Cyclical Parthenogenesis in Crustaceans
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Abstract
Apomixis is an asexual form of reproduction in plants. The cells formed are unreduced and can form an embryo sac without needing gamete fusion. Apomictic parthenogenesis is an asexual form of reproduction in animals.

Many taxa, including plants and crustaceans, should have a single genome able to express both sexual and asexual reproduction as long as the correct metabolic signaling is provided to the germline cells.

Oxidative stress affects the TOR (rapamycin complex 1), a regulator of cell growth, and affects reproduction causing cells to undergo the reduction phase of meiosis.

Current Hypothesis
Asexual reproduction occurs when the plant is not experiencing oxidative stress and has enough nutrients. In the presence of BR, a plant steroid that promotes growth, and DTBA, an antioxidant, the cells skip the reduction stage in meiosis.

Sexual reproduction and apomixis evolved simultaneously during eukaryogenesis, the evolution of eukaryotic life. We think that most organisms retain the capacity for apomixis and sexual reproduction in their genome.

Research Proposal
Members of the Crustacea subphylum have several modes of reproduction such as cyclical parthenogenesis and sexual reproduction.

This makes crustaceans a very good experimental subject to study the metabolic pathway of reproduction in animals, as apomorphic parthenogenesis and sexual reproduction both occur naturally.

I will use apomorphic parthenogenetic crayfish and sexual crayfish to study the reproductive pathway by injecting more nutrients and stressors into their ovaries respectively.

Previous Research
Apomorphic plants have a higher metabolism and an increased stress response, even without the presence of a stresser.

Boechera Gunnisoniana, an apomorphic plant, was treated with hydrogen peroxide (H₂O₂). This led to the cells undergoing the reduction stage of meiosis instead of skipping it.

Boechera stricta, a sexually reproducing plant, was treated with Brassinosteroids (BR), Dithiobutylamine (DTBA), Glucose, and 5-ave cytosine. All treatments caused the cells to skip the reduction stage and form an unreduced dyad.

Bioenergetics of apomixis sex switching in angiosperms (A,B) and hypothesized switching in animals (C,D). White and black-circled numbers indicate treatments that switch apomixis to sex and sex to apomixis.

Practical Application
Knowing the metabolic pathway for animal reproduction and the possibility of being able to switch an animal from sexual to asexual reproduction will really impact the world of breeders.

It can also change lobster and shrimp farming if they become parthenogenetic. Only one lobster or shrimp would be required to reproduce and mating pairs would no longer be a concern.

References

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