

H2GROW

content packet



# AQUATIC SYSTEMS



## key terms

- recirculation
- non-recirculating
- aquatic species
- environmental controls  
(water and air temperature,  
light, airflow)



## background information

Walking into any pet shop, we can witness aquaculture in many varieties. We will likely see aquariums full of fish from all regions of the world, cool aquatic plants, and sometimes varieties of shrimp, eels, sharks, and more! Likely we will notice some of these organisms are in fresh water and some in salt water. Looking closer at the aquariums, we will notice a thermometer that tells the water temperature and some sort of filter that is pumping water through it to clean and renew the tank. All of these things we observed are aquaculture! The “culture” (growth) of “aqua”tic (water) species. Being able to maintain an environment like an aquarium requires an understanding of the water used in the aquarium and the requirements of the aquatic species being kept in the tank.



## additional information

- <ftp://ftp.fao.org/fi/document/aquaculture/culturedspecies/index.htm>
- [http://aquaculture.ext.wvu.edu/farming\\_fish/growing\\_fish](http://aquaculture.ext.wvu.edu/farming_fish/growing_fish)
- <https://srac.tamu.edu/>
- <http://www.fao.org/aquaculture/en/>
- <https://www.nal.usda.gov/afsic/aquaculture>



# BIO- FILTRATION



## key terms

- bacteria
- nitrogen cycle/nitrification
- surface area
- media
- water flow
- filter maintenance



## background information

Every drop of water that we have consumed during our entire life has likely gone through a biofiltration process. “Biofiltration” refers to living “bio” organisms “filter”ing, or cleaning, water. Some biofiltration processes are natural and occur in areas like wetlands and some are engineered by man, like a wastewater treatment plant. When water goes down the drain, it moves through a world of underground pipes until it reaches a wastewater treatment plant. The goal of a wastewater treatment plant is to clean the water in an environmentally-friendly way and return the water back to the environment and into the water cycle. Wetlands and wastewater treatment plants work very similarly to a biofilter in a fish tank or hydroponic system. By using microscopic bacteria, unwanted waste products are turned into valuable nutrients that can be used by other organisms reliant on the water. The biofiltration process is designed to take unclean water and make it useable over and over and over again.



## additional information

- <https://srac.tamu.edu/>
- <http://www.biofilter.com/library.html>
- <http://bit.ly/2g4yuyZ>
- <http://fisheries.tamu.edu/files/2013/09/SRAC-Publication-No.-4502-How-to-Start-a-Biofilter.pdf>



# HEALTH + DISEASE



## background information

When we come down with a cold or aren't feeling well, we typically investigate to find out what might be lurking in our bodies and making us feel sick. We work quickly to get the illness under control and generally feel better in a short period of time. The same thing can happen to plants and other animals – they can become sick too. However, remedying their disease and reversing its affects are not always quite as easy. Being able to identify symptoms of disease early and provide a remedy is the key to the plant or animal surviving and continuing to thrive.

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## PLANT HEALTH AND DISEASE



### key terms

- disease
- symptom
- deficiency
- pathogen
- host
- environmental condition



### additional information

- <http://www.apsnet.org/edcenter/instcomm/TeachingArticles/Pages/DiseaseTriangle.aspx>
- <http://www.fao.org/3/a-i4021e/i4021e06.pdf>
- <http://www.fao.org/3/e46b3cd1-2bd1-4b90-9bea-af856a75bb03/i4021e.pdf>

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## AQUATIC ANIMAL HEALTH AND DISEASE



### key terms

- infectious disease
- symptom
- abiotic disease
- pathogen
- treatment



### additional information

- <http://www.fao.org/3/e46b3cd1-2bd1-4b90-9bea-af856a75bb03/i4021e.pdf>
- <http://tal.ifas.ufl.edu/publications.htm>



# NUTRIENTS + NUTRITION



## background information

One of the first things we do on a daily basis is eat. Our body signals to us that we need food to fuel the activities we are going to do the rest of the day. Plants and other animals work the same way—they need food to fuel the activities they are to complete that day. This is interesting because we do not see too many plants eating their food. However, if you recall the process of photosynthesis, they do not need to eat food because they make it inside of them. Even though plants can photosynthesize, they still need to take in nutrients. We often refer to these nutrients as fertilizer. We do see animals eat every day. Think of someone who has a pet, one of the daily chores of keeping a pet is to feed it. This is so that pet takes in the nutrients so it can function, grow, and even reproduce as intended. Without proper nutrition, plants nor animals can function properly.

## PLANT NUTRIENTS



### key terms

- micro-nutrients
- macro-nutrients
- nitrogen
- phosphorous
- potassium
- limiting nutrients
- fertilizer



## additional information

- [http://edis.ifas.ufl.edu/topic\\_aquaculture](http://edis.ifas.ufl.edu/topic_aquaculture)
- <http://ag.arizona.edu/hydroponictomatoes/nutritio.htm>
- <http://www.fao.org/3/a-i4021e/i4021e06.pdf>
- <http://www.fao.org/3/e46b3cd1-2bd1-4b90-9bea-af856a75bb03/i4021e.pdf>

## AQUATIC ANIMAL NUTRIENTS



### key terms

- limiting nutrients
- micro-nutrients
- macro-nutrients
- water
- carbohydrates
- protein
- lipids/fats
- vitamins
- minerals



## additional information

- [http://edis.ifas.ufl.edu/topic\\_aquaculture](http://edis.ifas.ufl.edu/topic_aquaculture)
- [www.elmavets.com/refId,54632/refDownload.pml](http://www.elmavets.com/refId,54632/refDownload.pml)
- <http://tal.ifas.ufl.edu/publications.htm>
- <http://www.fao.org/3/e46b3cd1-2bd1-4b90-9bea-af856a75bb03/i4021e.pdf>



# PLANT + WATER SYSTEMS



## key terms

- static solution
- continuous flow
- ebb and flow
- aeroponics
- nutrient film technique (N.F.T.)
- water tolerable plant species
- growing mediums
- environmental controls  
(water and air temperature, light, airflow)



## background information

Looking out the window, we can observe a variety of plants growing on Earth's surface. Whether those plants were put there naturally or if they are being cultivated by humans, the environment in which they live is affecting its growth. We know that we do not see all of the plant, because the roots are buried within the soil to help anchor the plant and gather nutrients. But is it possible to grow plants without soil? Yes, it's called hydroponics.



## additional information

- <https://www.nal.usda.gov/afsic/hydroponics>
- <http://www.fullbloomhydroponics.net/hydroponic-systems-101/>
- <http://aggie-horticulture.tamu.edu/greenhouse/hydroponics/index.html>
- <http://www.gardening.cornell.edu/factsheets/growflow/review.html>



# WATER QUALITY



## key terms

- pH
- temperature
- nitrogenous compounds—ammonia
- nitrite
- nitrate
- dissolved oxygen
- monitoring tools/tests
- nutrient solutions
- tolerable range for plants and aquatic animals



## background information

Up to 60% of an adult human body is water (by weight). For us to function on a daily basis, we need to replenish our bodies with quality water that does not contain toxins or chemicals that may harm the cells in our body and make them not function properly. The same is true for plants and other animals. When we turn on our faucet and get drinking water, it has been tested and monitored by people who work for our local governments. When we decide to raise aquatic animals or plants, we need to be the person testing and monitoring the water we give them. The key to these organisms living and reproducing lies in proper water quality.



## additional information

- <http://wegrowhydro.com/water-supply/>
- <http://www.fao.org/3/e46b3cd1-2bd1-4b90-9bea-af856a75bb03/i4021e.pdf>
- <http://ag.arizona.edu/hydroponictomatoes/nutritio.htm>
- <http://www.fao.org/3/a-i4021e/i4021e06.pdf>
- <http://www.state.ky.us/nrepc/water/wcparint.htm>

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