Does Nature Have the Power to Create New Biological Forms?

Arguments of Evolution—Mutations and Natural Selection

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Darwin's evolution

- In Darwin's theory, evolution is the product of
  - Heritable variation
  - Struggle for life
  - Natural selection (survival of the fittest)
- In the struggle for survival, natural selection preserves the most favorable traits.
- The less favorable traits go extinct.

Genetic Variations and Mutations

- The motor of evolution is natural genetic variation.
- In Darwin's time, the mechanisms of genetic variation were unknown.
- Now we know that new variations originate as mutations or accidental changes in the DNA.
- Neo-Darwinists believe that even if natural variations do not provide enough information to build new organs, structures or body plans, new mutations in the genes can.

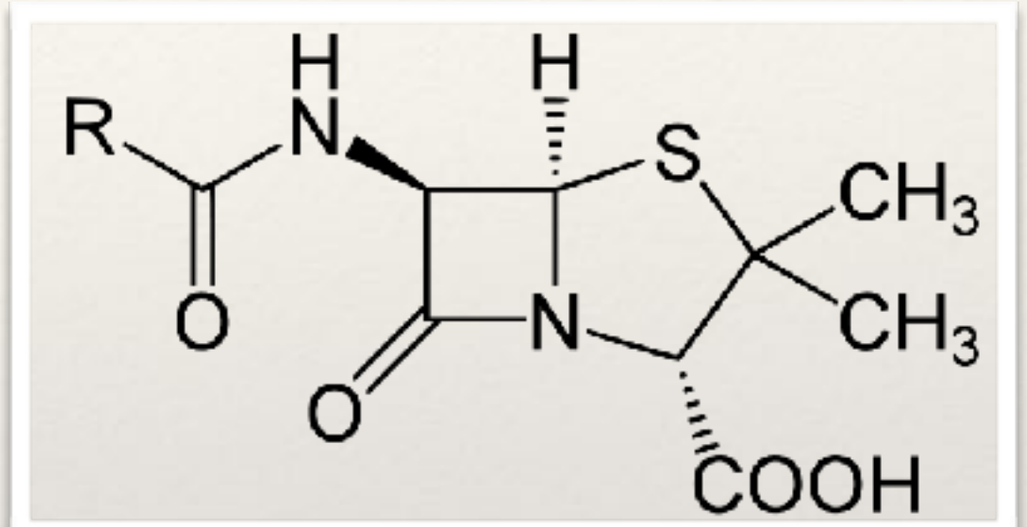
Mutations

- Mutations are changes in the DNA structure: changes in the sequential arrangements of the DNA bases (ACTG), which its the genetic text.
- There are different kinds of mutations depending on what they change:
  - Point mutations: a change in a single base.
  - Duplication mutation: a swap of genetic material between paired chromosomes.
  - Inversion mutation: a section of the DNA is flipped over so that it reads backwards.

- Some DNA mutations have no effect (neutral)
- Most others are harmful.
- Beneficial mutations are extremely rare.
- Neo-Darwinists claim that beneficial mutations, though extremely rare, mutations provide genetic variations, and ultimately new traits, structures, organs and organisms.
- Textbooks offer a few examples of putative beneficial mutations:
  - Antibiotic resistance
  - Insecticide resistance

Antibiotic Resistance

- The first antibiotic—penicillin—was discovered in 1928 by Alexander Fleming.
- Penicillin, and other antibiotics discovered afterwards, were shown to kill bacterial life.
- However, many types of bacteria have developed *antibiotic resistance* following extensive use.
  - Bacteria survive their encounter with the chemical antibiotic and continue to reproduce.



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Antibiotic Resistance

- How does bacterial resistance work?
- Most cases are due to the production of complex enzymes that inactivate the poison.
  - The bacteria produces *penicillinase,* which chemically cuts the antibiotic before it enters through the bacteria cell wall.
  - Some bacteria are able to produce penicillinase and survive, others don't produce it and die.
- Bacteria that become resistant to antibiotics survive, reproduce and pass their DNA to their descendants.
- As a result, the next generation of bacteria is also resistant to the antibiotic.

- There is another way by which bacteria become resistant to antibiotics: spontaneous mutations.
- Bacteria multiply very quickly, and sometimes copying errors occur in the duplication of DNA.
- A copying error may replace one amino acid in a bacterial protein with a different amino acid.
- Often this replacement is harmful to a bacterium, but sometimes it provides a mechanism of resistance to an antibiotic.
- How does that happen?

- Antibiotics work by attacking fundamental genetic information processes or molecular machines, such as DNA replication, RNA synthesis and enzymatic protein synthesis.
- The antibiotic kill bacteria by inserting themselves into a an *active site* of the molecular machine or protein, preventing such machine from working properly.
- As a consequence, the bacterium either fails to grow or dies.

- However, sometimes a DNA mutation changes the shape of the *active site* of the target protein.
- As a result, the antibiotic is not able to attach to the active site of the protein.
- A simple mutation may, therefore, render the bacterium resistant to the harmful effect of the antibiotic.
- Thus the mutation gives a competitive advantage to the bacterium over other bacteria.
- In a few generations, as the non-resistant bacteria have died, the population of antibiotic-resistant bacteria become predominant.

- Neo-Darwinists claim that the development of resistance to antibiotic is a good example of microevolution through random mutations that provide a source of beneficial variation.
- Mutations produce new genetic information upon which natural selection can act.

The Four-Winged Fruit Fly

- *Drosophila melanogaster*
- The second thoracic segment bears a pair of wings
- Third thoracic segment bears a pair of *halteres* or balancers.
- The balancers stabilize flight
- Mutations have been triggered to alter the haltered to produce four wings.

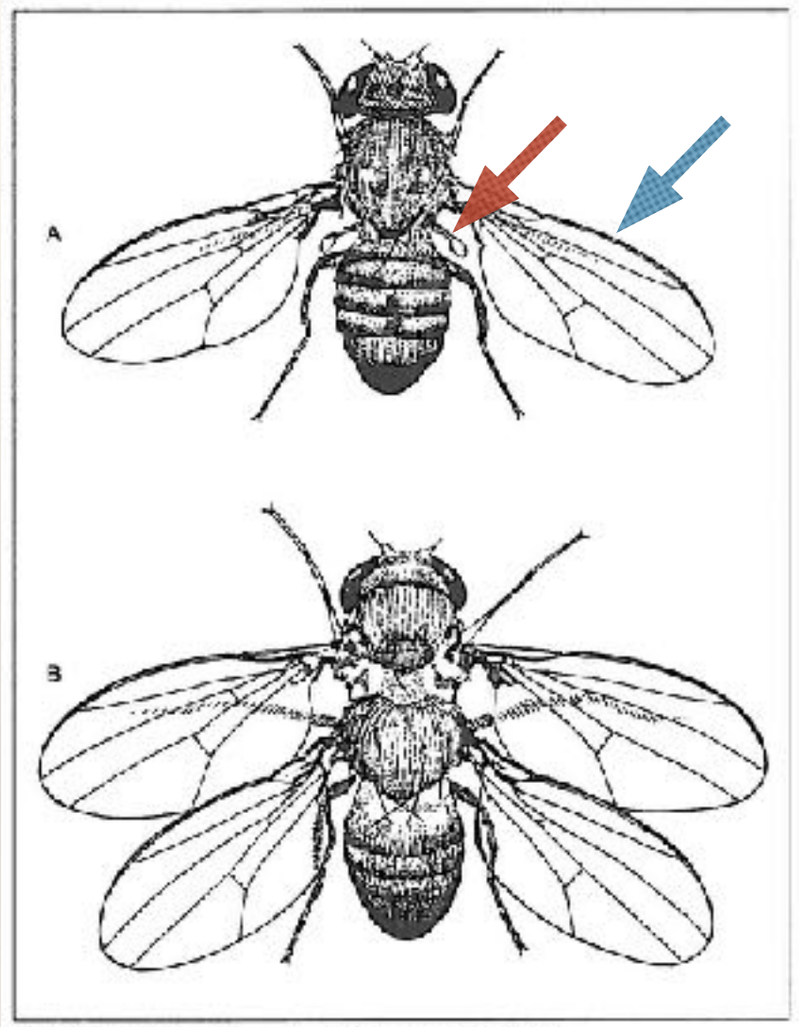

FIGURE 9-1 Normal and four-winged fruit flies.

(A) A normal or "wild-type" fruit fly, with two wings and two halancers or "halteres" (tiny appendages on either side between the wings and the rear legs); (B) A mutant fly in which the halteres have developed into normal-looking wings.

(Wells 2000)

Mutations and Evolution

- Textbooks claim that both bacteria resistant to antibiotics and fruit flies with four wings are good examples of:
  - Genetic mutations that originate new variations.
  - Evolution.
- However, critics of neo-Darwinism assert that
  - Mutations are significantly limited in what they can produce: 99.99% of them are harmful.
  - Mutations are not able to produce enough of the right type of change needed to form new structures or life forms.

Antibiotic Resistance is Not Evolution

- Antibiotic resistance shows that DNA ha a limited capacity for change, not the extraordinary capacity for change that neo-Darwinism requires.
- When penicillin is in the body, bacteria with gene coding for penicillinase will have significant survival advantage over bacteria without penicillinase.
- Bacterial cells either have a gene for penicillinase or they don't, but they don't develop such a gene when the antibiotic is introduced.

- Therefore, the bacterial defense mechanism against antibiotics tell us nothing about whether mutations can produce new structures or forms of life.
- However, bacterial resistance, as we have mentioned, also develops by point mutations.
- And natural selection, when acting upon such beneficial mutations, can produce small-scale change (microevolution).

- The question is whether these point mutation that produce microevolution can lead to macroevolutionary.
- There are limits to the kinds of change that these mutations can produce.

- The mutation changes the shape of the molecular machine's active site, which prevents the antibiotic fro attaching to it.
- But that process also hampers the molecular machine, which will not function adequately.
- The bacteria survives the antibiotic, but becomes "handicapped."
- And there is another problem.

- If more mutations happen that affect the active site, vital systems may be damaged.
- The molecular machine(s) may stop to work altogether.
- Multiple mutations eventually kill bacteria as well.
- This helps to explain some observations made in the laboratory.

- Experiments sow that once the antibiotics are removed from the environment, the non-resistant bacteria makes a come-back and replace the resistance bacteria within a few generations.
- Why does this happen?

- A mutation gives an advantage to bacteria: resistance to antibiotics.
- However, the same mutations weakens the bacteria, which are not able to perform other vital functions.
- When the environment is back to normal (absence of the antibiotic), the mutant bacteria is less fit in the struggle for survival.
- Biologists call this the “fitness cost” of a mutation.
- When bacteria acquire resistance to antibiotics by mutations at active sites, the new mutant bacteria become less fit for short-term competitiveness.

- Because of that some scientists claim that several mutations of the same kind are more likely to destroy functions and organisms than to produce fundamental new organs, structures or forms of life.
- Therefore, there are limits to the amount and type of change that mutations and natural selection can produce.
- Could mutations causing antibiotic resistance produce new forms of life?

- Resistance results from small-changes to a single protein molecule.
- These mutations do not contribute to fundamental changes in the organism's shape or structure, no matter how many times those mutations occur.
- These mutations don't even change the bacterium into a different kind of bacterium.
- Neo-Darwinists assert that in order to produce major biological change, mutations to multiple separate protein machines must occur.

- But evolution needs mutations that produce new morphologies, including at the molecular level.
- Mutations can cause antibiotic resistance only change a small part of the active site of a protein molecule.
- They do not change the molecule or its overall morphology.
- Thus these mutations will not change the structure of the fundamental proteins of the organisms, the organization of the organism or the organism as a whole.

- Scientists have done thousands of experiments inducing lots of mutations in bacteria.
- These experiments attempt to simulate evolution over many generations.
- Yet no new bacterial species has ever been formed.

The Four-Winged Fruit Fly

- It's not easy to produce a four-winged fruit fly.
- Three mutations are needed.
  - *Bithorax* mutant discovered in 1915.
    - With tiny second
  - Other mutations artificially produced.
    - *Postbithorax*, with tiny wing, but deformed
    - *Anterobithorax*
      - Combining the other two mutations
      - Large second wing
- Only a fly possessing all three mutations bears four normal-looking wings.

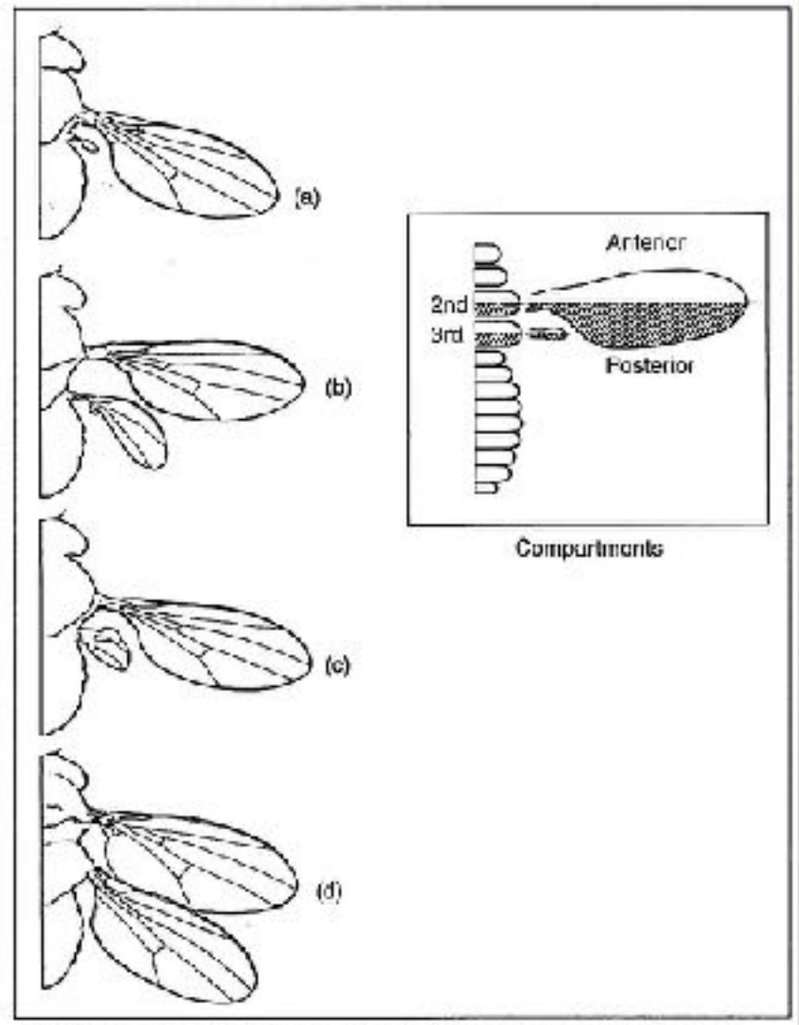

FIGURE 9-2 Steps in the construction of a four-winged fruit fly.

The box at the upper right shows how each segment is divided into an anterior and posterior compartment. (a) Normal fly; (b) *bithorax* mutant; (c) *postbithorax* mutant; (d) triple mutant (*anterobithorax*, *bithorax*, and *postbithorax*). The *anterobithorax* mutation enhances the effect of *bithorax*.

(Wells 2000)

- To produce a four-winged variation, the all three mutations had to be *artificially* combined.
  - An intelligent agent has to manipulate three generations of flies and trigger mutations to obtain the desired four-winged fly.
- Neo-Darwinism postulates that new structures arise by natural selection acting upon unguided, random mutations.
- The four-winged *Drosophila* are the result of engineered experiments in carefully controlled environments.
- Such a combination is extremely unlikely to occur in nature.
- It does tell us much about what undirected mutations can produce in the natural environments.

- Nevertheless, what happens to the four-winged fly?

- All three mutations in the four-winged fruit fly affect a single large gene, *Ultrabithorax*.
- The mutations do not affect the proteins produced by the gene, but only where the protein is produced.
- This depends on “regulatory sequences” that turn on or off the activity of genes.

- The second pair of wings in *non-functional*.
  - It lacks flight muscles.
- The fly's ability to fly is seriously impaired, and not only because the extra wings have no muscles, but also because the balancers are missing.
- The fly has difficulties mating.
- Some evolutionists call these flies "hopeless monsters" (Mayr 1963)

Mutations and Functionality

- Evolution happens when new structures appear in organisms.
- The extra wings do not represent a *gain* of structures.
- Instead, it represents a *loss* of structures:
  - The balancers, which the flies need for flight.
- Therefore, these mutations have not added anything new.
- Instead, they produce dysfunctional flies.

Mutations and Evolution

- Some evolutionists belief that two-winged flies evolved from four-winged forms (NAS 1998, 1999)
- Perhaps, B*ithorax* is a mutation back to the ancestral form.
- Although this could be possible, evidence indicates the opposite.

Mutations and Evolution

- What really changes the number of wings in a fly is not just mutations.
- The *Ultrabithorax* gene does not work alone to cause the four-winged variation.
- A complex genetic network of genes works to generate variations.
  - Those genes are independently regulated
- There is a hierarchy.
- The hierarchy had to evolved simultaneously and not just one gene.

Mutations and Evolution

- Mutations can shut down a complex system of genes, enzymes, hormones and proteins (a regulatory network).
- But mutations cannot explain how the system originated.
- And the origin of the system is what evolution theory needs to explain, and not how it can be shut down.
- Therefore, it does not provide evidence for the origin of the raw material for morphological characters.

- Thousands of genetic experiments have been carried out to increase the mutation rates of fruit flies (*Drosophila melanogaster*) and other organisms.
  - Subjected to X-ray treatments
  - Mutation rate increases up to 150 times the normal rate
  - No new species emerged from these experiments
  - Random mutations are either irrelevant or lethal
  - Experiments failed to confirm Darwin's assumption that the accumulation of small differences will produce new species.

- Success in mutations have been limited to changes within fixed limitations or genetic boundaries.
- No new structures are produced.
- No explanation on how existing structures came to be.

The Sickle Cell Mutation

- A mutation that first occurred in humans thousands of years ago.
- Causes a deformation in the blood cells.
- When a person inherits the mutant gene from both parents, he develops a terrible sickle-cell disease
  - Disability
  - Death

The Sickle Cell Mutation

- Why the mutant gene persisted in the species for so long instead of being eliminated by natural selection.
- Often a person inherits the mutation from only one parent.
  - In this case he does not get the full disease.

- The mutation confers some protection from the ravages of malaria
- Malaria-bearing people in Africa with the sickle-cell mutation have some likelihood of surviving to adulthood.
- For the descendants of Africans in other America or Europe, however, the anti-malarial protection is irrelevant because there is no malaria.
- In those areas, the mutation is only a terrible killer with no benefit.
- Natural selection will eliminate it.

- The sickle-cell mutation is deadly.
- It causes degradation
- In the case of malaria bearers, it only increases likelihood of survival.
- It does not build
  - New complex structures
  - New organs
  - New information
- The mutation is not preparing the organism to become something different and better

Conclusion

- Textbooks examples of small-scale variations (microevolution) fail to provide models for major changes (macroevolution).
- These small changes can be beneficial in certain environments or under specific conditions.
- However, these small changes do not produce new structures, organs, or body plans.
- Mutations either have no effect on the development of the embryo or they have a damaging effect.
- Mutations never change the *direction* of development, as would have to happen if evolutionary change were to occur.
- Most mutations are harmful or deadly.
- Large-scale, beneficial mutations do not occur.

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