Lecture 29
Darwin on Similarities between Species

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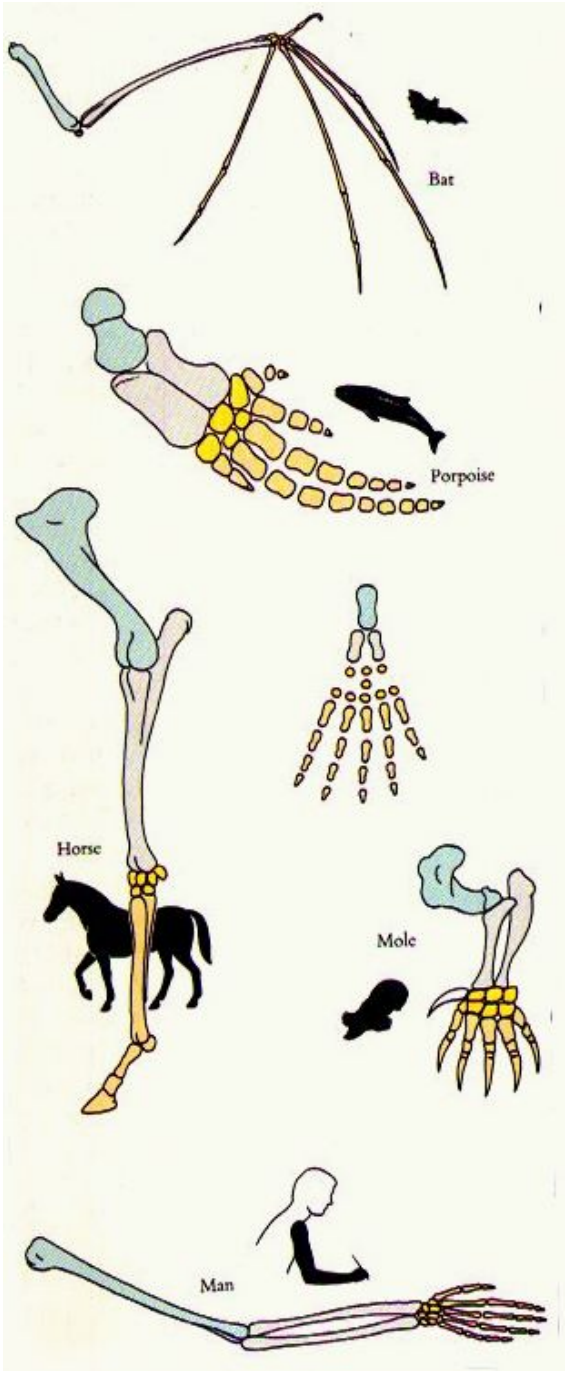
Homology



What can be more curious than that the hand of a man, formed for grasping, that of a mole for digging, the leg of the horse, the paddle of the porpoise, and the wing of the bat, should all be constructed on the same pattern, and should include similar bones, in the same relative positions? (382)

Other examples (382–83)

We see the same great law in the construction of the mouths of insects . . . The same law governs the construction of the mouths and limbs of crustaceans. So it is with the flowers of plants.

Definitions

- Homologous: Having the same structure. E.g., the arm of a man and the wing of a bat are homologous.
- Homology: The correspondence between homologous parts. E.g., there is a homology between the arm of a man and the wing of a bat.

Let H = different species have homologous parts used for very different purposes, C = species were independently created.

H not expected given C (383)

Nothing can be more hopeless than to attempt to explain this similarity of pattern in members of the same class, by utility or by the doctrine of final causes. The hopelessness of the attempt has been expressly admitted by Owen in his most interesting work on the 'Nature of Limbs.' On the ordinary view of the independent creation of each being, we can only say that so it is;—that it has pleased the Creator to construct all the animals and plants in each great class on a uniform plan.

Let N = species arose by natural selection.

H expected given N

- Natural selection can only modify species in small steps, so it can't alter the relative position of parts.
- All mammals are descended from some ancient species and hence all mammal limbs today are modifications of the same general structure.
- Similarly with mouths of insects, parts of flowers, etc.

Application of the law of likelihood

- Since H is expected given N, but not given C, $p(H|N) > p(H|C)$.
- So by the law of likelihood, H favors N over C.

Embryology

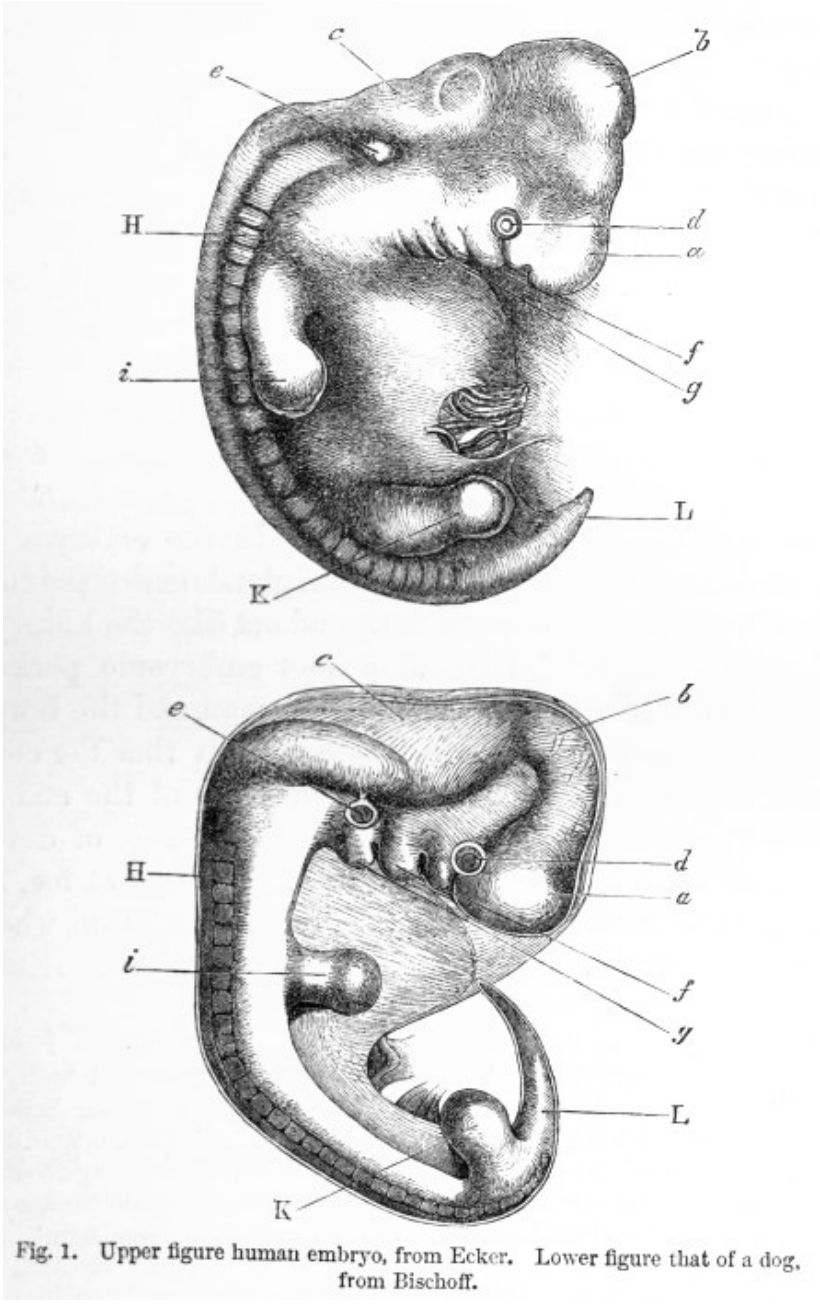
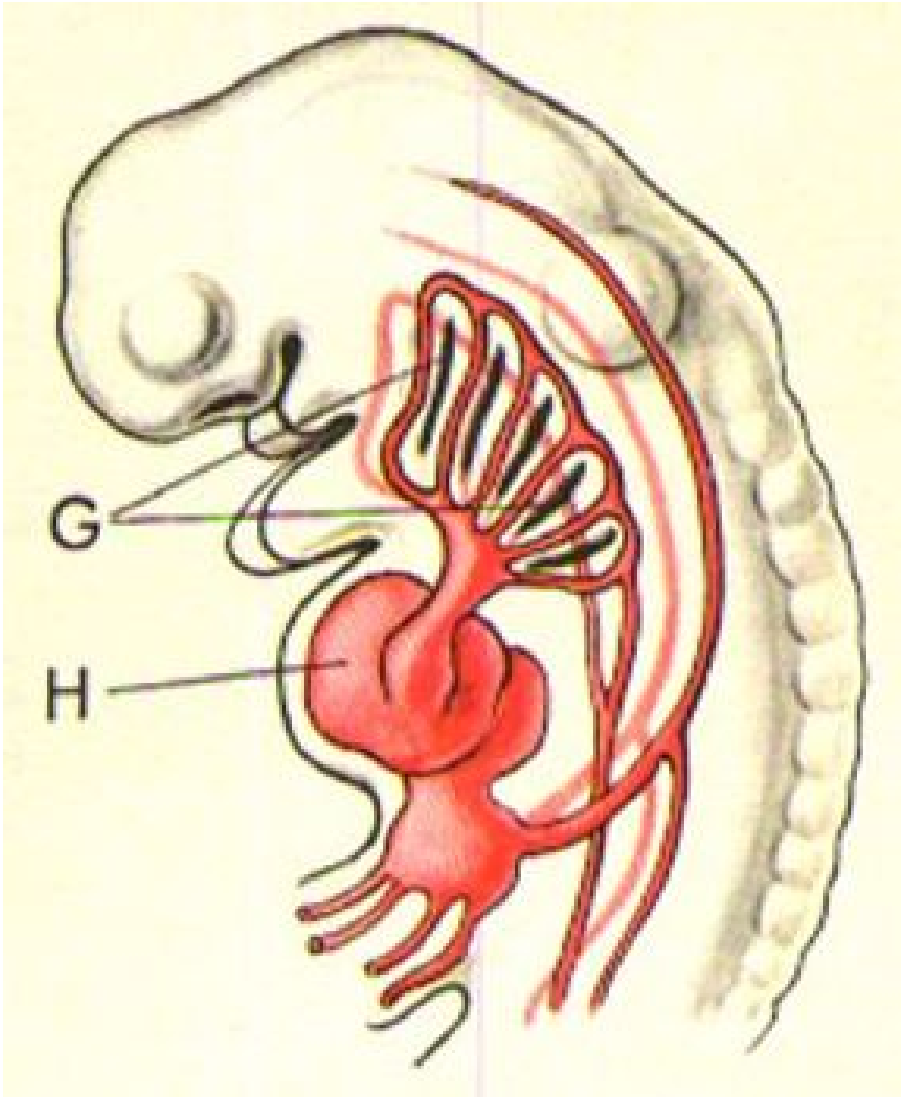


Fig. 1. Upper figure human embryo, from Ecker. Lower figure that of a dog, from Bischoff.

Generally the embryos of the most distinct species belonging to the same class are closely similar, but become, when fully developed, widely dissimilar. A better proof of this . . . cannot be given than the statement by Von Baer that . . . "In my possession are two little embryos in spirit, whose names I have omitted to attach, and at present I am quite unable to say to what class they belong. They may be lizards or small birds, or very young mammalia." (388)



The points of structure, in which the embryos of widely different animals within the same class resemble each other, often have no direct relation to their conditions of existence. We cannot, for instance, suppose that in the embryos of the vertebrata the peculiar loop-like courses of the arteries near the branchial slits are related to similar conditions,—in the young mammal which is nourished in the womb of its mother, in the egg of the bird which is hatched in a nest, and in the spawn of a frog under water.

(388)

Let E = embryos of different species are similar.

E not expected given C

- The similarities aren't necessary for the embryos, e.g., gill slits.
- It's possible the creator would make the embryos of many species alike for some reason, but this isn't what you'd expect a priori.

E expected given N

- The differences between species are adaptations for different ways of living. Embryos don't engage in those ways of living, so for them there is no advantage in having the characteristic features of their species.
- So natural selection can be expected to modify the form of grown organisms and not change the embryos much.
- *We look at the embryo as a picture, more or less obscured, of the progenitor . . . of all the members of the same great class.* (396)

Application of the law of likelihood

- Since E is expected given N, but not given C, $p(E|N) > p(E|C)$.
- So by the law of likelihood, E favors N over C.

Rudimentary organs

Organs or parts in this strange condition, bearing the plain stamp of inutility, are extremely common, or even general, throughout nature . . . In snakes one lobe of the lungs is rudimentary; in some species [of birds] the whole wing is so far rudimentary that it cannot be used for flight. What can be more curious than the presence of teeth in fœtal whales, which when grown up have not a tooth in their heads; or the teeth, which never cut through the gums, in the upper jaws of unborn calves? . . . There are beetles belonging to closely allied species, or even to the same identical species, which have either full-sized and perfect wings, or mere rudiments of membrane, which not rarely lie under wing-covers firmly soldered together; and in these cases it is impossible to doubt, that the rudiments represent wings. (397)

Let R = rudimentary organs are common.

R not expected given C (399–400)

I have now given the leading facts with respect to rudimentary organs. In reflecting on them, every one must be struck with astonishment; for the same reasoning power which tells us plainly that most parts and organs are exquisitely adapted for certain purposes, tells us with equal plainness that these rudimentary or atrophied organs, are imperfect and useless. In works on natural history rudimentary organs are generally said to have been created "for the sake of symmetry," or in order "to complete the scheme of nature." But this is not an explanation, merely a re-statement of the fact.

R expected given N

- Species inherit these organs from an ancestor species, for whom they were useful. The organs are now useless because the species has changed.
- Useless organs may be reduced in size to conserve energy, or because the organ is harmful in the new situation (e.g., wings of beetles on oceanic islands). They aren't immediately eliminated because natural selection works slowly.
- *On the view of descent with modification . . . the existence of organs in a rudimentary, imperfect, and useless condition . . . might even have been anticipated.* (402)

Application of the law of likelihood

- Since R is expected given N, but not given C, $p(R|N) > p(R|C)$.
- So by the law of likelihood, R favors N over C.

Questions

1. Do the observed homologies between different species favor natural selection over independent creation as the origin of species? Justify your answer using the law of likelihood.
2. Does the similarity of embryos of different species favor natural selection over independent creation as the origin of species? Justify your answer using the law of likelihood.
3. Does the existence of rudimentary organs favor natural selection over independent creation as the origin of species? Justify your answer using the law of likelihood.

Reference


Charles Darwin.
On the Origin of Species.
London, 6th edition, 1872.
At darwin-online
Numbers in parentheses are page numbers of this edition.