EVOLUTIONARY INFORMATION FLOW

Changes In Grade and

Positive and Negative Feedback

What we are after is an explanation of how positive feedback can increase in an evolutionary system, . . .

. . . Resulting in macroevolutionary changes,. . .

. . . Explained by microevolutionary processes.

☺ It all does have to tie together into a whole to have an internally consistent, coherent theory of evolution.

Basic Principle or Premise

According to Elizabeth Vrba the rate of speciation remains constant.

- ☞ That is, the frequency of demes separating allopatrically remains constant, and is random.
- ☞ What differs is the rates of survival of these sibling species
- ☞ According to the Turnover Pulse Hypothesis the rate of survival is controlled by the environmental conditions.

The Turnover Pulse Hypothesis

① Stasis is the norm for both species and ecosystems.

② Ecosystems undergo periodic disruption.

③ Ecosystem disruption results in extinctions.

- ☞ Extinction hurts specialists more than generalists.

④ Extinction either . . .

- ☞ Creates new opportunities in environments, or . . .
- ☞ Results in new environments with opportunities.

⑤ New opportunities result in a rapid pulse of opportunistic and essentially random speciation of specialists.

⑥ Species sorting determines the ultimate direction of the new evolution.

☞ Evolution is historical, not teleological.

⑦ Rapid speciation and species sorting quickly leads to a new stasis, with more specialists in marginal niches than generalists in broad niches.

Although this argument is made mostly in terms of "environmental" changes, environmental changes can also be caused by the organisms themselves,. . .

☺ As when a major new predator evolves,. . .

☺ Or, an area is invaded by outside species,. . .

☺ Or, a Red Queen condition is in effect,. . .

☺ Or, a new evolutionary grade is achieved - our interest here.

Positive Feedback as Increased Information Flow

☺ The achievement of a new grade of adaptation by a deme or a species represents a new stratified stability.

☺ The new stratified stability tends to destabilize or unbalance the ecosystem.

☺ This destabilization increases the information flow in the evolutionary system, which increases the positive feedback.

WHY AND HOW THE INFORMATION FLOW INCREASES

The positive feedback increases because the organism is better adapted than the species immediately surrounding it.

① It gathers more food more efficiently and is more competitive.

➳ Increases the energy flow at this step.

② Therefore, population size and range expands.

- ➳ The increased population leads to expansion of the matings, mutations, and exchange of genetic information.
- ➳ In essence increased information flow.

③ The number of demes (local breeding populations) representing the species increases greatly.

④ These demes have a greater probability of expanding off into, and becoming adapted to, the marginal environments.

- ➳ This increases the diversity in the gene pool.
- ➳ In essence, increased amount of information.

⑤ As a result the marginal demes are more likely to evolve specializations that adapt them to that marginal environment

- ➳ Number of new speciation events increases
- ➳ Many of these species are more specialized (following the Effect Hypothesis of Elizabeth Vrba).
- ➳ More species that are more specialized means more information.

⑥ Increases in the number of species increases the information flow in the ecosystem.

- ➳ A Red Queen Hypothesis effect - greater interaction increases competitiveness which increases the information flow as species try to adapt.
- ➳ Alternatively (according to the Effect Hypothesis) clades which speciate more rapidly (have greater information flow) increase in the population, increasing the information flow.

Therefore, the sum result of a new grade (stratified stability) in an increase in the rate of speciation and creation of specialized species.

Because there are more specialized species the clade expands rapidly in a new adaptive radiation.

The result is a burst of rapid evolution and exploitation of the new grade of evolution.

Longer Term Effects

☺ Because the new grade (clade) is evolving rapidly it is experimenting (specializing) with a large number of new adaptations.

IF there is a major environmental crisis then there is the likelihood that these new specialized adaptations may be wiped out, and the more generalized species survive (Effect Hypothesis).

However . . .
IF all the experimentation can result in a new stratified stability (grade) (platform) that is robust . . .

. . . {Might move into a new habitat (such as a terrestrial one for first amphibians), or create a new niche . . .}

THEN it has a good chance to be the generalized species in that new habitat or niche and thus surviving the extinction event.

Because it is now the best thing on the block it starts the whole adaptive radiation cycle off again on the way toward another stratified stability.