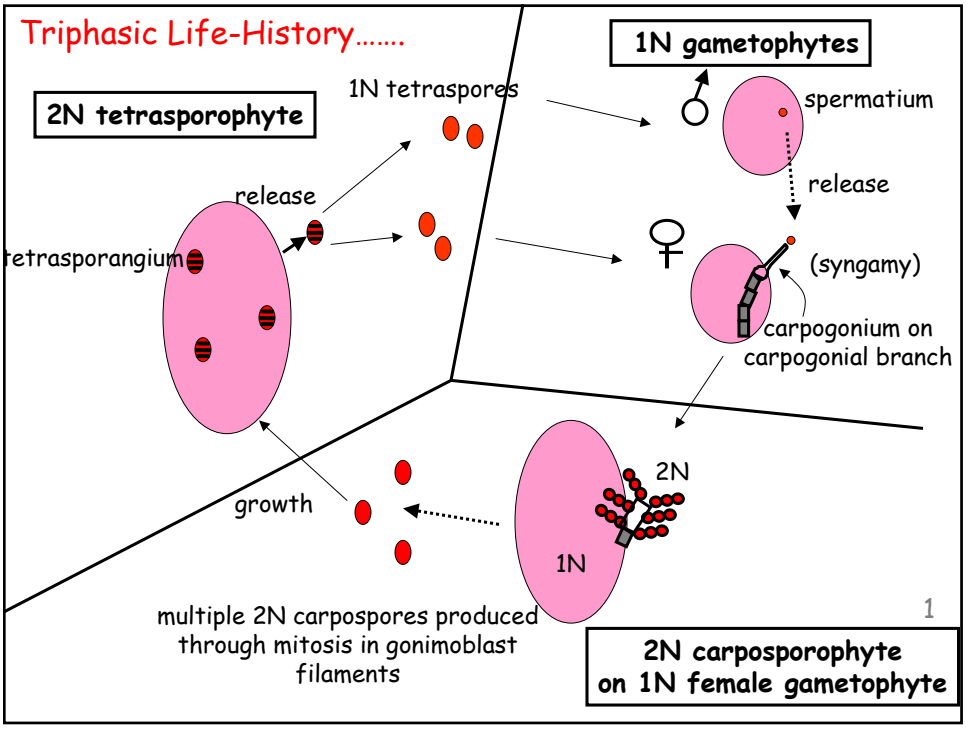
Division: Rhodophyta

Part II

Triphasic Life-History…….



Division: Rhodophyta

Class: Rhodophyceae

Subclass: **Bangiophycidae** **Florideophycidae**

- "simple" reds
- unicells, filaments, blades; parenchymatous
- marine, terrestrial, freshwater
- uninucleate
- one stellate chloroplast per cell
- pit connections relatively rare; if present, only primary, and in 2N stage
- biphasic life history

- advanced reds
- always multicellular (filaments, psuedoparenchymatous blades)
- marine, freshwater
- almost always multinucleate
- many discoid chloroplasts
- primary and secondary pit connections
- triphasic life history

Division: Rhodophyta

Class: Rhodophyceae

Subclass: **Bangiophycidae** Florideophycidae

Order: Bangiales

Celebrity Genera:

Bangia

Porphyra

Porphyra……..

1N gametophyte:

- parenchymatous blade
- monostromatic or distromatic
- annual

2N sporophyte:

- "conchocelis" stage
- discovered in 1949
- microscopic filament
- lives on/in mollusk shells
- perennial

- haplodiplontic life history
- saxicolous or epiphytic
- harvested for nori

Conchocelis stage= 2N filamentous stage; lives in/on $CaCo_3$ shells of mollusks

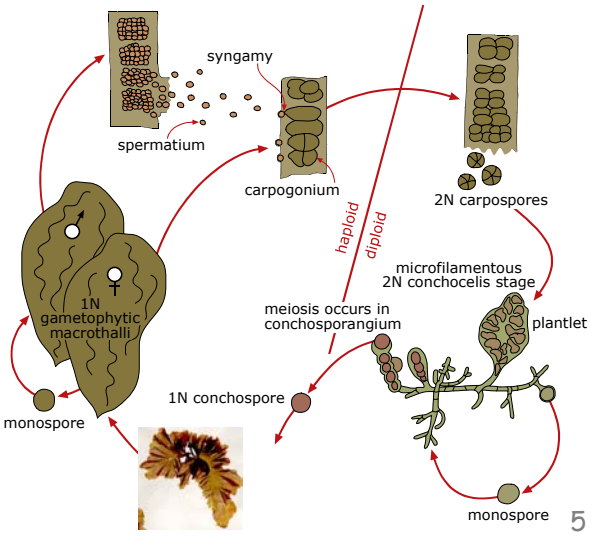
Conchospore = 1 N spore produced by 2N conchocelis stage

Monospore= asexual spore that develops into the same phase as the parent

Asexual vs. Sexual: gametophyte switches from monospores to gametes; triggered by daylength (fall = shorter days = sex)

Life Cycle of the Bangiales

Haplo-diplontic
e.g. *Porphyra gardneri*



Bangia……..

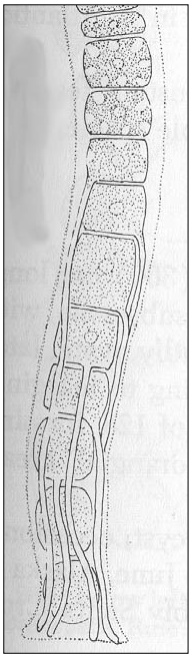
- Unbranched uniseriate filament in early development; later becomes multiseriate; rhiziodial extensions of lower cells

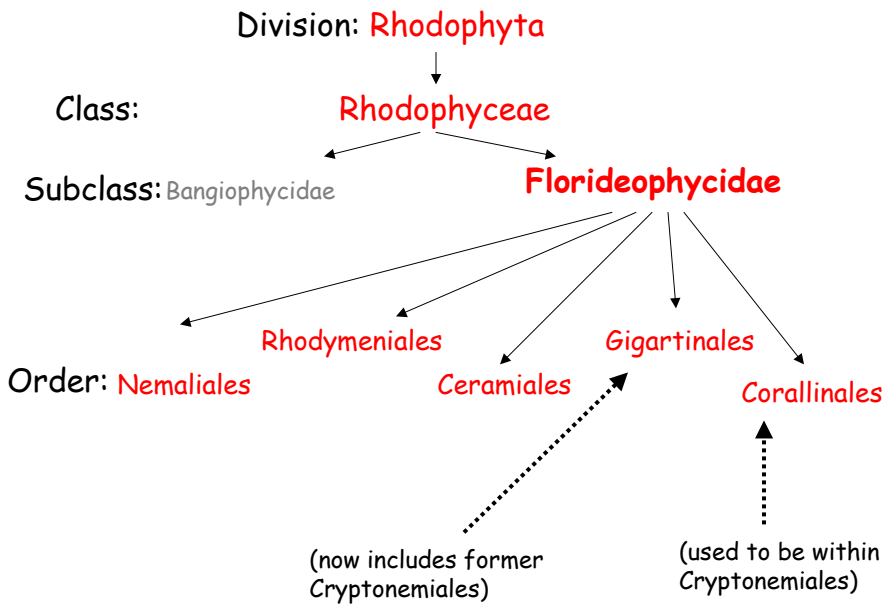
- 2N conchocelis stage like *Porphyra*

- Asexual reproduction by monospores

- Pit plugs present in conchocelis stage but not in gametophyte

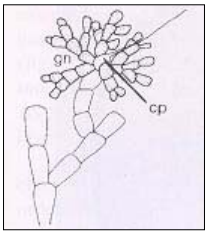
- Inhabits upper intertidal splash zone on rocks – rarely epiphytic



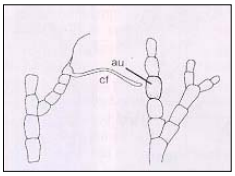


Distinguishing between Orders of Florideophycidae…..

Traditionally **post-fertilization events**→.now pit plug characters also

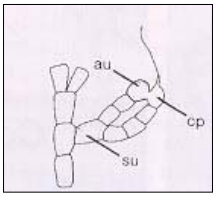


auxiliary cell absent



•auxiliary cell present but on distant branch

•(gn) from (au) cell



•auxiliary cell present

•(au) branch and (cp) branch arise from same cell (su)

connecting filament or **ooblast filament** = cell that carries the zygote nucleus from fertilized egg to internal auxiliary cell where it is cloned and differentiates into carpospores (in some Orders!)

auxiliary cell = vegetative cell that receives the 2N zygote nucleus after fertilization (in some Orders!)

supporting cell = cell from which the carpogonial branch arises

Division: Rhodophyta

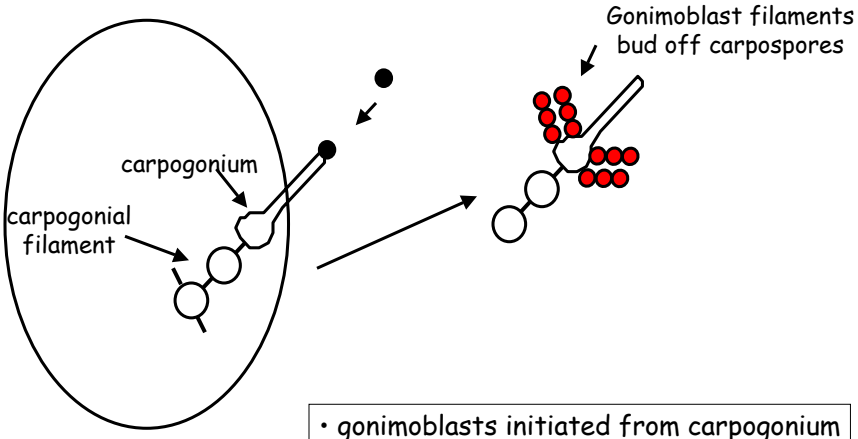
Class: Rhodophyceae

Subclass: Bangiophycidae **Florideophycidae**

Order: Nemaliales Rhodymeniales Ceramiales Gigartinales Corallinales

Celebrity Genera: *Nemalion* *Cumugloia*

Order: Nemaliales….



- gonimoblasts initiated from carpogonium
- no auxiliary cell

Division: Rhodophyta

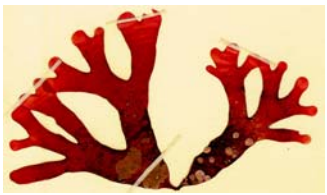
Class: Rhodophyceae

Subclass: Bangiophycidae | **Florideophycidae**

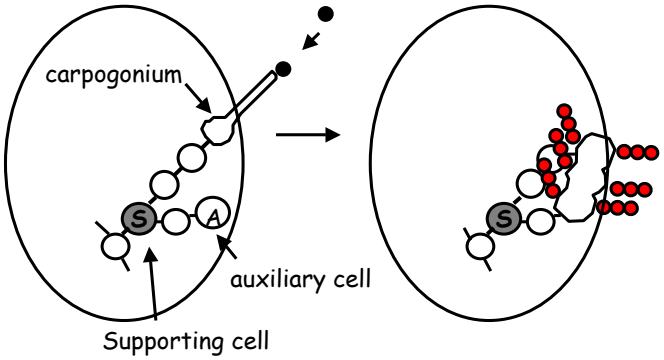
Order: Nemaliales | Rhodymeniales | Ceramiales | Gigartinales | Corallinales

Celebrity Genera:

Rhodymenia



Order: Rhodymeniales



- Auxiliary cell filament born on supporting cell of carpogonial filament
- Auxiliary cell formed BEFORE fertilization
- Fusion of carpogonium and auxiliary cell to form gonimoblast

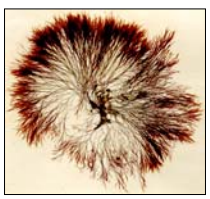
Division: Rhodophyta

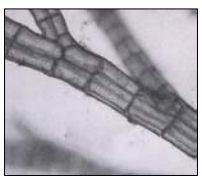
Class: Rhodophyceae

Subclass: Bangiophycidae, Florideophycidae

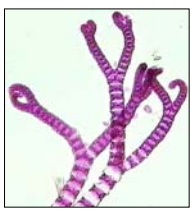
Order: Nemaliales, Rhodymeniales, Ceramiales, Gigartinales, Corallinales

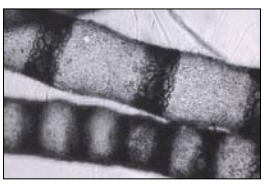
Celebrity Genera:





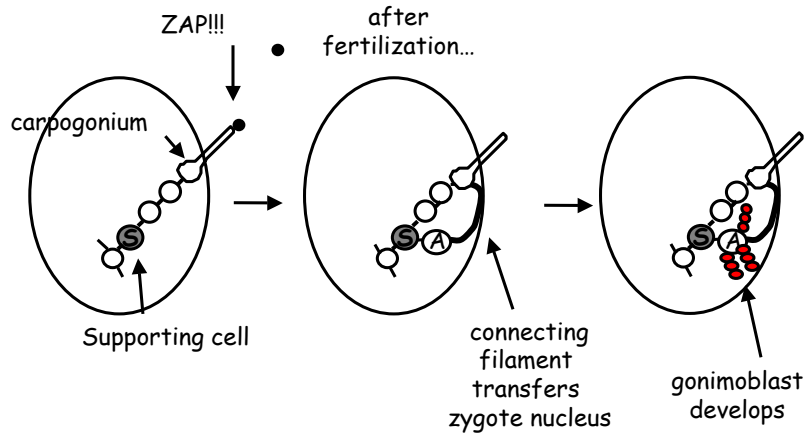
Polysiphonia





Ceramium

Order: Ceramiales



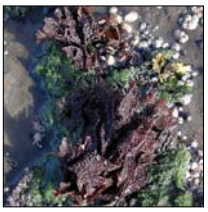
•auxiliary cell develops from supporting cell of carpogonial branch AFTER fertilization

Division: Rhodophyta

Class: Rhodophyceae

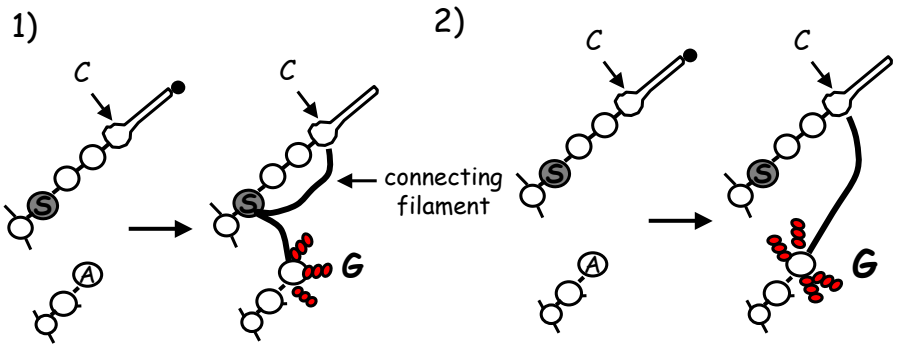
Subclass: Bangiophycidae, Florideophycidae

Order: Nemaliales, Rhodymeniales, Ceramiales, Gigartinales, Corallinales



Celebrity Genera: *Mazzaella*, *Mastocarpus*

Order: Gigartinales (includes former Cryptonemiales)……



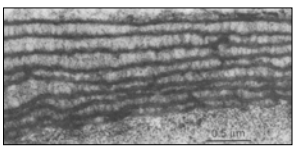
•Auxillary cell present but on distant branch from carpogonial branch

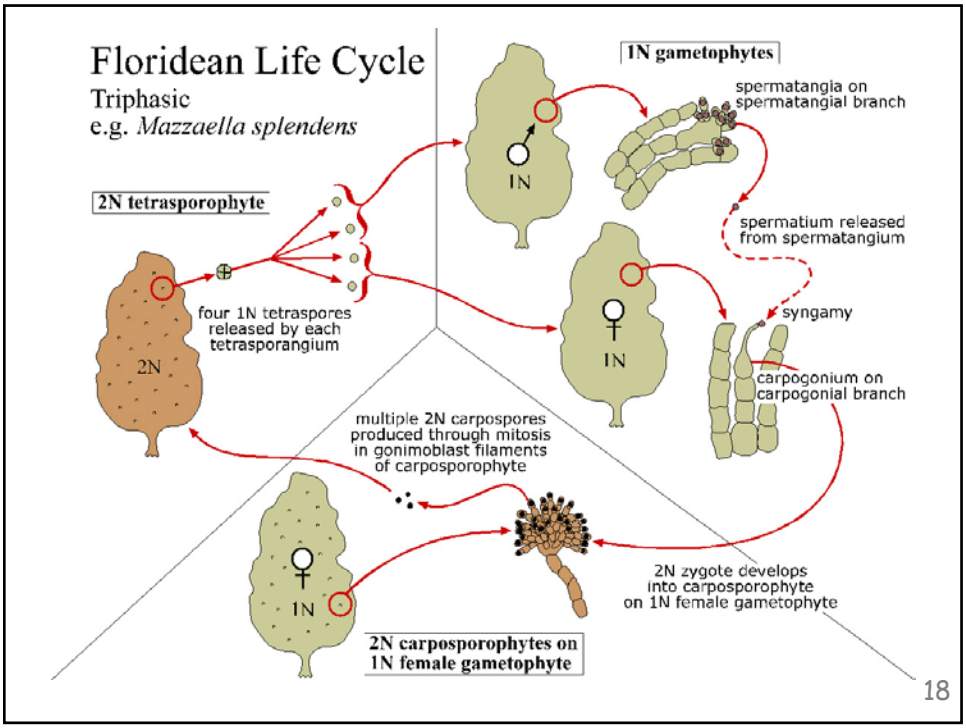
Mazzaella……..
(old name = *Iridaea*)

Common local species:
•*M. flaccida – yellow/green; mid to upper intertidal*

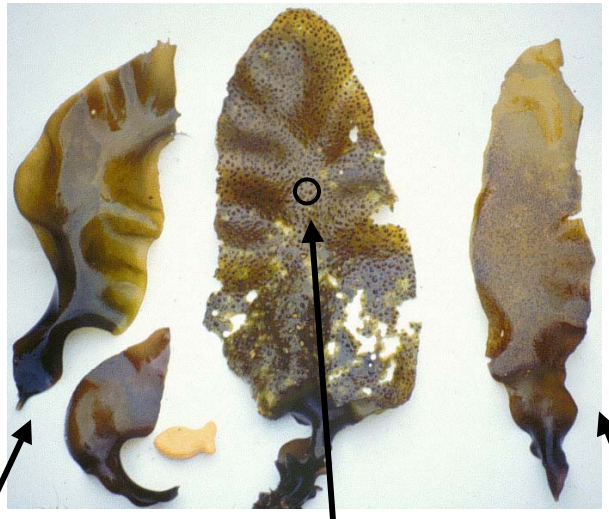
•*M. Splendens – red/purple; low intertidal*

Iridescence
• proteinaceous cuticle
• multiple layers
• alternating opaque and translecent layers
• layering produces light interference patterns that give iridescent appearance when submerged
• adaptive advantage unknown





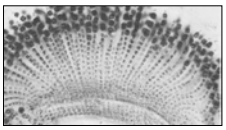
Mazzaella……..

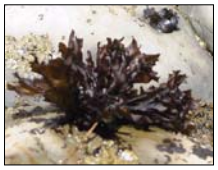


gametophyte carposporophyte tetrasporophyte

Mastocarpus/"Petrocelis" life history:

same as *Mazzaella* but heteromorphic





1N gametophytes

2N tetrasporophyte

2N carposporophytes
on female gametophyte

Division: Rhodophyta

Class: Rhodophyceae

Subclass: Bangiophycidae

Florideophycidae

Order: Nemaliales

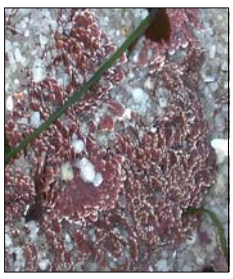
Rhodymeniales

Ceramiales

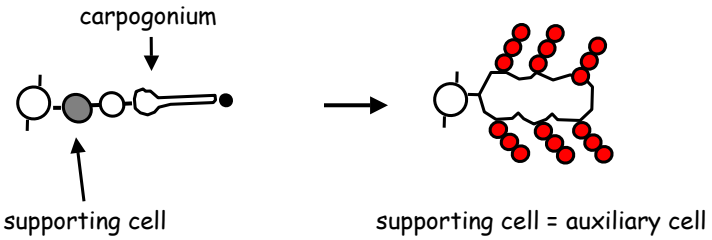
Gigartinales

Corallinales

- cell walls impregnated with CaCO3
- isomorphic alternation of generation
- reproductive structures in conceptacles
- ecological importance: stabilize reefs, induce invert settlement



Order: Corallinales……



•carpogonial branches in conceptacles
•fusion of cells in carpogonial branch after fertilization

Celebrity Genera:

Corallina
- common intertidally
- conceptacles on tips
- finely branched, pinnate
- more highly branched than *Bossiella* or *Calliarthron*
- calcareous sections are thin and tubular and smaller than those on *Bossiella* or *Calliarthron*

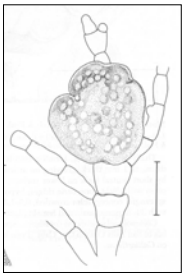
Bossiella
- common intertidally
- segments typically "heart-shaped"
- conceptacles in pairs on the face of a segment, not margins
- calcareous sections are larger than *Corallina*

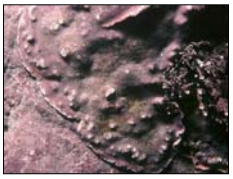
Calliathron
- common intertidally
- segments typically "wingnut-shaped"
- conceptacles mainly on margins of segments but could be on margins or surface of segments
- calcareous sections are larger than *Corallina*

Geniculate vs. Non-geniculate……

Geniculum
(flexible joint)

Intergeniculum
(hard part
between genicula)



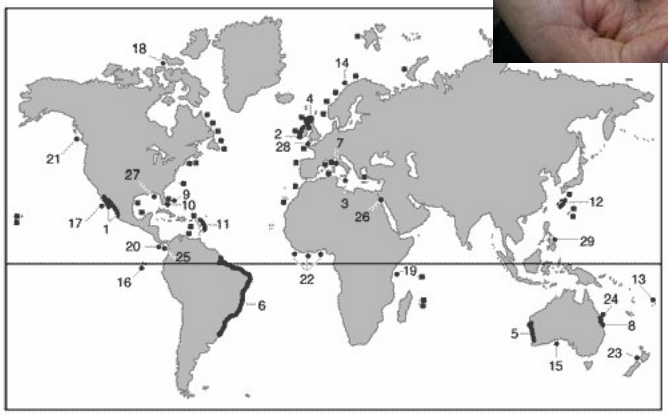


- upright
- articulated
- geniculate

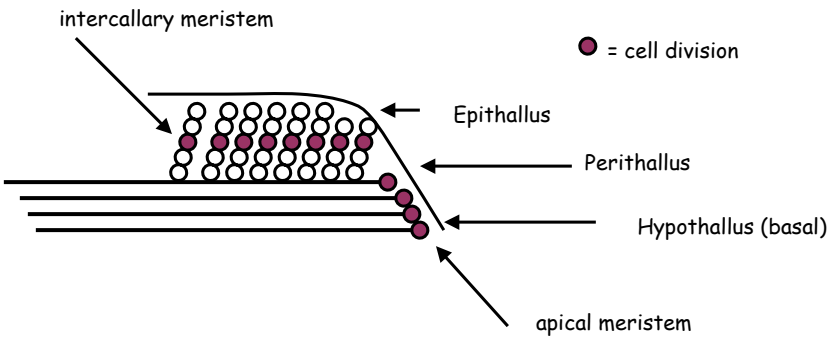
- crustose
- encrusting
- non - geniculate

Rhodoliths……

- unattached
- free-living
- non- geniculate form
- guest lecture: Diana Steller

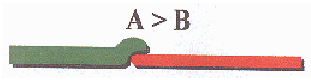


Heterotrichous growth……



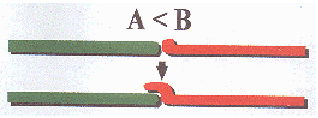
Competitive interactions among coralline crusts

e.g. Steneck



Thick crusts have a competitive advantage over thinner crusts and will generally overgrow them.

Crusts of equal thickness frequently reach a competitive stand-off.



Crusts with raised margins are able to overgrow thicker corallines with adherent margins of equal or greater thickness.

How do coralline algae become calcified?

Lots of theories on how calcification actually occurs, nobody really knows for sure; likely to be different mechanisms in different taxa

What is known:

- ✓High rates of photosynthesis correlated with high rates of calcification
- ✓Calcification 2-3x faster in light than dark
- ✓Highest in young tissue
- ✓Seawater typically contains lots of calcium carbonate, precipitates at high pHs (Digby 1977, ph 9.6); Photosynthesis may raise the pH immediately outside a cell