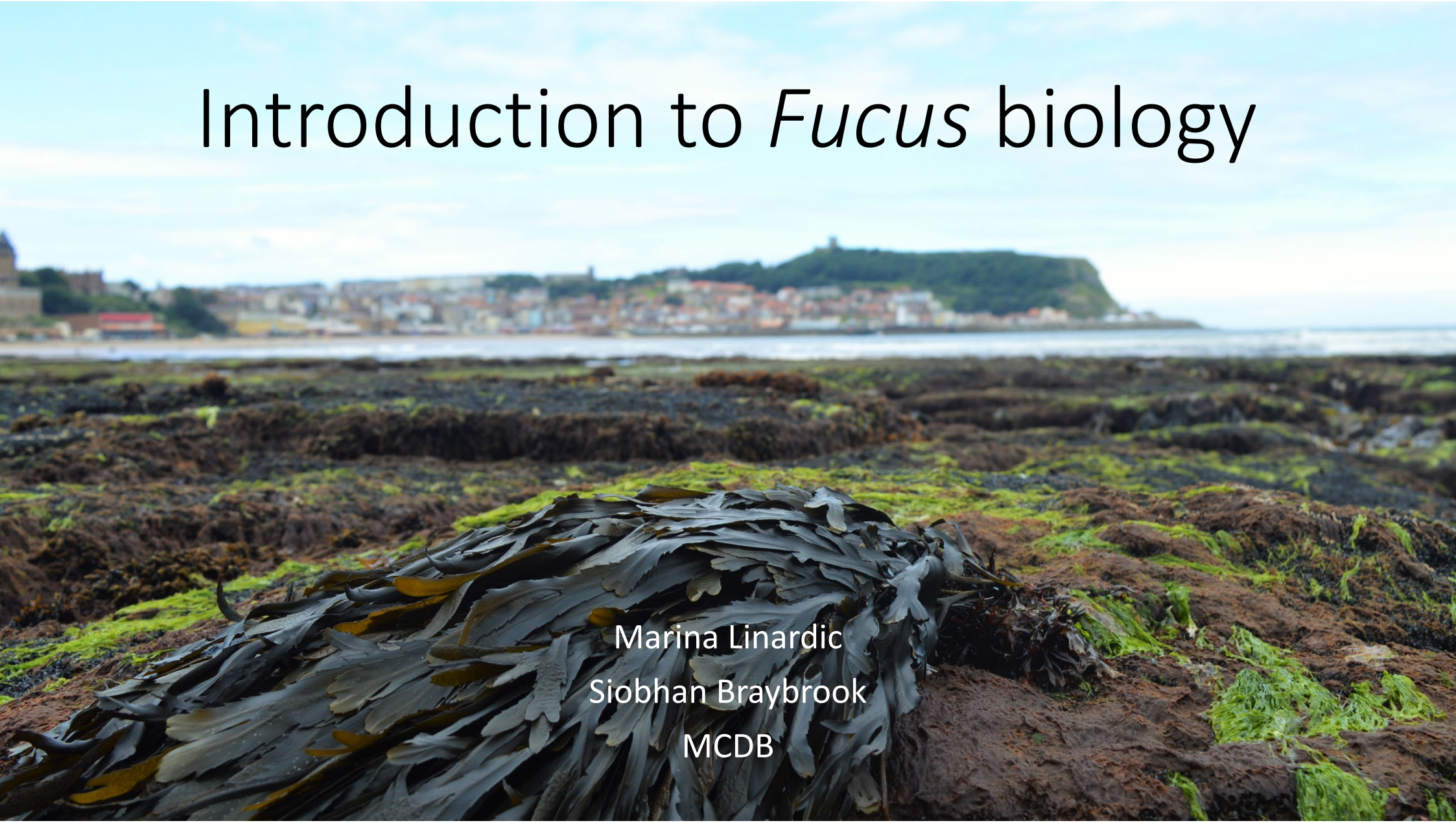
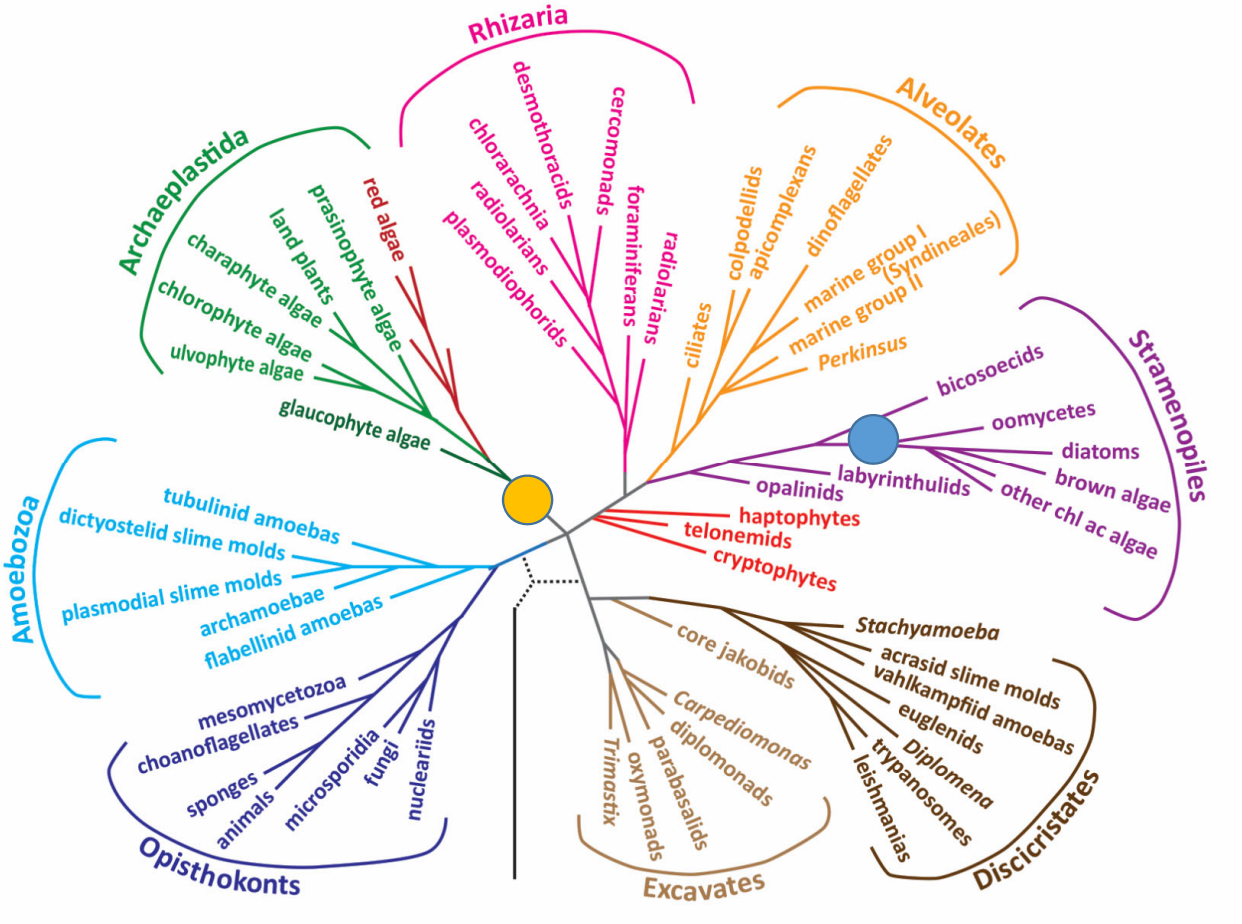
Introduction to *Fucus* biology



Marina Linardic
Siobhan Braybrook
MCDB

What are the brown algae (seaweeds)?

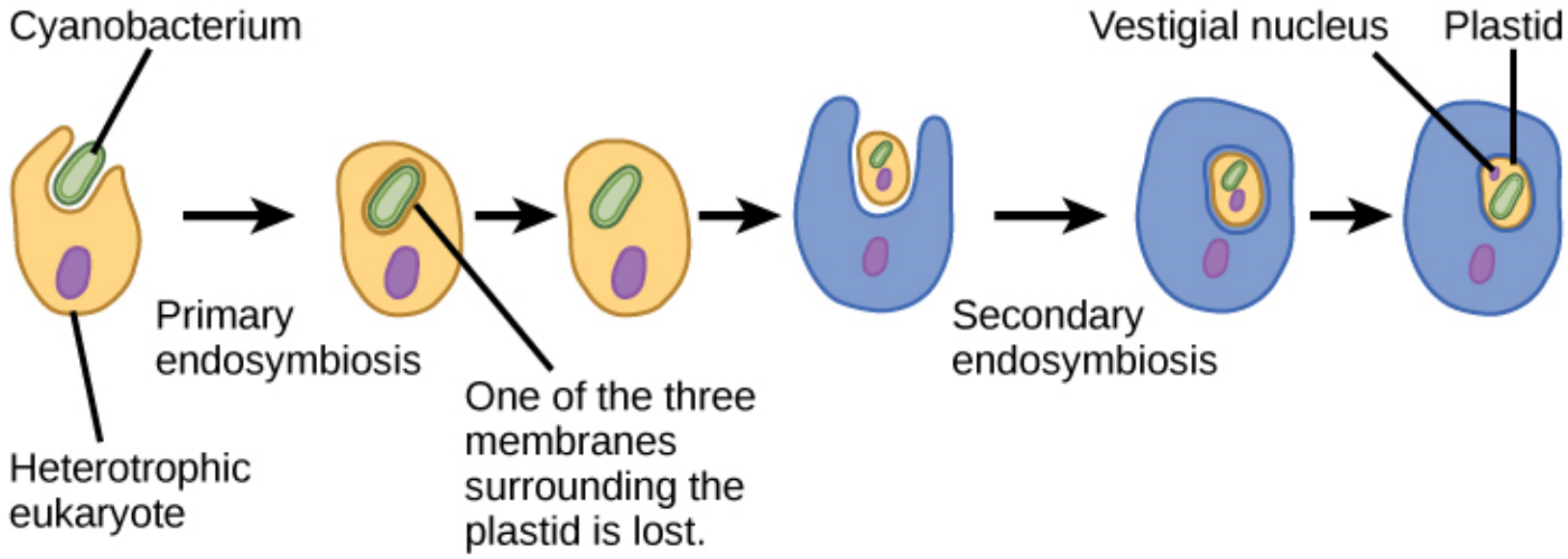


Primary endosymbiosis

Secondary endosymbiosis

Adapted from Baldauf (2003)

Primary and secondary endosymbiosis

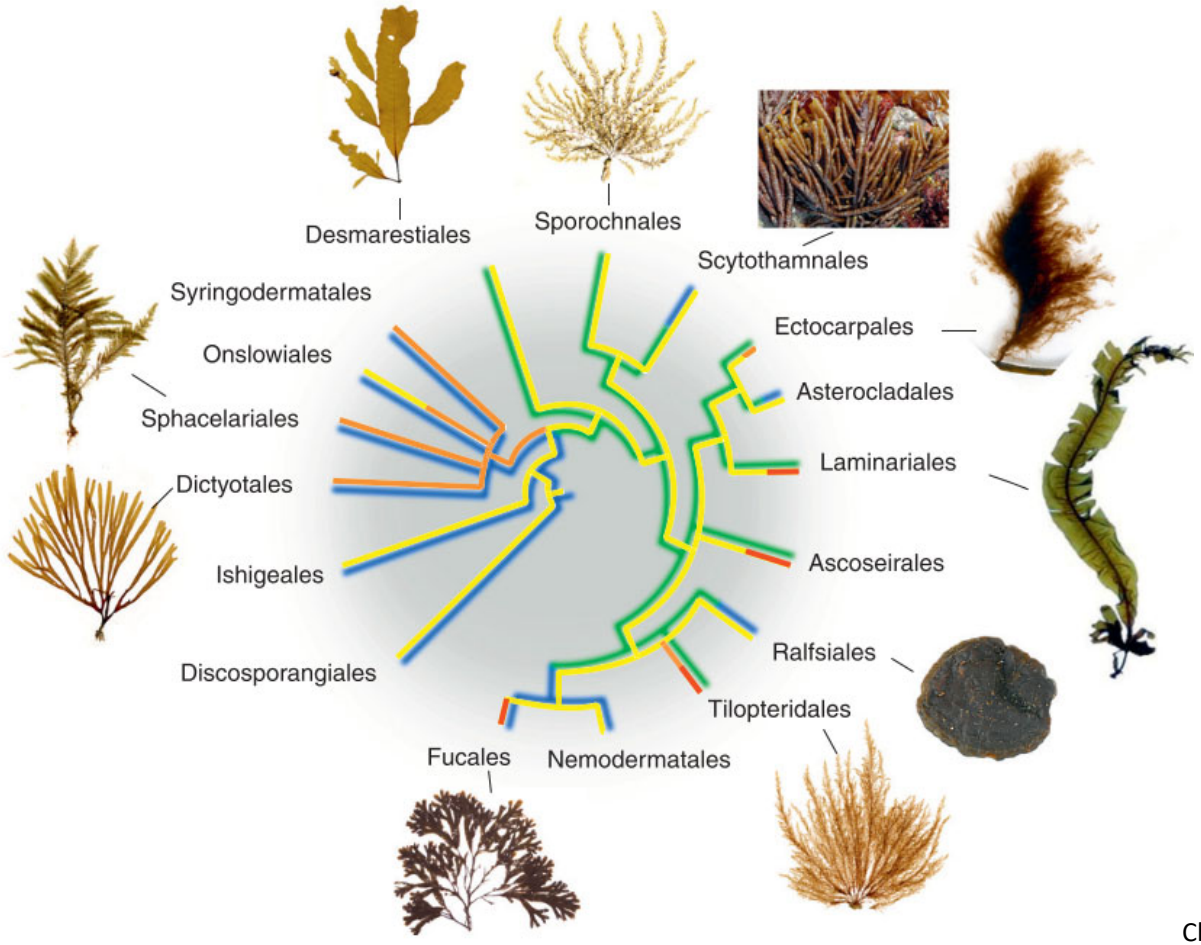


Primary **Secondary**

http://cnx.org/content/m44614/latest/Figure_23_01_05.jpg

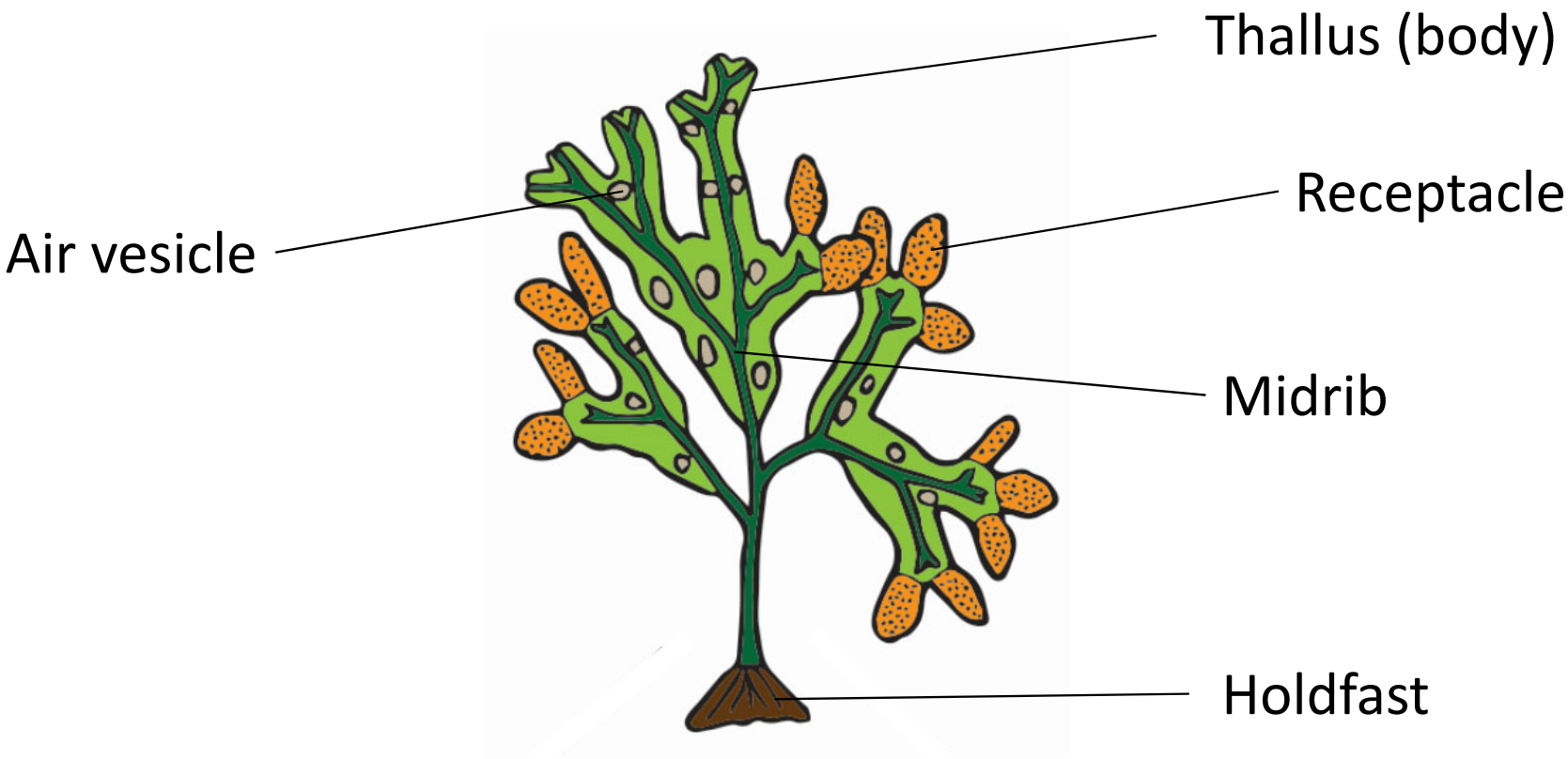
What do seaweeds look like?

Seaweeds come in all shapes and sizes



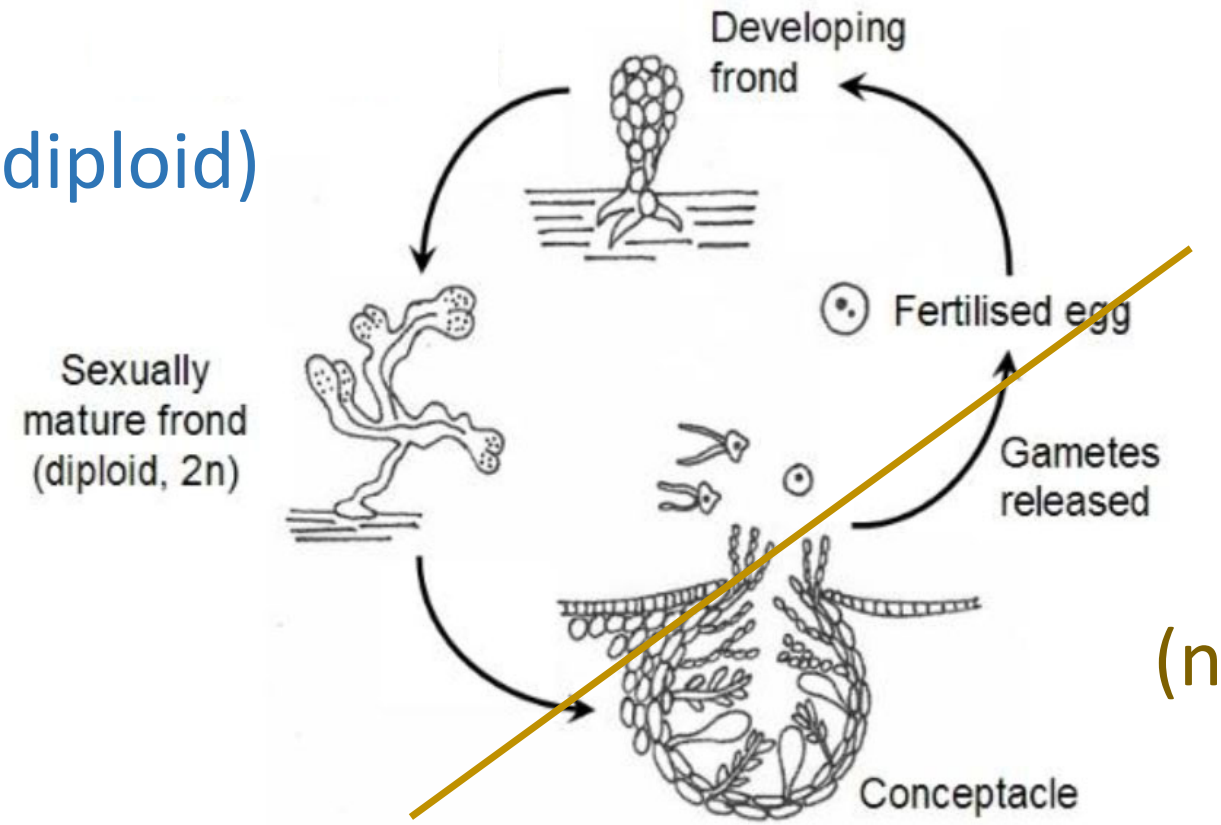
Charrier et al. (2012), Trends in Plant Science

Body plan of a ‘complex’ seaweed



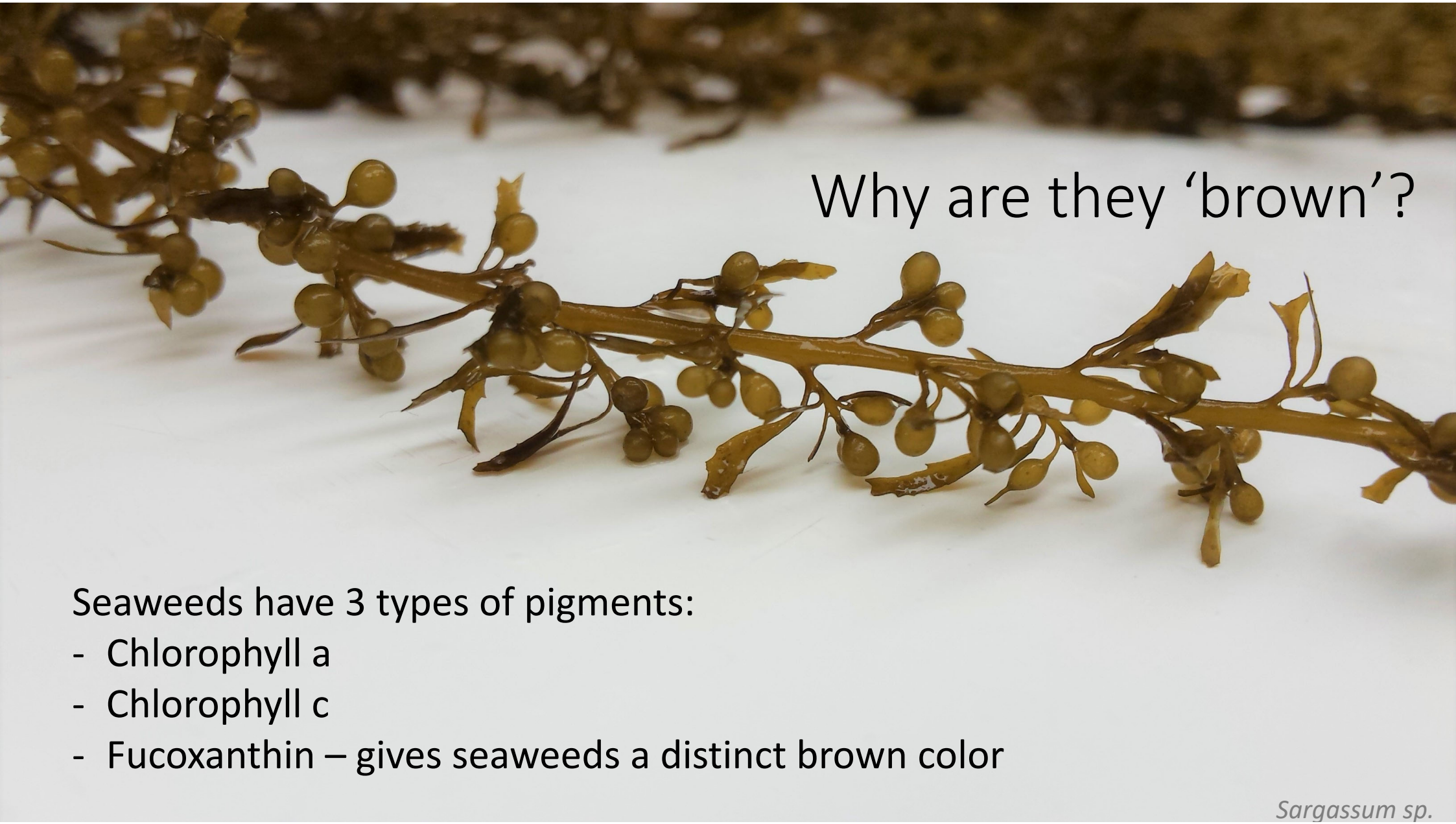
The general seaweed lifecycle

(2n, diploid)



(n, haploid)

http://cronodon.com/BioTech/Seaweeds.html



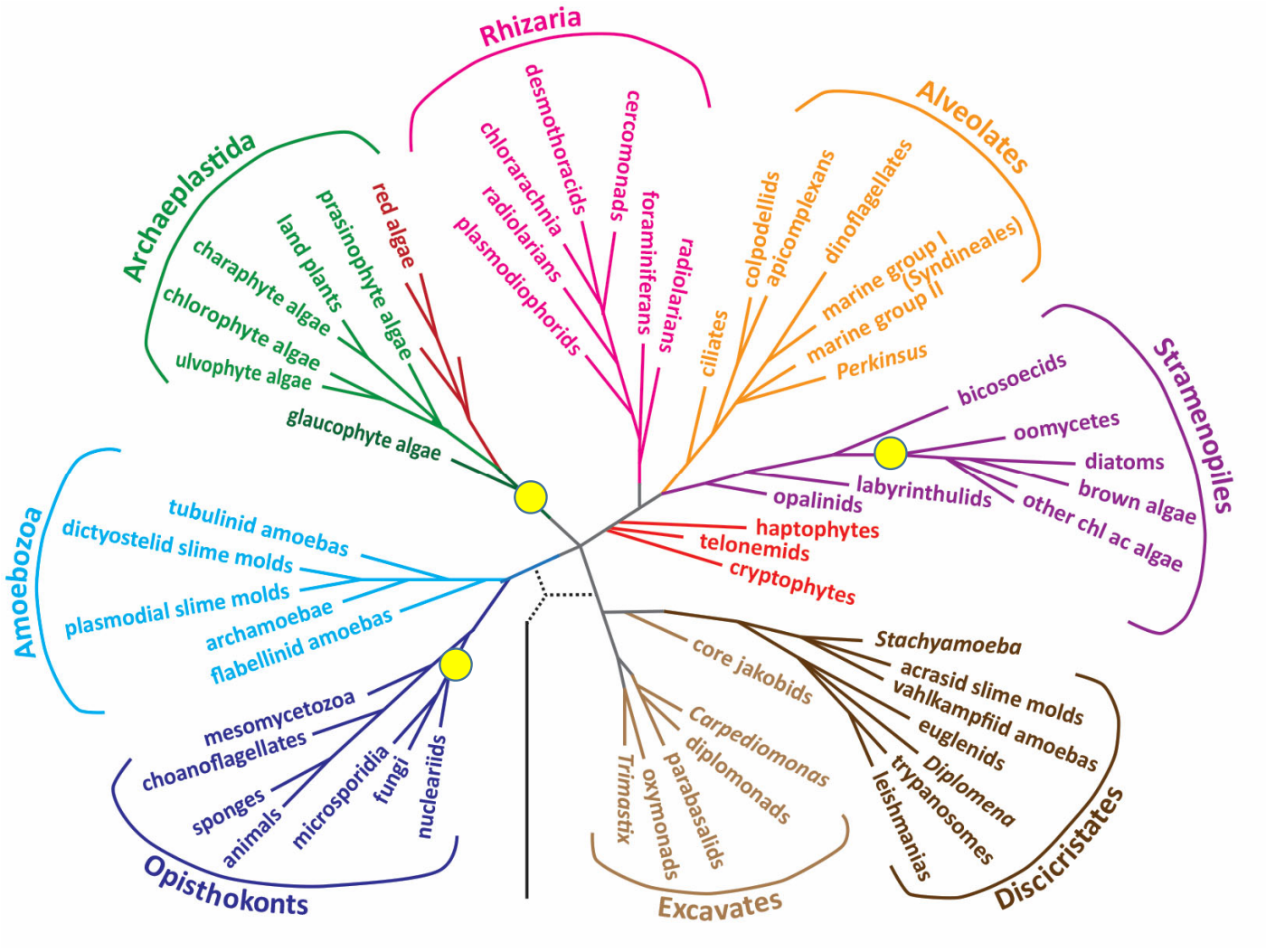
Why are they ‘brown’?

Seaweeds have 3 types of pigments:

- Chlorophyll a
- Chlorophyll c
- Fucoxanthin – gives seaweeds a distinct brown color

Sargassum sp.

What else makes them special?

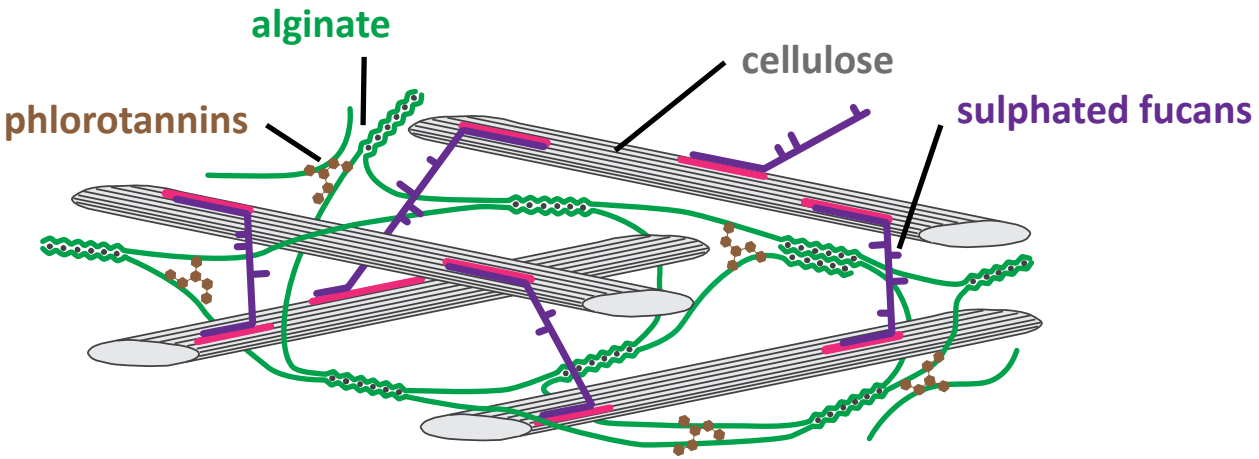


Adapted from Baldauf (2003)

Cell wall

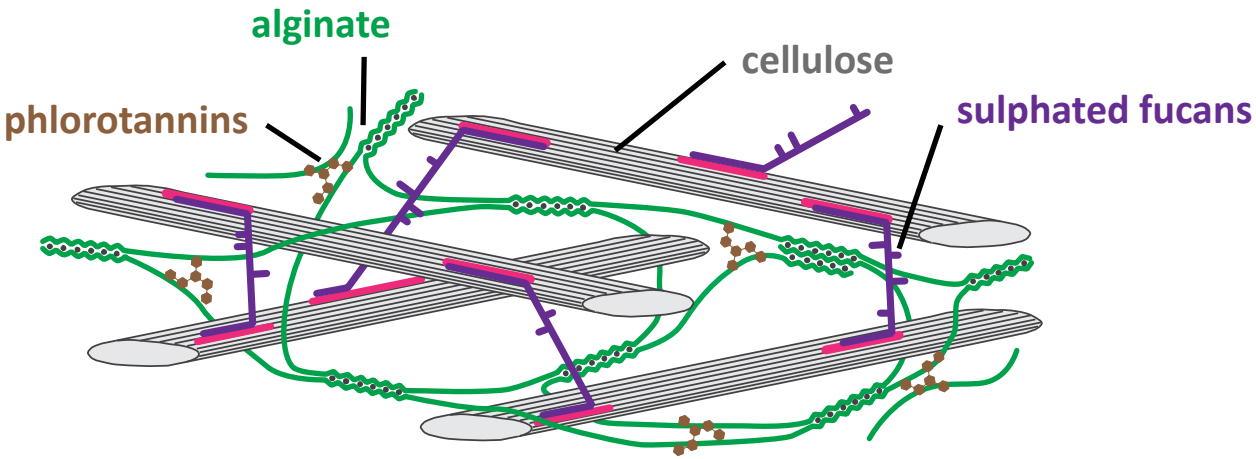
- Present in 3/4 eukaryotic kingdoms
- Encapsulates every cell
- Provides mechanical strength and support
- Withstands turgor pressure to maintain cell shape
- Modifies to allow growth

The seaweed cell wall



The cell walls are formed of cellulose microfibrils tethered by sulphated fucans, embedded in an alginate hydrogel, reinforced with phlorotannins.

Uses of cell wall polysaccharides



Sulphated fucans

- Anti-tumor
- Anti-microbial
- Anti-viral
- Anti-inflammatory
- Anti-thrombotic
- Anti-coagulation
- Anti-oxidant
- Anti-aging

Phlorotannins

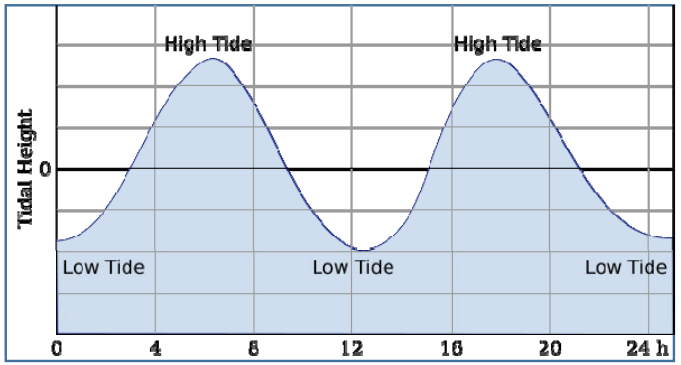
- Antioxidant
- Anti-inflammatory
- Antibacterial
- Anti HIV

Alginate

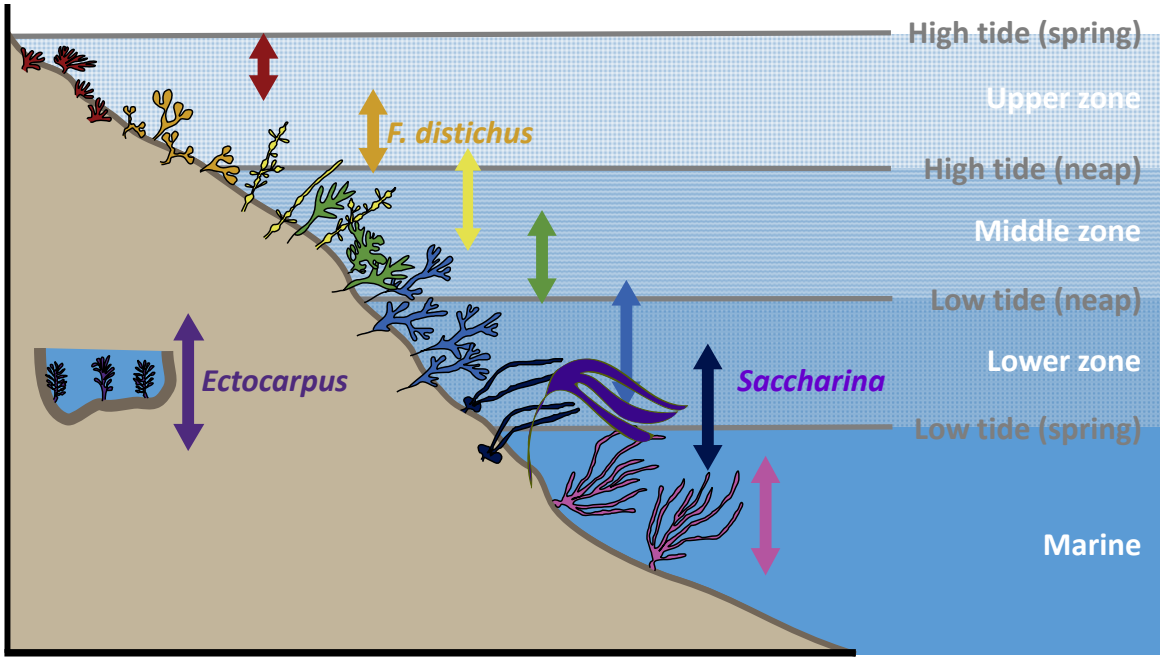
- Food additives (E400-5)
- Weight-loss supplement
- Cell encapsulation
- Drug delivery

Where do seaweeds live?

Seaweeds live mostly in *coastal marine habitats*



https://www.sailingissues.com/navcourse6.html



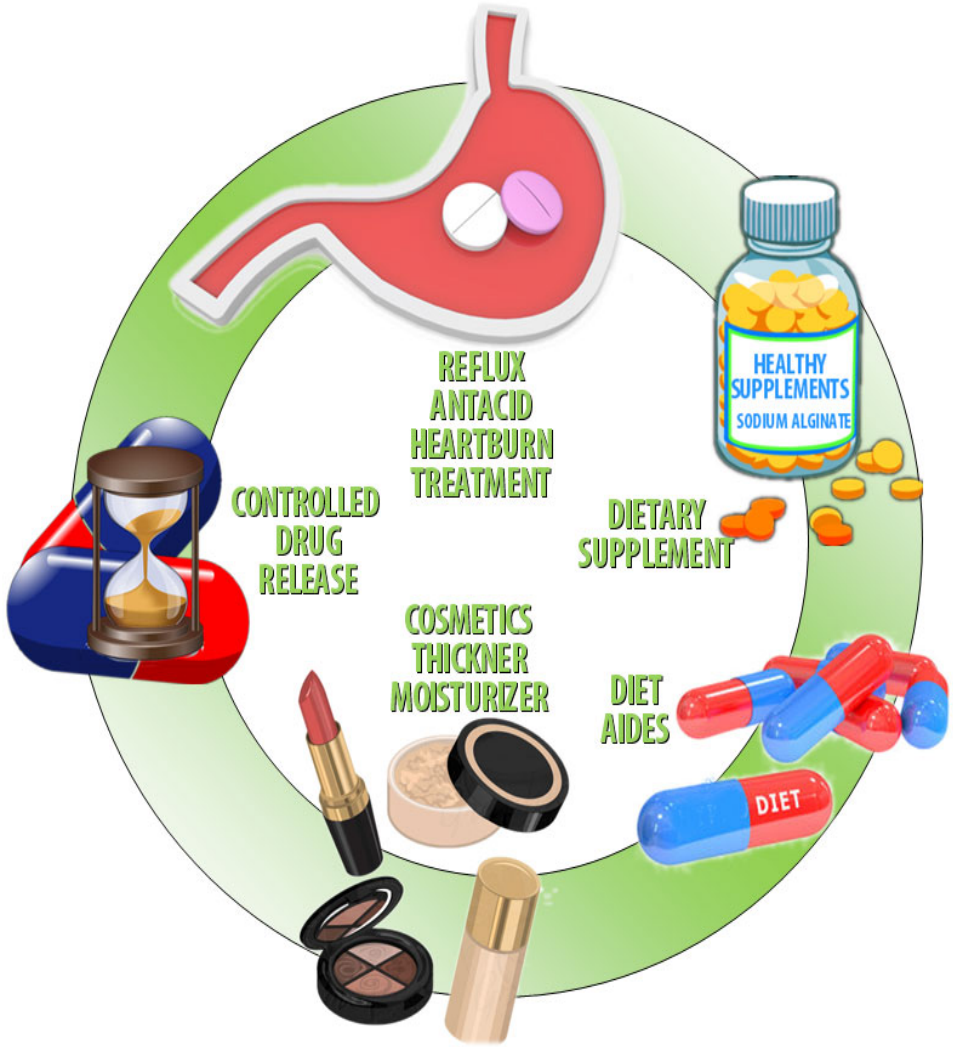
What are seaweeds good for?

Seaweeds for bioproducts

https://www.edibleeastend.com/2017/08/30/eat-kelp-on-long-island/

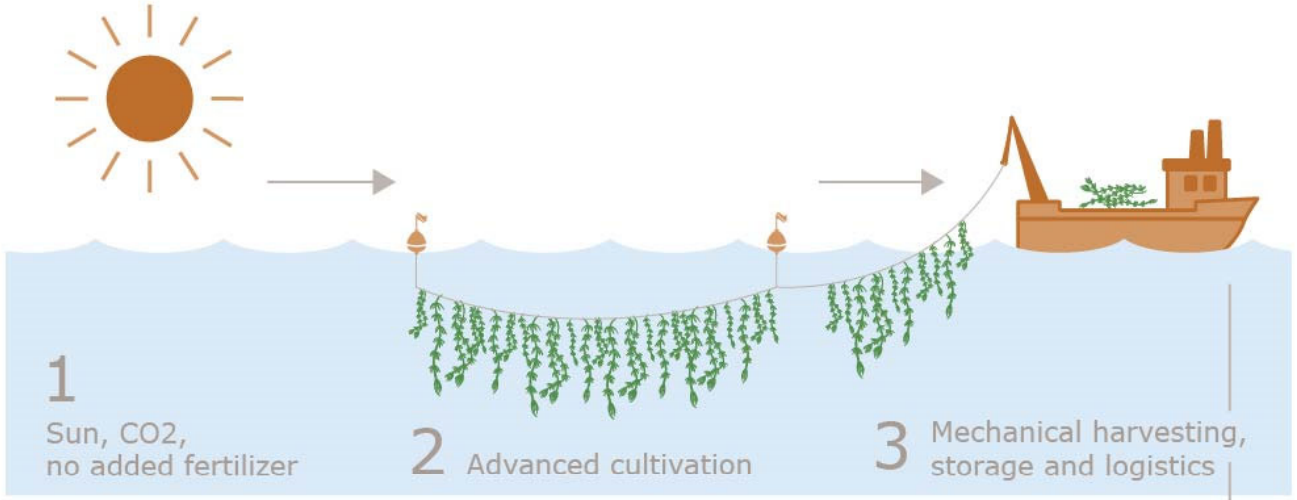
Homedepot.com

https://www.theprairiehomestead.com/2014/06/kelp-livestock.html



https://www.artmolds.com/alginate-pharmaceutical-uses

Macro-algae as a sustainable source for biofuels



1
Sun, CO2,
no added fertilizer

2 Advanced cultivation

3 Mechanical harvesting,
storage and logistics

4
Advanced pre-treatment

5
Advanced (bio)chemical
fuel production

6
Advanced biofuels

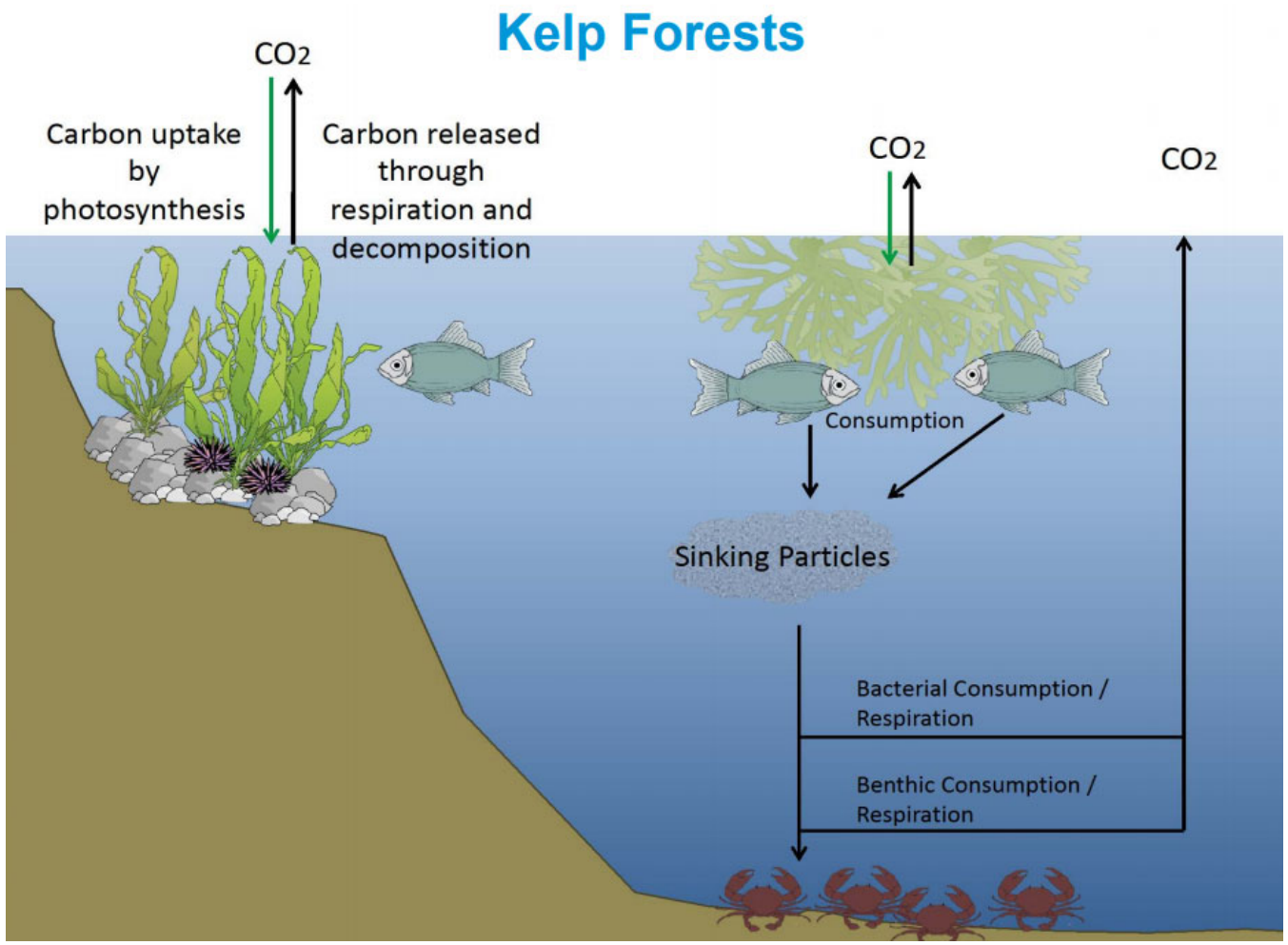
WAGENINGEN UR
For quality of life

CO2 sequestration

Better photosynthesis than land plants

~500 Tg/C year

Co-cultivated to generate/protect marine habitats and organisims



https://www.un.org/depts/los/consultative_process/icp18_presentations/howard.pdf

BROWN ALGAL GENOMES

Ectocarpus siliculosus

Genome size: 195.8 Mb
Number of genes: 16,256

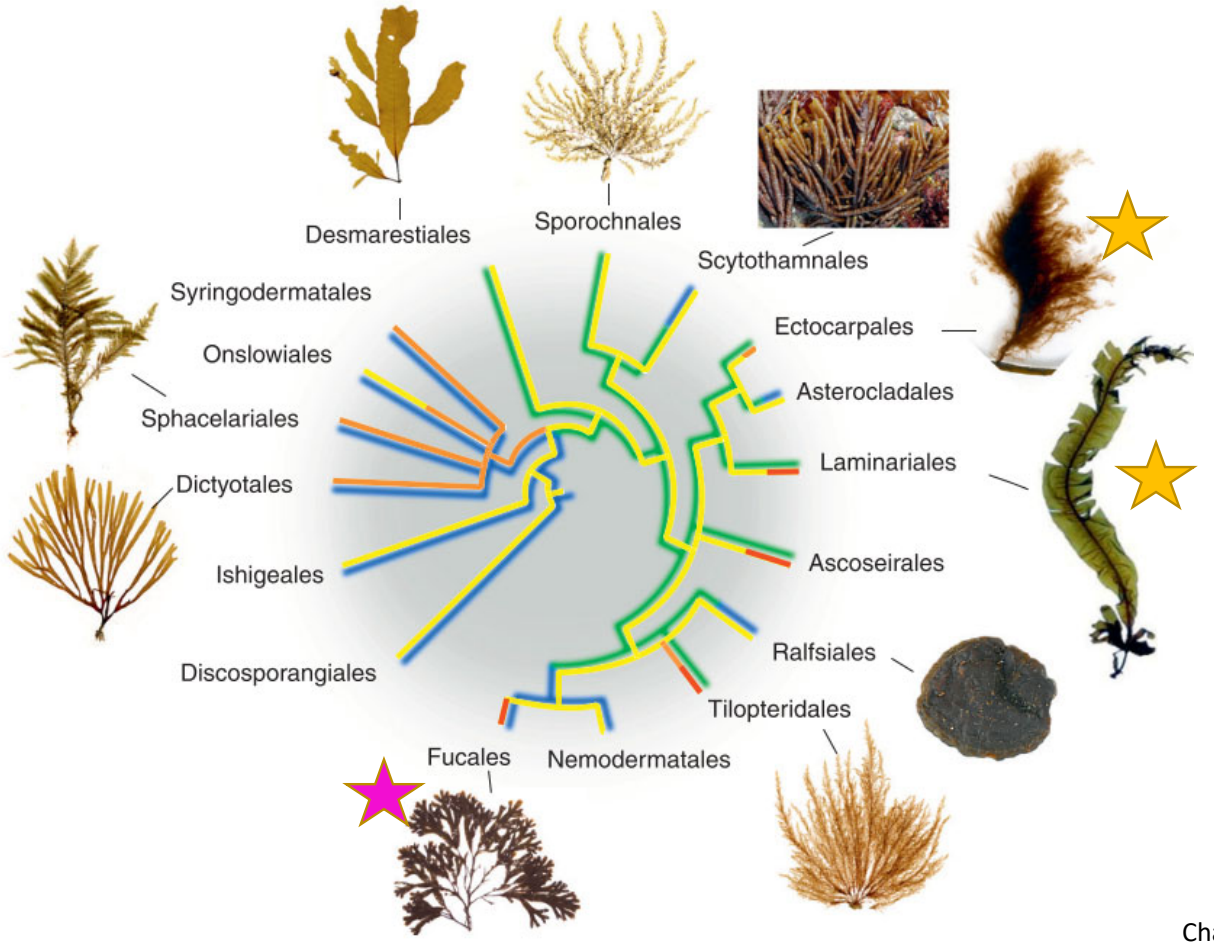
Cock et al. (2010), Nature

Saccharina japonica

Genome size: 454 Mb
Number of genes: 18,733

Ye et al. (2015), Nature Communications

Seaweed genomes in relation to each other



Charrier et al. (2012), Trends in Plant Science