e12 Artificial selection and natural selection < inbreeding, Malthus>

There is no creature whose inward being is so strong that it is not greatly determined by what lies outside it. —George Eliot, *Middlemarch*, 1871-2.[1]

I think I may fairly make two postulata. First, That food is necessary to the existence of man. Secondly, That the passion between the sexes is necessary and will remain nearly in its present state. —**T. R. Malthus**, *An Essay on the Principle of Population*, 1798.[2]

It is difficult to believe in the dreadful but quite war of organic beings, going on in the peaceful woods, & smiling fields. —Darwin, March 12, 1839, *Notebook E*.[3]

Animal and plant breeders can produce a great variety of domestic organisms as for example: breeds of dogs and pigeons of which Darwin knew, and of which we know: maize, with multiple rows of large, soft kernels on a large corn cob, from teosinte with its two side-by-side rows of bone-hard seeds (this wild grass persists in the Central Balsas Valley in Mexico's southern highlands where evidence of domestication of a subspecies is two tiny maize cobs that date 6,300 years old excavated from Guilá Naquitz Cave); the giant tomato (brought to Europe by Hernán Cortés)[4] from the pea-sized wild plant; and, over the possible objections of some super-tasters, borecale, braganza, broccoli, brussels sprouts, cabbage, cauliflower, cole, collards, kale, and kohlrabi from just one species, *Brassica oleracea*. Conscious selection and controlled cross-breeding and inbreeding of variant types does the job. This human activity is *artificial* (or *domestic*) *selection*. The question that Darwin asked was: can unconscious nature do a similar job? The answer he conjectured was: *given time enough, the struggle for survival of competing organisms for limited resources would be a process of natural selection*. Forty years earlier, Hutton's proof of an exceedingly old Earth lent Darwin (via Lyell) all the time he reasonably needed. (Hutton, whose writings had not been read by Darwin, had himself earlier argued for the origin of races by natural selection, see ***Footnote e12.1***.) *Natural selection* makes a wild species more fit by the competitive elimination of its less fit. In that sense it is utterly different from the physical evolution of the inanimate aspects of the world or the universe in which the world is, for the "evolution" of inorganic entities in no way involves Darwinian natural selection. To clearly make this distinction, one can use the retronyms: *physical (or inorganic) evolution* and, what is not the same, *organic evolution* (which is now understood to mean *neo-Darwinian evolution, see* Topic *f14*).

The harsh realities of nature have long been recognized. The life of an individual in a state of nature is "solitary, poor, nasty, brutish, and short" wrote Thomas Hobb in *Leviathan*, 1651. And from 1798 on, there existed an awareness of **Thomas Robert Malthus**'(1766-1834) pessimistic principle that domestic population growth will always tend to outrun the food supply as population will increase, if unchecked, in a geometrical progression, while the means of subsistence will increase only in an arithmetical progression. Starkly realized as causative of genocide in Rwanda where by 1992 burgeoning population had reduced median farm size to 0.72 acres from 0.89 acres in 1988.[5] As for wild populations, Darwin had perceived a similarly harsh truth: parsimonious nature selects by restriction, in time, of its unfit and promotion of the more fit. And with exceeding art, for "Man can act only on external and visible characteristics: nature cares nothing for appearances, except so far as they may be useful to any being. She can act on every internal organ, on every shade of constitutional difference, on the whole machinery of life." A population (a species), by this process, evolves *gradually*. "It may be said that natural selection is daily and hourly scrutinizing, throughout the world, every variation, even the slightest; rejecting all that is bad, preserving and adding up all that is good. ..." wrote Darwin in 1859. And Huxley, in gloomy summary in 1887 would pen: "You see a meadow rich in flower & foliage and your memory rests upon it as an image of peaceful beauty. It is a delusion ... Not a bird that twitters but is either slayer or [slain and] ... not a moment passes in that a holocaust, in every hedge & every copse battle murder & sudden death are the order of the day." This process, however, does not explain the rise (evolution) of the more fit than are present already in a species. Darwin realized that natural selection must operate on a creative mechanism that produces new forms. What this is he did not know. In mind though, his grandfather Erasmus Darwin had scooped by seven years Lamarck's central tenant of

inheritance of acquired characteristics, in *Zoonomia; or, The laws of organic life*, 1794-6, a materialistic assessment, written in verse, that humans, and by analogy species, adapt to their environment in a purposeful way:[6] "All animals undergo perpetual transformations; which are in part produced by their own exertions ... and many of these acquired forms or propensities are transmitted to their posterity." But nature has no discernable agenda. So, disavowing his grandfather's tradition of ascribing to teleology laden ideas, Darwin was at a loss for how novelty comes to be.[7] For lack of any better alternative that he could find or be directed to (an understanding of genetics and the inevitability of mutation was not knowledge for him in his lifetime, see ***Footnote e12.2***), Darwin by default urged Lamarckian inheritance of physical change acquired by non-purposeful (immediate) copings of ancestors. In the interval between Darwin's publications and the discovery of genetic mechanism for evolution, E. Ray Lankester (1847-1929), who was aware of Mendel's discovery but had little time for it, showed, from examples, that natural selection can lead to local adaptation by simplification and not improvement by elaboration. By shedding features, parasites achieve envious adaptation with fewer organs and streamlined morphologies.[8] ❑

Footnote e12.1 The principle of seminal variation is that whereas asexual reproduction (propagation of plants by taking cuttings and grafting) does not produce variety, sexually reproducing organisms have offspring with features at some small variance to that of the parents. Hutton elaborating on this principle in *An Investigation of the Principles of Knowledge*, published 1794,[9] and in *Elements of Agriculture*, in preparation 1794-97,[10] described how races of a species can be the result of natural selection and how artificial selection can accelerate the same to perfect traits (as in domesticated dogs, cattle, pigs, sheep, apples, dahlias, pears, and potatoes), perpetuate the seedless (breadfruit, bananas, navel oranges—a mutant appearing in a garden at a monastery in Bahia, Brazil around 1820[11]), and even produce useful hybrids (the sterile mule) that, being unnatural ("not properly in nature"), nature would eliminate. In the paradigm of his day, "the essential property of a species, among living bodies, consists of this, that each individual have the capacity of breeding with the rest of opposite sex, in such a manner as resulting offspring may continue to augment the race. Great variety may be admitted among the individuals of a species, provided that they have this property; and, without this property, different individuals may resemble much, without being both of the same species. Even this essential property, in a species, may exist in various degrees; for, as two species approach in their distinctive properties, they also may be found to have in some degree the power of breeding together in a mixed race. This, however, from the experience of man, goes but a little way; and it is not certain, if ever any new species had been thus produced, or any lasting confusion thus introduced among distinct species." Hutton held that species are original: "We are not here to indulge in the romantic fancy of a fowls of a Telliamed [/ de Maillet,[12] a neptunist], forming flying fish, and men of mermaids or some aquatic animal." He made the case that if the observed variation in an "organized" (organic) species is not original, then natural selection explains how, in pace with shifting environmental conditions, races of species arise.

Footnote e12.2 Unfounded rumor is that in Darwin's library, Mendel's 1865 paper lay unperused. The reverse is true. In Mendel's library, Darwin's *Origin*, 1860 German translation, lay perused with, "There are many laws regulating variation, some few of which can be dimly seen." pencil underlined and "!" put in the margin.)[13] So Mendel failed to comprehend that he held the key that, when rediscovered by others, would open the way for the neo-Darwinian understanding of evolution.

Table e13.1 Examples of species in which the male has evolved sexual traits for which the female selects.[1]

species	MALE TRAIT	FEMALE PREFERENCE
Hooded seals Proboscis monkey	Nose	Largest air Inflation Largest blood Inflation
Peacock Barn swallow Crested newt	Tail	Greater number of "eyespots" Longer tail Greater tail height
Meadow katydid American toad Greentree frog Tungara frog Song sparrow	Call (song)	Greater Intensity Greater frequency Longer duration Greater complexity Larger repertoire
Sage grouse	Courtship display	Greater frequency
Red jungle fowl	Comb	Larger comb
Satin bowerbird	Bower	More decorated bower
Great titmouse	Breast stripe	Larger stripe size
Guppy House finch	Body color	Greater area of orange Greater brightness
Convict-cichlid fish	Body size	Larger size