Chronology: from Beagle to Origin

1. Beagle Voyage: Dec.1831-Oct. 1836
2. March 1837: Gould tells him varieties of Mocking bird really good species.
3. March 1837, jots a few notes in Red Notebook about species change
4. June 1837: begins Transmutation Notebook B, “Zoonomia”
5. June 1837-July 1839: Notebooks B,C,D, E
6. Sept. 1838: Reads Malthus, gets a “theory by which to work.”

Darwin's Path to Natural Selection

1. Through spring 1837, Darwin considered mostly problem of species duration and extinction in nature.
2. In summer, he began reading breeders' articles and essays. He had known of appeal to domestic breeding from Lyell, Lamarck, and Grandfather.
3. Darwin was comparing domestic breeds with natural species through notebooks from late summer 1837 up to time reads Malthus (and thereafter).
    a. Understands that new environments cause variability and organisms through habit adapt.
    b. Also begins to understand breeders are picking the best of their flocks to breed. But is there anything in nature like that?

He had already anticipated natural selection in nature, but without being fully aware of it:

a. In spring, 1837, he considered how a multitude of varieties might yield creatures better adapted to circumstances: "whether every animal produces in course of ages ten thousand varieties, (influenced itself perhaps by circumstances) & those along preserved which are well adapted." B90

b. In spring, 1838: "Whether species may not be made by a little more vigour being given to the chance offspring who have any slight peculiarity of structure. <<hence seals take victorious seals, hence deer victorious deer, hence males armed & pugnacious all orders; cocks all war like>>" C61. Likely a gloss on Sebright.

He begins to compare breeders' "selecting"—John Sebright's term—with what might occur in nature. In summer, 1838, he writes:

The Varieties of the domesticated animals must be most complicated, because they are partly local & then the local ones are taken to fresh country &breed confined. To certain best individuals.—scarcely any breed but what some individuals are picked out.—in really natural breed, not one is picked out, & few even of local varieties approaches quite to wild local variety.

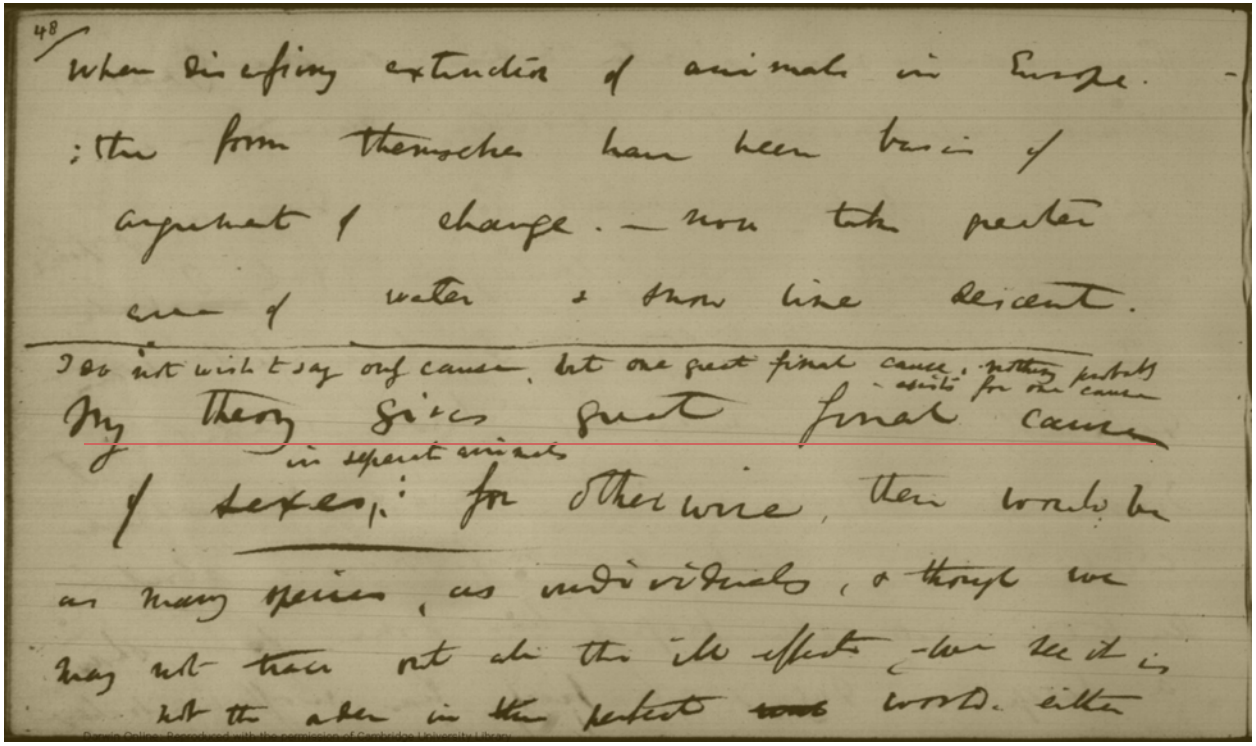
Notebook D 20.

Sept. 1838, picks up Thomas Malthus's *Essay on the Principle of Population* for amusement

In the northern states of America, where the means of subsistence have been more ample . . . the population has been found to double itself, for above a century and half successively, in less than twenty-five years. . . It may safely be pronounced, therefore, that population, when unchecked, goes on doubling itself every twenty-five years, or increases in a geometrical ratio. . . But the food to support the increase from the greater number will by no means be obtained with the same facility. Man is necessarily confined in room (Malthus, 1826, 5-7).

Darwin's Notebook D, Sept. 28, 1838

Even the energetic language of <Malthus> <<Decandoelle>> does not convey the warring of the species as inference from Malthus. . . population in increase at geometrical ratio in FAR SHORTER time than 25 years—yet until the one sentence of Malthus no one clearly perceived the great check amongst men. . . One may say there is a force like a hundred thousand wedges trying force <into> every kind of adapted structure into the gaps <of> in the oeconomy of Nature, or rather forming gaps by thrusting out weaker ones. <<The final cause of all this wedging, must be to sort out proper structure & adapt it to change (Notebook D, 134e-135e).



"My theory gives great final cause of sexes in separate animals: for otherwise there would be as many species, as individuals, . . . but we can see if all species, there would not be social animals, hence not social instincts, which as I hope to show is probably the foundation of all that is most beautiful in the moral sentiments of the animated beings. If man is one great object, for which the world was brought into present state.--& if my theory be true then the formation of sexes rigidly necessary.".

Charles Darwin, *E Notebook,* pp. 48-49

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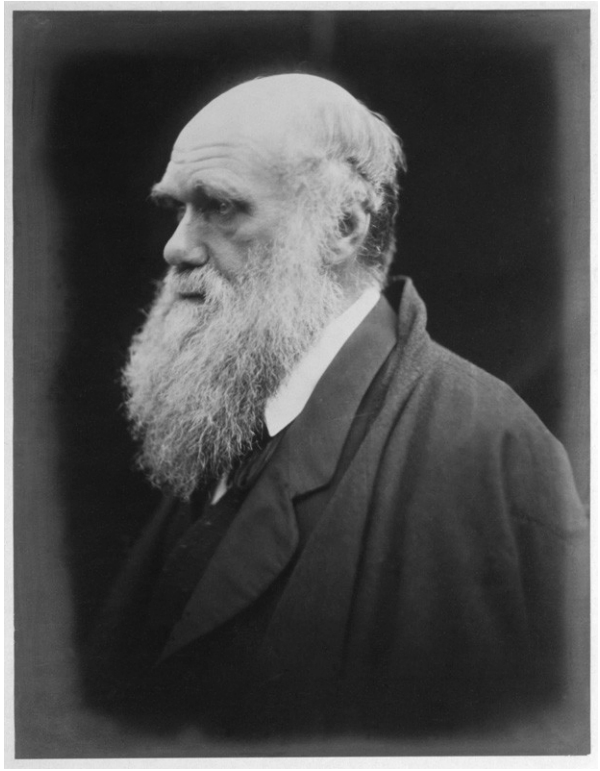
6. **Sept. 1838: Reads Malthus, gets a “theory by which to work.”
7. July 1838-April 1840: Notebooks M and N
8. 1839: “Journal of Researches of Voyage of Beagle” published; Marries Emma Wedgwood
9. 1842-1846: Publishes 3 vols. on the “Geology of the Voyage of the Beagle”
10. 1842: 35-page pencil sketch of his theory
11. 1844: 230-page sketch of his theory
12. 1844: Robert Chambers anonymously publishes “Natural History of Creation”
13. 1846-1854: Darwin works on barnacles; publishes 4 volumes on them.
14. March 1855: starts breeding pigeons
15. May 1856, warned by Lyell he would be scooped. Starts writing “Natural Selection”
16. June 1858: Letter from Alfred Russel Wallace with sketch of species theory

17. June 1858, begins abridging “Natural Selection” and adding second half.
18. July 1858: Wallace’s essay and selection from Darwin’s 1844 essay read before Linnaean Society and published in their journal. Secretary summarized the year: Nothing unusual.
19. Nov. 1859, 1200 copies of Origin printed and sold by John Murray. It would go through 6 editions up to 1872.



Darwin, 1868. Photo by Julia Cameron

From the Introduction to the Origin

1. He will tackle that “Mystery of Mysteries.”

2. Gives a short history of his thought

3. Facts could be given as against his opinion, but he will develop “One long argument.”

4. Others may have suggested species change, but to little avail if they had not a principle to explain exquisite adaptations of animals—natural selection.

"Of course I allude to that mystery of mysteries, the replacement of extinct species by others. Many will doubtless think your speculations too bold, but it is as well to face the difficulty at once. For my own part, I cannot but think it an inadequate conception of the Creator, to assume it as granted that his combinations are exhausted upon any one of the theatres of their former exercise, though in this, as in all his other works, we are led, by all analogy, to suppose that he operates through a series of inter- mediate causes, and that in consequence the origination of fresh species, could it ever come under our cognizance, would be found to be a natural in contradistinction to a miraculous process—although we perceive no indications of any process actually in progress which is likely to issue in such a result."

From Charles Babbage, *Ninth Bridgewater Treatise, A Fragment* 2nd ed. (London: Murray, 1838) pp. 228-29. He is quoting from a letter of John Herschel to Charles Lyell, of Feb. 20, 1836.

From the Introduction to the Origin

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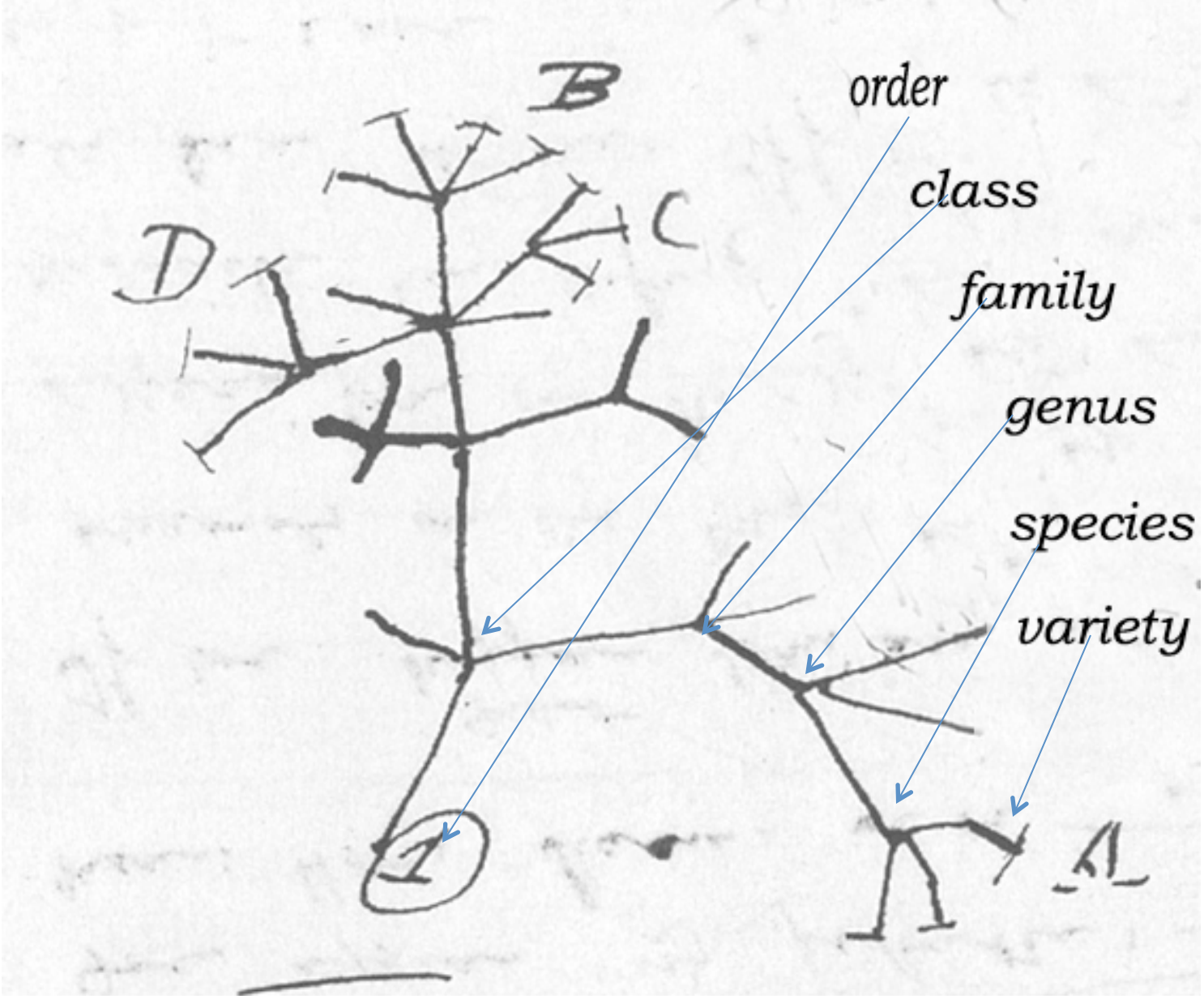
What his Theory Argues:

"I am fully convinced that species are not immutable; but that those belonging to what are called the same genera are lineal descendants of some other and generally extinct species, in the same manner as the acknowledged varieties of any one species are the descendants of that species. Furthermore, I am convinced that Natural Selection has been the main but not exclusive means of modification." (Darwin, *Origin*, p. 6)

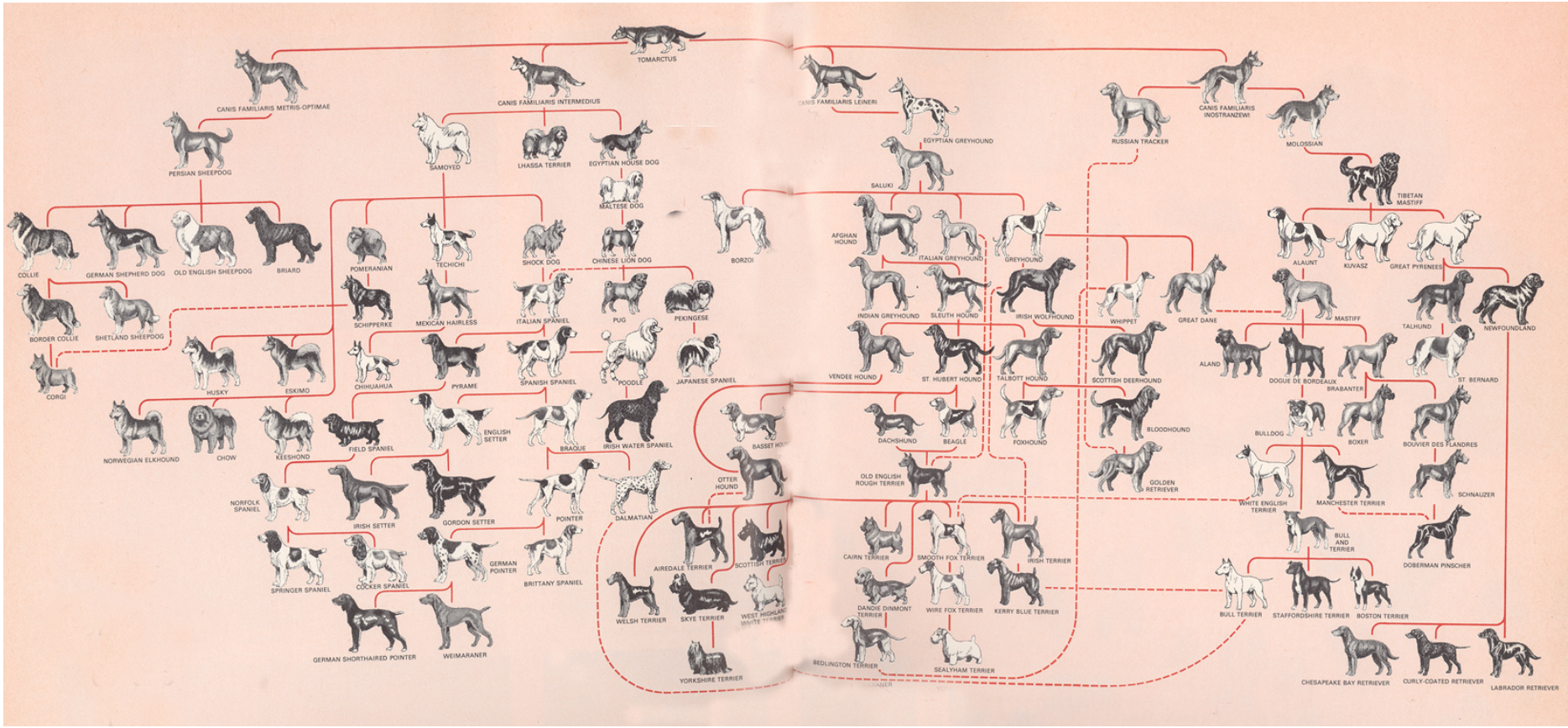
What this Means:

Varieties of a species ——selection➔ different species ➔
Which form genus type ➔ which will form family type, etc.

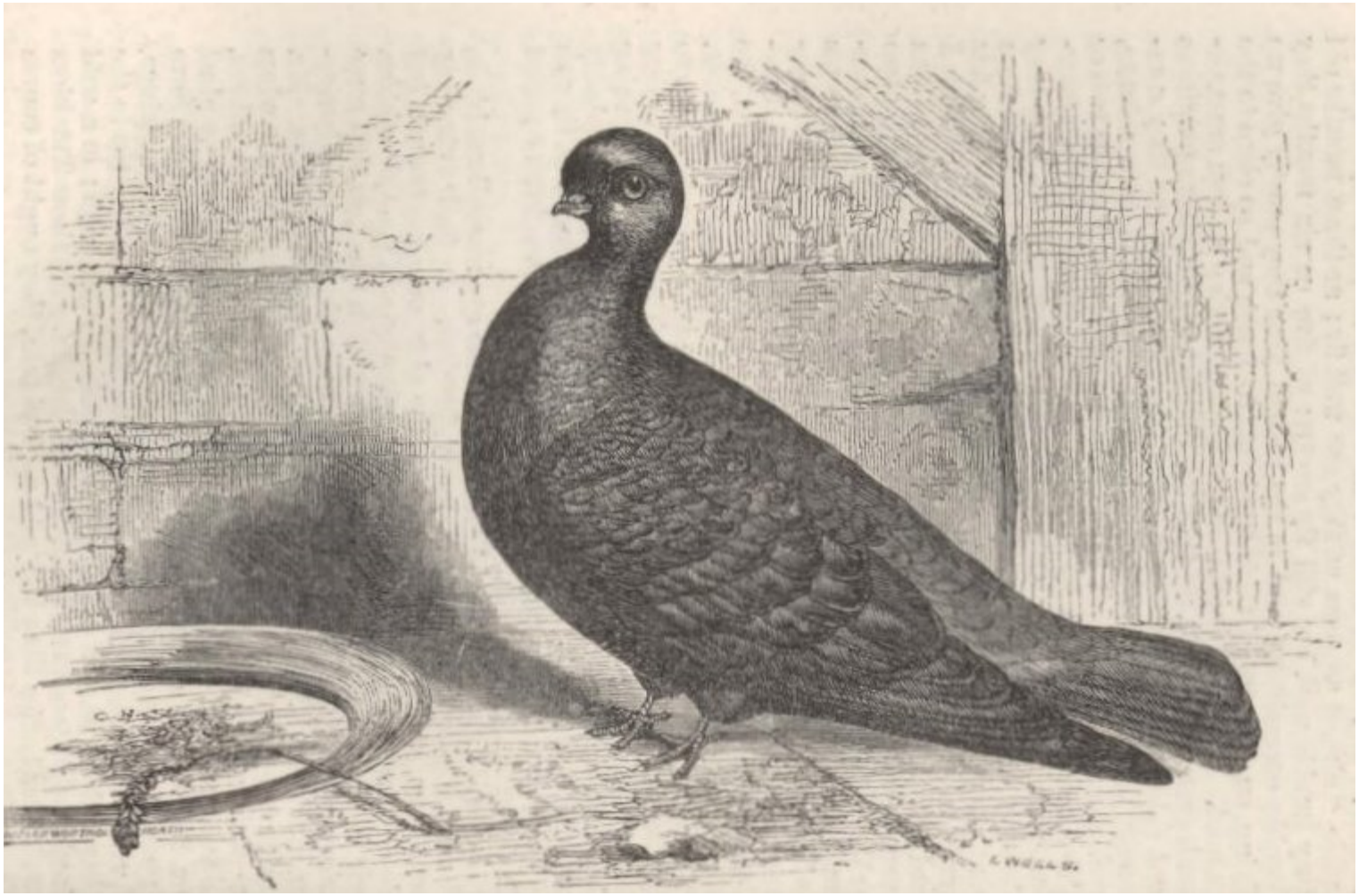

B
C
D
order
class
family
genus
species
variety
I
A

Some Questions Regarding Chap. 1 of *Origin*

1. What strikes you about Darwin's style in the chapters?
2. Why does he begin with "Variation under Domestication"?
3. What are the causes of variation in the domestic sphere?
4. Why does he use the example of pigeon and not dogs?


TOMARCTUS
CANIS FAMILIARIS METRIS-OPTIMAE
CANIS FAMILIARIS INTERMEDIUS
CANIS FAMILIARIS LEINERI
CANIS FAMILIARIS INOSTRANZEWI
PERSIAN SHEEPDOG
SAMOYED
LHASSA TERRIER
EGYPTIAN HOUSE DOG
EGYPTIAN GREYHOUND
RUSSIAN TRACKER
MOLOSSIAN
SALUKI
MALTESE DOG
TIBETAN MASTIFF
COLLIE
GERMAN SHEPHERD DOG
OLD ENGLISH SHEEPDOG
BRIARD
POMERANIAN
TECHICHI
SHOCK DOG
CHINESE LION DOG
BORZOI
AFGHAN HOUND
ITALIAN GREYHOUND
GREYHOUND
ALAUNT
KUVASZ
GREAT PYRENEES
BORDER COLLIE
SHETLAND SHEEPDOG
SCHIPPERKE
MEXICAN HAIRLESS
ITALIAN SPANIEL
PUG
PEKINGESE
INDIAN GREYHOUND
SLEUTH HOUND
IRISH WOLFHOUND
WHIPPET
GREAT DANE
MASTIFF
TALHUND
NEWFOUNDLAND
CORGI
HUSKY
ESKIMO
CHIHUAHUA
PYRAME
SPANISH SPANIEL
POODLE
JAPANESE SPANIEL
VENDEE HOUND
ST. HUBERT HOUND
TALBOTT HOUND
SCOTTISH DEERHOUND
ALAND
DOGUE DE BORDEAUX
BRABANTER
ST. BERNARD
NORWEGIAN ELKHOUND
CHOW
KEESHOND
FIELD SPANIEL
ENGLISH SETTER
BRAQUE
IRISH WATER SPANIEL
BASSET HOUND
DACHSHUND
BEAGLE
FOXHOUND
BLOODHOUND
BULLDOG
BOXER
BOUVIER DES FLANDRES
OTTER HOUND
OLD ENGLISH ROUGH TERRIER
GOLDEN RETRIEVER
WHITE ENGLISH TERRIER
MANCHESTER TERRIER
SCHNAUZER
NORFOLK SPANIEL
IRISH SETTER
GORDON SETTER
POINTER
DALMATIAN
AIREDALE TERRIER
SCOTTISH TERRIER
CAIRN TERRIER
SMOOTH FOX TERRIER
IRISH TERRIER
BULL AND TERRIER
DOBERMAN PINSCHER
SPRINGER SPANIEL
COCKER SPANIEL
GERMAN POINTER
BRITTANY SPANIEL
WELSH TERRIER
SKYE TERRIER
WEST HIGHLAND WHITE TERRIER
DANDIE DINMONT TERRIER
WIRE FOX TERRIER
KERRY BLUE TERRIER
BULL TERRIER
STAFFORDSHIRE TERRIER
BOSTON TERRIER
GERMAN SHORTHAIRED POINTER
WEIMARANER
YORKSHIRE TERRIER
BEDLINGTON TERRIER
SEALYHAM TERRIER
CHESAPEAKE BAY RETRIEVER
CURLY-COATED RETRIEVER
LABRADOR RETRIEVER

Rock pigeon (Columba livia)—common pigeon found in cities throughout US and England.



English short-faced tumbler, from Darwin's *Animals and Plants under Domestication* (1868).

English Short-faced Tumbler

Fig. 19.—English Carrier.

English Carrier Pigeon, from Darwin's *Animals and Plants under Domestication* (1868)

English carrier pigeon

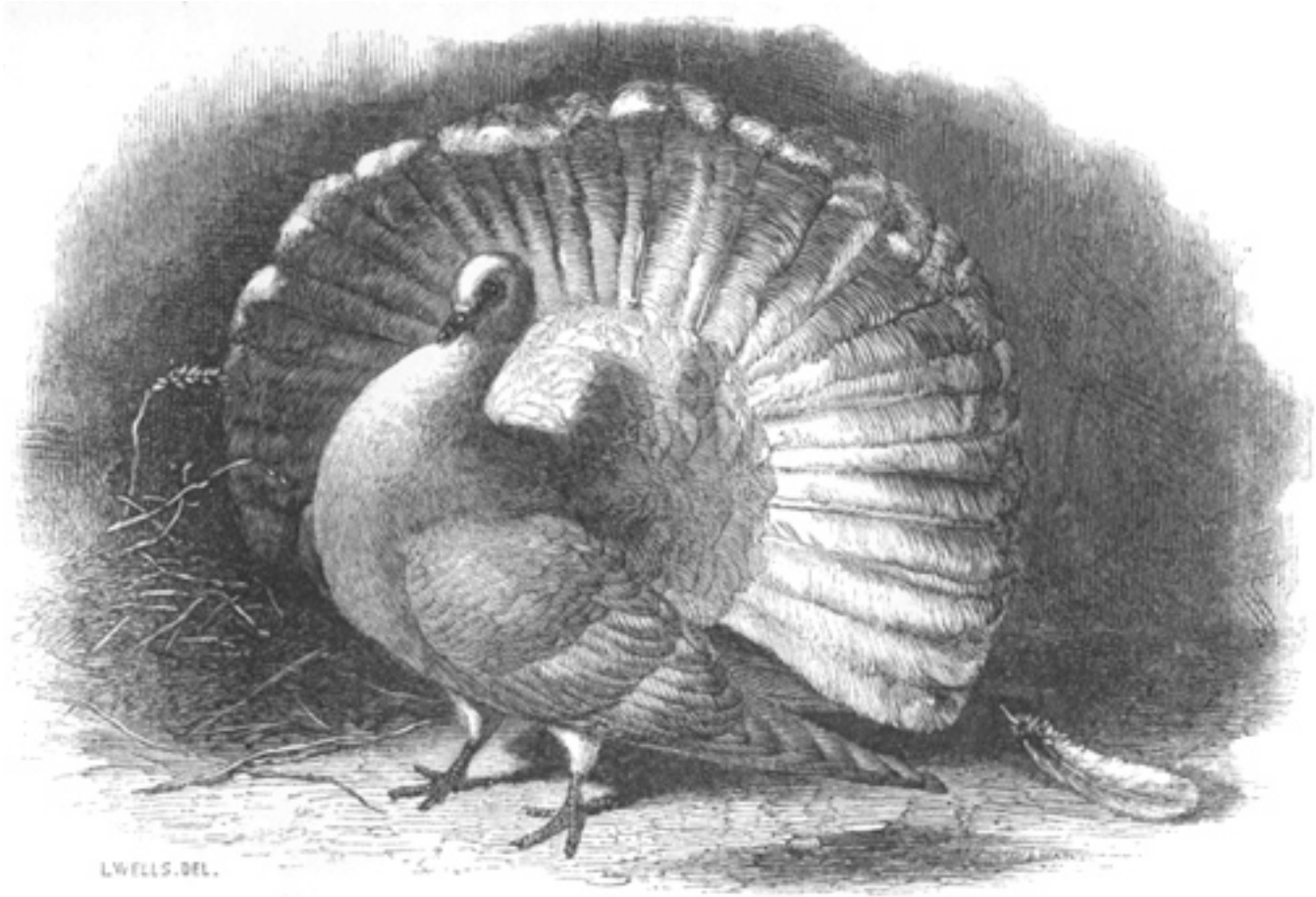


Fig. 21.—English Fantail.

English Fantail pigeon, from Darwin's *Animals and Plants under Domestication* (1868)

Fan-tail pigeon

English Pouter, Scandaroon, and Nun

Jacobin Pigeon

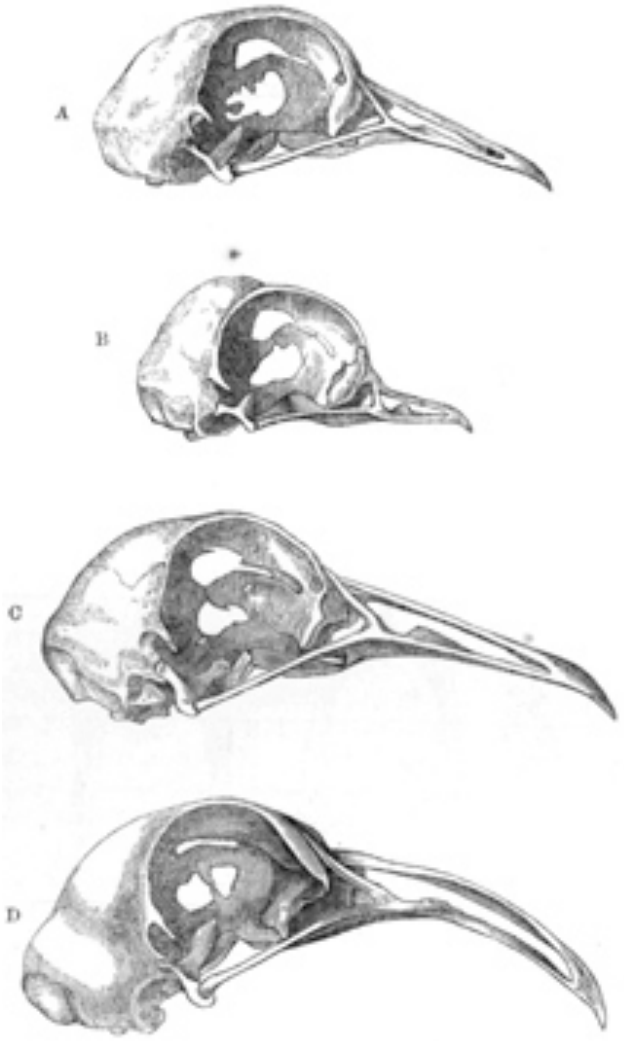
Pouter Pigeon

Nun Pigeons

Indian Fan Tail Pigeon

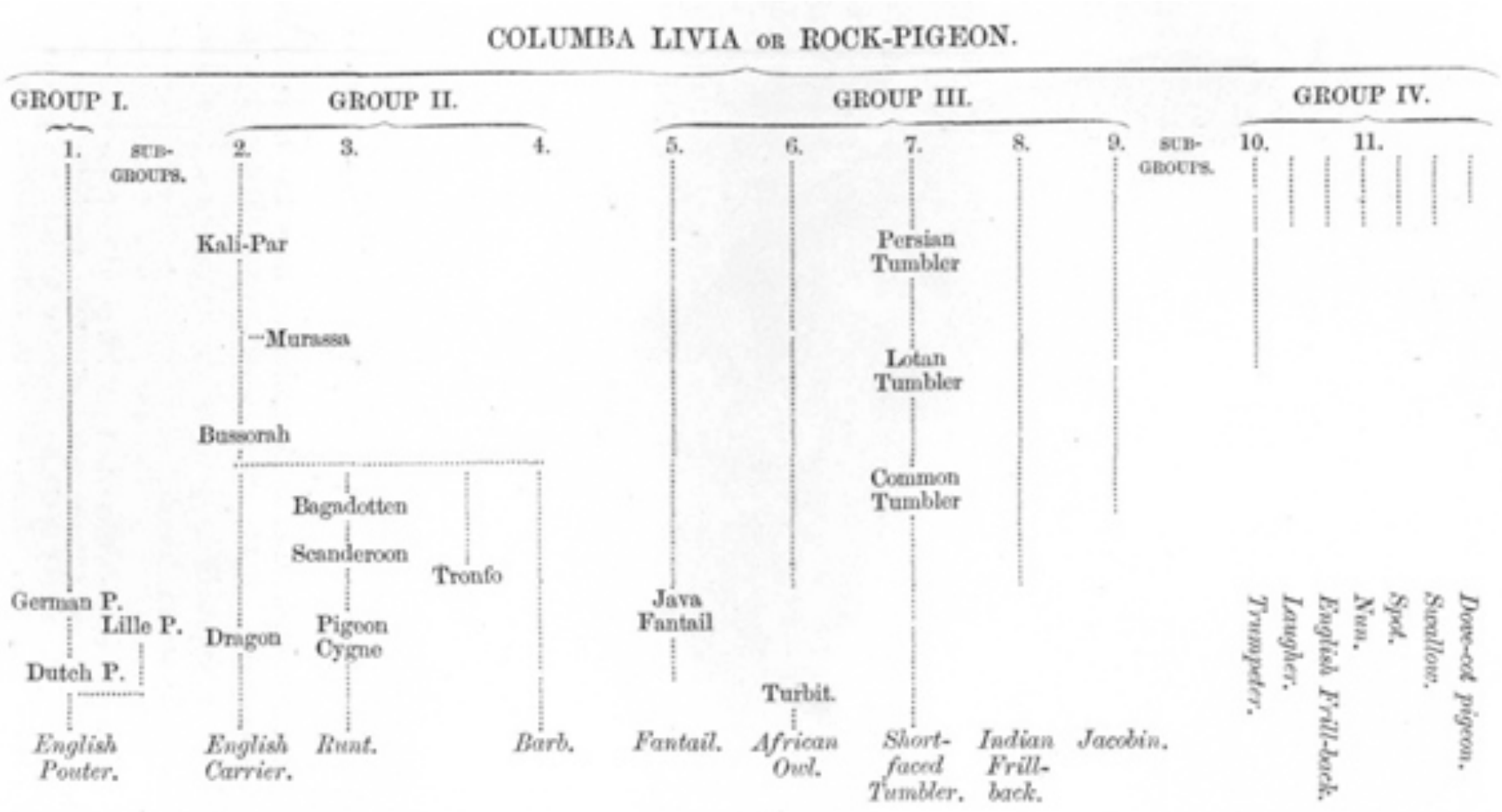
Hungarian House Pigeon

English Tumbler



Skulls of Rock Pigeon, Short-faced Tumbler, English Carrier, and Bagadotten Carrier, from Darwin's *Animals and Plants under Domestication* (1868).

Wild Rock Pigeon (Columba livia), from Darwin's *Animals and Plants under Domestication* (1868)



Descent of Domestically Bred Pigeons from the Rock Pigeon, from Darwin's *Animals and Plants under Domestication* (1868).

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4. Why does he use the example of pigeon and not dogs?
5. One possibility of new races being produced is that they are the result of cross of more ancient kinds. He wishes to exclude that possibility. Why?
    a. He says in crossing of fancy pigeons: "The offspring from the first cross between two pure breeds is tolerably and sometimes (as I have found with pigeons) extremely uniform, and everything seems simple enough; but when these mongrels are crossed one with another for several generations, hardly two of them will be alike." What's happening?
6. How does he argue that fancy pigeons all descended from the rock pigeon?
7. What is methodical selection vs. unconscious selection?
8. Does he make assumptions about progress?

Mendelian Ratios

First generation AA (smooth) + BB (wrinkled): AB

Second generation

	A (smooth)	B (wrinkled)
A	AA	AB
B	AB	BB

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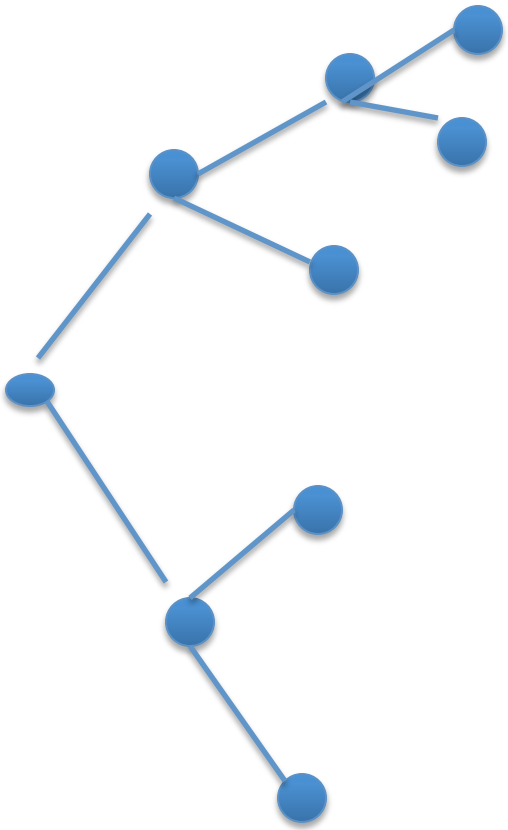
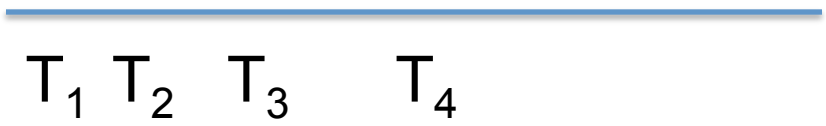



T_1 T_2 T_3 T_4

Primula marginata

Primula veris

Primula elatior

TABLE A[1]

The numerator gives the number of the much diffused or the common species in each country.
The denominator gives the number of species in the left column in the larger genera & in the right hand column in smaller genera—See Supplement to this chapter for titles of Works etc.

		Larger Genera	*Smaller Genera*
Britain:	London Catalogue (1857) H. C. Watson—Larger genera with 5 species and upwards, smaller with 4 species and downwards—The numerator expresses the number of species found in all the 18 Provinces, into which Britain is divided.	148 = 250 592 1000	138 = 219 629 1000
Russia:	Ledebour (Dicotyledonae alone). Larger Genera with 10 species and upwards, smaller genera with 9 species and downwards. The numerator expresses the number of species found in at least 8 of his 16 Provinces. The species inhabiting 8 Provinces have about thrice the average range of all the phanerogamic plants:—	239 = 70 3385 1000	131 = 67 1937 1000
Centre	France: Boreau—Larger genera with 5 species and upwards, smaller with 4 and downwards. The numerator expresses the species marked C.C. or very common.	163 = 222 732 1000	155 = 209 741 1000
Holland:	Miquel—Larger Genera with 4 species and upwards, smaller with 3 species and downwards. The numerator expresses the number of common species.	120 = 192 622 1000	108 = 193 557 1000
Ratisbon:	Furnrohr—Larger genera with 4 species and upwards, smaller with 3 species and downwards. The numerator expresses the number of species marked "sehr gemein".	102 = 191 533 1000	79 = 150 526 1000
N. United	States: Asa Gray—Larger genera with 5 species and upwards, smaller with 4 species and downwards. The numerator expresses the number of species marked as "common".	326 = 286 1136 1000	195 = 212 917 1000

[1] [Darwin's holograph draft of this table is ULC Darwin MSS. vol. 16.1, fol. 172.]

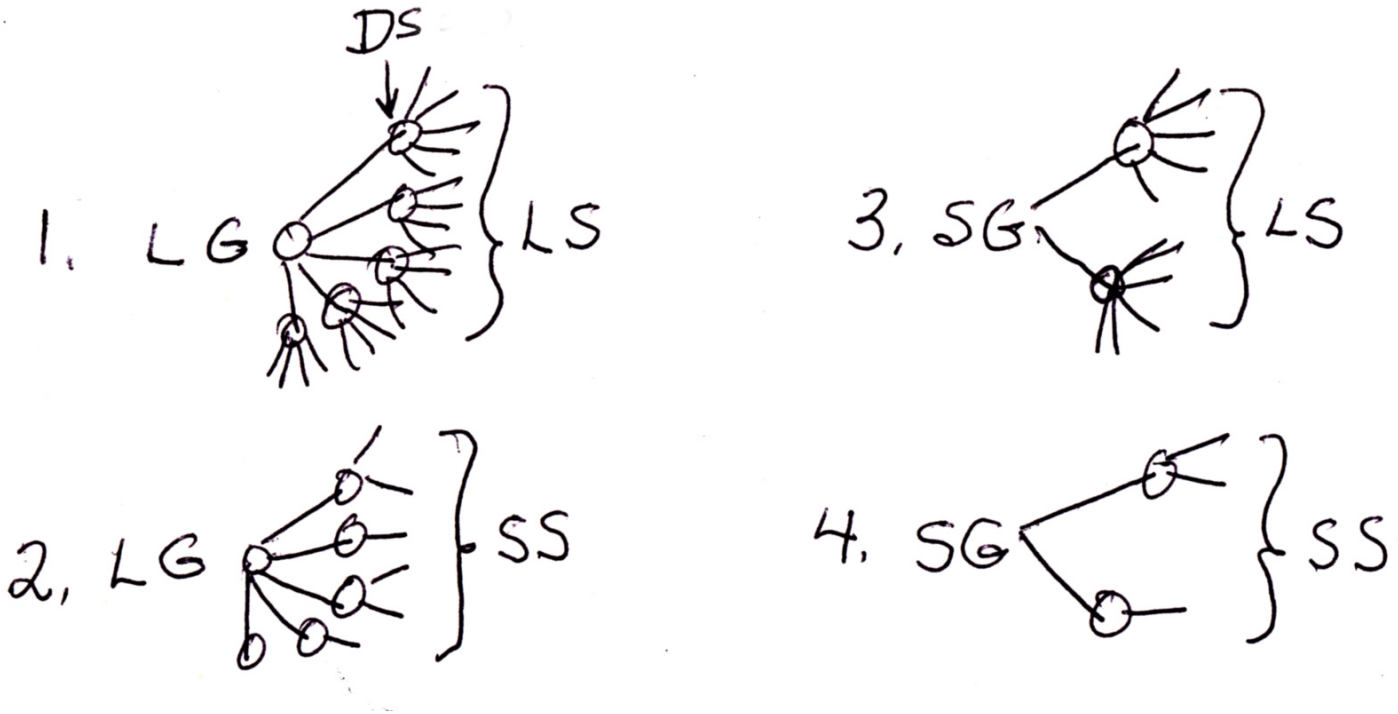
Darwin's argument: Large genera have large species

He assumes: geographical conditions that lead to the production of species with large number of varieties (i.e., a large species) will in the past have also been conducive to that. So in past, as varieties of large species become themselves species, those species will spawn large varieties, etc.

Darwin's argument: Pattern of Speciation Supports his Theory

Code: LG = large genus (i.e., many species); LS =large species (i.e., many varieties); DS = dominant species (i.e., widely diffused with many individuals.

Possible patterns:



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Large genus=large no. of species; small genus=small no of species.

Say a flora book records 1000 species; half = 500 species

1. Take smallest genus (say 2 species), and count no. of species in those small genera.
    a. Assume there are 50 general having 2 species =100 species
    b. 30 genera with 3 species = 90
    c. 25 genera with 4 species =100
    d. 45 genera with 5 species = 225
    e. Total = 515; so genera with 5 species or lower = small genera; and those with 6 species or above are large

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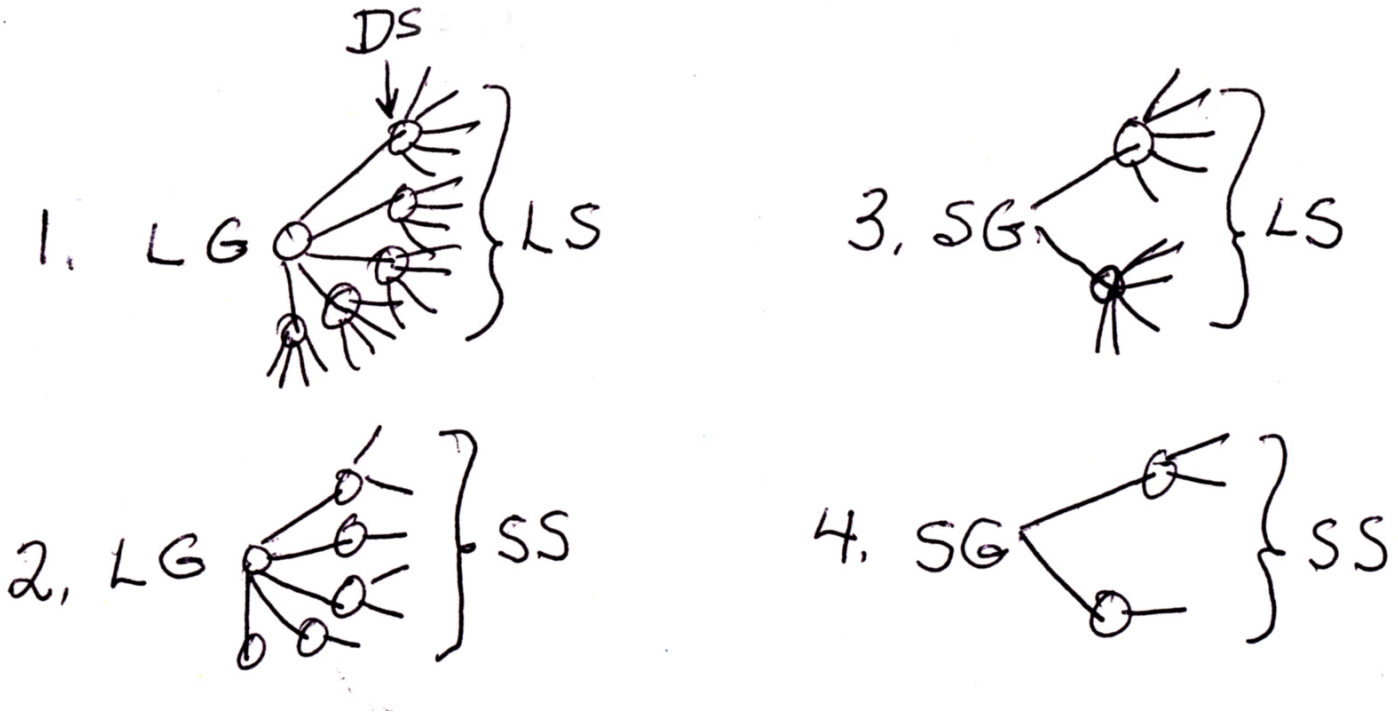

Stages in the Argument that Large Genera have Large Species

1. Dominant species (i.e., those with wide range, and many individuals) have more varieties (p. 53), or
   a. DS > LS
2. Large genera have more dominant species
   a. LG > DS
   b. In comparison to: SG > DS
3. Large genera have species with large varieties, i.e., large species
   a. LG > LS

LG >DS, DS>LS, ergo LG>LS

Demonstration of 2: LG>DS
(From table on p. 142 of Species Book)

	LG (having 5 species or more)			SG (4 down)		
No. of dom.	148		250	138		219
	___	=	___	___	=	___
Total no.	592		1000	629		1000

How to find large and small genera: take total number of species in the flora (for Great Britain), or 1221, half of which is 610.5; then start with smallest genus and count number of species in those small genera, e.g., 1 genus with 1 species, 44 genera having 2 species or 88; 80 genera at 3 species or 240, 75 genera at 4 species or 300 = 629 species

Darwin's Mistake(s)

1. Statistical analysis (Karen Parshall) doesn't support eyeball statistics.
2. Conceptual problem: Darwin wants to know whether large genera have more dominate species, but he merely masses the species in the large genera.

- Say you have 10 large genera and 30 small. What if you have among the large genera, one genus with 55 species, of which 50 are dominate, and the other 9 genera had none with dominate species—then only 1 out of ten large genera would be dominate; and say in small, one dominate in each of the 30 genera, or 30/30; though in aggregate only 30/100, while in large 50/100.