A little background/ homework before the DIY bio-filter building class at the February meeting:

Types of filtering:

1. **Mechanical filtering** - separating out the particles of dirt, fish waste, leaves, etc. from the water.
2. **Biological filtering** - using beneficial bacteria to naturally process fish poop/ ammonia into less toxic nitrite then finally nitrates, which are fertilizer for algae and other aquatic plants.
3. **Chemical filtration** - using activated carbon or other materials to remove various chemicals from the water such as ammonia, chlorine, pesticides, etc.

All these methods of filtration can be used to help clean the water for the benefit of the fish and other creatures living in your ponds.

Biological filtration is a natural process that uses 2 varieties of bacteria found in pond water to break down ammonia/fish waste into nitrite (still toxic to fish) then to nitrate (bad for fish at higher levels). The nitrate must be removed from the pond by one of two ways; either diluting it out with water changes or adding algae or other plants to that use up the nitrate as they grow.

The process of biological filtration naturally occurs on all surfaces in the pond. The reason for adding an external biological filter system is to increase the surface area for the bacteria to multiply on and allow for the processing the large amounts of fish waste generated by backyard ponds. The biological filter is just an efficient home for bacteria to multiply in and consume/process fish waste. The bacteria grow/ multiply on artificial 'media' that is designed to provide massive amounts of surface area within the filter.

Types of biological filters:

1. **Pressurized**
2. **Gravity up flow**
3. **Gravity down flow/ trickle tower**

The pressurized filter uses a closed vessel to contain the filter media and usually have a reverse flow function to clean them. This feature keeps the operator cleaner during cleanouts. This design tends to be left to the professionally built systems due to engineering constraints and cost.

The gravity up flow can be an open vessel that uses media that is fully submerged in water at all times. This keeps the media wet and alive longer during power failures. This is a common do it yourself type filter, but it can be harder to clean.

The down flow trickle tower can use an open vessel and usually rains the water over the media keeping them wet but not submerged. This can help to add more oxygen to the system, increasing efficiency. This is another do it yourself friendly design with many good variations that can be adopted.

Media:

The part all three of these filter types have in common is they use a media to grow the beneficial bacteria on. The more surface area that is provided by the filter media, the more bacteria can grow and greater volumes of water can be processed. Some examples of cheaper media are gravel, lava rock and sand. These materials are cheap and easy to find but are a nightmare to clean once dirty. You can buy designer media made of space age plastics or ceramics but they can cost $100 per cubic foot. The middle ground for the do it yourself filter is some sort of sponge/ kitchen scrubber.

Whats left:

Once you have your biological filter installed it will need 3-4 weeks to fully colonize with the beneficial bacteria. The bacteria can be purchased in bottle form or by simply getting some pond water from a trusted source. During the grow in phase you'll need to feed the fish a little to generate some fish poop for the process to start but not so much to make to pond toxic like a port o potty.

Depending on the pond you'll need to clean the filter between 1 to 10 or more times a year. It would be ideal to oversize the filter to minimize the number of cleanings to avoid depleting the system of the necessary bacteria that occurs when cleaning out the other biological residues. It is also recommended to have some form of mechanical filtration before the biological filter to prevent larger debris from plugging up the media. Now that you have a working biological filter don't forget to add some plants to your pond or you'll end up with an algae farm.