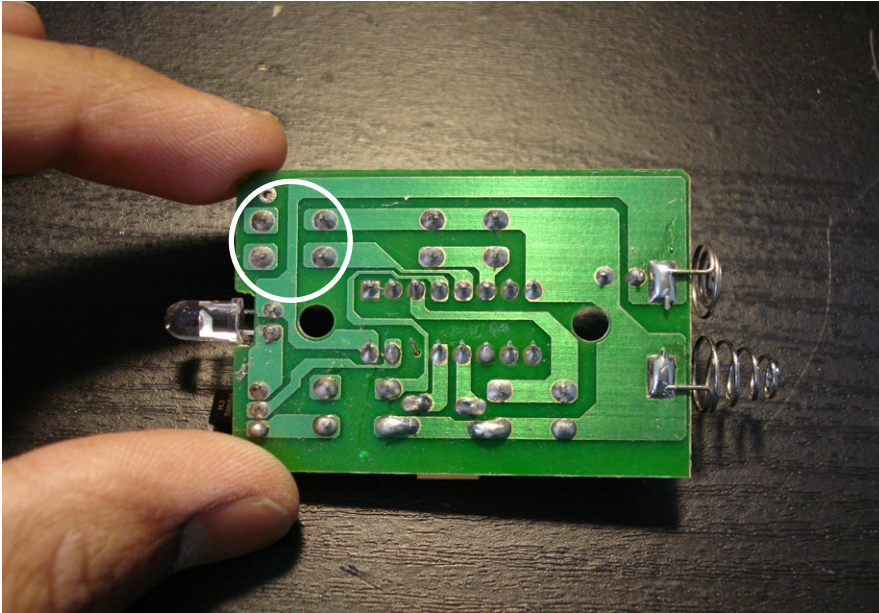


2 This is the backside of the button where the wires from the camera will get soldered.

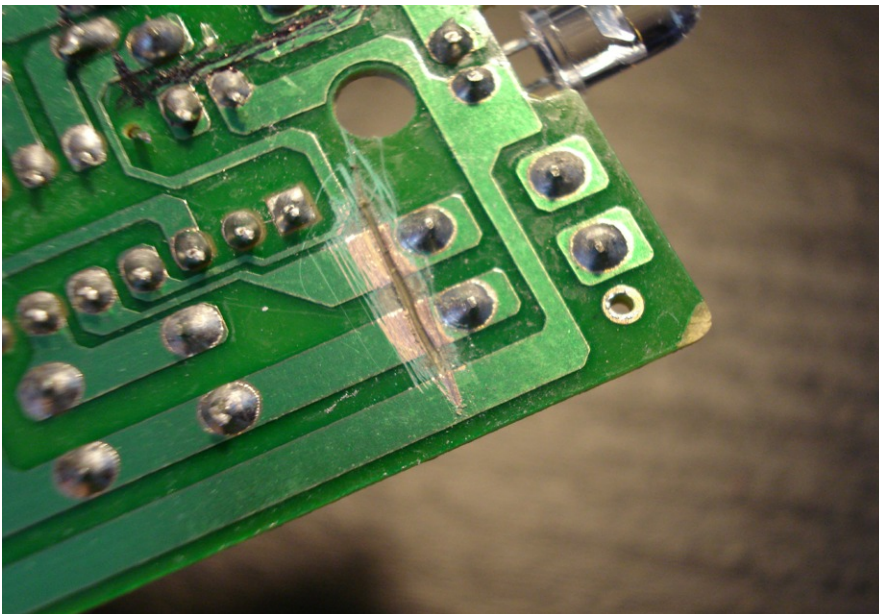
3 The circuit board from the remote control. All we are interested in from this circuit is one of the micro switch. I am specifically targeting the "Breeze" switch on the lower right. This will be the button that will control the camera's snapshot feature.

Arrow: Remove this Infrared LED because we will not need it, plus it will be in the way of the wire going to the camera.

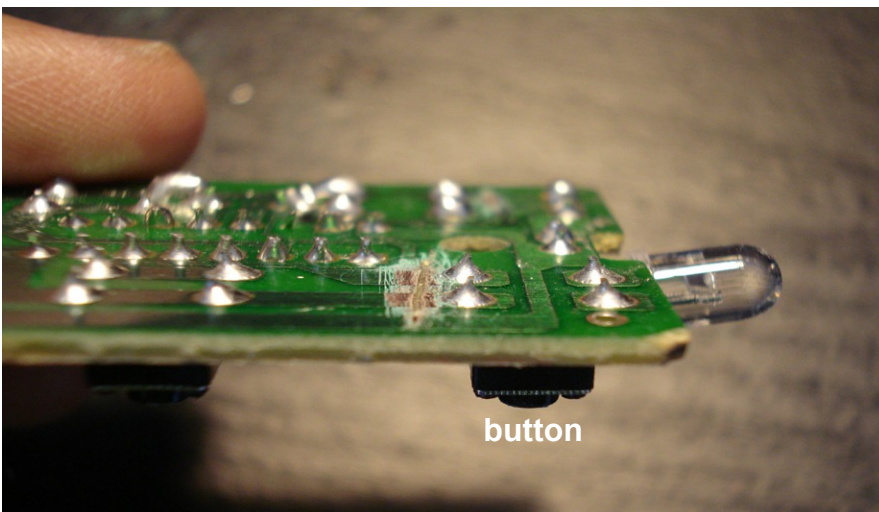




4 This is the bottom view of the circuit. The four leads on the upper left hand side, above the Infra-red LED are the leads to the button. (circle). This button has to be disconnected from the circuit. To do this I am going to take a sharp flat head screw driver or a knife and scratch off the copper tracking from the two leads on the right. I checked if the leads are still connected using a multimeter.



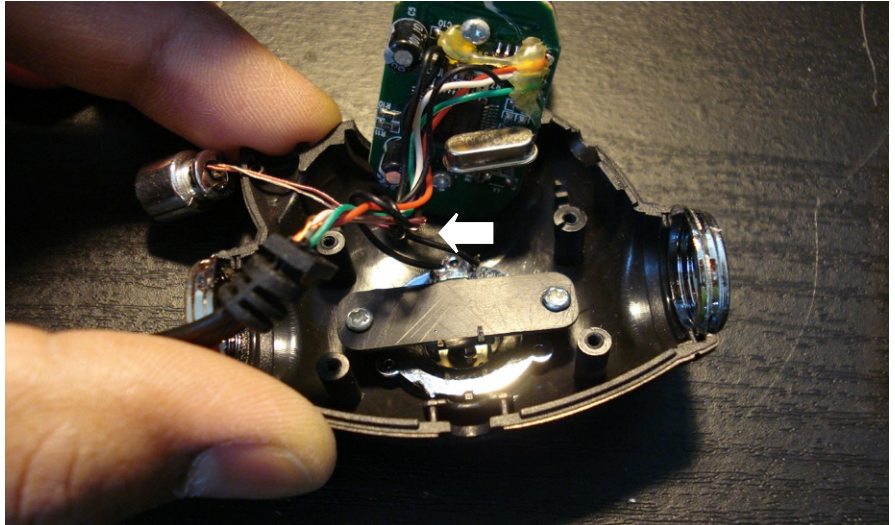
5 This is the result of scratching it to the point of disconnecting the button from the circuit. At this point this button is now free for me to connect the webcam. The button is no longer connected to this circuit. Also, to make sure it really is not connected, I went ahead and checked the leads with a multimeter for continuity. There was no continuity - success!



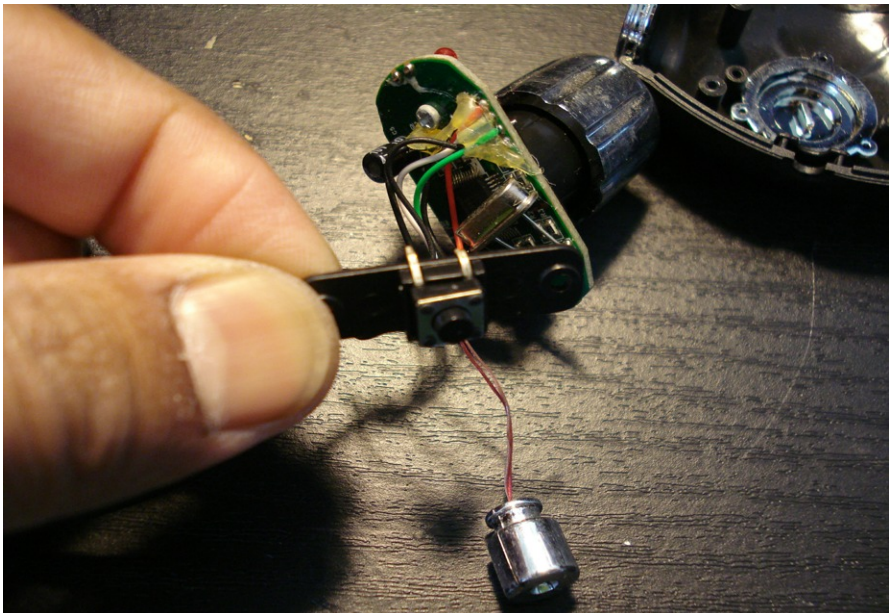
6 Here is another view of the where the scratch has been made and to what button it belongs to.

7 Here is my webcam with the back cover removed. The Snapshot button is located directly in the center of the picture under the black plastic plate with two silver screws. The chrome looking plastic piece under my index finger is a built on microphone (which will be snipped off eventually to use the wires from it, note the wires for it are copper and yellow). Lastly, the circuit board in this picture is where the CCD is located.

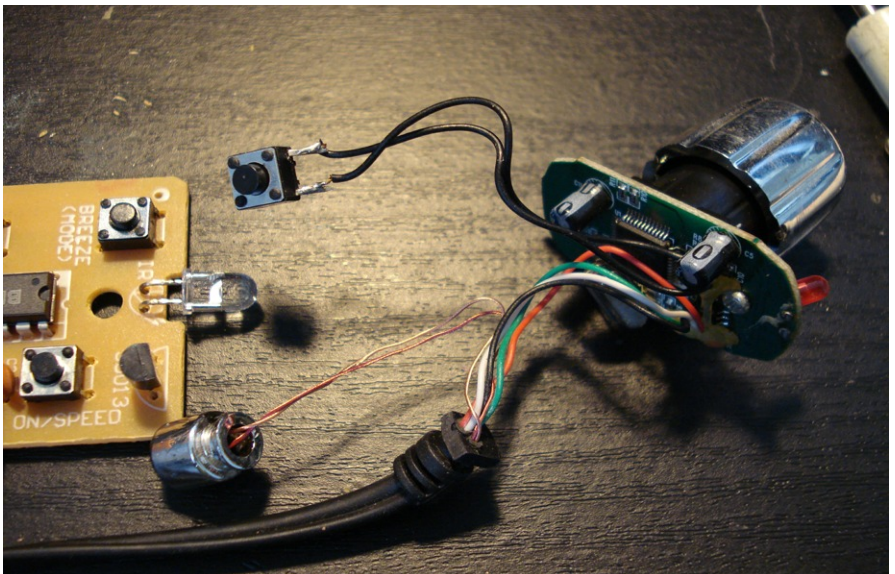
Two black wires connect the snapshot button to the circuit board of the camera (arrow). Essentially we want to disconnect these wires from this button. These black wires will now get soldered to the microphone wires (copper and yellow).

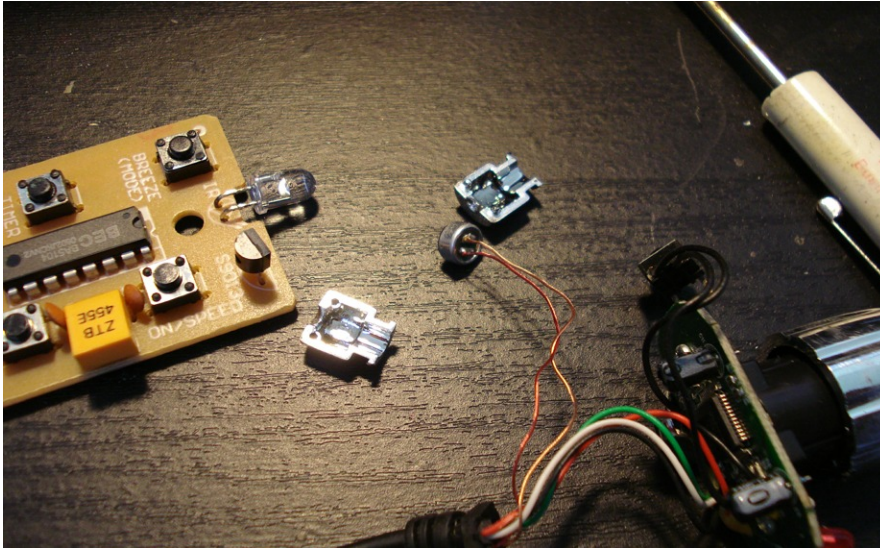


8 Here is a look at the Snapshot button after the two silver screws have been removed. Also, note the chrome looking microphone which will be removed.

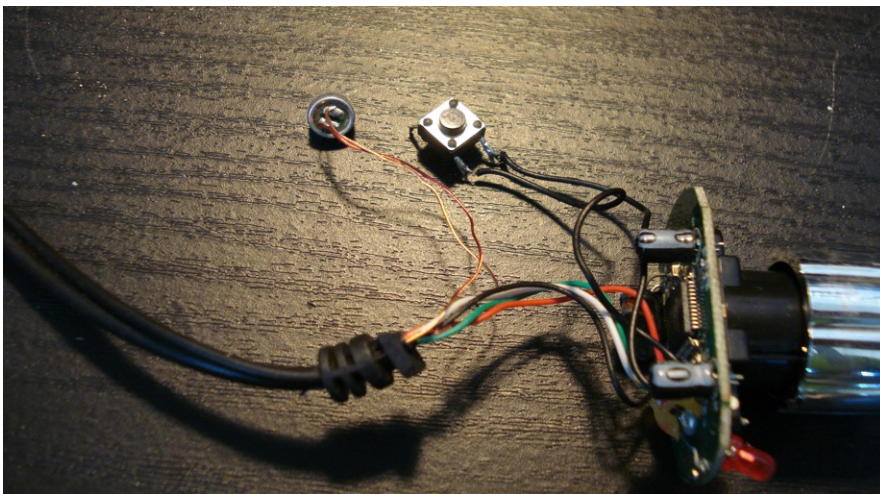


9 Another view of the Snapshot button and the microphone.

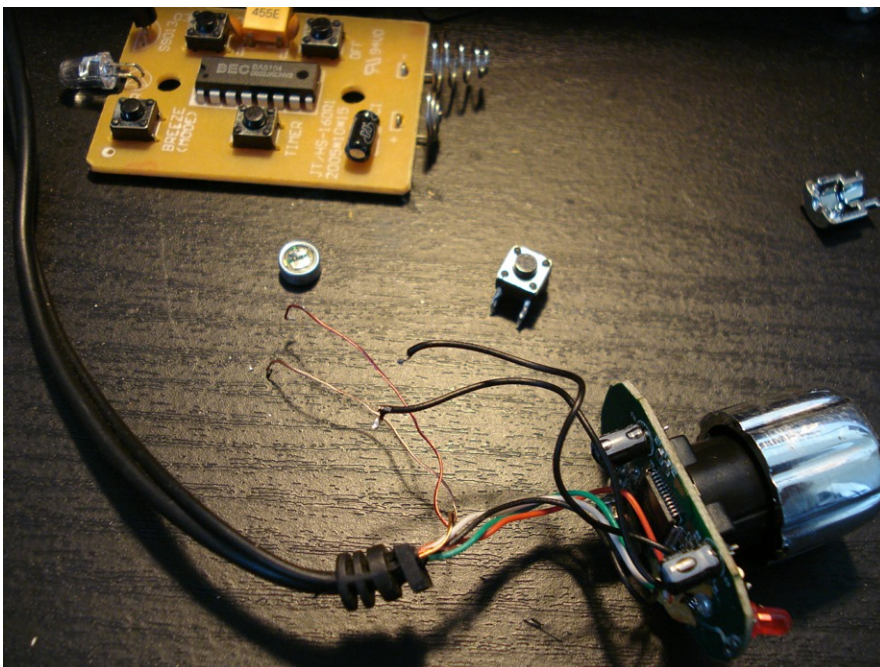




The microphone and its copper and silver wires are exposed after the silver housing is removed. **10**

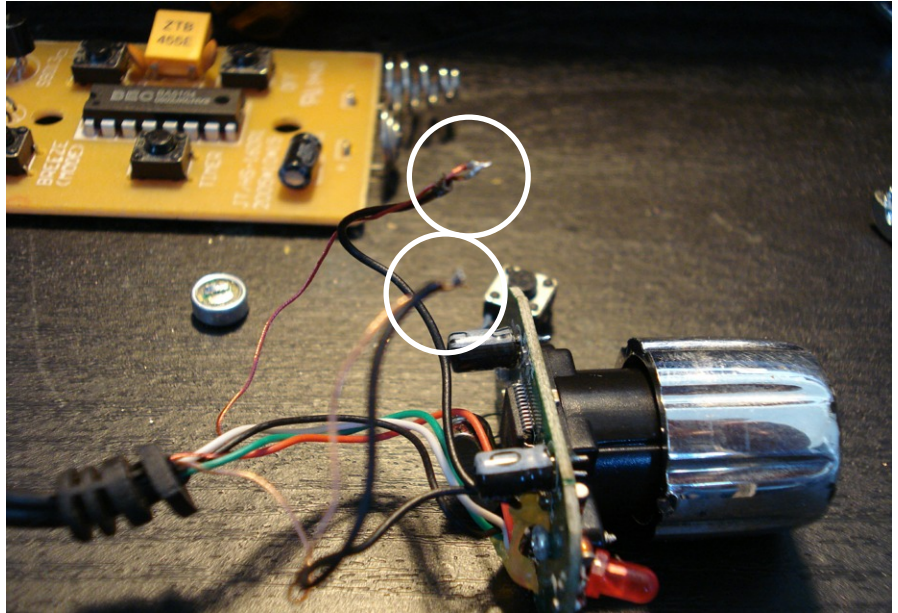


De-solder the leads (black wires) from the button, and the leads (copper and yellow) from the microphone. These will be soldered together. **11**

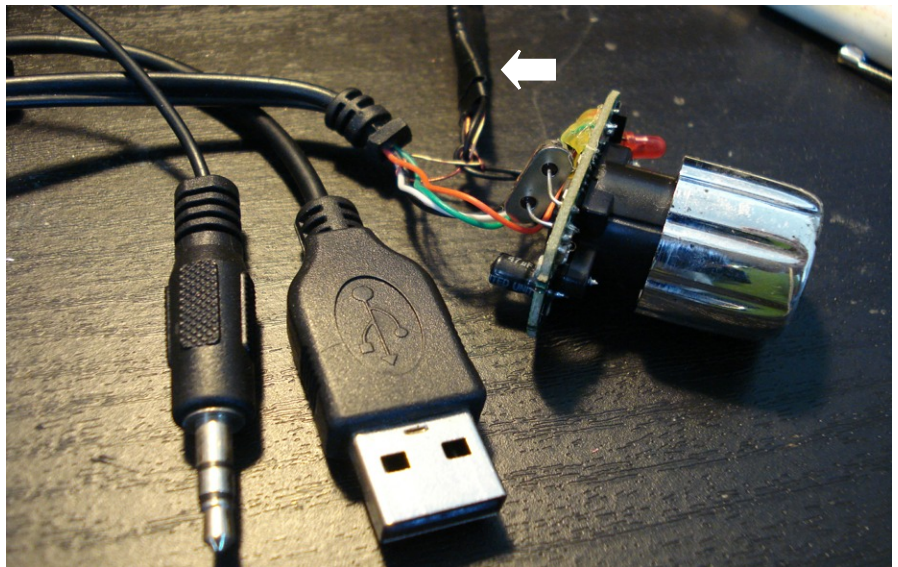


Both the microphone and the Snapshot button are now de-soldered. **12**

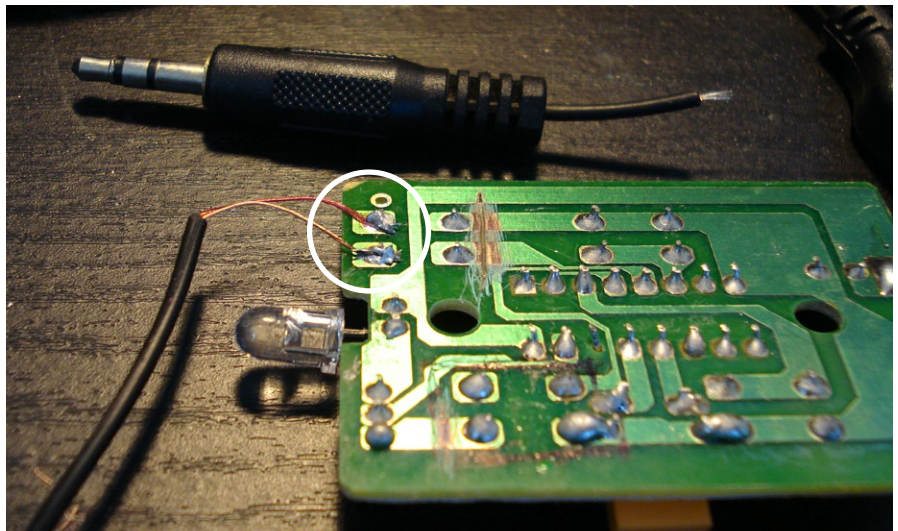
13 The exposed copper and yellow (from microphone) and two black wires (from the snapshot button) should now get soldered together. So essentially what I have done here is made an extension of the snapshot button and completely removed the microphone. If not apparent as to what I have done right now, continue onwards with the pictures and it will become very clear.

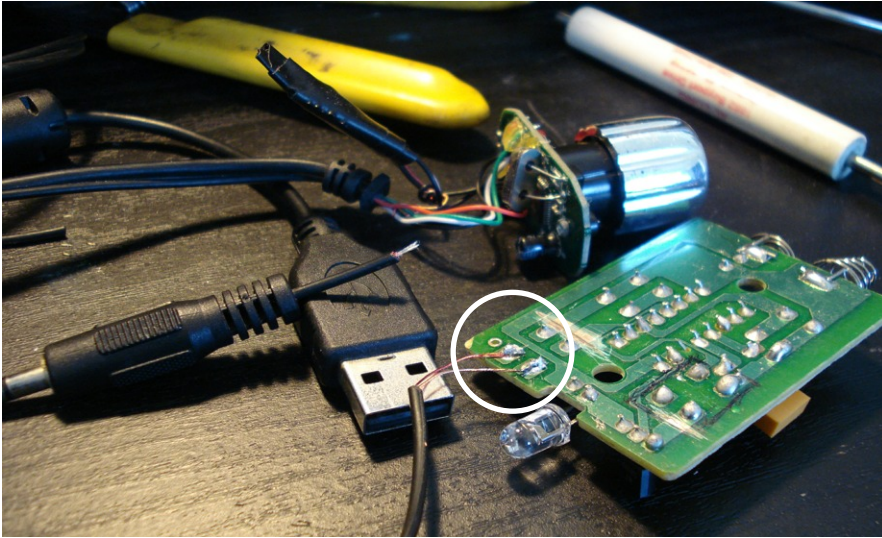


14 This is the bundle of our soldered wire from the previous photos. I have taped the soldered wires (arrow) with electrical tape this way nothing shorts the circuit. The copper and yellow wires end here, which means this headphone plug needs to be snipped off. The wires from this end will be soldered to the remote control button.

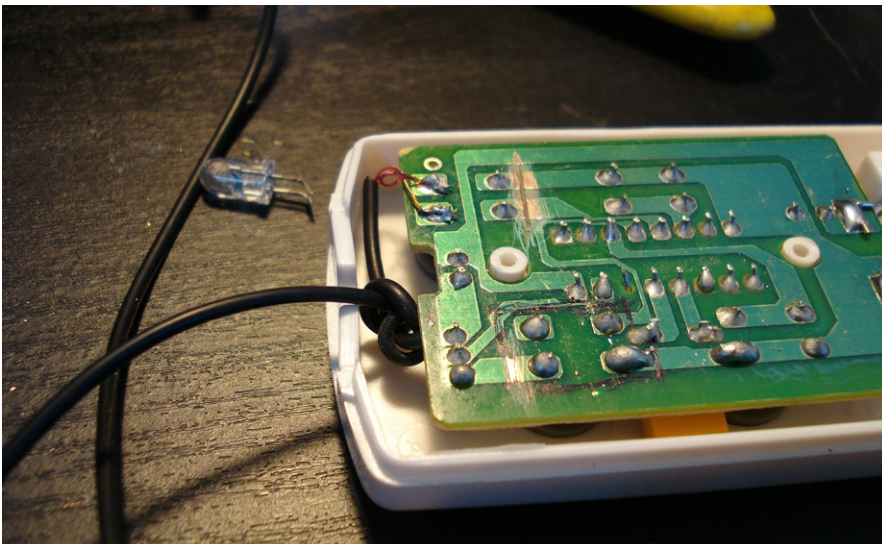


15 After having cut the headphone plug off the camera, those wires (copper and yellow) are now ready for soldering on to the remote control button.





At this point the hard part is done. So your project should look something like this. The circle indicates the snapshot button to microphone wire connection. **16**



I snipped off the LED to make room for the wire going to the camera. Also, note that I have tied a few knots on the wire to prevent any damage if the wire is ever pulled. After this is complete I screwed the back plate of the remote and the camera and this portion of the project is done! **17**



This is what the completed project looks like. I tested it out and it works great. I simply connect the USB to my laptop and then press the "breeze" button on the remote and the Webcam software is activated. If I press the "breeze" button again (with the software on) the camera takes a snapshot, this process can be repeated. I wanted to make this remote to eliminate having to touch the camera once it has been fully and finally mounted to my microscope; this can really help reduce capturing unwanted vibrations. I hope this was helpful, if anyone has any questions or comments feel free to shoot away. **18**

Buying Microscopes for Kids

Choosing an appropriate microscope can be a complicated thing for novices. Here is a short guide.

By *Oliver Kim*

Occasionally parents of my students contact me and ask me which kind of microscope to buy for their children as a present. In the best case, they ask which microscopes we use in biology lab in school, in some other cases, they show me an advertisement for toy microscopes (often advertised with a 2000x magnification) and then ask me if the magnification is good enough to see cells. Only insiders know that anything beyond 400x magnification is probably not useful for beginning observation anyway. It is for this reason, that I decided to compile a short FAQ to help parents a little in finding an appropriate microscope.

How much can I expect to pay for a microscope for children? The minimum price for a useable microscope is around EUR 150/USD 200 and up. You would probably like to spend a bit more. Anything much less is likely not to be of sufficient quality, but simply because a microscope is expensive does not mean that it is automatically suitable and of good quality. Specialized optics may quickly drive the price up, but may not be suitable.

What can I expect to see under the microscope? This depends to a large extent on two factors: The type of microscope (stereo or compound) and the quality (resolution) of the optics. Do not place a too strong emphasis on magnification. With stereo microscopes you can observe opaque objects, such as rocks, whole plant parts or insects. With compound microscopes you can observe the much smaller cells.

Which type of microscope, stereo or compound, should I buy? The choice of the right microscope type (stereo vs compound) is a fundamental issue. After all, you do want to keep the child interested. Buy stereo microscopes if the child is very young (up to 10 years) or if you want to do uncomplicated natural observation without much specimen preparation. Buy stereo microscopes also if you want to extend an existing hobby or interest such as stamp collecting, collecting coins, mineral and insect collecting or plants. Buy compound microscopes if you or your child is also interested in specimen preparation or if you are interested in seeing smaller objects. Older children may be more interested in compound microscopes, as this is the kind that gives more interactivity. If you want to do observe water samples and cells, then compound microscopes are the way to go. Be aware that some children may not consider stereo microscopes as "real" microscopes and that they may be disappointed if they are not able to observe paramecia and other small water life. Also be aware that compound microscopes need more guidance and practice.

Where can I buy them? Microscopes can be bought from specialized microscope dealers. These also supply schools and universities with microscopes. Do not buy second hand devices unless you really know what you are doing. There are simply too many things that can go wrong. It's well possible that second hand microscopes are equipped with specialized objectives that are not suitable (or simply too expensive) for children. Unlike consumer products, which come out of the box, microscopes are commonly assembled according to the research needs and second hand microscopes may have a research or medical background. It is best to personally talk to a dealer.

Do my children need support? A microscope is a scientific instrument and its use requires appropriate education and support. After all, inappropriate handling may damage the device. Sooner or later the child will have observed all the provided slides and samples and will want to observe new things. Guidance is then needed to prepare more samples (unless you buy ready-made slides). Safety issues must also be considered: How can you protect the microscope and how can you protect the child? Some chemicals used for preparing samples are toxic, do not use them and do not blindly trust them. There is also the danger of cutting oneself, when preparing samples.

Should I buy a second hand microscope? Unless you have worked with microscopes yourself and unless you know what you are doing, I would not buy them second hand. Some microscope dealers do also sell them second hand and in this case this is not a problem. You run the risk of buying a microscope with objectives that are not appropriate for education, or microscopes that are not operating reliably. There is no way to see from a picture if the objectives are intact, if there is no stage drift and if the gear operate smoothly. Hospitals and research institutions sometimes sell useful used microscopes, but these may be equipped with specialized optics. Also do not buy microscopes from people who do not know much about them. Non experts are not able to assess the quality of a microscope. There are so many things that you have to look out for, that it is not possible for me to summarize this in a few lines. I may write a second FAQ about them.

Is there a single quality criterion to look out for? Look for two things in new microscopes. The microscope should be made of metal and should be



Left: stereo microscope. These are useful for observing opaque objects at low magnification with a stereoscopic view. **Center and right: These are both compound microscopes,** the middle one with a binocular head. It is not possible to see stereoscopic images with these, even if a binocular head is present. Compound microscopes provide a higher magnification but do not allow for the observation of opaque objects.

heavy. Devices made mostly of plastic can be considered toys, and these do not provide the stability and optical quality to keep children interested over a longer time period. Also check that the objectives adhere to the DIN standard. These objectives have the number “160” printed on them. Most educational and routine microscopes use these. These objectives are interchangeable with each other. Microscopes that use infinity corrected objectives are expensive and can be found more on research microscopes. What about second hand devices?

Is there anything that I should not buy? Talk to a real microscope dealer who also equips schools and universities with educational microscopes. Do not buy second hand microscopes unless you also buy them from a dealer, who is able to give warranty and service. Otherwise there is the risk that you buy microscopes which are not suitable.

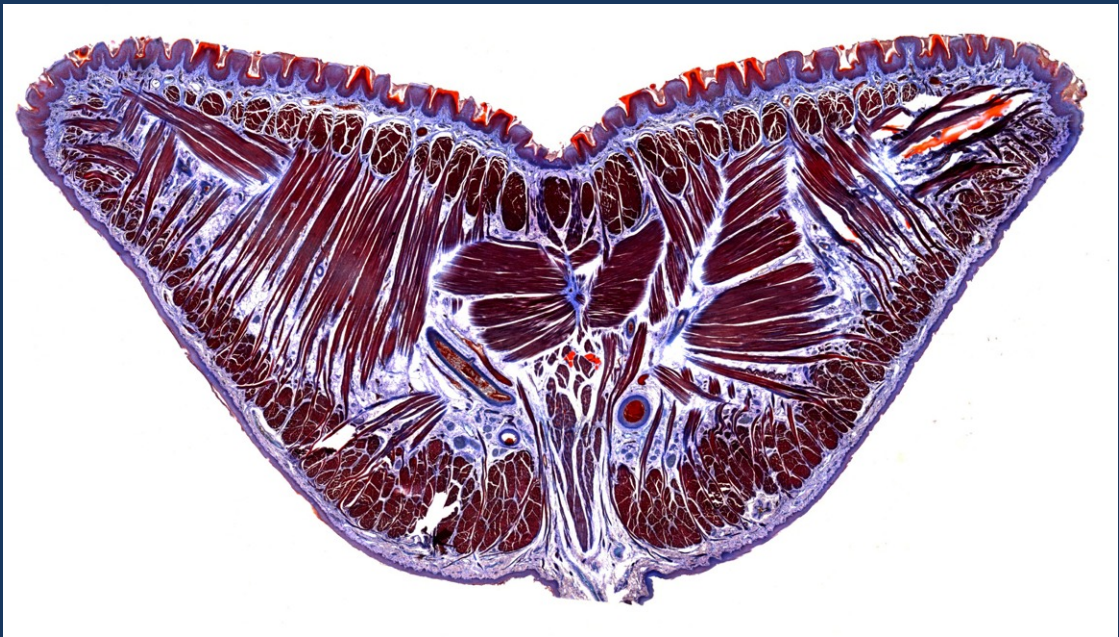
Do not buy specialized microscopes such as inverted microscopes, metallurgical or polarizing microscopes. Again, if you search Ebay, you may not always know the difference. Do not buy scopes that have only a mirror. Kids may point them to the sun and destroy their eye sight. Do not buy historical microscopes. They should go into the museum and also may not have the optical quality (fungal growth on the optical surfaces is a problem, etc.)

Where can I save money? You do not need: Köhler illumination, 100x oil immersion objective: actually I really advise getting one. This requires the use of immersion oil, which is problematic for children (difficult to use), phase contrast, DIC and other fancy stuff.

Which objectives and eyepieces should I buy? Buy achromatic DIN objectives with the magnifications 4x, 10x, 40x and a 10x eyepiece. A 100x oil

immersion is not needed and may even be counter-productive. This objective requires advanced techniques and is more expensive. Better to get a 60x objective instead, but this is optional. This is a standard combination and microscope dealers supplying for schools will already offer these combinations.

This all sounds complicated. What is the easiest approach? Find a dedicated shop selling microscopes and contact them. Write them an email and be honest about the needs. Tell them that you need a scope for your kids and also tell them if it should be a compound or stereo microscope. A serious dealer will know the requirements and will not sell you an inappropriate device. Serious dealers are interested in long term customer relationships and not in quick money. ■



What's this? Answer on page 3.