

# Lectures 9

## Darwin and Wallace: Voyages of Exploration

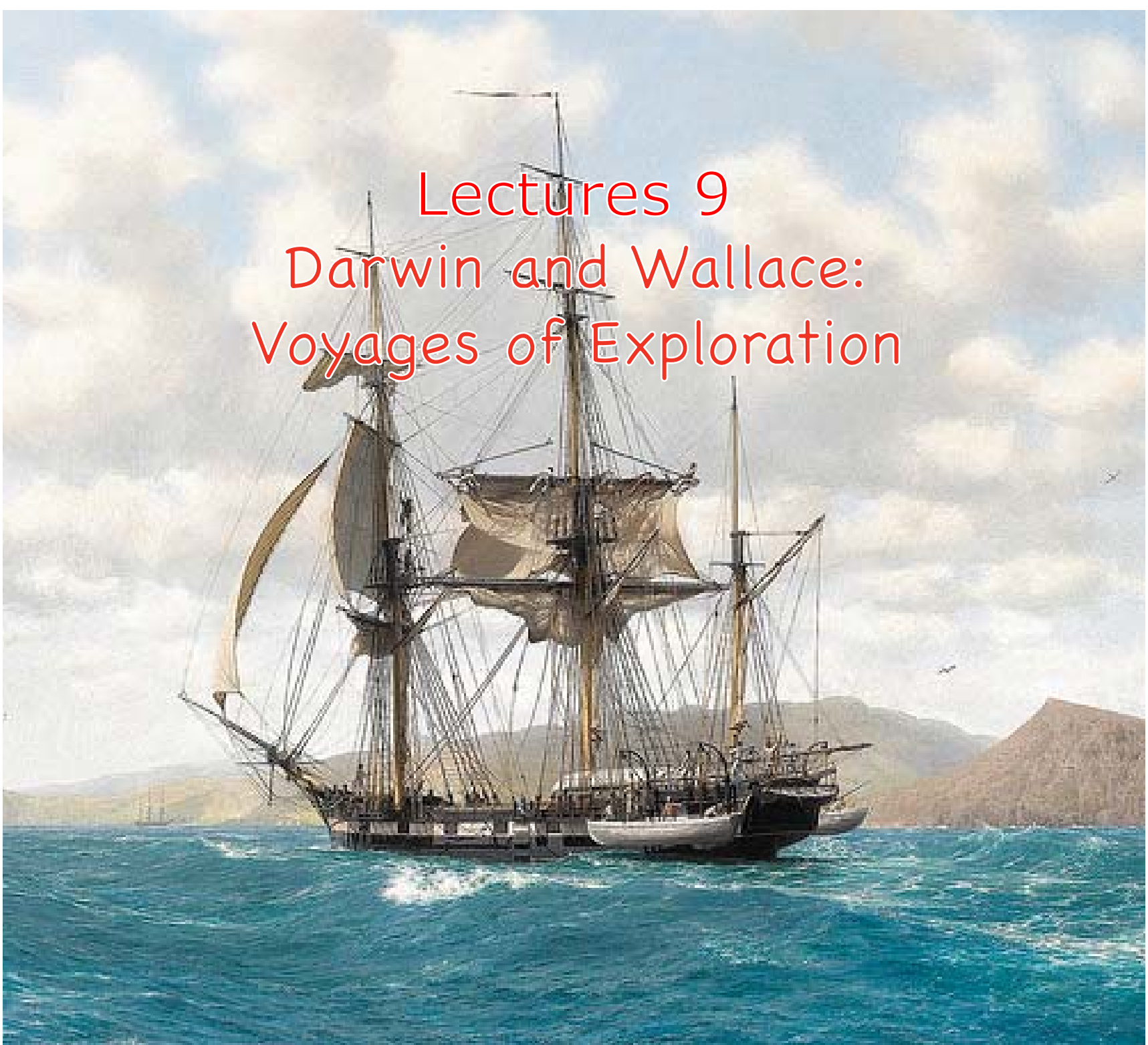


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# Outline

1. Darwin's path to a theory
2. Wallace's voyages of exploration
3. Wallace's path to a theory
4. The two men's paths converge
5. Lyell's advice to Darwin  
*publish - fast - or perish!*

# Darwin: the adventure of a lifetime

The Beagle voyage  
gives Darwin

- World-wide geological & biological experience
- The material with which to establish his scientific reputation
- The germ of an idea about “that mystery of mysteries...”

# The young scientist “in public”

*“On March 7th, 1837, I took lodgings in Great Marlborough Street in London, and remained there for nearly two years, until I was married. During these two years I finished my Journal, read several papers before the Geological Society, began preparing the MS. For my Geological Observations, and arranged for the publication of the Zoology of the Voyage of the Beagle....”*

Charles Darwin, Autobiography, 1876

# The young scientist “in private”

*“In July I opened my first note-book for facts in relation to the origin of species, about which I had long reflected, and never ceased working for the next twenty years.”*

Charles Darwin, Autobiography, 1876

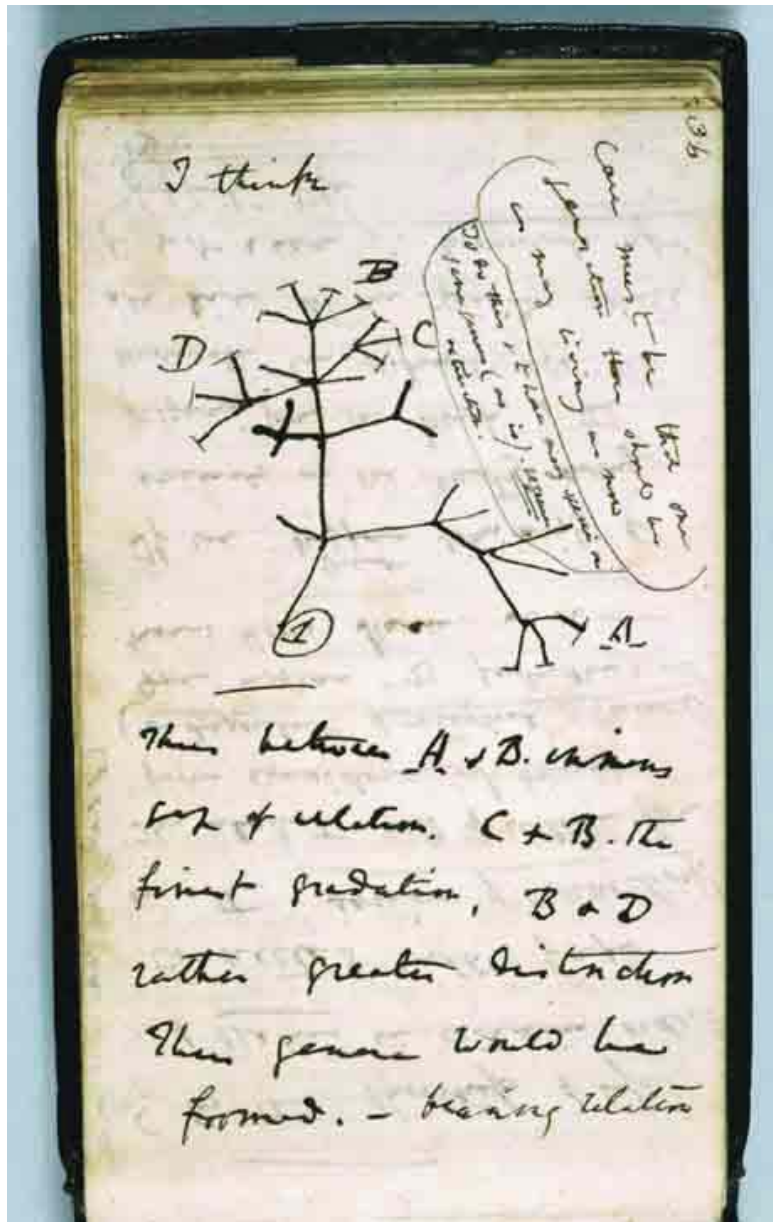
# What inspired Darwin's private quest?

*"During the voyage of the Beagle I had been deeply impressed by discovering in the Pampean formation great fossil animals covered with armour like that on the existing armadillos; secondly, by the manner in which closely allied animals replace one another in proceeding southwards over the Continent; and thirdly, by the South American character of most of the productions of the Galapagos archipelago, and more especially by the manner in which they differ slightly on each island of the group; none of the islands appearing to be very ancient in a geological sense."*

Charles Darwin, Autobiography, 1876

# Darwin's hypothesis

- Species are not separate creations; rather, they arise from by *descent with modification* from ancestor species
- If this were true, it would explain
  - *Why the past and present inhabitants of the same continent are closely related*
  - *Why the inhabitants of oceanic islands are related to but distinct from those on neighboring continents*
  - *And, potentially, much, much more...*



A famous page  
from one of  
Darwin's early  
private  
notebooks



# How to work on the hypothesis?

## Look for instructive analogies

*"After my return to England it appeared to me that by following the example of Lyell in Geology, and by collecting all facts which bore in any way on the variation of animals and plants under domestication and nature, some light might perhaps be thrown on the whole subject. My first note-book was opened in July 1837. I worked on true Baconian principles, and without any theory collected facts on a wholesale scale, more especially with respect to domesticated productions, by printed enquiries, by conversation with skilful breeders and gardeners, and by extensive reading."*

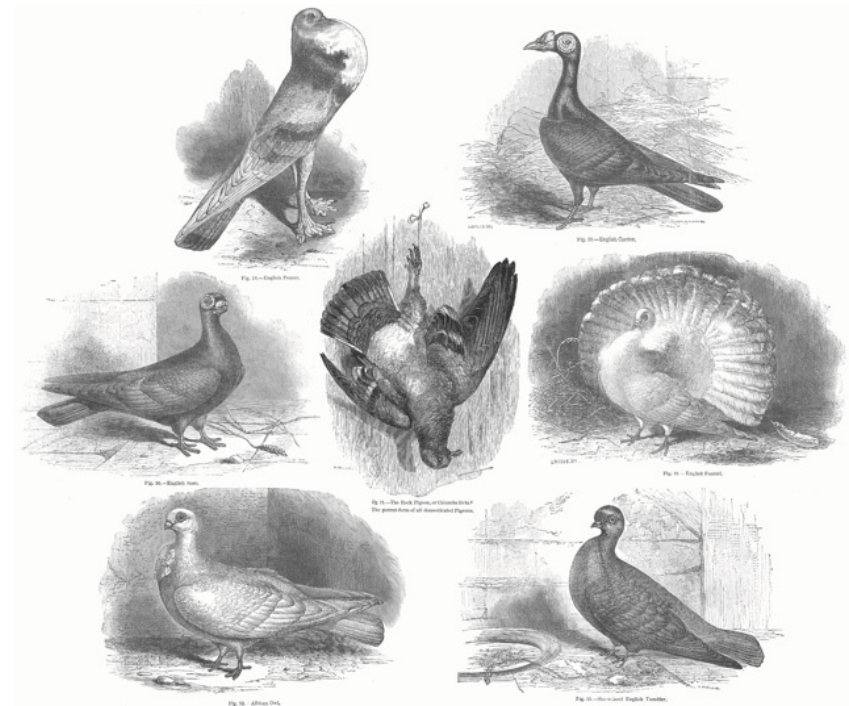
Charles Darwin, Autobiography, 1876

# The instructive analogy

- Key idea: *descent with modification*
- *Question:*  
*Where do we see descent with modification happening today?*
- *Answer:*  
*Among domesticated varieties of plants and animals*

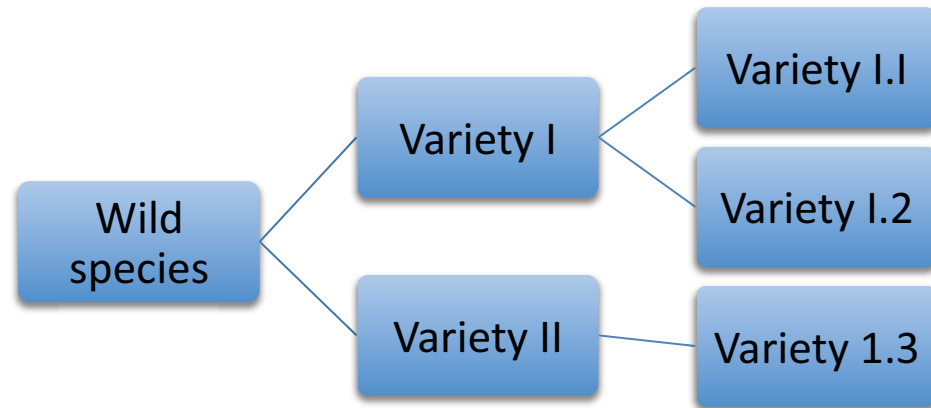
# “Artificial Selection”

“I soon perceived that selection was the keystone of man's success in making useful races of animals and plants. But how selection could be applied to organisms living in a state of nature remained for some time a mystery to me.”

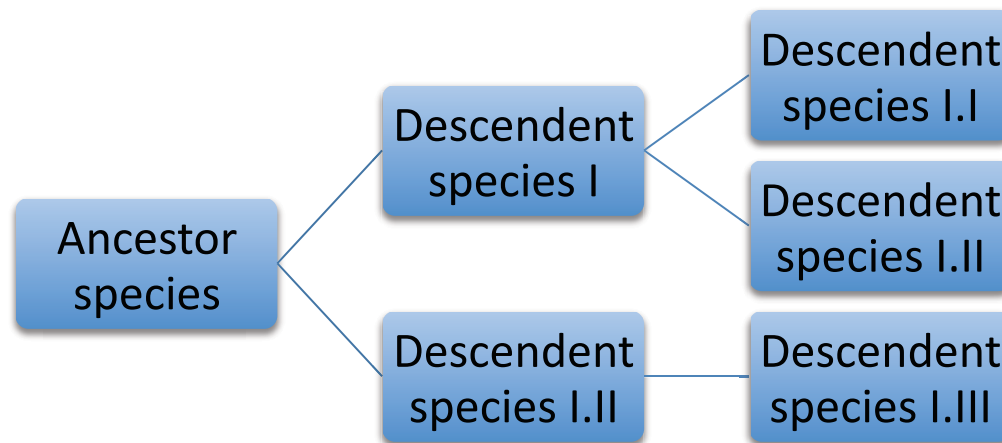


# The analogy

Domestication



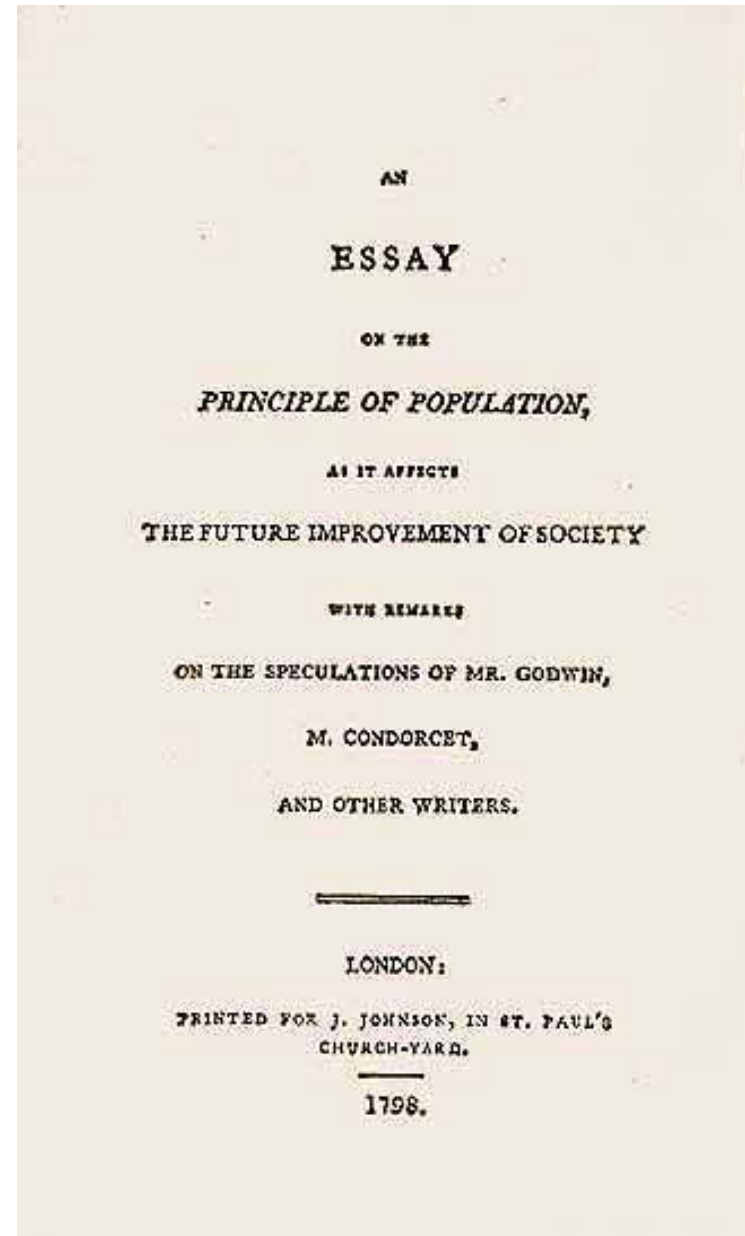
Evolution



# The analogy suggests

- Artificial varieties are produced by “artificial selection, so...
- Natural species may be produced by “natural selection”, but...
- *What could possibly substitute in nature for the selective power of the plant and animal breeder?*

# Thomas Robert Malthus, 1766-1834



# Darwin's Malthusian "Eureka! moment"

*"In October 1838, that is, fifteen months after I had begun my systematic enquiry, I happened to read for amusement Malthus on Population, and being well prepared to appreciate the struggle for existence which everywhere goes on from long-continued observation of the habits of animals and plants, it at once struck me that under these circumstances favourable variations would tend to be preserved, and unfavourable ones to be destroyed. The result of this would be the formation of new species. Here then I had at last got a theory by which to work...."*

Charles Darwin, Autobiography, 1876

# “A theory by which to work...”

- Darwin set straight to work on his theory, continuing his intensive study of origins in his private notebooks....
- But meanwhile, a few hundred miles away...

Another English naturalist was beginning to get interested in philosophical natural history

....



# Alfred Russel Wallace, 1823–1913

- Son of unsuccessful lawyer
- Worked as apprentice builder, surveyor, railway surveyor & teacher
- Undertook two major voyages of exploration in the 1840s and 1850s
- Came to theoretical conclusions about origins that were startlingly similar to Darwin's



# Wallace as a Naturalist

- Learnt natural history traveling in England and Wales as a surveyor
- Conceived first voyage to the Amazon as a way of developing a satisfactory naturalistic explanation for the origin of species
- Might have gotten to a solution even sooner but for one or two setbacks along the way....

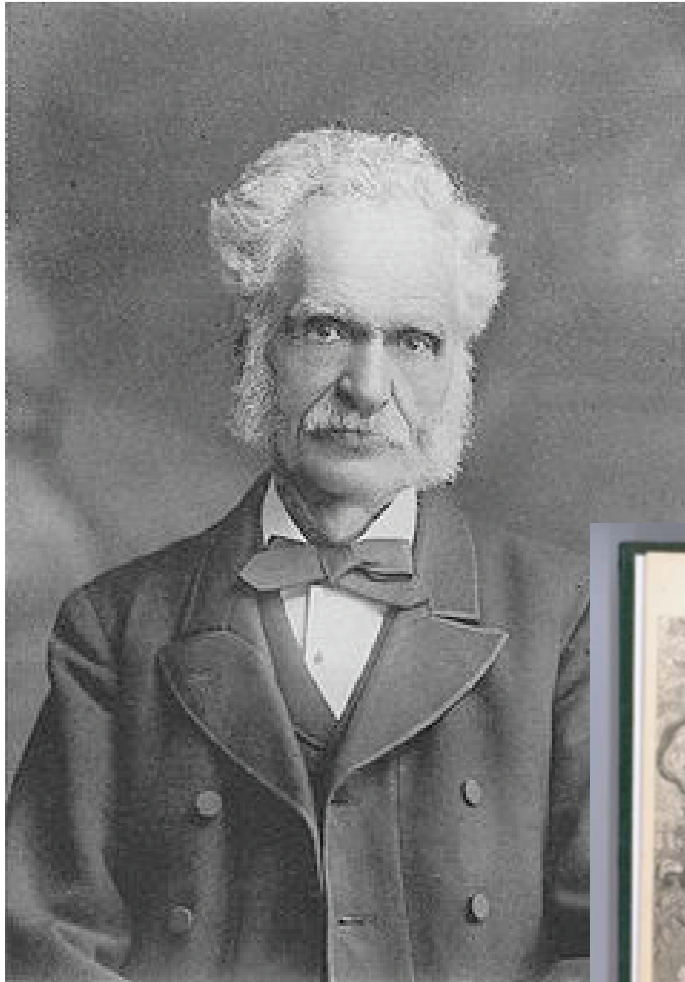


# Henry Walter Bates, 1825-1892

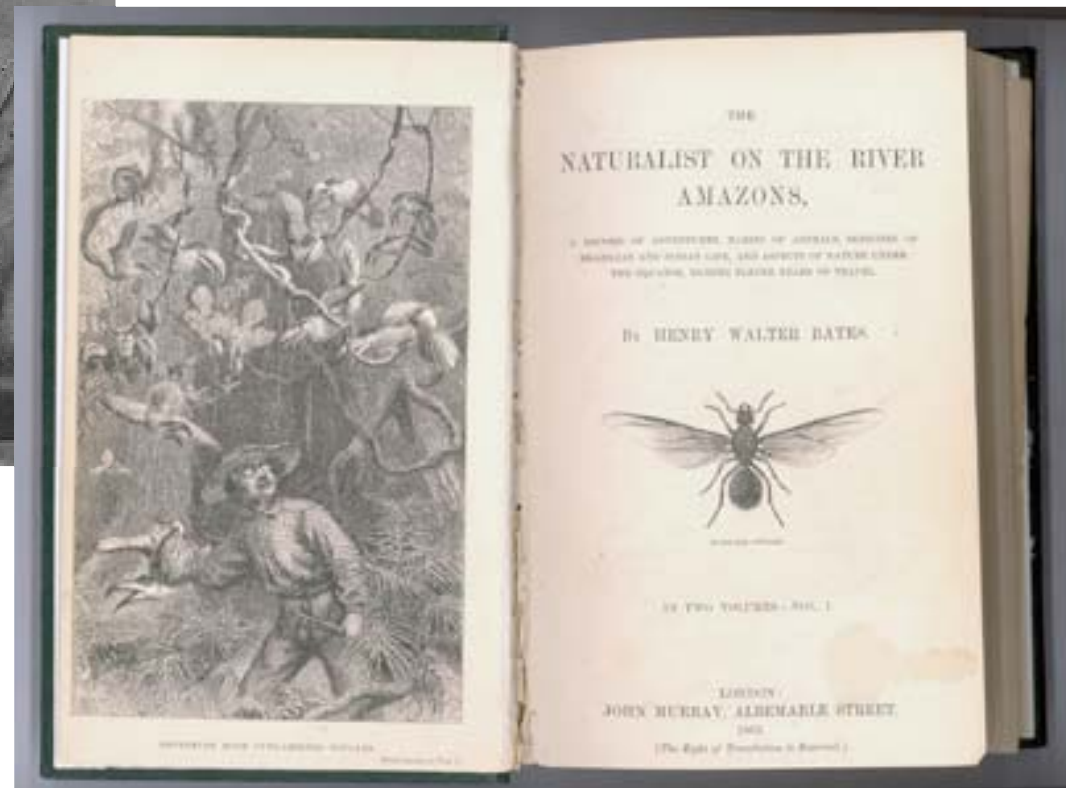
- Explorer and naturalist
- Encouraged Wallace to become a serious collector
- Joined Wallace in journeying to the Amazon in 1848, & stayed 11 years
- Collected 14,000 species, of which 8,000 were new to science



ADVENTURE WITH CURL-CRESTED TOUCANS.



# A naturalist on the River Amazons, 2 vols, 1863



# Wallace's inspiration for his voyages

*"I have a rather more favourable opinion of the 'Vestiges' than you appear to have. I do not consider it a hasty generalization, but rather as an ingenious hypothesis strongly supported by some striking facts and analogies, but which remains to be proven by more facts and the additional light which more research may throw upon the problem. It furnishes a subject for every student of nature to attend to; every fact he observes will make either for or against it, and it thus serves both as an incitement to the collection of facts, and an object to which they can be applied when collected."*

*Wallace, letter to Bates, 1845*

# Wallace on the Amazon

- Departed for South America with Bates in 1848
- Spent a year collecting with Bates, then the two separated
- Collected along & charted Rio Negro for 4 years
- Set sail for England on the brig *Helen* in 1852, with vast collections, notes & manuscripts
- But was ship-wrecked after 28 days at sea, with the almost total loss of four years' work!

# Back in England, and off again...

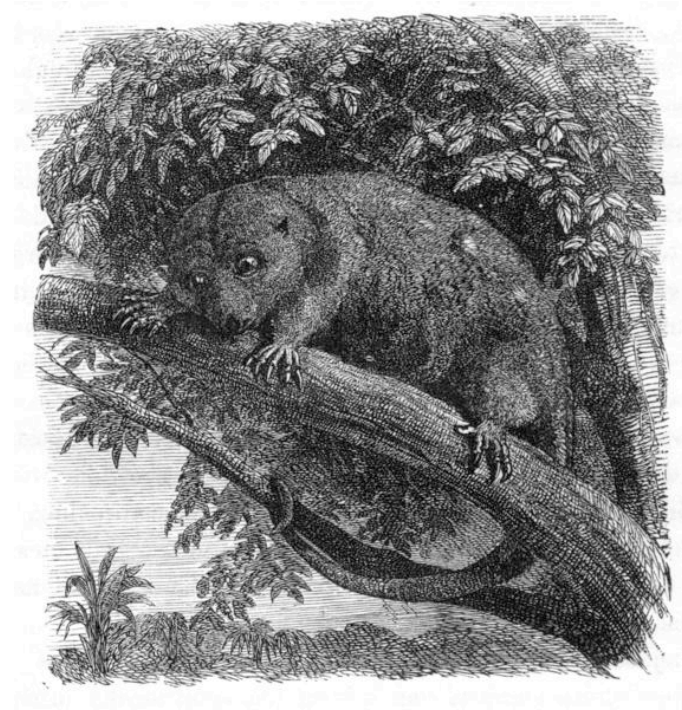
- For a time, Wallace lived on the (modest) insurance pay-out for his lost collections
- On the basis of meager materials preserved from the ship-wreck (including part diary, notes & sketches), he produced several papers & 2 books
- “On the monkeys of the Amazon” (1853) asks:
  - *“Are very closely allied species ever separated by a wide interval of country?”*
- Quickly planned a second, even more ambitious voyage
  - this time to the “Malay Archipelago”
- Finally set off again in 1854

- The Malay Archipelago
- A string of islands connecting Asia & Australia, including modern
  - Malaysia
  - Indonesia
  - East Timor
  - Borneo
  - New Guinea





# Wallace as a collector



# Wallace as a collector

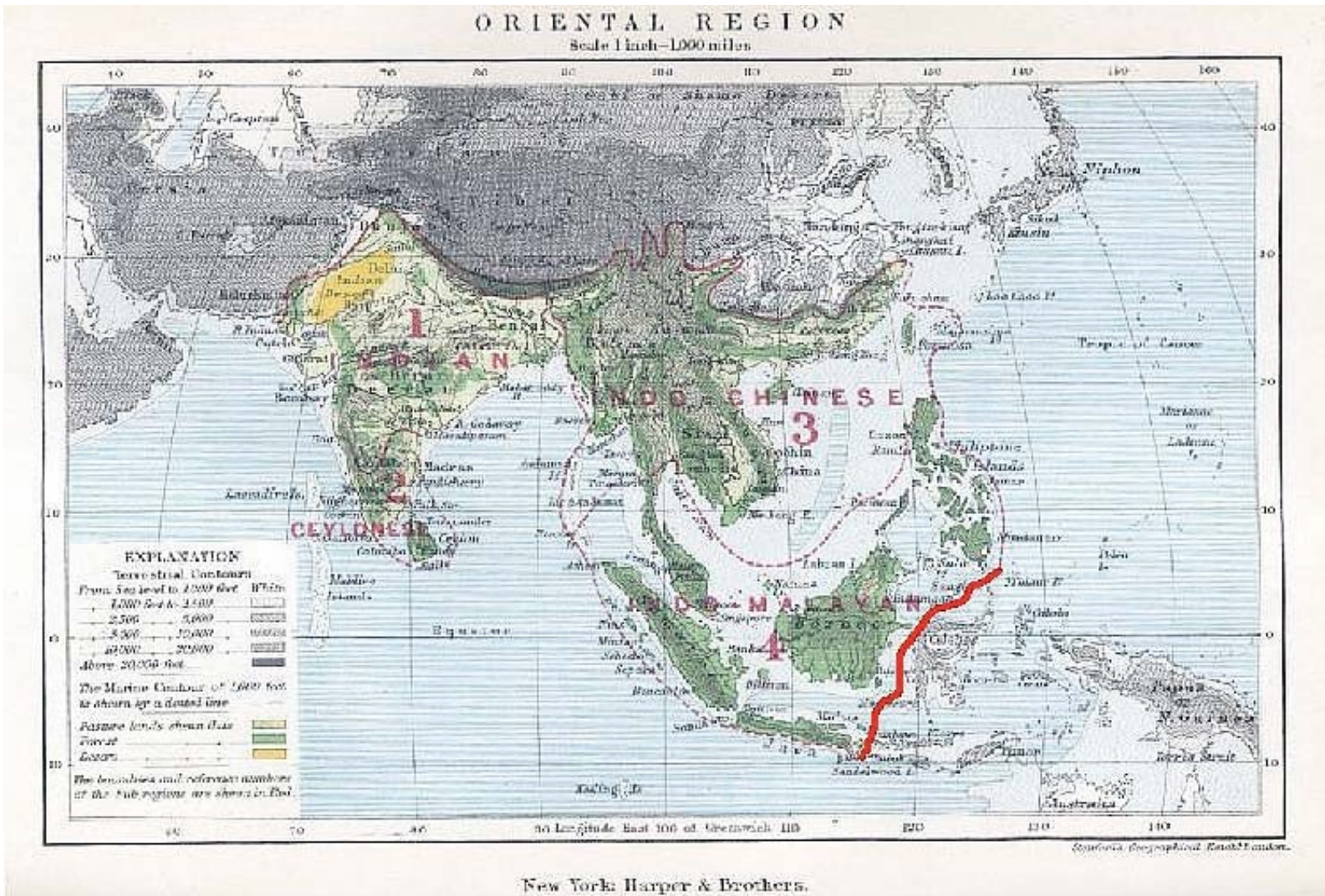


# Wallace as a collector



*"The beauty and brilliancy of this insect are indescribable, and none but a naturalist can understand the intense excitement I experienced when I at length captured it. On taking it out of my net and opening the glorious wings, my heart began to beat violently, the blood rushed to my head, and I felt much more like fainting than I have done when in apprehension of immediate death. I had a headache the rest of the day, so great was the excitement produced by what will appear to most people a very inadequate cause"*

# "Wallace's line"



# Wallace throws down the gauntlet

## The "Sarawak Law"

*"Each species has come into existence coincident in both space and time with a closely allied, pre-existing species"*

Alfred Russel Wallace, "On the law which has regulated the introduction of new species", Annals and Magazine of Natural History, September 1853

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