MAKING VIRUSES LOCALLY

23&me marriage

03 TUESDAY
WEEK 36

SEPTEMBER, 2013

HOW VIRAL CAPSIDS FORM FROM PROTEINS? CODE? 11-3-2020

VIRAL ECOLOGY

4TH RINBERG SYMPOSIUM ON GIANT VIRUS ECOLOGY

17-20 november 2019 tegernsee, germany

ECOLOGY

- a study of relationships of organisms to each other and to their environment.
- microecology - interaction of viruses within their hosts.
- macroecology -
  - ekological disruptions that lead to zoonotic spillover.
  - global effects of viruses.

ECOLOGY AND EMERGING VIRUSES

- disruption or invasion of ecological niches can lead to cross species transmission

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NOTES

- origins of every human virus, and zoonotic viruses, can be traced to such invasions and disruptions.
- measles virus (cow), ebolavirus (bushmeat), nipah virus (bat), SARS-CoV-2 (meat mkt) (?)

11. 7. 2020

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SEPTEMBER, 2013

WEDNESDAY 04

WEEK 36

VIROME

• nervous system	>3 viruses	35% RNA virus
• respiratory tract	>17	25% RNA
• digestive tract	>19	26%
• urogenital tract	>6	0%
• blood	>19	30%
• skin, hair, nails	>13	0%

THE PHYTOBIOME

not only plant viruses, but the viruses of everything that interacts with plants, including other microbes, insects and other invertebrates, other plants and herbivorous animals.

NOTES

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virome → all the viruses in us. (genome, proteome, kinome, ...)

05 THURSDAY
WEEK 36

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VIRUS HOST SYMBIOSES

a. antagonistic tomato bushy stunt virus infection of eggplants

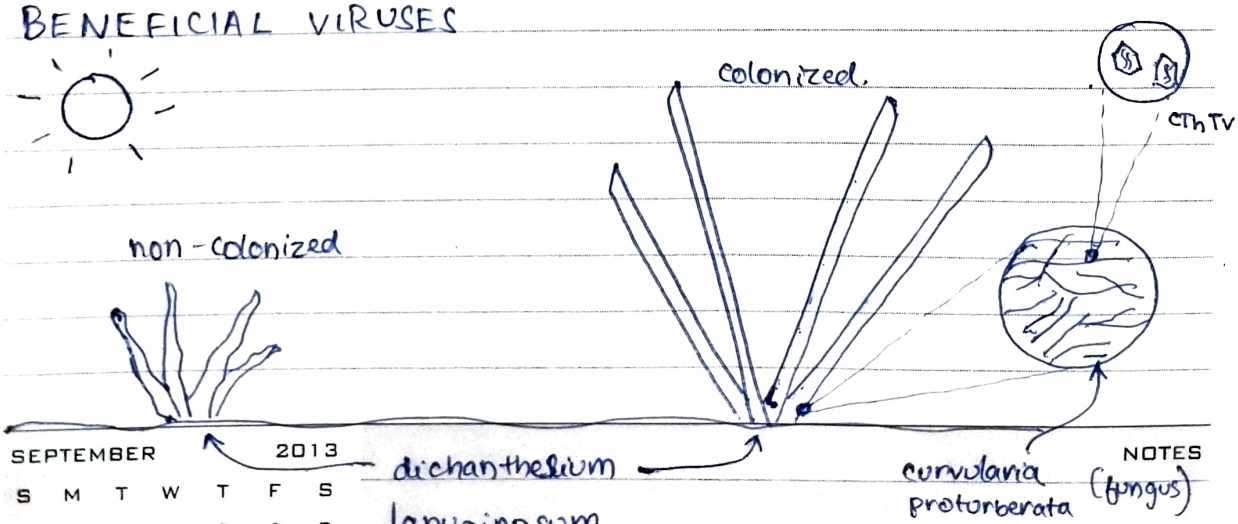
b. commensal viruses with no apparent impact

c. conditionally mutualistic virus induces formation of winged morph of rosy apple aphid, smaller and less fecund but able to move to a new plant when crowding occurs.

d. mutualistic phage infection of vibrio cholera causes toxin production and invasion of host gut.

e. symbiogenic exaption of retroviral gene to form placenta.

BENEFICIAL VIRUSES



many viruses confer drought tolerance to plants.

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NOTES

12.9.2020

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FRIDAY 06
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FACTORS LEADING TO NIPAH VIRUS EMERGENCE

- first outbreak malaysia 1998.
- reservoir: fruit bats (pteropus vampyrus)
- 1970s - 1990s deforestation for pulpwood and industrial plantations reduced fruit bat habitat.
- haze from slash and burn blanketed much of southeast asia in months before outbreak.
- exacerbated by drought driven by severe 1997-98 el niño southern oscillation.
- acute reduction in availability of flowering and fruiting forest trees.
- enchroachment of flying foxes into cultivated fruit orchards
- location of open piggeries in fruit orchards.

{india, bangladesh} → fyling foxes feed from date palm sap collection pots (toddy)

NOTES

nipah vaccine is in development

- of those, some of the pigs passed the virus to humans (125 died)
- many developed respiratory neurological disease
- millions of pigs got infected.

perak, malaysia → singapore

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07 SATURDAY
WEEK 36

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ARGENTINE HEMORRHAGIC FEVER, JUNIN VIRUS

- use of herbicides to convert the argentine pampa to land for growth of maize.
- weeds controlled with herbicides to allow growth of maize.
- a new shade tolerant grass grew in shadow of maize.
- this grass led to emergence of new dominant mouse, colonys muscolinus, reeservoir of junin virus.
- argentine hemorrhagic fever first described in 1953, virus isolated 1958.

WHAT DO AQUATIC VIRUSES DO?

08 SUNDAY
WEEK 36

- most viruses thought to infect heterotropic bacteria.
- also abundant viruses infecting cyanobacteria. ← make a lot of O_2 that we have
- Some viruses infect eukaryotic phytoplankton and can collapse large blooms.

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NOTES

virus in seawater - 10^7 per mL (Curtis).
junin virus - ambisense genomes

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6 MONDAY 09 WEEK 37

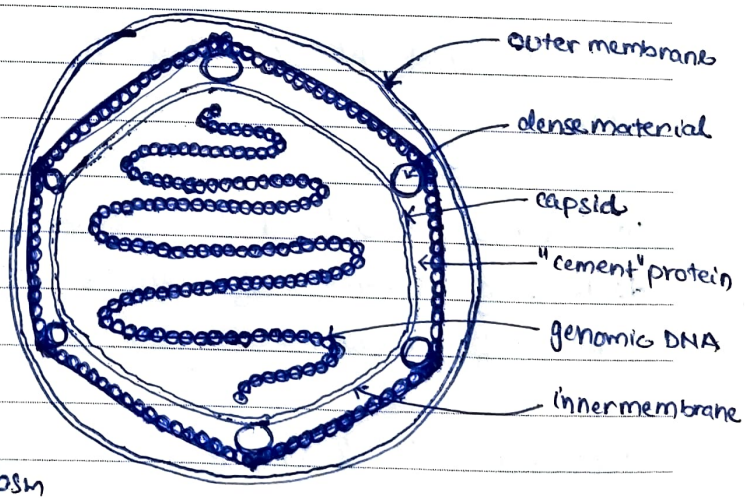
EMILIANIA HUXLEYI

- single-cell coccolithophore (photosynthetic plankton) found in all oceans
- one of many parts of marine food web.
- forms extensive blooms in nutrient-depleted waters after reformation of summer thermocline.
- covered with calcite disks
- important source of calcium carbonate and dimethyl sulfide (cloud formation).

↑induces regulating their own formation

EMILIANA HUXLEYI VIRUS 86, A COCCOLITHOVIRUS

linear, dsDNA genome of 410 - 415 Kb encoding ~472 proteins



nucleo cytoplasmic replication (NCLDV)

↑ replicate in nucleus & cytoplasm of the cell

giant virus.

T-164

NOTES

LDV = large DNA virus.

thermocline → top layer of the ocean gets warm, and the bottom is still cold, that forms in the summer.

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10 TUESDAY
WEEK 37

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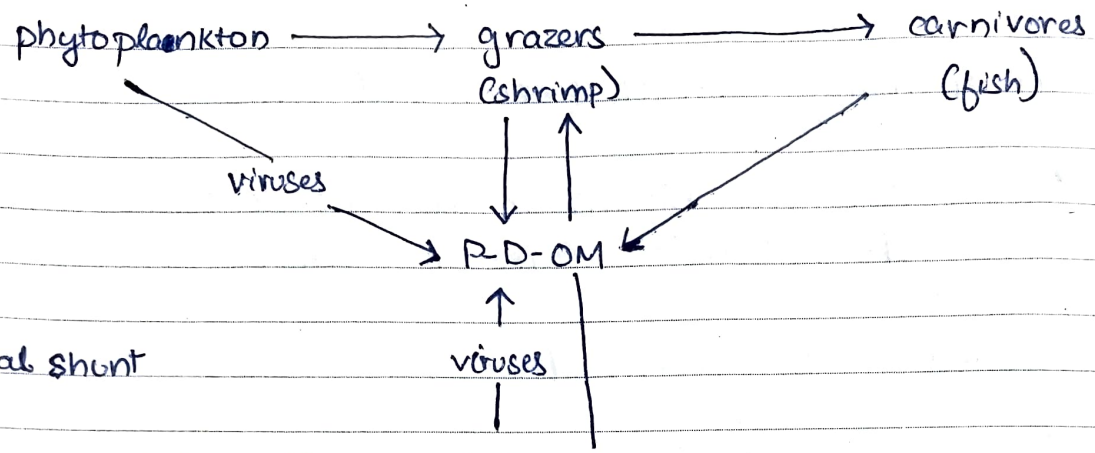
VIRUSES ARE CATALYSTS FOR BIOGEOCHEMICAL CYCLING.



viruses catalyze the movement of nutrients from organisms to the DOM & POM pools.

VIRUSES CAN AFFECT THE EFFICIENCY OF THE BIOLOGICAL PUMP

in oceans $\sim 10^{29}$ virus infections d^{-1}.
destroying 20-40% of marine bacteria & releasing 10^8-10^9 tonnes of carbon.

deforestation: 2 Gt/y
fossil fuels: 7000 Gt

fossil fuel use: 5 Gt/y
atmosphere: 805 Gt ± 4 Gt/y
ocean: 38,500 Gt

↑ CO_2 90 Gt/y ↓ CO_2 93 Gt/y.

P-D-OM - particulate / dissolved organic matter

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WEDNESDAY 11
WEEK 37

RULER OF THE SEAS - WHERE IS THE CARBON?

whales	bacteria	viruses	total
4.1-12	2740 - 27400	27-270	10^6 tonnes.

VIRUSES NOT ONLY SHAPE ACTIVITY, THEY SHAPE POTENTIAL.

horizontal gene transfer:
although true ecological extent remains unknown, it is thought that viroses move genes between related (and unrelated) hosts.

- are these movements important?
- can we observe one in progress?
- can viruses utilize these other genes?

A GIANT VIRUS INFECTING GREEN ALGAE ENCODES KEY FERMENTATION GENES.

A GIANT CHOANOVIRUS ENCODES RHODOPSIN PHOTOSYSTEM

virus of choanoflagellate
thought to be ancestors of multicellular eukaryotes (cus)

NOTES

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AUREOCOCCUS ANOPHAGEFFERENS

- alga responsible for NY/NJ brown tides.
- in mid-atlantic US estuaries since 1985
- detrimental to bivalve populations.
- detrimental to beds of zostera marina (eelgrass).
- $50 million losses anually.

OF COURSE THERE IS AN AUREOCOCCUS VIRUS

AUREOCOCCUS ANOPHAGEFFERENS VIRUS

- giant virus, isolated during a brown tide bloom.
- likely regulates blooms.
- has acquired genes from a variety of cellular sources.

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to
FRIDAY 13
WEEK 37

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PARAMECIUM BURSARIA CHLORELLA VIRUS

- large icosahedral dsDNA viruses (331 kb)
- worldwide in fresh waters
- chlorella hosts is a symbiont of protozoan paramecium bursaria. ← full of algae. ← algae

VIRUS ECOLOGY - WE HAVE BARELY SCRATCHED THE SURFACE

- just a sampling of interactions among viruses, hosts, and their environments.
- a growing field with the addition of metagenomics needs a transition to experimental scene.
- plants and their viruses
- unicellular inhabitants of oceans, freshwater, land environments.
- how mutualism function

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