



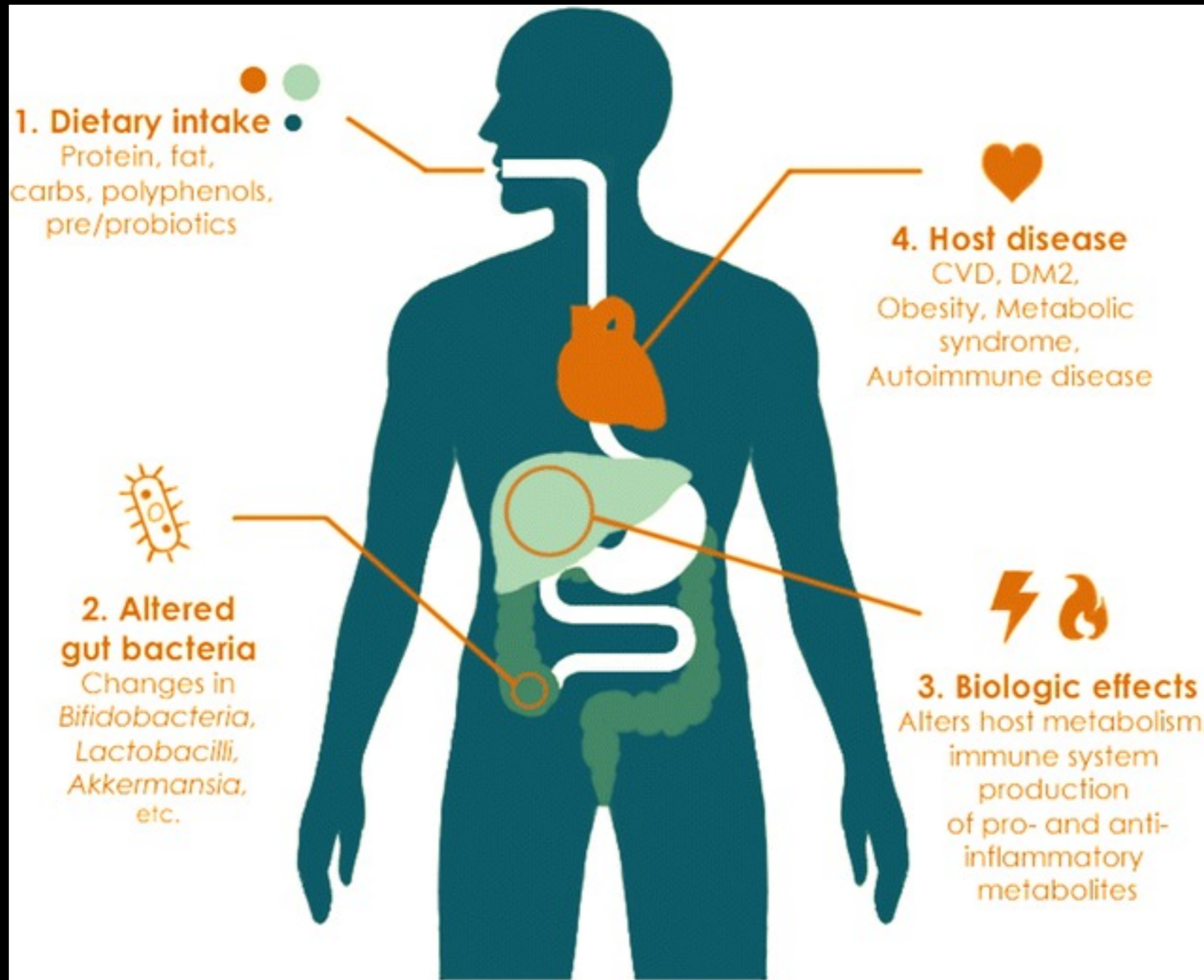
FENECAM 2018, NATAL BRAZIL
A TALK BY DR. DANIEL GRUENBERG

**TITLE: NATURAL METHODS FOR PROFITABLE
SHRIMP FARMING IN THE PRESENCE OF WSSV
AND EHP, EXPERIENCE IN ASIA AS A GUIDE**

DIET AND HEALTH: IS THERE A LINK?



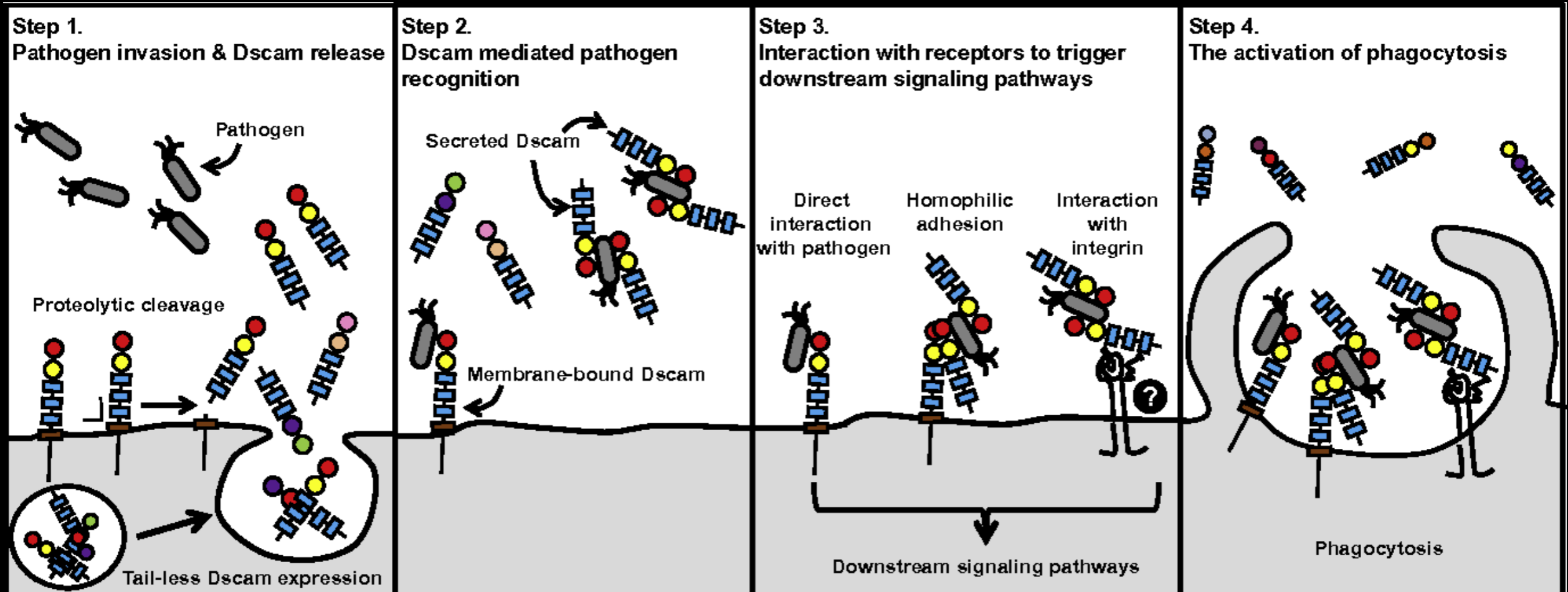
SPECIFIC HUMAN HEALTH EXAMPLES



DO SHRIMP HAVE IMMUNITY?

- Fallacies!
- Shrimp don't have immune systems
- Shrimp have only innate immunity
- Shrimp don't have immunological memory
- **ALL FALSE!**

SHRIMP IMMUNITY



Shrimp immunity is actually strikingly similar to vertebrate immunity!

WHAT DO THE EXPERTS SAY?

production

sustainable aquaculture practices

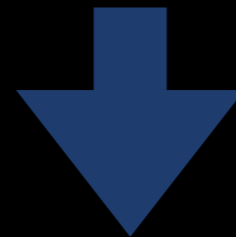


Aquaculture ponds with significant levels of diatoms are desirable for shrimp production because of the diatoms' high nutritional value, particularly for younger shrimp.



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HOWEVER...EXPERTS COULDN'T BE MORE WRONG!



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Diatoms And Silicon

The ratio of carbon:nitrogen:silicon:phosphorus in diatom cells averages 106:15:16:1. Thus, diatoms require about the same amounts of nitrogen and silicon for growth.



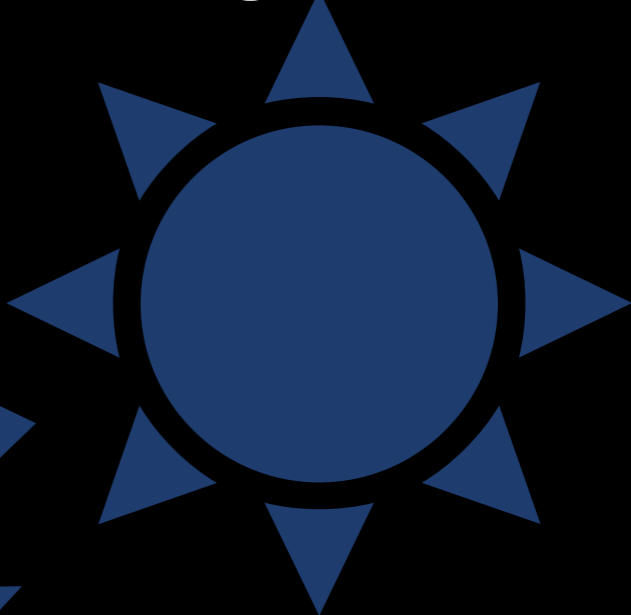
Really?



Are Redfield Ratios really indicative of environmental conditions conducive to diatom growth?

COMPETITION IN POND ENVIRONMENT

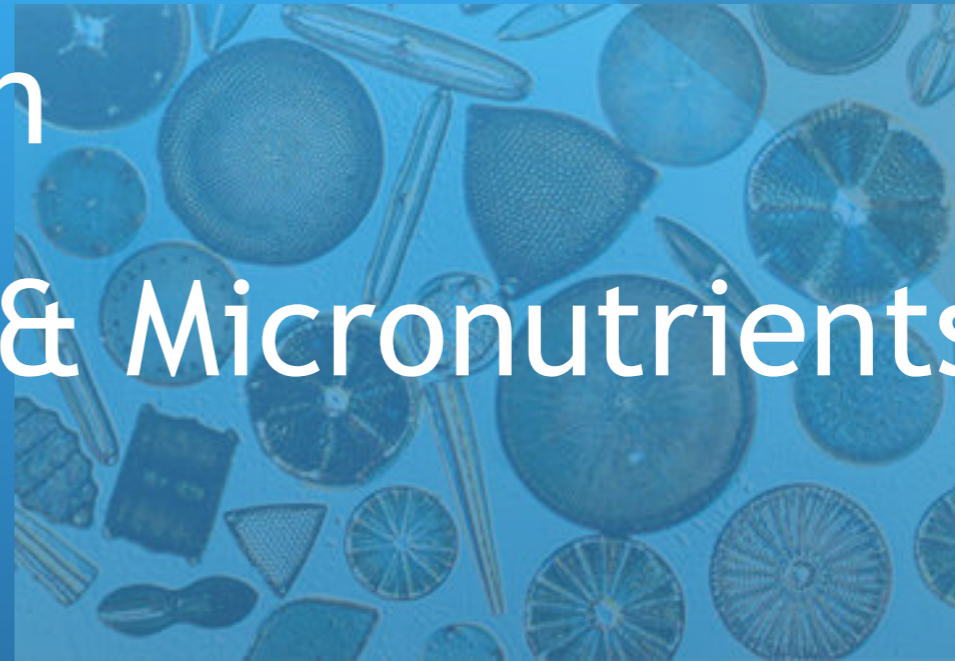
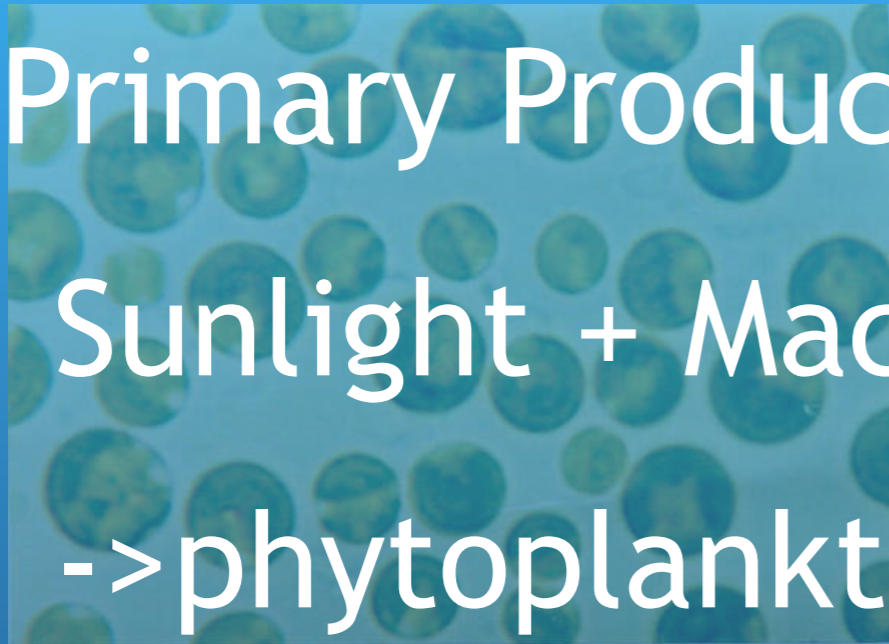
Macronutrients



Micronutrients

Simplified Pond Ecology

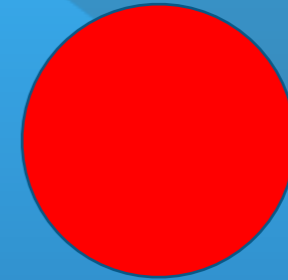
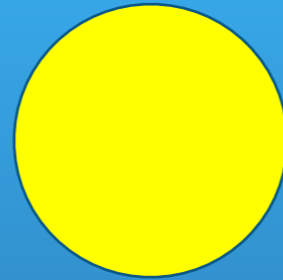
- Primary Production
- Sunlight + Macro & Micronutrients
-> phytoplankton



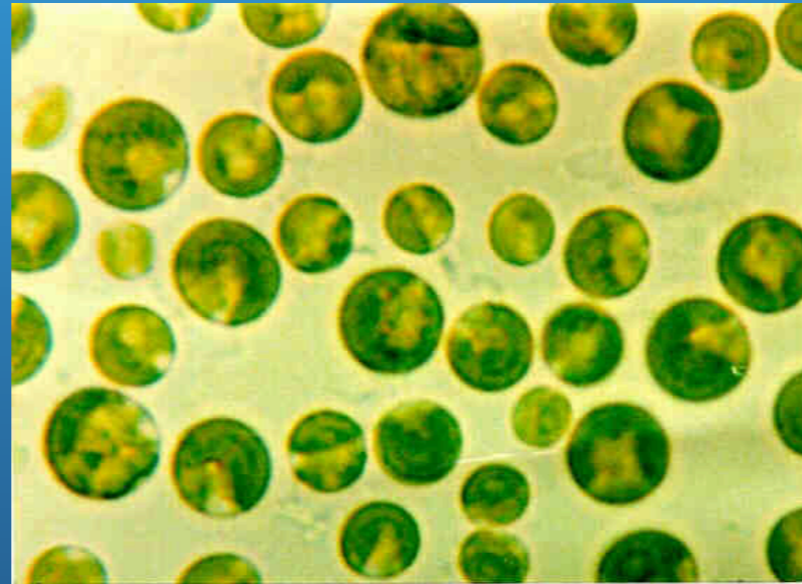
- Zooplankton consume phytoplankton
- Fish larvae consume zooplankton



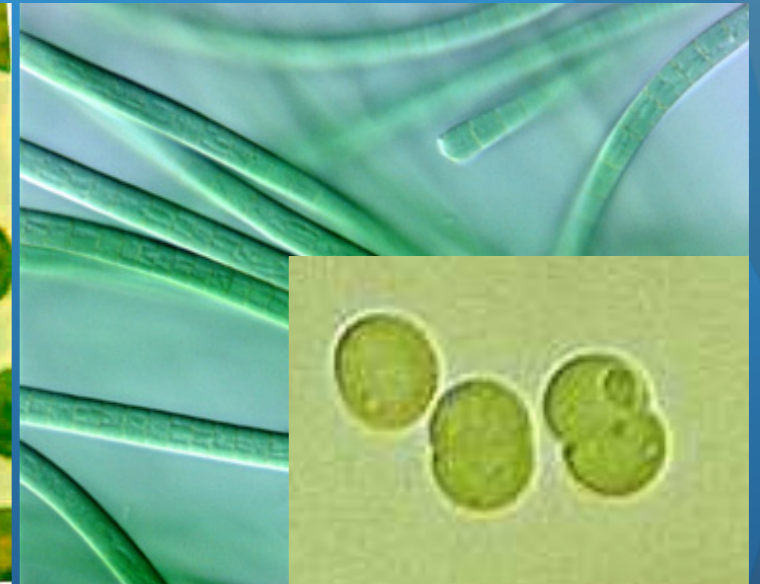
Phytoplankton Types



DIATOMS



CHLORELLA

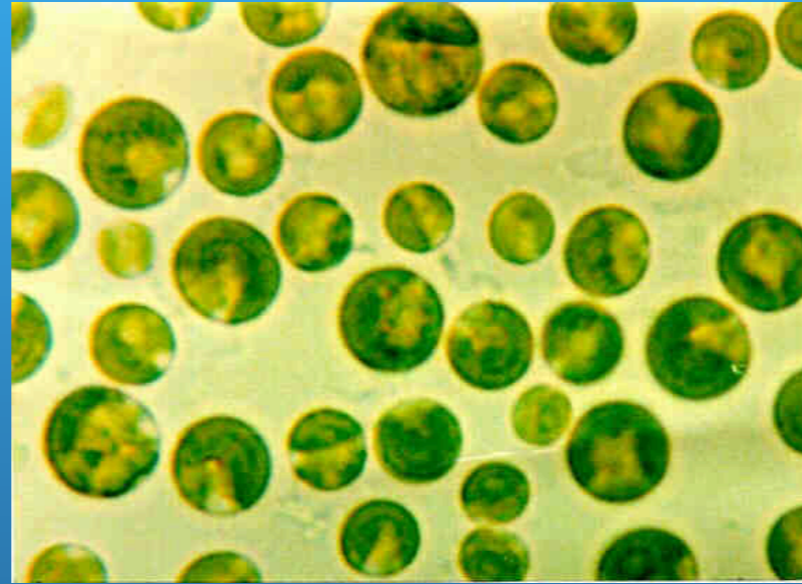


CYANOBACTERIA

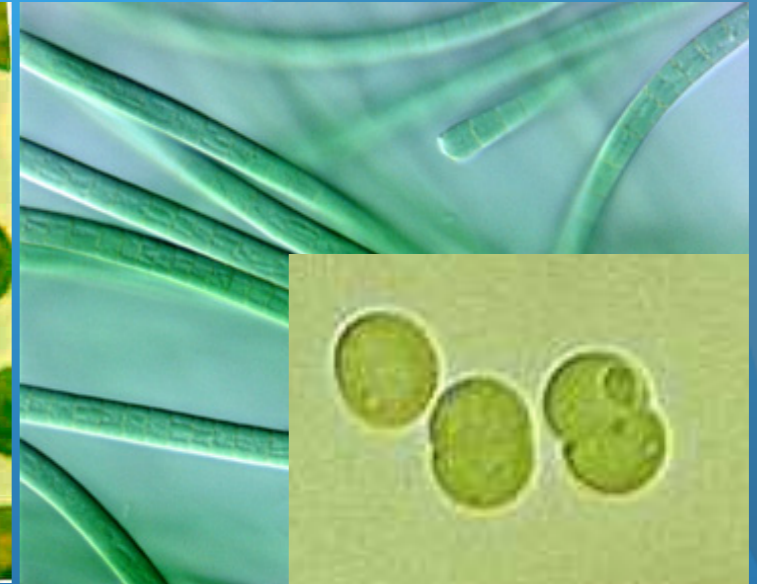
Phytoplankton Affects Zooplankton



DIATOMS



CHLORELLA



CYANOBACTERIA



COPEPODS



ROTIFERS

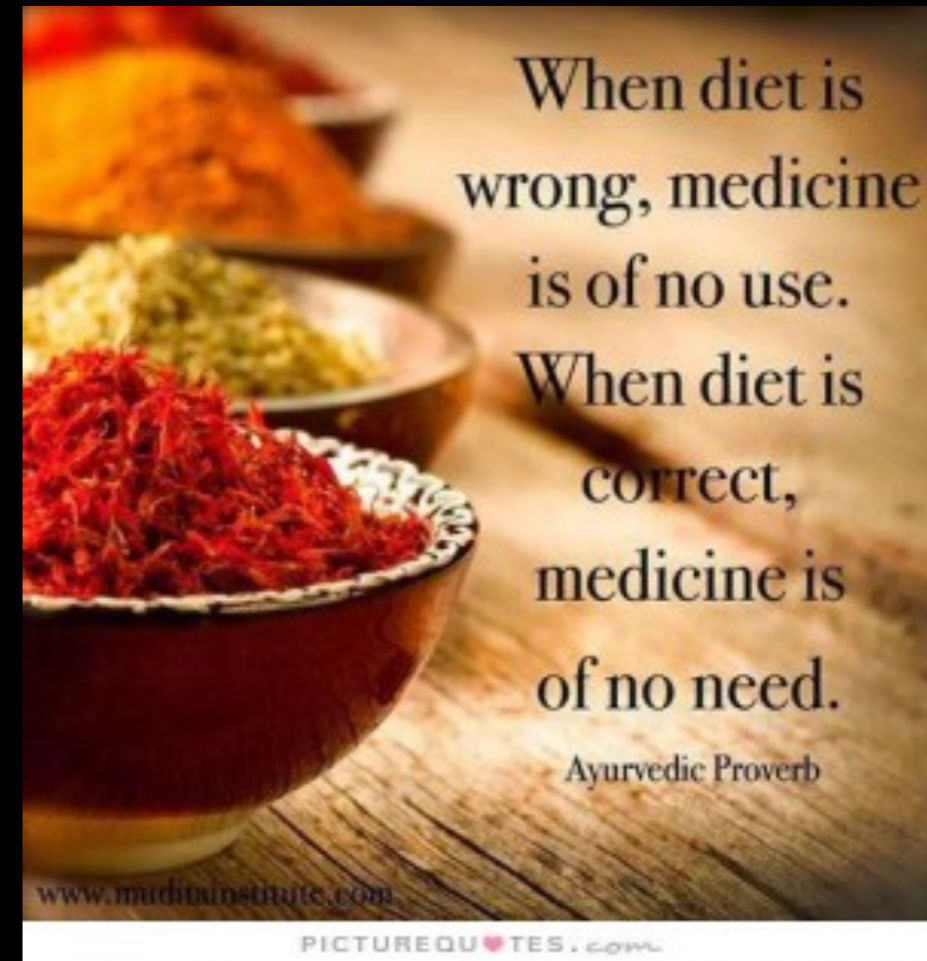
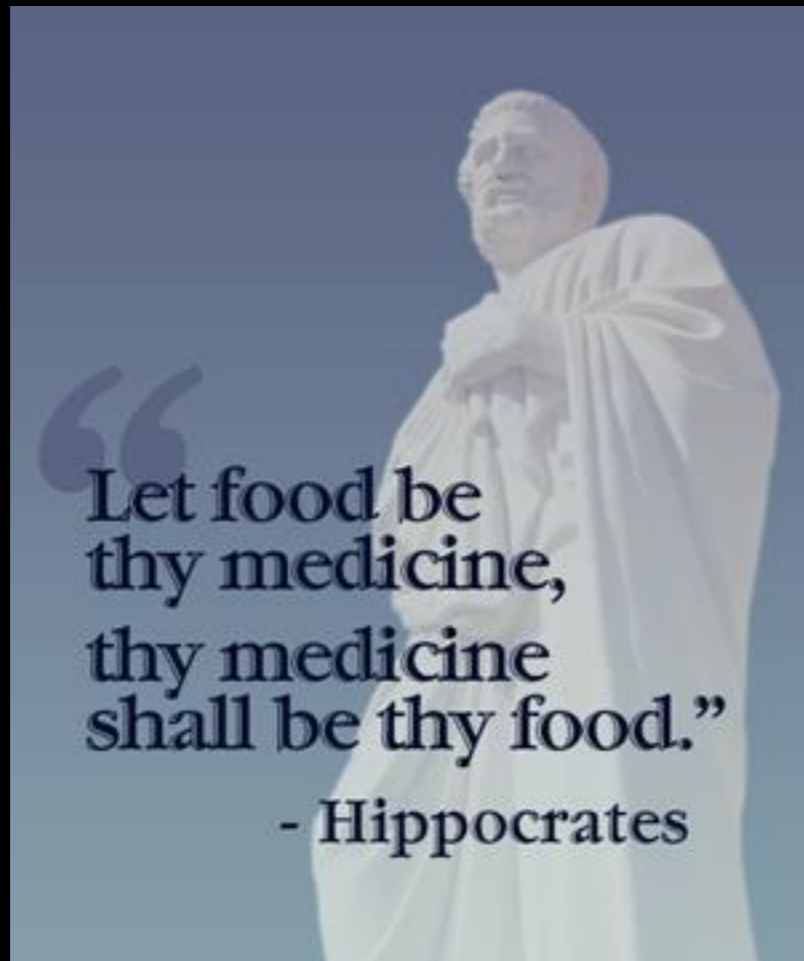


Putting it all together

	NPM	STANDARD
# PONDS	10	40
CROPS	1	1
EMERGENCY HARVESTS (WSD)	0 (0%)	26 (65%)
EMERGENCY HARVESTS (EMS)	1 (10%)	15 (37.5%)
SURVIVAL	88%	76%
ADG	0.3	0.25

NPM nearly stops WSD and improves EMS survival
Survival, ADG, FCR all improved
(large economic impact)

DIET AND HEALTH: THERE IS A LINK!



Thank you!