

# Biology

## SCI102

### Module 4

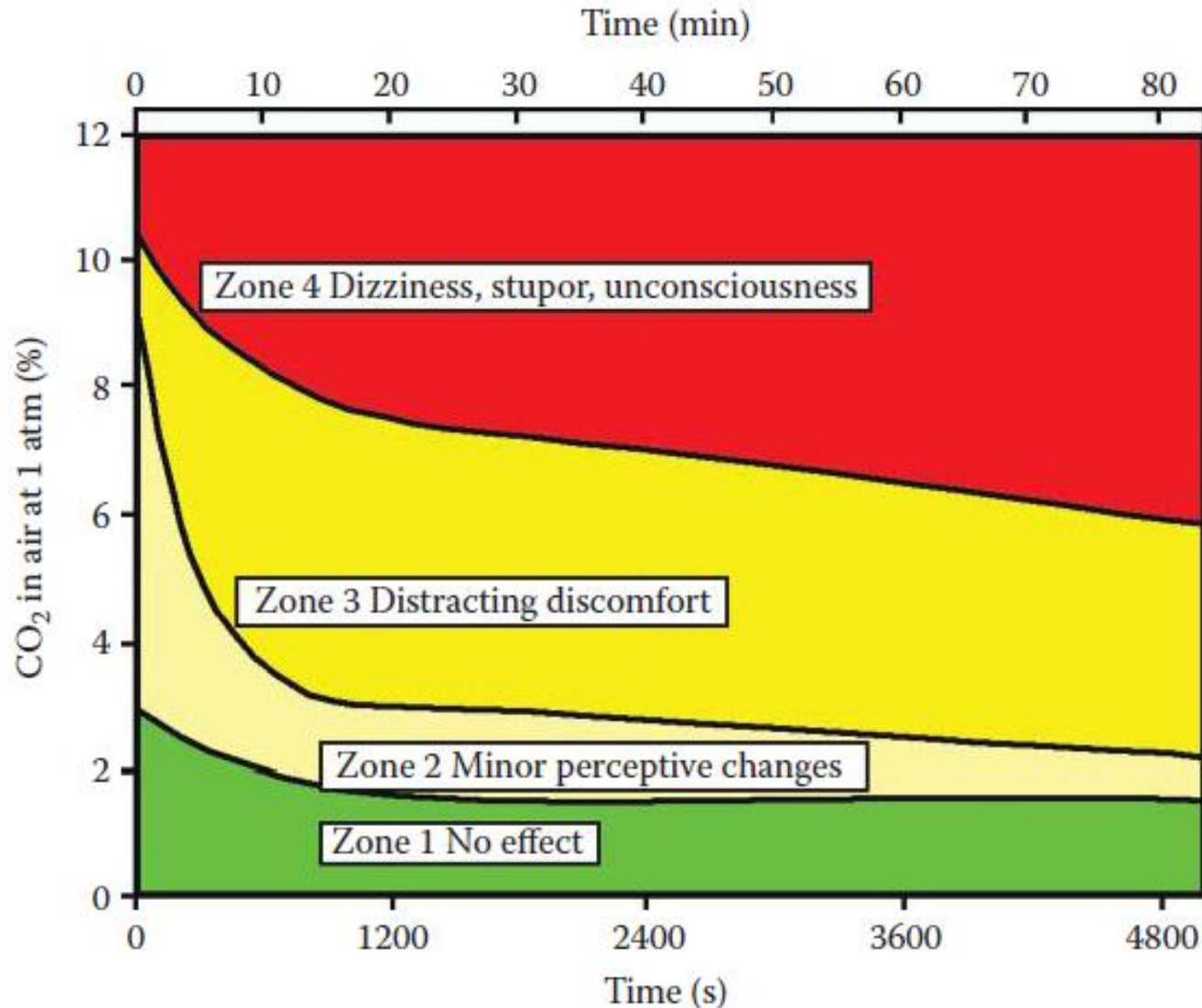
Biological responses in context  
Effect of Toxic Substances or Waste Products

# Effect of Toxic Substances

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- Biological units become ill in the presence of wastes
- Wastes are produced from metabolic processes
- Aerobic Respiration produces CO<sub>2</sub> and H<sub>2</sub>O as by-products

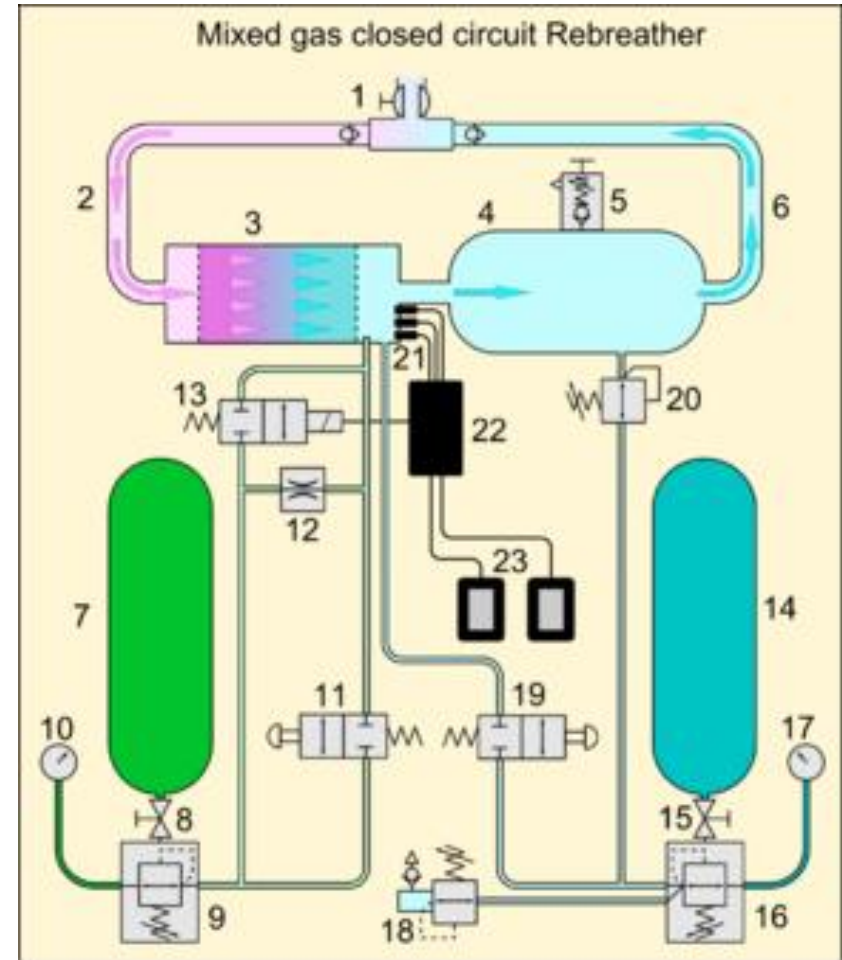
# CO<sub>2</sub> as a Waste Material



# Closed Loop Re-breathing System

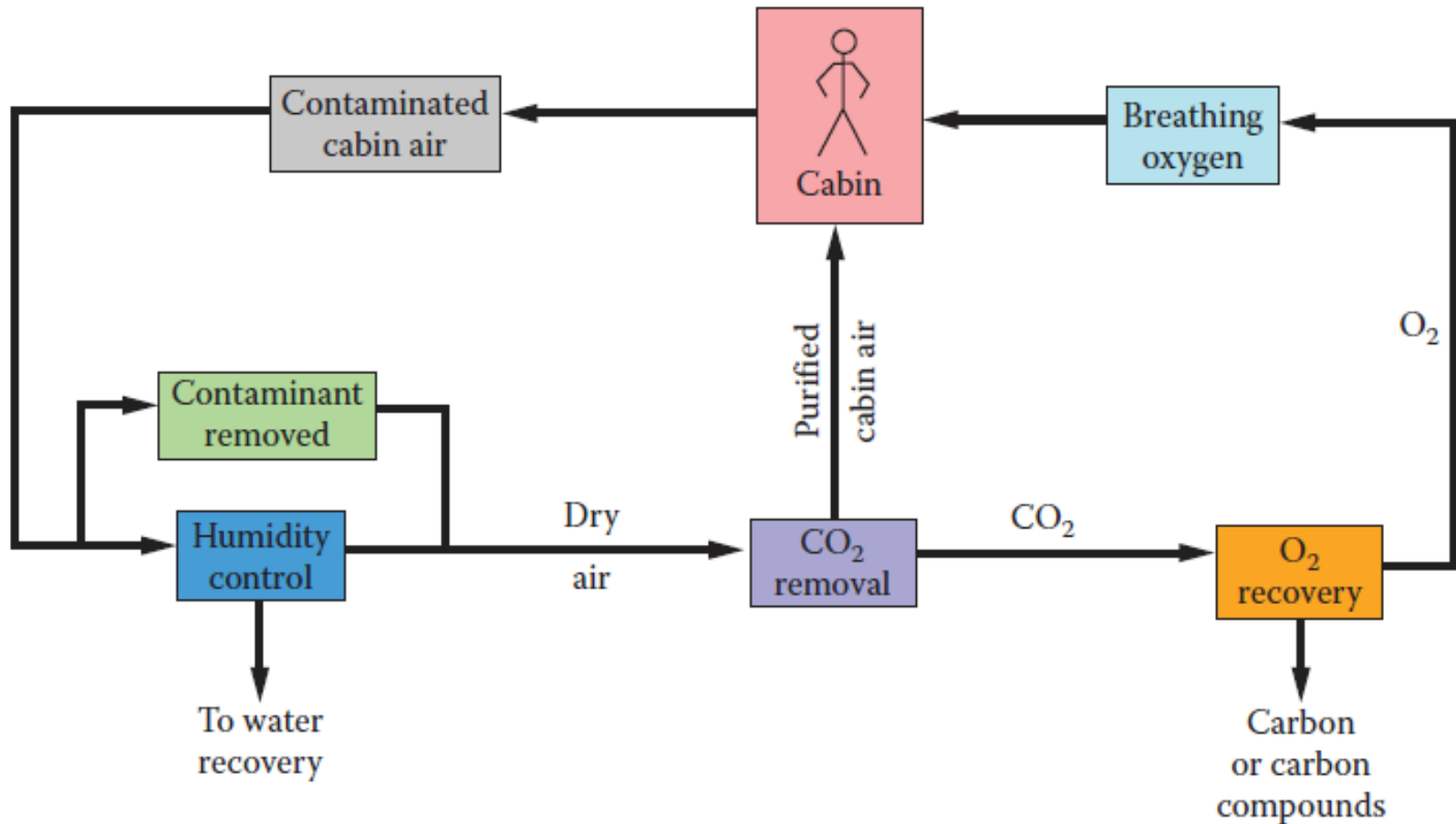


Closed loop re-breathing systems are common in space vehicles, undersea vehicles, and diving equipment



# Atmosphere Control in Space Vehicle

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# Can Water be Toxic???

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- The high atmospheric concentrations of water vapor encourage the growth of undesirable or dangerous microorganisms on surfaces where condensation occurs
- Excess water vapor should also be removed from the atmosphere

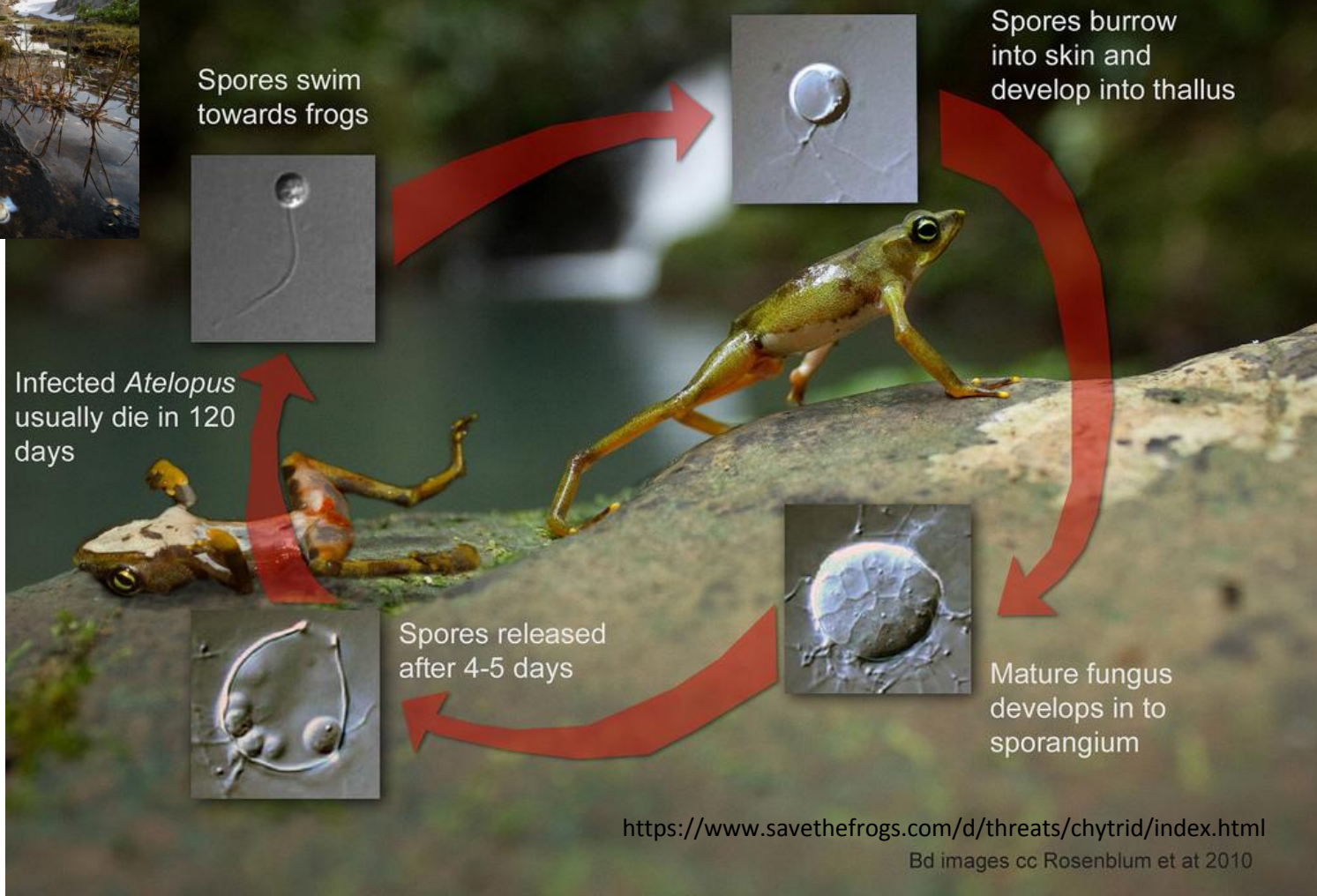




# Chytrid Fungus

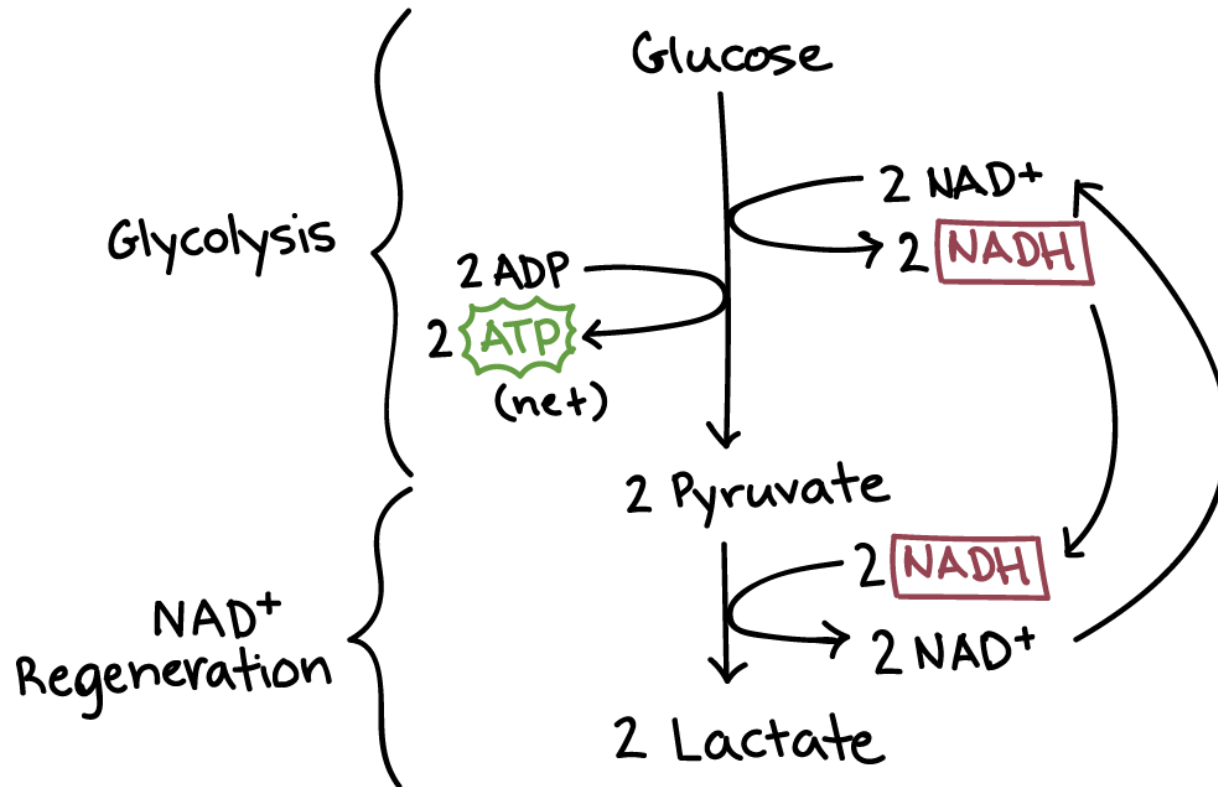


## Amphibian chytrid lifecycle



# Products of Anaerobic Respiration

- Products of anaerobic respiration, such as Lactate and Pyruvate can be toxic to animals.





# Products of Anaerobic Respiration

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- Alcohol, as a product of anaerobic yeast metabolism is toxic to the yeast at concentrations approaching 15% by volume.



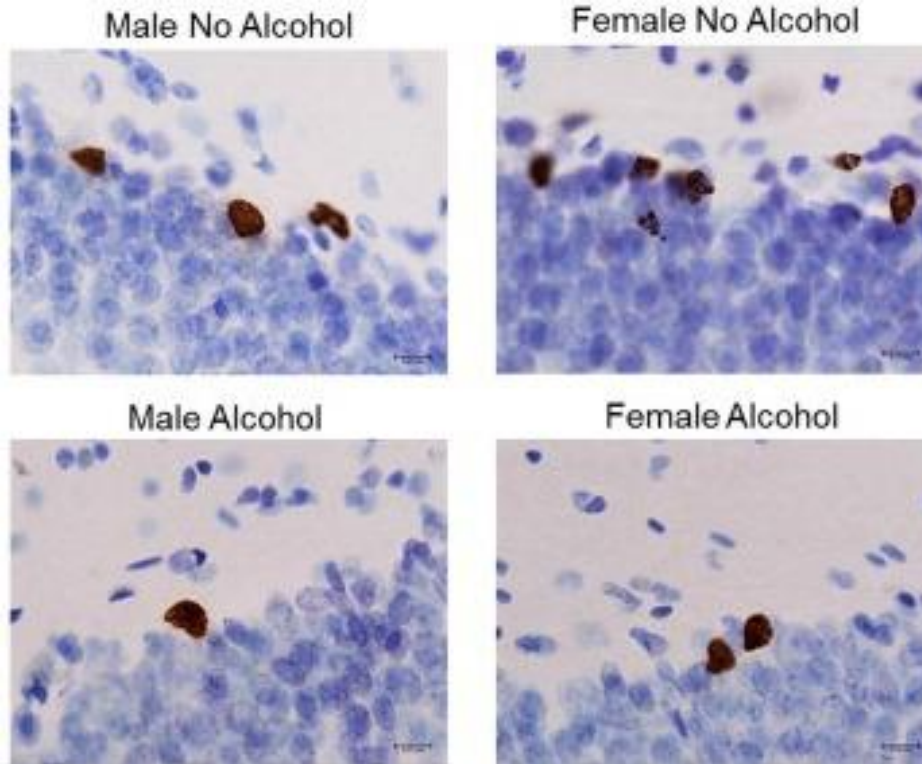
# Alcohol/Ethanol

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# Even Moderate Drinking Impairs Brain Cell Formation

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- Rats at Rutgers University were given liquid diet spiked with ethanol for two weeks
- New brain cells were marked
- Rats blood alcohol concentration was 0.08%
- Daily alcohol exposure, however, did impact the ability of the hippocampus to produce and retain new cells, reducing new brain cell production by nearly 40 percent

# Liquid Wastes

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- Liquid wastes (urine) frequently contain substances that can be toxic to the organism that produced them.
- The products of protein metabolism are nitrogen compounds that may have ill effects if not removed.
- Acids in urine can irritate skin.

# Solid Wastes

- Solid wastes contain disease-causing microorganisms.
- Infectious diseases such as cholera, dysentery, typhoid, and diarrhea were largely abolished as major causes of death in the United States when treatments to drinking water eliminated infection sources (Bell, 2010).



"U.N.: 1310 DEAD IN YEMEN CHOLERA EPIDEMIC;  
ALSO WARNS OF 300,000 INFECTIONS BY  
END OF AUGUST"

—AL JAZEERA, JUNE 2017

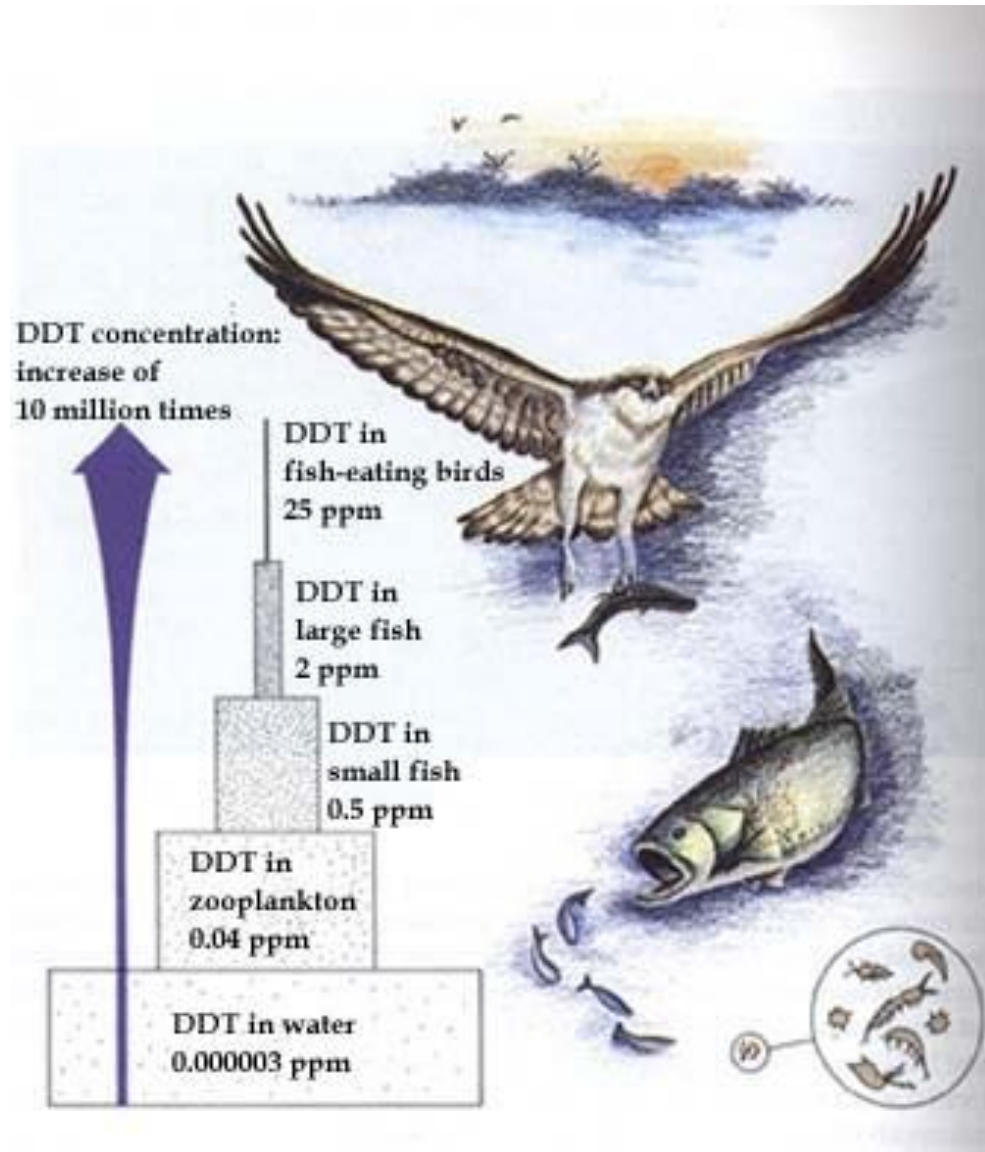


# Solid Wastes

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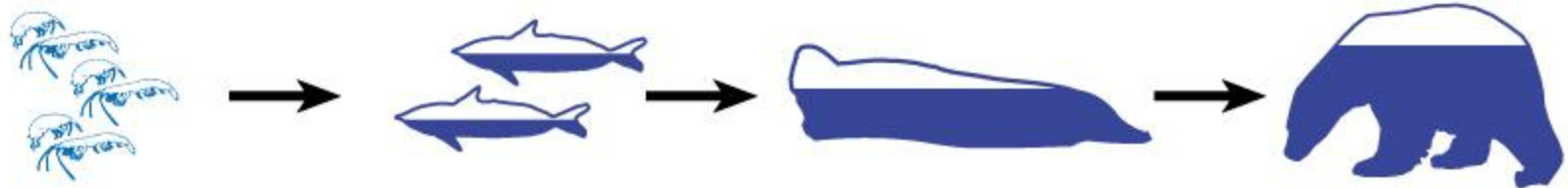
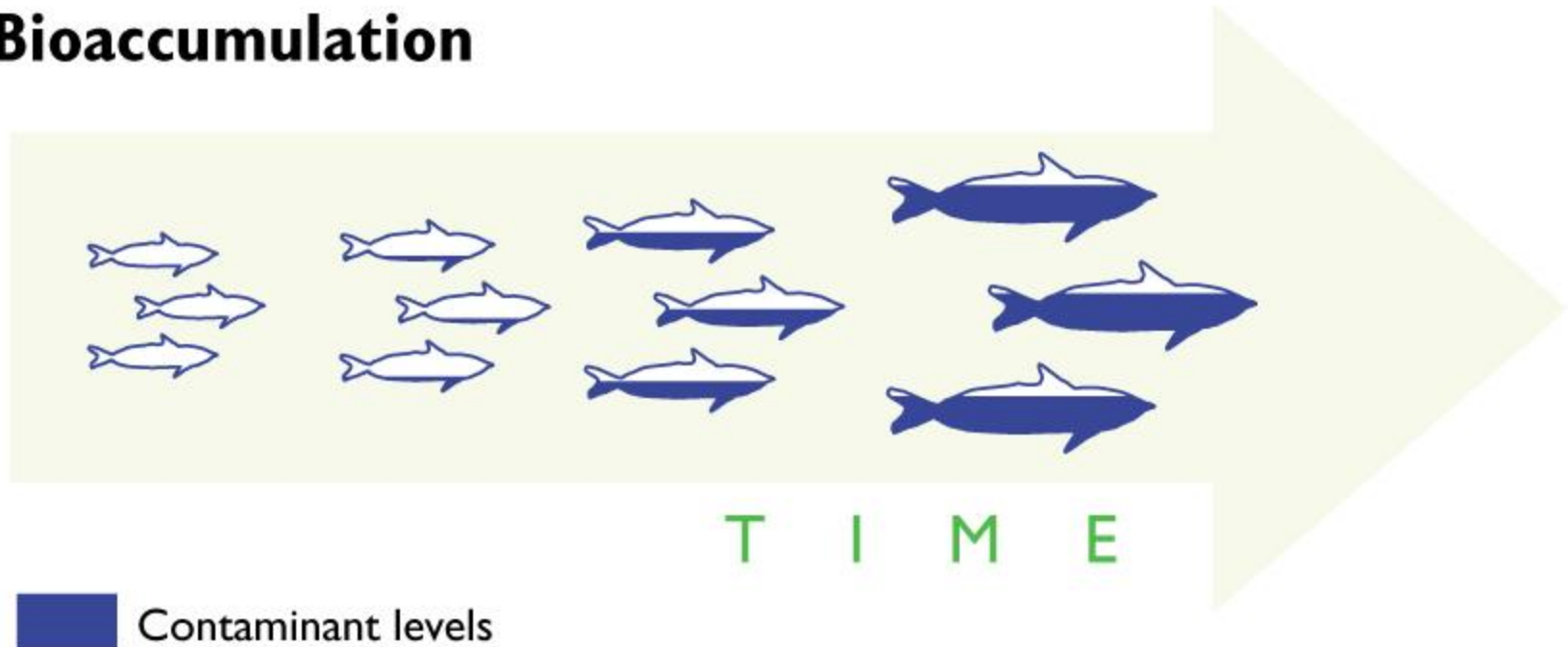
- The amount of waste produced depends on the amount of food ingested, and this, in turn, depends on body mass and activity levels.
- The biological engineer designing closed or semi-closed environments for BU must account for waste removal.
- Indeed, it is well known that sanitation is one of the leading contributors to health maintenance among the BU of all kinds and trophic levels.

# DDT (Dichlorodiphenyltrichloroethane)



# DDT – Bioaccumulation & Biomagnification

## Bioaccumulation



## Biomagnification



# DDT

DDT was thought to be safe enough that people were sprayed with it to kill pests.

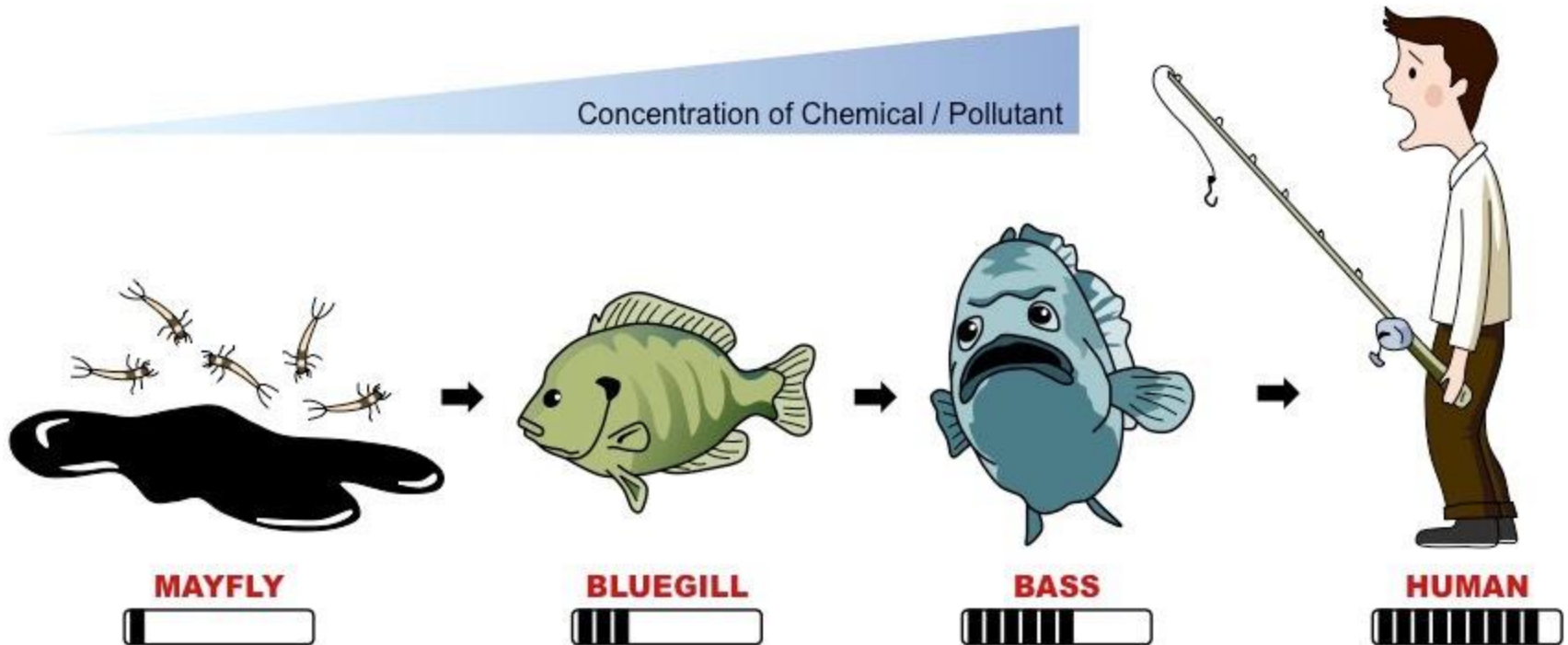


DDT weakens egg shells.



This woman has eye cancer. She lives near a DDT factory in India.

# Any Harmful Chemical





# Story of BT Cotton

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*Helicoverpa armigera*

# Story of BT Cotton

