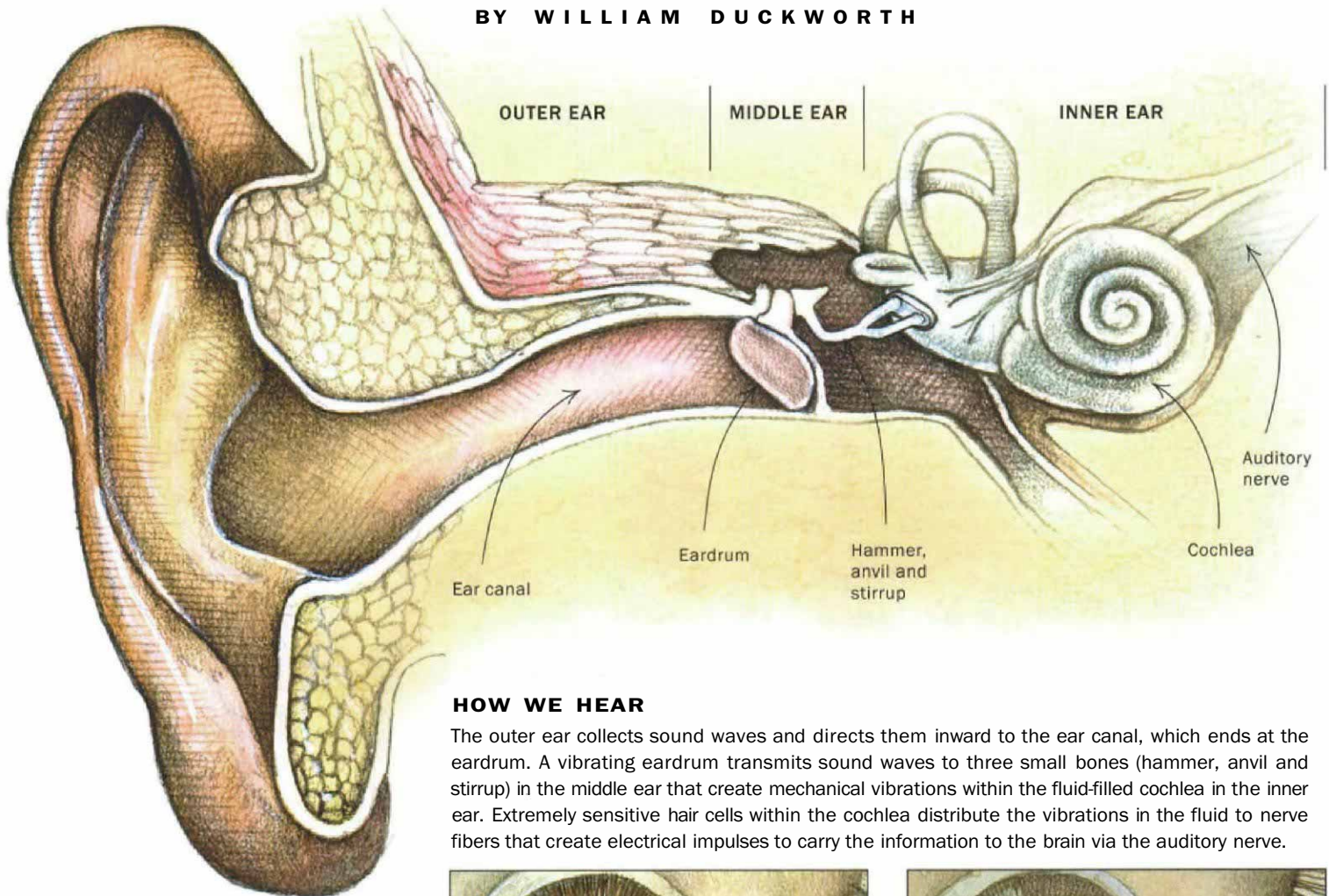


# Protect Your Hearing in the Shop

Choose ear protection that's comfortable, and learn how to use it correctly

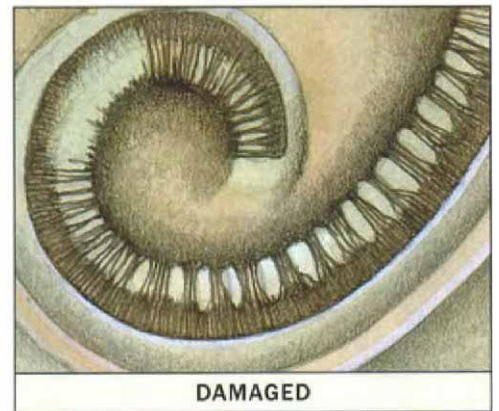
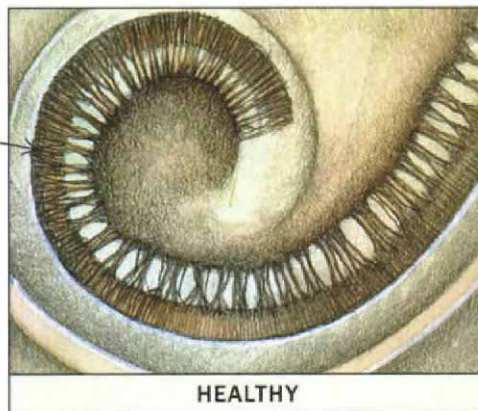
BY WILLIAM DUCKWORTH



## HOW WE HEAR

The outer ear collects sound waves and directs them inward to the ear canal, which ends at the eardrum. A vibrating eardrum transmits sound waves to three small bones (hammer, anvil and stirrup) in the middle ear that create mechanical vibrations within the fluid-filled cochlea in the inner ear. Extremely sensitive hair cells within the cochlea distribute the vibrations in the fluid to nerve fibers that create electrical impulses to carry the information to the brain via the auditory nerve.

The inside of a normal, healthy cochlea contains thousands of cilia and hair cells that transmit sound vibrations. Noise damage causes hair cells to die, resulting in hearing loss.



For nearly 20 years I was exposed to the often painfully loud whines of tablesaws and routers, banging hammers, whirring planers and the assorted din you hear daily in a small cabinet shop. Did I wear hearing protection? Well, some of the time, but more often than not, no. I'd characterize those habits more as careless than as cavalier. I had two sets of earmuffs—one good pair for an employee and one fairly cheap set that I'd use on occasion. What I didn't like about those earmuffs was that they just weren't comfortable. The cushion quickly lost its spring and softness, affecting the seal; the plastic covering around the cushion was scratchy and hot, and it stuck to sweaty skin on warm days.

After speaking with a number of people in the hearing conservation industry, from makers of protection devices to hearing-aid suppliers, it turns out that my experience was not uncommon. The biggest challenge many makers of hearing protectors face is making devices comfortable enough that people will actually use them. Another thing I learned is that the science behind the effort to provide good hearing protection can be quite complicated. But like most other fields of study, you don't have to understand all the science to benefit from its hard-won results. With that said, it may help to put some of that science into perspective.

### Hearing loss—what is it, and what causes it?

The onslaught of damaged hearing can result from medical problems, including illnesses. But the most common cause of damage is being too close to too much loud noise for too long. How much is too much? Average daily noise levels of 80 decibels and lower pose no threat of hearing damage. Noise levels of 90 decibels and higher can be hazardous, and several machines in a woodshop exceed those levels (see the graphic at right). The duration of exposure has as much to do with it as the decibel level. Noise-induced damage is cumulatively degenerative and mostly irreversible.

Our outer ears collect sound (see the drawing on the facing page), directing it down the ear canal to the eardrum. Fluid in the inner ear conducts sound vibrations to the cochlea. The cochlea is to hearing what the retina is to seeing: Within each cochlea are approximately 35,000 tiny microscopic hairs, or cilia, that bend to the movements of fluid motions caused by the sound vibrations. The cilia connect to hair cells that set off nerve impulses that move through the auditory nerve to an area of the brain where the electrical messages translate into sounds the brain can recognize.

It is those cilia and hair cells that become the victims of noise-induced hearing loss. Repeated loud blasts of sound (air guns and hammer blows) or extended high-pitched whines (routers and belt sanders) can simply obliterate them or wear them out. And when those hair cells are destroyed and disappear, they don't grow back.

### Noise-reduction ratings are the standard of measure

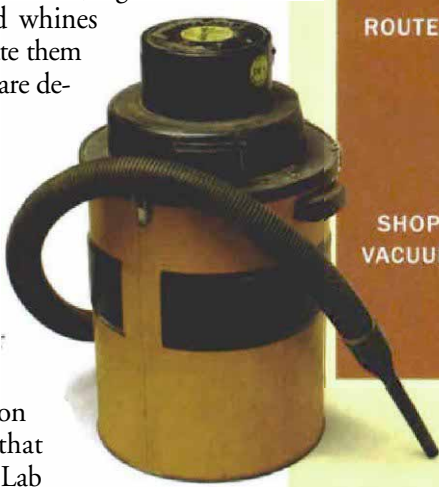
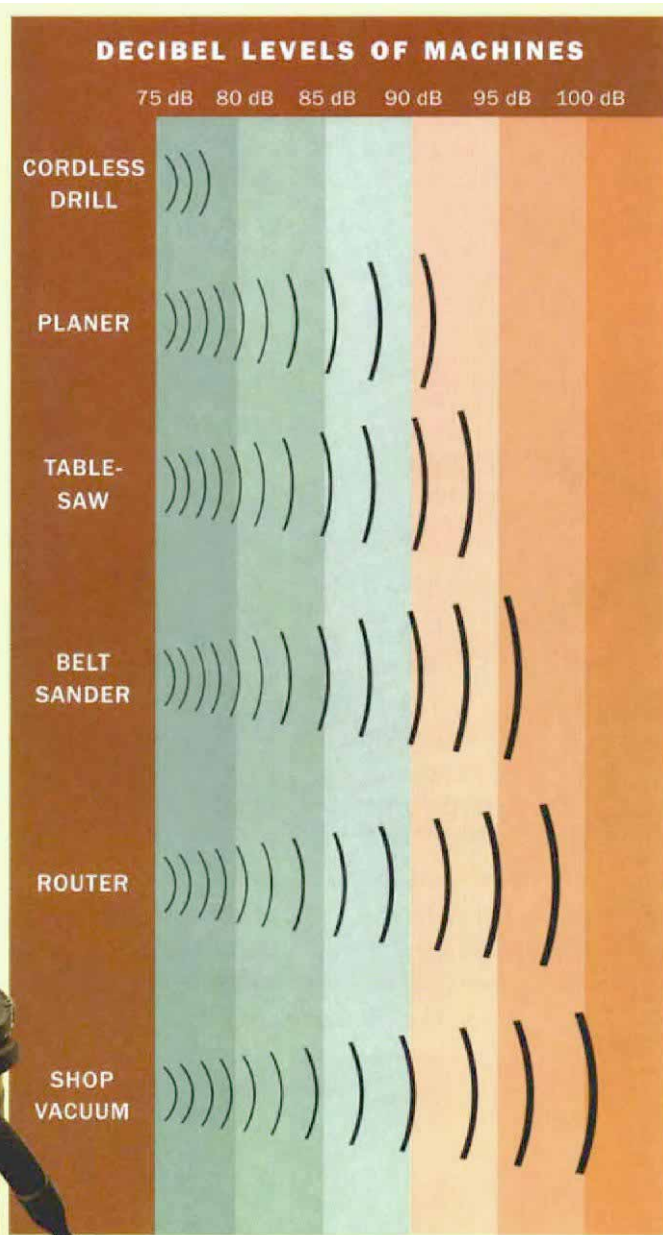
Look at any package of earmuffs or disposable plugs, and you'll find a government-mandated noise-reduction rating (NRR), which is an ideal laboratory measure. The NRR figure (usually in the teens or 20s) represents in decibels how much noise—on average across a spectrum of frequencies—that particular device will attenuate, or reduce. Lab



## Shop noise: How loud is it?

We set up a sound meter in the *Fine Woodworking* shop and took readings on machines and power tools running under load. We placed the meter on a tripod at ear level off the floor and placed it at a distance from the machines that would approxi-

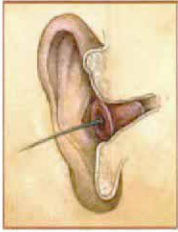
mate an operator's position. Listed below are the decibel levels of the equipment we tested. Prolonged exposure to noises louder than 90 decibels poses the greatest threat.



**Not a surprise for many.** The loudest machine in the shop is the vacuum.



## PLUGS

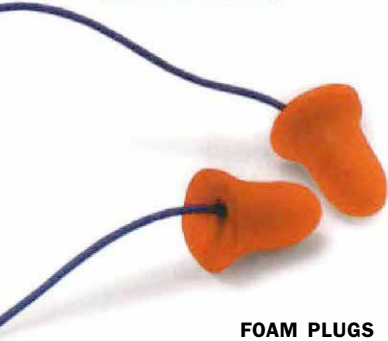


### DISPOSABLE FOAM PLUGS

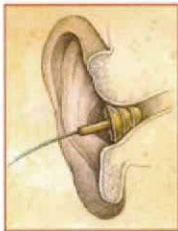
Learning to fit disposable foam plugs requires an education. Inserted properly, foam plugs offer considerable protection.



*Depress the foam first between your fingers, then pull up and back on the ear to insert the plug.*

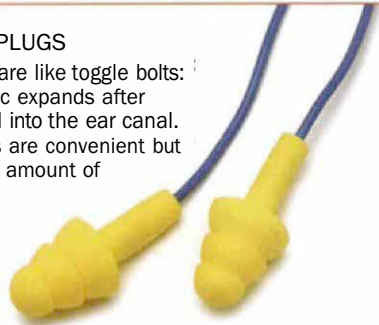


FOAM PLUGS



### REUSABLE PLUGS

Barbed plugs are like toggle bolts: The soft plastic expands after being inserted into the ear canal. Hearing bands are convenient but offer the least amount of protection.



BARBED PLUGS



HEARING BANDS

technicians arrive at the figure by averaging the effects on at least 10 different people fitted with that device in a lab. Higher numbers signify greater effectiveness. However, in the real world these ratings don't mean a whole lot

In the real world, people don't always fit themselves with a hearing-protection device correctly, as is often the case with plugs. One manufacturer I spoke with makes foam earplugs with an NRR of 29 decibels and a set of muffs with an NRR of 22 decibels. So I asked the scientist in the research and development lab whether I could then conclude that the foam plugs offered considerably better protection. The answer was a resounding no; as a matter of fact, the opposite is true. Earmuffs are relatively idiot-proof: You put them over your ears, and the spring action holds them firmly in place. Generic-sized foam plugs don't fit all ears the same, and many people simply don't know how to install them properly. So in the real world, the muffs usually offer better protection despite their lower rating.

And in the real world, people don't always use the device when they're exposed to noise. Is one quick cut on the table saw always worth a walk across the room to pick up that set of muffs you left on the workbench? One manufacturer suggested that for a more accurate and realistic assessment of how well a hearing-protection device will reduce sound within a workplace, you could roughly divide its NRR figure in half.

### There are many types of gear on the market

Among the three or four major manufacturers, woodworkers have never been offered more choices than they have now. The two major categories of products offered—muffs and plugs—can be broken down into several subsets of hearing-protection devices (for a list of sources, please visit [finewoodworking.com](http://finewoodworking.com)).

**Disposable foam plugs**—These things are surprisingly effective—as long as you learn how to fit yourself with them properly—and for about 20 cents a pair, you can't beat the price. We found one brand (Howard Leight Industries) with an NRR of 33 decibels. To fit them, it's important to insert them fully into the ear canal; otherwise, they won't offer much protection. Depress the foam by rolling it between your fingers. Pull back and up on your outer ear with one hand (which gives you better access to the ear canal) while inserting them with the other. As the foam begins to expand

## CUSTOM-MADE EARPLUGS

In the price range of \$65 to \$80, custom-fitted plugs are the most expensive alternative for plug-type protection. You can get plugs made with a filtered air channel (that facilitates conversation while wearing them) that offer protection with an NRR of 25 decibels to 29 decibels. Custom plugs without the air channel are rated as high as 37 decibels. You

know these plugs will fit perfectly because they are made from an actual mold of each of your ears. To have a set made, look in your local yellow pages for a certified hearing specialist or a hearing-aid supplier.



CUSTOM PLUGS



*Custom-fitted plugs offer the best for the most. For people who already have damaged hearing or who simply want first-rate protection and don't mind paying for it, custom plugs can be the answer. Here, silicone is injected into the ear to make a mold.*

it sounds as though you've got an ear full of soda water for a few minutes until the foam fully regains its shape.

Foam plugs come with or without cords that hold a pair together. With the cord you're less likely to plop down the plugs on a workbench covered with sawdust.

**Reusable plugs and hearing bands**—Reusable plugs are made of soft plastic rather than foam. They're tapered and have successively larger barbed rings of the flexible plastic, which block off the ear canal. A hearing band is worn under the chin instead of over the head. The spring action of the plastic band holds two foam pads in place. But the pads cover only the outside of the ear canal, so they offer the least amount of protection of all of the devices I examined.

It actually hurt to wear the reusable plugs. The hearing band was just the opposite—comfortable and convenient. The NRR for the hearing band is low (20, 21 decibels), so it wouldn't be my first choice for protection from really loud noises. But when you're putting on hearing protection and taking it off repeatedly, there is something to be said for the convenience of leaving the band hanging around your neck. Also, you can wear the band and a set of safety glasses or goggles at the same time without compromising the hearing protection you are getting.

**Muffs**—Among the various brands of muffs, you'll find a wide range of choices regarding cost and comfort. Surprise—the more expensive ones (\$20 or more) are the most comfortable, but even the lower priced versions (less than \$10) are fairly cozy until they get too old and worn out. NRRs of muffs vary from as low as 15 decibels to as high as 33 decibels.

The one big downside with muffs is that you can't wear them with safety glasses without sacrificing their effectiveness, because the stem of the glasses breaks the seal of the foam surrounding the ears. They also don't work well with full-face masks. You can wear them with a set of goggles held in place with an elastic band, but many people don't like wearing goggles because they tend to fog up, obscuring good vision.

More than one industry source suggests a solution for people who have to face extended exposure to extremely loud environments or people who already have hearing damage and can't risk exacerbating it. Wearing both the foam plugs and earmuffs at the same time increases the level of hearing protection by about 6 decibels. □

*William Duckworth, associate editor, is a lucky man. A hearing specialist recently tested him and said that despite all that time spent in the shop he has "unbelievably good hearing."*

## MUFFS

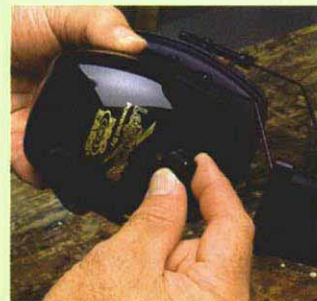
*Muffs are the benchmark of the industry. Regular earmuffs range in cost from about \$8 to \$25, and have an NRR of 15 decibels to 33 decibels.*



### UNUSUAL MUFFS FOR THE MONEY

**Here are two special exceptions to your standard foam-filled earmuffs. Lightning Powered by Pro-Ears, made by Howard Leight Industries (800-327-1110), are marketed primarily to gun users, who need protection from the loud impulse noise of shots being fired. Battery-powered electronics, small built-in microphones and independent volume controls for each ear allow the person wearing these earmuffs to monitor conversations while loud noises are electronically compressed to safe levels. Wearing these muffs, you can still hear what goes on around you, but the noises don't hurt. At sporting-goods stores these muffs sell for about \$250.**

**The Peltor Lite-Com, made by Aearo (800-225-9038), is a wireless headset with a five-channel FM radio that has a communication range of more than 1,000 ft. The muffs connect to a transmitter/receiver, which is equipped with a belt clip. These muffs would work in a busy commercial or industrial shop, where workers face an all-day din. They might also work for the well-to-do home hobbyist who wants to keep in touch with a spouse in another part of the house. These units sell for about \$300, and they are designed for extended wear.**



**Adjusting the volume.** The small foam pad on the bottom of the Lightning Pro-Ears muff is a microphone. The volume control adjusts the noise level.



**Keep in touch in a busy shop.** The Peltor Lite-Com headset, designed for daylong wear in noisy environments, makes it possible to communicate with others by way of a built-in radio.