

Longwood University

Digital Commons @ Longwood University

Fall Showcase for Research and Creative Inquiry

Office of Student Research

Fall 11-16-2021

Why is it beneficial for crustaceans to become crab-like?

Dylan Blanton

Follow this and additional works at: https://digitalcommons.longwood.edu/rci_fall



Part of the [Biology Commons](#)

Recommended Citation

Blanton, Dylan, "Why is it beneficial for crustaceans to become crab-like?" (2021). *Fall Showcase for Research and Creative Inquiry*. 179.

https://digitalcommons.longwood.edu/rci_fall/179

This Poster is brought to you for free and open access by the Office of Student Research at Digital Commons @ Longwood University. It has been accepted for inclusion in Fall Showcase for Research and Creative Inquiry by an authorized administrator of Digital Commons @ Longwood University. For more information, please contact hamiltonma@longwood.edu, alwinehd@longwood.edu.

Why is it beneficial for crustaceans to become crab-like?

Dylan Blanton
BIOL 488, Department of Biological and Environmental Science
Longwood University

Background Information

- There are two types of crabs, true crabs, Brachyurans (image 1), evolved from the original lineage and false crabs, Anomurans (image 2), have evolved from separate lineages.
- Carcinization is the development of crab-like morphologies from a non-crab species lineage.

Image 1. examples of brachyura (Poupin 2016)

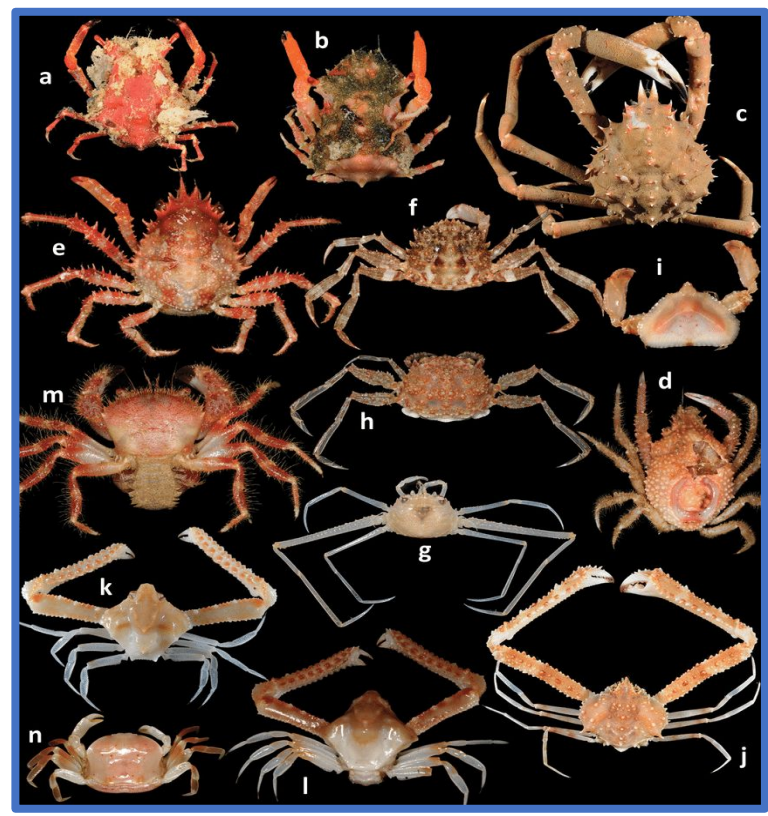


Image 2. examples of anomura (Baeza 2016)



Aim

- The main research plan is to analyze the use of each morphological feature, through visual observation, that is similar between the Brachyurans and Anomurans and identify if it provides an edge over other competitive organisms that do not exhibit that trait.

Methods

Identify three research locations

Analyze morphological characteristics of crab-like and non-crab like crustaceans

Observe the benefits/disadvantages through behavioral analysis of said characteristics

Compare the benefits/disadvantages to that of similar traits exhibited by other crustaceans

Determine if crab-like traits can lead to a competitive edge over other crustaceans

Expected Results

- The trait of sideways walking will be favored due to its advantage over avoiding predators.
- The trait of a flattened carapace will be favored due to it often resulting from increased salinity during development, as well as the benefit of having a small body.
- We will find that not all advantages directly act as a competitive edge, because every organism has their own way of doing things.
- We will solidify that Hox genes play more of a role than expected, as well as the direct species interactions being more impactful than global changes.

Figure 1 - 3D model of right P5 of brachyura (Schmidt 2020).

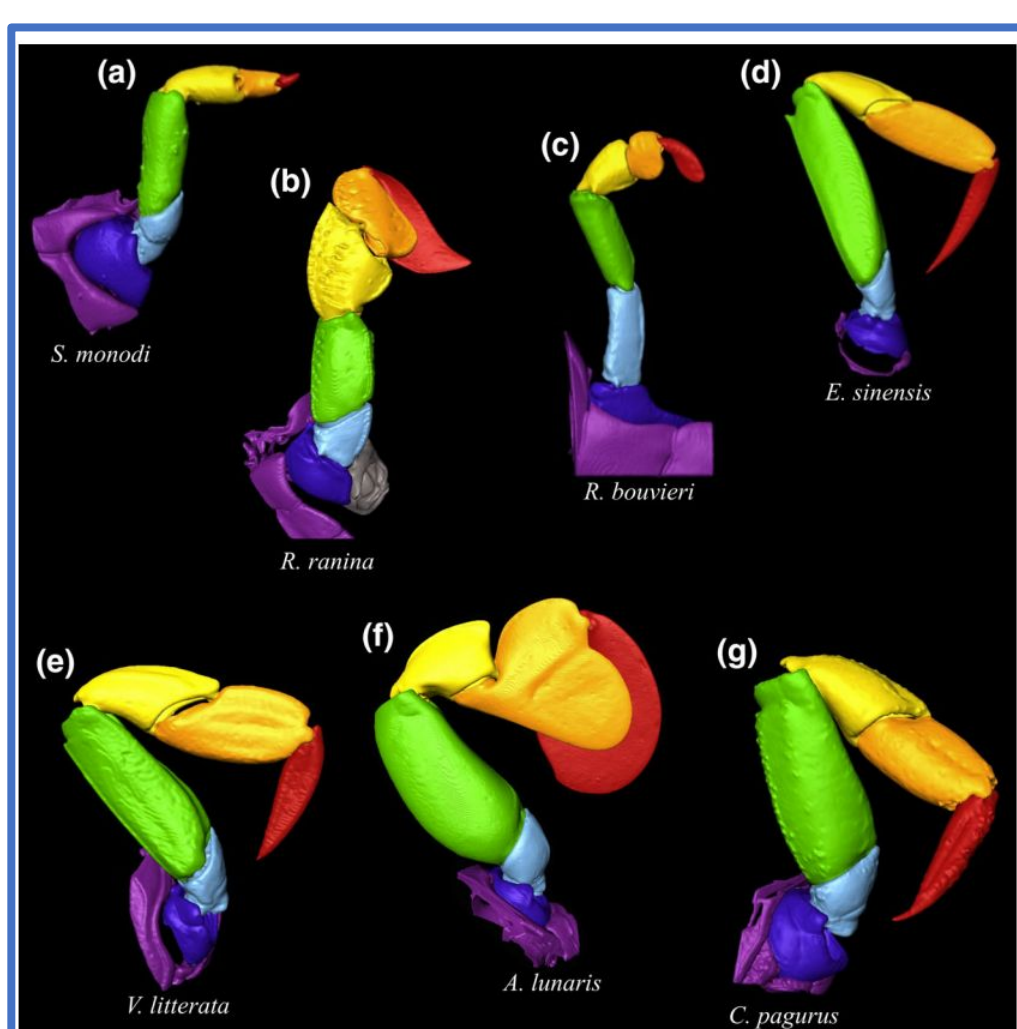
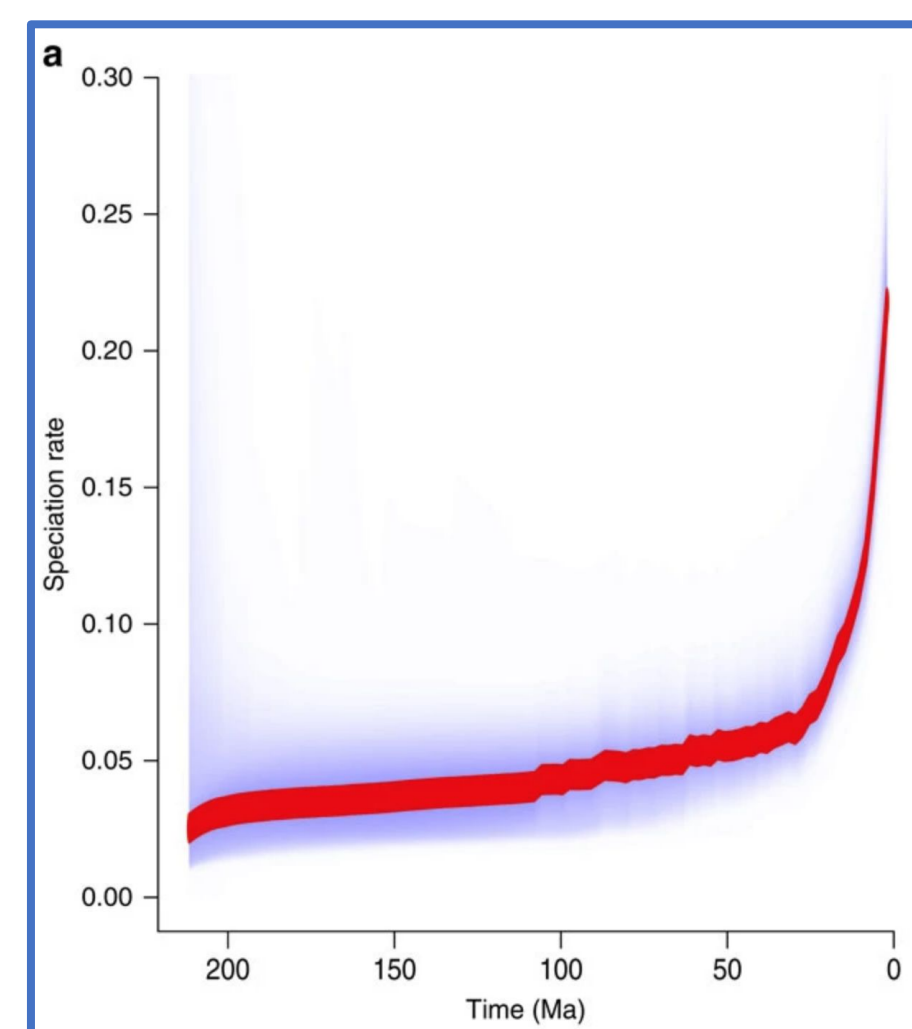


Figure 2 - Speciation rate of marine crustaceans (Davis 2016).



Importance

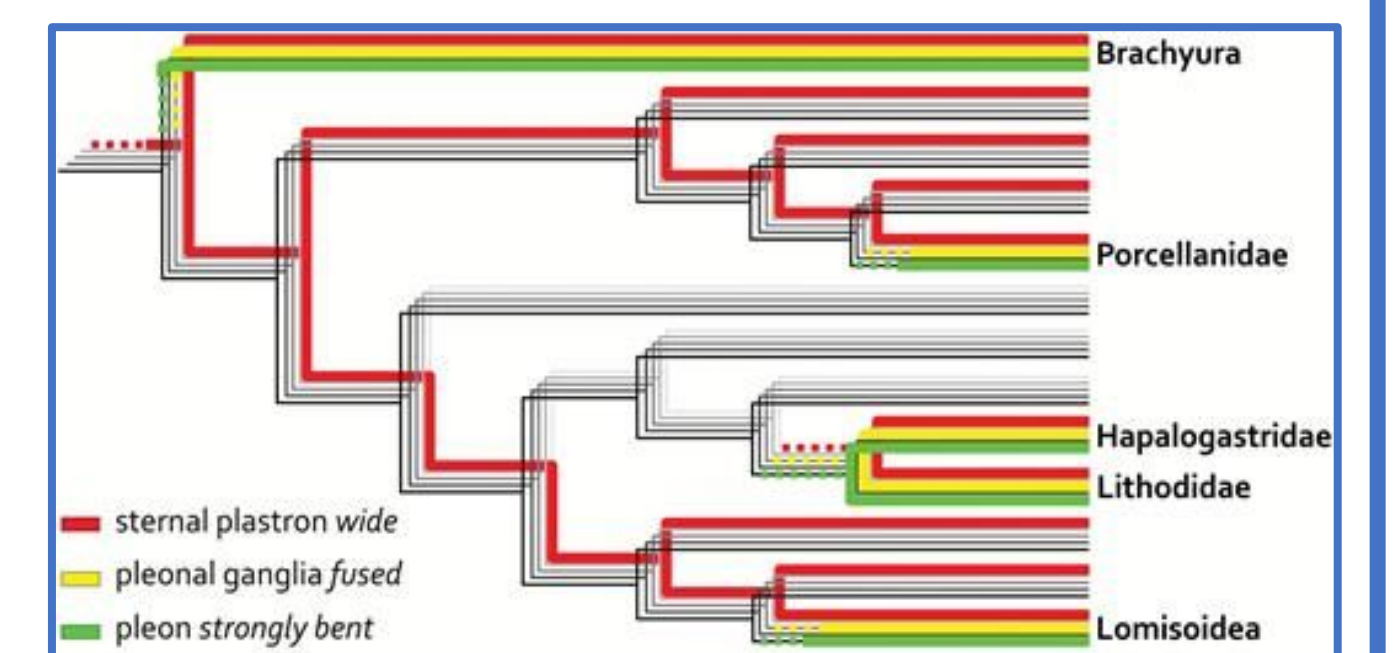
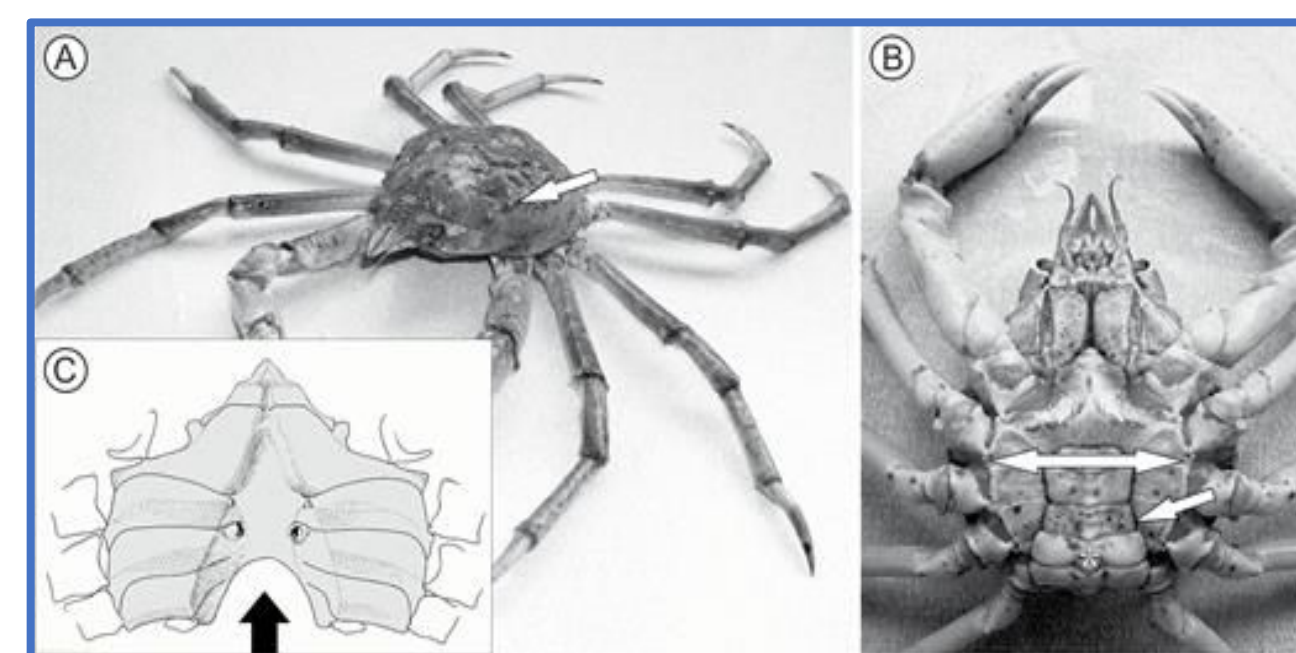
- It is important to understand which traits are favorable because crabs play a key role in both terrestrial and aquatic ecosystems and they can hold many different niches in those ecosystems.
- Also, if we determine which traits are favored by natural selection, we can determine how natural selection might work.

Current Literature

• Characteristics of Carcinization

- Carapace is flatter than it is wide and has lateral margins.
- Pieces of the sternum are fused into one wide plate that aids the function of the gills, and in sideways walking.
- Pleons, posterior body segments, are flattened and strongly bent underneath covering other pleons (Keiler, et al 2017)

Image 3 - Flattened carapace of brachyura **Figure 3 -** Convergent morphological changes to crab-like form (Keiler, 2017).



• Ecological pressures leading to Carcinization

- Protection, locomotion, and ability to occupy different niches (Wolfe 2021).
- Each ecosystem has its own variation that leads to evolution (Anderson 2016).
- Temperature and salinity (Castejón, 2015).

Figure 4 - Chronic effect of the → salinity on the survival to megalopa stage in *Maja brachydactyla* (Castejón, 2015).

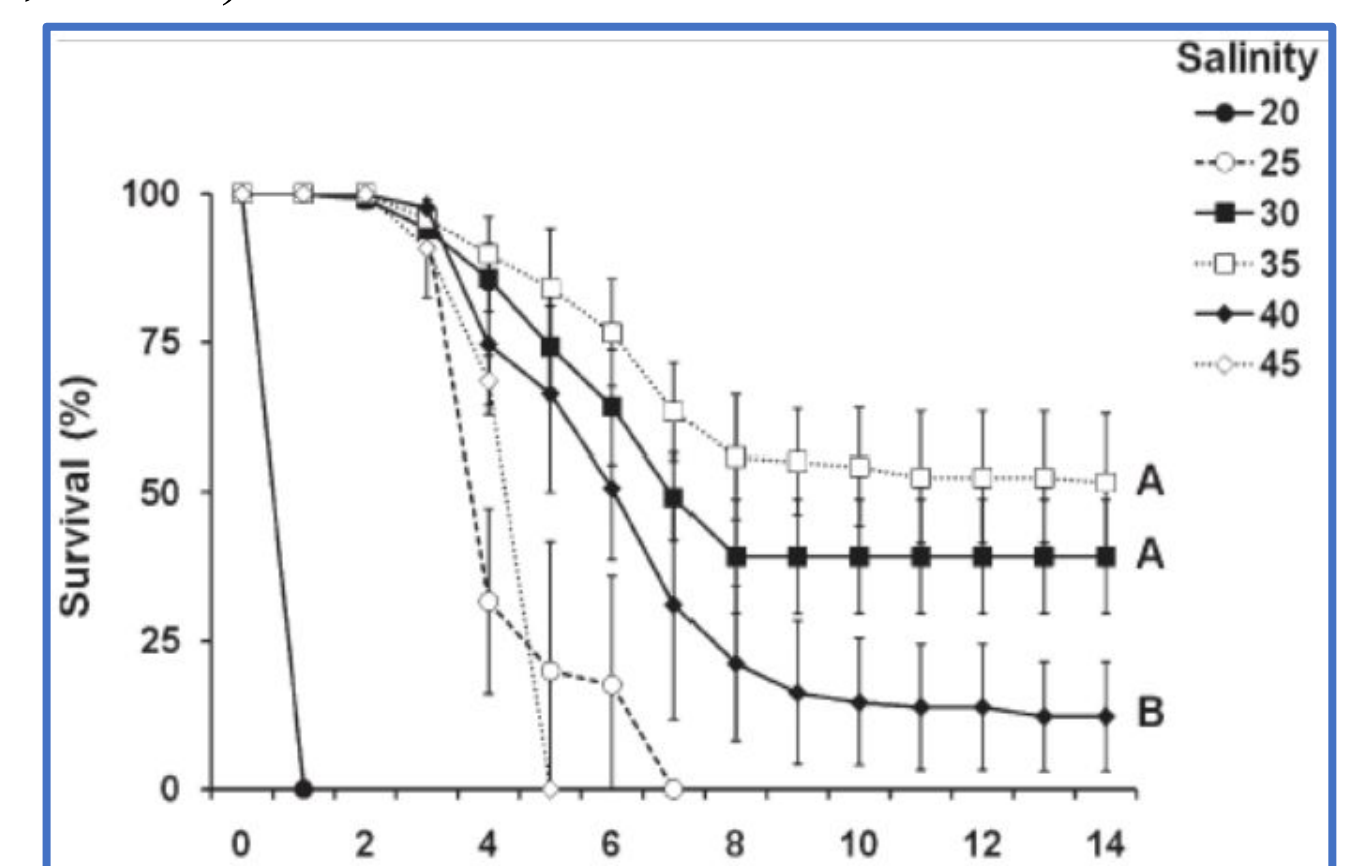


Figure 5 - comparison of gene expression between shrimp, lobster, and crab (Cui, 2021).↓

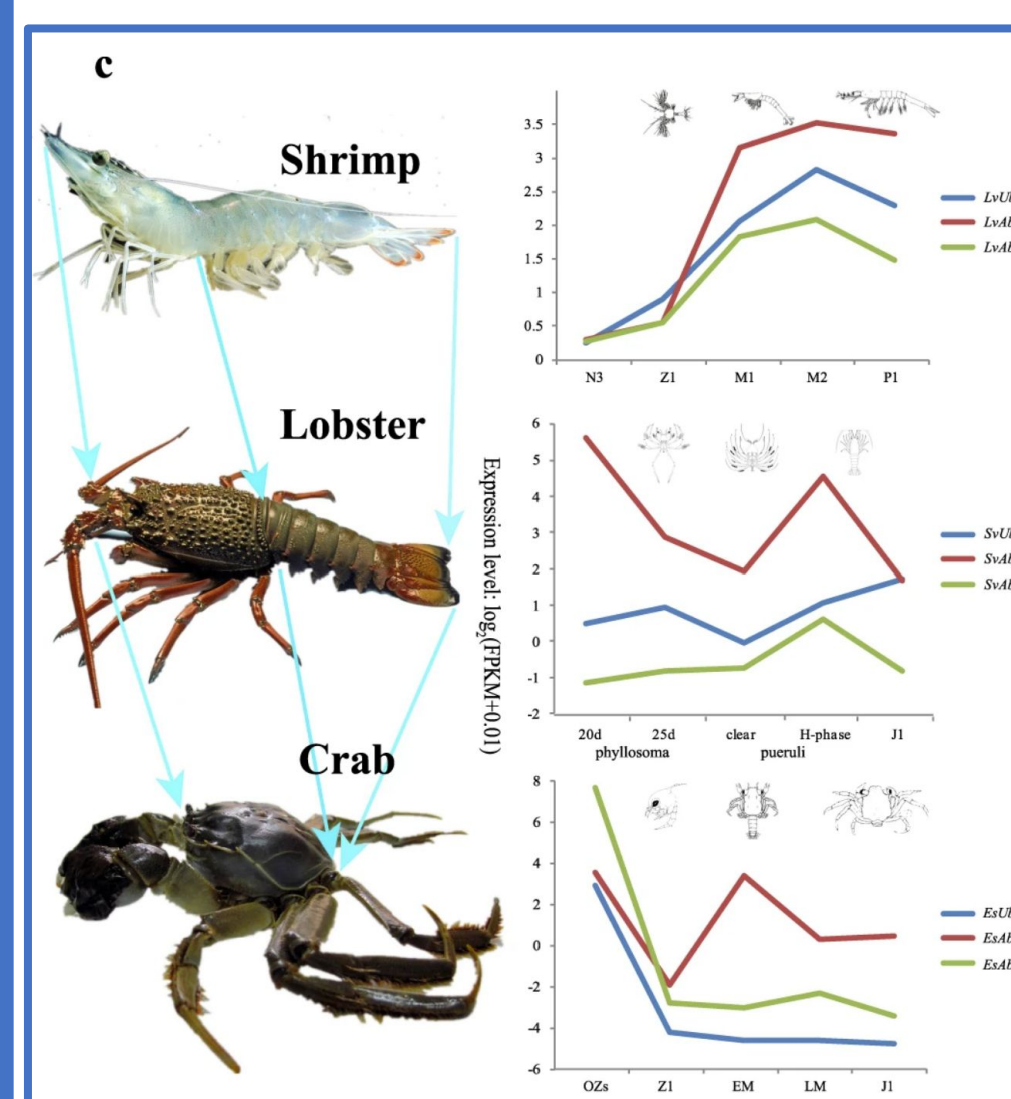
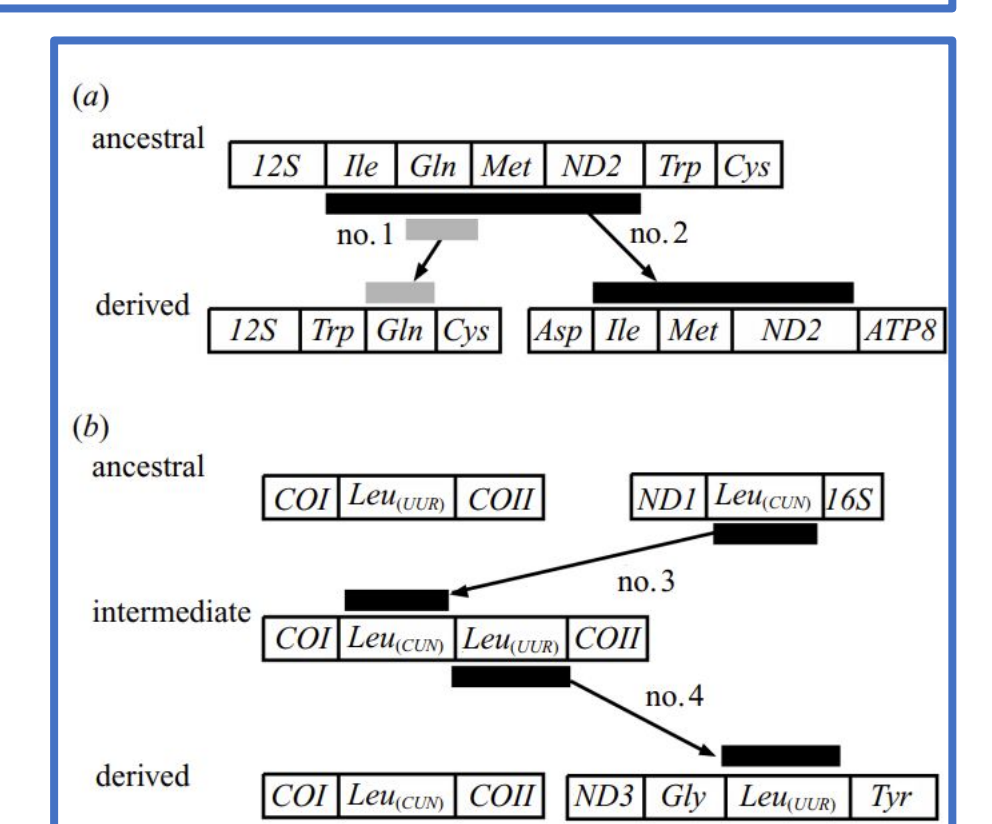


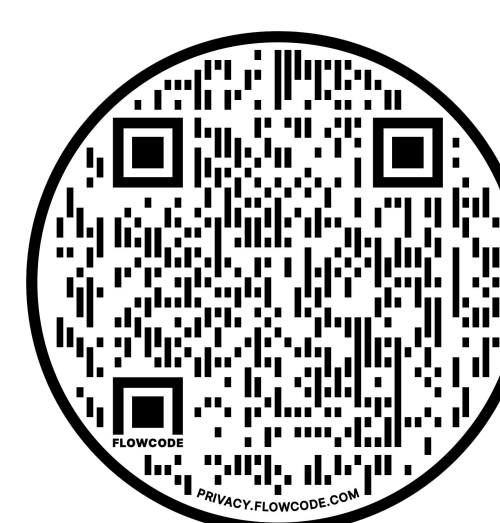
Figure 6 - Gene arrangements that have association with carcinization (Morrison 2002).



• Evo-Devo

- Changes in gene expression of Hox genes that lead to changes in morphology (Morrison 2002)
- Changes in developmental regulation that leads to changes morphology (Cui 2021).
- Morphological changes include the formation of the gastric mill, the shortening of the abdominal nerve cord, the curving of the abdomen beneath the cephalothorax, and the development of functional pereopods, pleopods, and lamellae gills (Castejón, 2018).

References



Acknowledgments

Thank you to Dr. Mark Fink for guided support, and Dr. Richard Franssen for preliminary information on what is carcinization.