



第二部分

拉马克和达尔文的演化思想



一. 拉马克

**Jean Baptiste Pierre
Antoine de Monet,
Chevalier de
la Marck (Lamarck)**

(1744-1829)



简历

1744. 8. 1. 出生在法国农村的一个世袭军人家庭，
11个孩子中最小的
- 1761年 入伍，参加法德战争
- 1768年 退伍(意外受伤)，学习医学和植物学(银行职员)，
后拜 **Bernard de Jussieu**为师学植物学



- 1778年 《法国植物志》三卷（得到Buffon的资助）
- 1779年 Buffon推荐他为法国科学院院士
- 1781-1783 以法国皇家植物学家出访其他国家，采标本
- 1788年 法国皇家植物园标本馆馆长，医学教育和植物学研究的中心

1790年 法国大革命 (Louis XVI + 王后 → 断头台), 皇家植物园 → 植物园

1793年 法国国家自然博物馆教授, 分工负责昆虫和软体动物 (对此一无所知)

最不受重视 — 很多标本, 没有很好的分类, 很乱
→ invertebrate (无脊椎动物)



1809 年 “*Philosophic Zoologique*”

1818 年 双目渐渐失去视觉

1829 年 去世

“科学工作能予我们以真实的益处；同时，还能给我们找出许多最温暖，最纯洁的乐趣，以补偿生命场中种种不能避免的苦恼。”

1909 年 法国在拉马克工作过的地方为他建了塑像



1800年前讲学内容→生物永恒不变

1800年以后(56岁)→生物是变化的，为什么？

软体动物标本 + 化石

拉马克1803年在巴黎国家博物馆的演讲

"Do we not therefore perceive that by the action of the laws of organization . . . nature has in favorable times, places, and climates multiplied her first germs of animality, given place to developments of their organizations, . . . and increased and diversified their organs? Then. . . aided by much time and by a slow but constant diversity of circumstances, she has gradually brought about in this respect the state of things which we now observe. How grand is this consideration, and especially how remote is it from all that is generally thought on this subject!"

拉马克的生物演化思想

1. 主要论点

- 机物是自然界经过漫长时期形成的产物
- 最简单的生物是自然界的最初产物
- 物种最初所在的环境促使了各种器官的发育
- 生物身体任何部分的生长都是能遗传的



- 环境的变化使得生物的需求发生改变
- 需求的变化使得生物的行为发生改变
- 行为的变化使得不断使用的结构或器官得到加强，反之则削弱；这些变化都能被遗传到下一代
- 所有物种都是在不断改变的

第一定律：用进废退

不断使用的结构或器官得到加强，反之则削弱；

第二定律：获得性状遗传

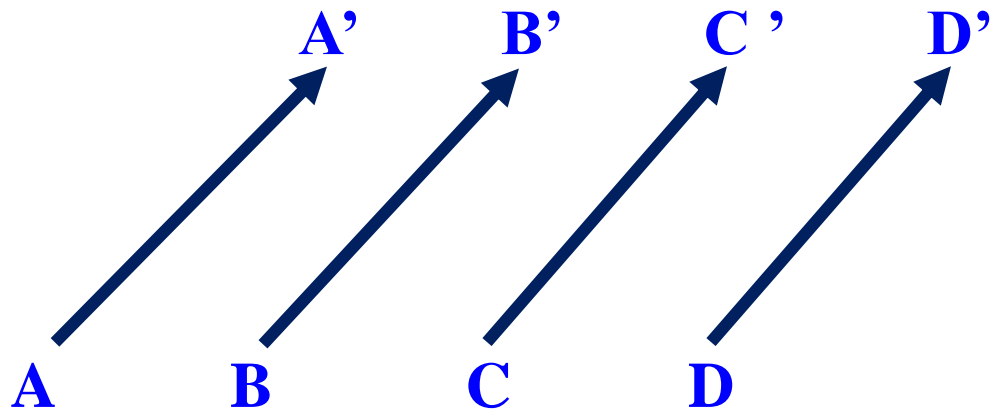
所有由环境变化而产生的生物体的主要的变化是可遗传的（inheritance of acquired characters，又称为 soft-inheritance）。



2. Lamarck演化理论的演化机制

- 物种从简单到复杂的改变是一种天赋，
- 物种有对环境的应变能力，有变化的“欲望”
(环境作用下产生的生理需求)

3、拉马克的物种演化模式



"Nature, in producing in succession every species of animal, and beginning with the least perfect or simplest to end her work with the most perfect, has gradually complicated their structure."

不承认灭绝 (extinction)



4、新拉马克主义 (Neo-Lamarckism)

在拉马克以后, 反对自然选择, 坚持“获得性状遗传”观点总称

- 物种生来就有不断完善的天赋
- 演化是单向的, 由简单至复杂
- 获得性状遗传—生殖细胞会得到生长过程中的所有事件
 - ♥ 环境直接引起变化; 用进废退; 一些经历可遗传
- 代表人物 **CE Brown-Sequard** 和 **P Kammerer**



5、拉马克的进化论是否一无是处？

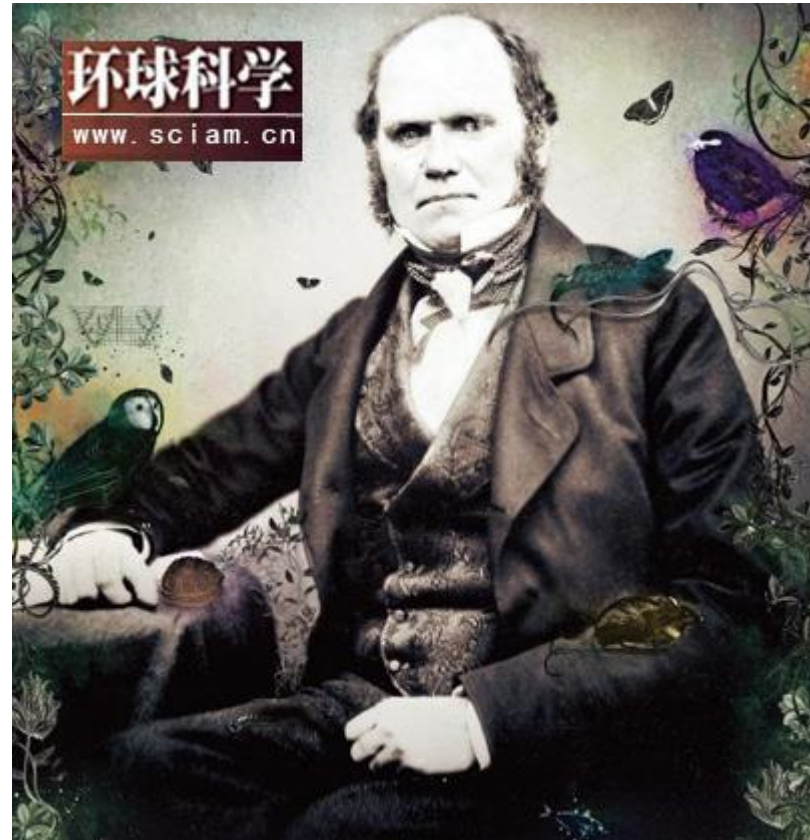
基因或基因启动子的甲基化现象 - epigenetics (表观遗传) ?



二. 达尔文

Charles Robert Darwin

(1809 – 1882)





简历

1809年 Shrewsbury, England
医生世家

1825-1827年 Edinburgh 学医



达尔文祖父



1828-1831年
Cambridge 神学院

Henslow 教授





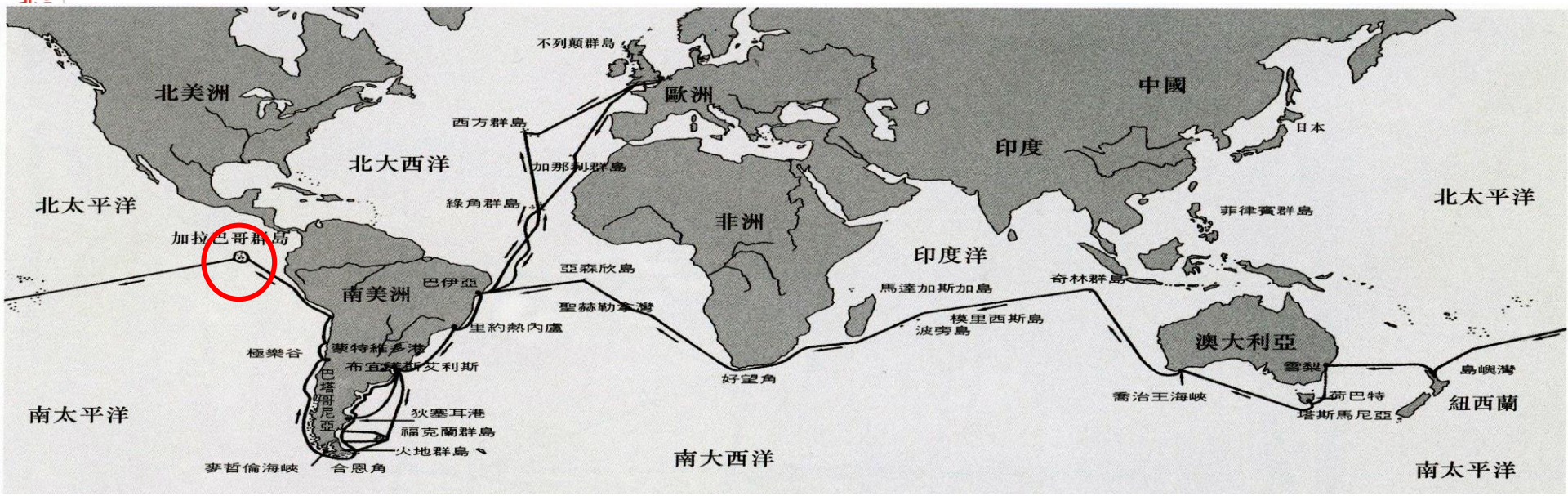
1831-1836
乘 Beagle 远航

船长 FitzRoy





Beagle号的航行路线



晕船
第一封信 女朋友吹了
与船上其他人员的关系
官员的刁难、土著的威胁

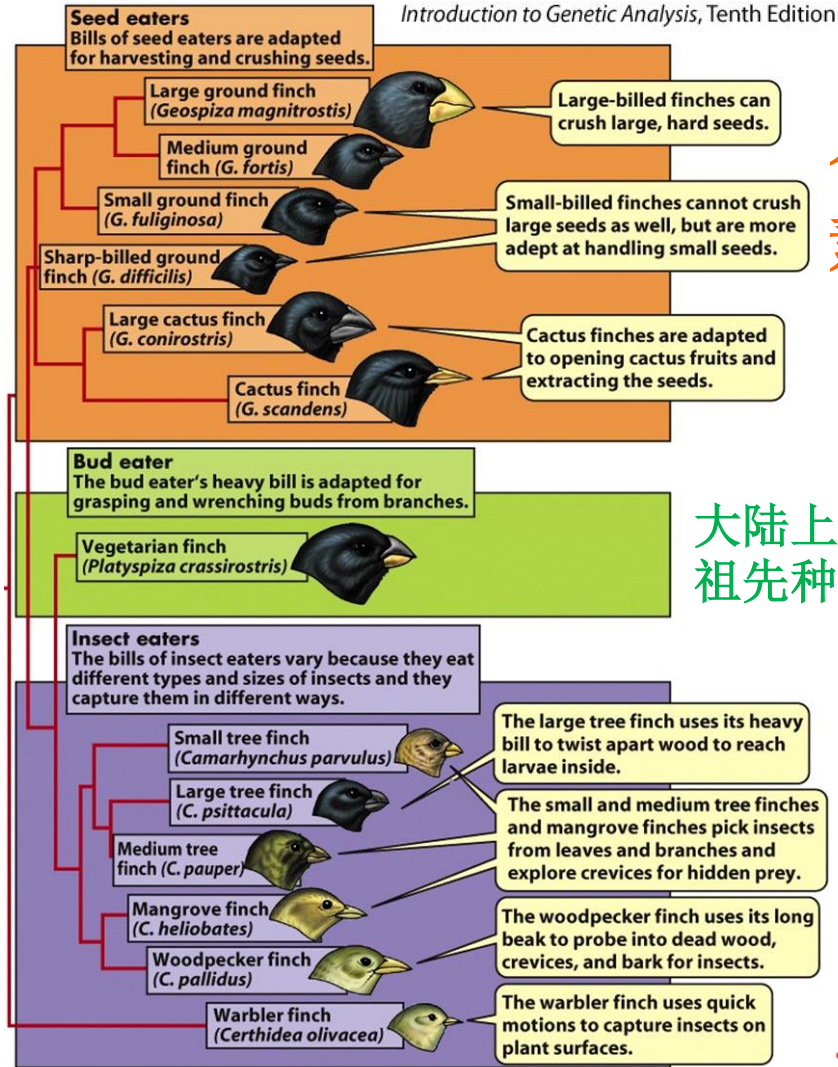
采集了很大生物和化石的标本
观察到了土著人的原始的生活习性
加拉帕戈斯群岛上的各种生物

加拉帕戈斯群岛上的生物给了达尔文灵感

达尔文雀

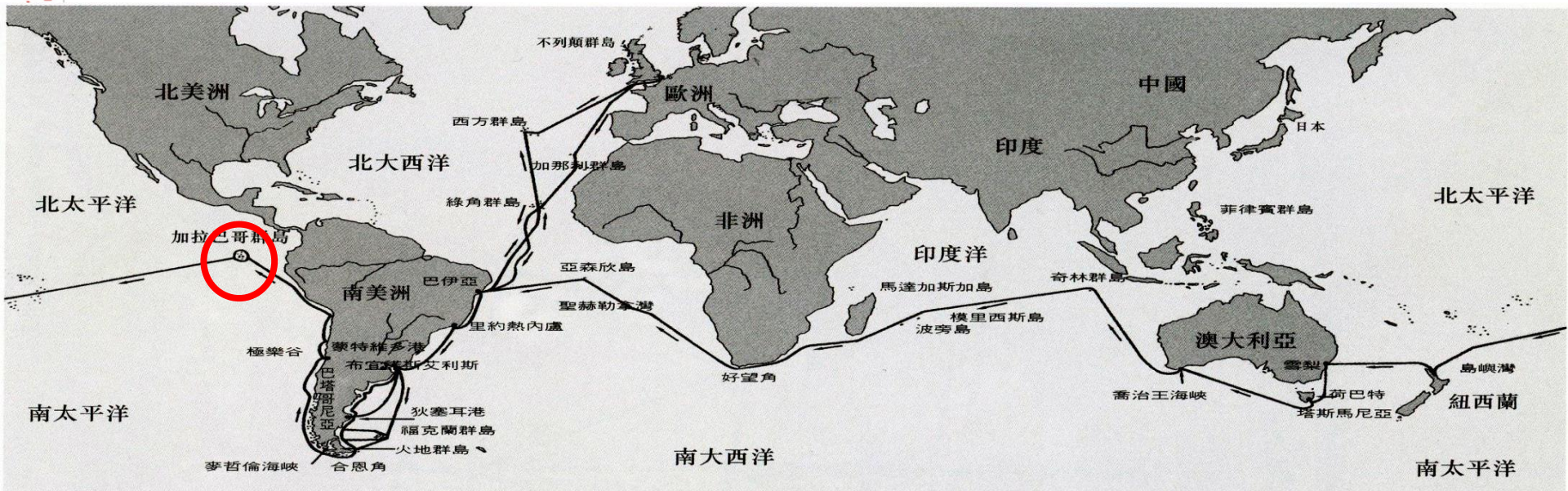
Figure 20-1 part 1

Introduction to Genetic Analysis, Tenth Edition
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Beagle号的航行路线

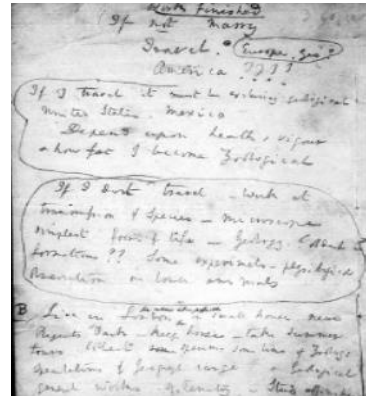


晕船
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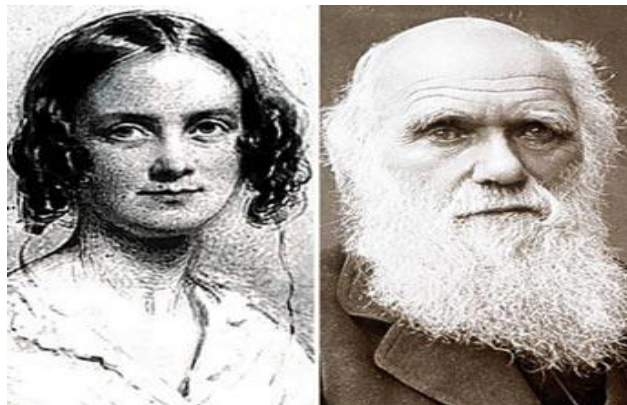
采集了很大生物和化石的标本
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渐渐在英国的科学界中有了名气

结束了5年的航行后，达尔文对其进行了总结，并对生物演化规律进行了深度思考

1839年 “Zoology of Beagle” 出版 结婚



孩子 – 可宠爱，玩耍
有家 – 音乐，与太太坐着舒适的沙发，在壁炉旁聊天
不用独自一人生活在伦敦烟熏火燎的房中



结婚、结婚、结婚！

没孩子 – 老了没人疼
自由 – 在俱乐部与聪明男人聊天，不用迫使自己访问亲戚
买书的钱少了，过度工作可能影响健康

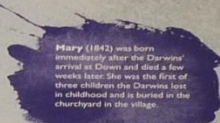
达尔文的孩子們



William (1829-1914) was Darwin's pride and joy when he was born, a 'little prince'. Darwin recorded William's facial expressions as an infant and published some of his observations in *Expression of the Emotions in Man and Animals*. William went to Rugby School and then to Cambridge University, where he lived in his father's old rooms in Christ's College. He left Cambridge early to become a banker.

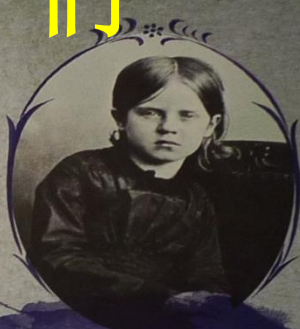


Anne (1841-1851), Emma and Charles' first daughter, left a huge hole in their lives when she died aged 10, from an unknown fever possibly brought on by tuberculosis. She used to run and dance in front of Darwin during his walks around the Sandwalk, or bring him a pinch of snuff in his study. She was full of joy, he said.



Mary (1842) was born immediately after the Darwins' arrival in Down and died a few weeks later. She was the first of three children the Darwins lost in childhood and is buried in the churchyard in the village.

The Darwin children



Henrietta (1843-1927) was lively and intelligent and sometimes found her father rather tame. She was ill with a 'low fever' for a long period stretching through her teenage years and afterwards became very conscious of her health. As a young woman, she forged Darwin with the proofs of his books. Later on she published a book of her mother's letters.



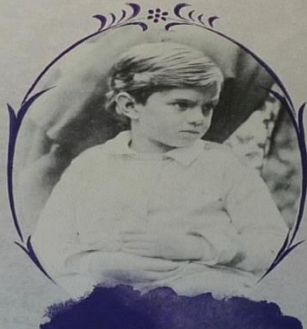
George (1845-1912) enjoyed drawing from a very early age. After conversations with Aristotle, detailed portraits of tigers, horses and warships. He went to Christ's College School, a type of boarding school, and then to Cambridge University. He did exceptionally well in his mathematics final exams - Darwin was advised and eventually became a professor of astronomy at Cambridge.



Elizabeth (1847-1926) had an inconspicuous life. Known as Bess, she and Henrietta were taught by governesses until they were grown up. She never married, but kept her mother company into old age.



Francis (1848-1925), known as Frank, helped his father with his researches, especially in botany. He went to Clifton Grammar and Cambridge, and then to Garmany where he studied with the famous botanist Julius Sachs. He returned to Down House to act as Darwin's secretary and assistant. After Darwin's death, he became a biologist at Cambridge University. He published a selection of Darwin's letters and an account of his life.



Leonard (1850-1943) was Henrietta's and many of his amateur works were recorded by Darwin. When he was 12 he caught scarlet fever, a fearful disease in Victorian times. He had such a passion for insect collecting that Darwin's scientific friends sent him rare examples to cheer him up. Leonard joined the Royal Engineers. Several of his photographs of Down House have been used in restoring the ground floor of the house.



Horace (1851-1928) had a special aptitude for understanding and designing machinery. When he was a boy Darwin took him to one of several local manufacturers in Down and in later life he set up an extremely successful engineering business in Cambridge. He built the 'waterworks' which you can see in the garden.



Charles (1854-1882) was the first in the family to leave Down House. He was remarkably strong, played football and chess. He was only 19 months old when the single-headed fever died within a few days. He is buried in the churchyard at Down.



1842年 完成了《物种起源》的手稿，健康状况极差，
搬离了伦敦，住进了Down House





CROSS AND SELF-FERTILISATION

柳穿鱼 (*Linaria vulgaris*)



18 July 1864 (later breeding)

Linaria vulgaris self-fertilising when sown, was very fertile compared to plants raised - & I raised 1000 seedlings of the two; when very immature I sowed in very compact - the self-fert. plant, that was quite so thick - in fact was shorter - the 3 tallest plant was given - of the naturally crossed plant, I took 3 tall one of course; these latter certainly better & will grow up & try to cross -

[The intention was to give the yellow seedlings & no pollen coming from the plants with & cross pollen; & the main intention of yellow pollen]

3 self-fert. (to be seen)

3 naturally crossed plants

Sedphium *complanata* - seedlings from self & open crossing first flower, of the size of seedlings from previous 1000 - crossed will pollen for the flowers - I believe the plants - to be *Sedphium* - have no harm for the breeding -

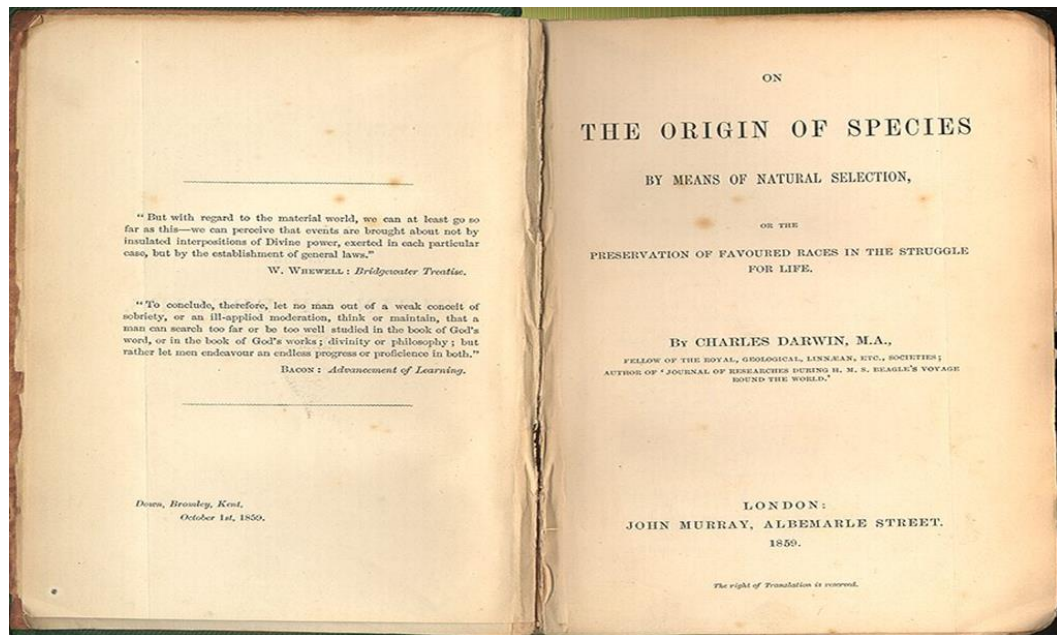




1858年与Wallace同时发表自然选择的论文

1859年出版《物种起源》，1250册当天卖完

The Origin of Species – by
means of natural selection
or the preservation of
favored races in the
struggle for life



达尔文演化理论的主要论点

1. 变异

- 驯养条件下动物的变异 (Variation under domestication)

野生种→多个变种

生活条件的改变→造成变异, 为什么?

用进废退→野鸭和家鸭; 奶羊、牛等和野生亲本

- 自然条件下的变异（**variation under nature**）

个体之间的变异，广布种变异大，大属种变异大



2. 生存竞争 (struggle for existence)

- 个体产生尽量多的后代
- 动植物关系很复杂
- 同种个体竞争最激烈
- 自然界中的战争和死亡是短暂的，茁壮、健康、快乐生物得以生存、繁衍

3. 自然选择，即最适者生存（Natural selection or the survival of the fittest）

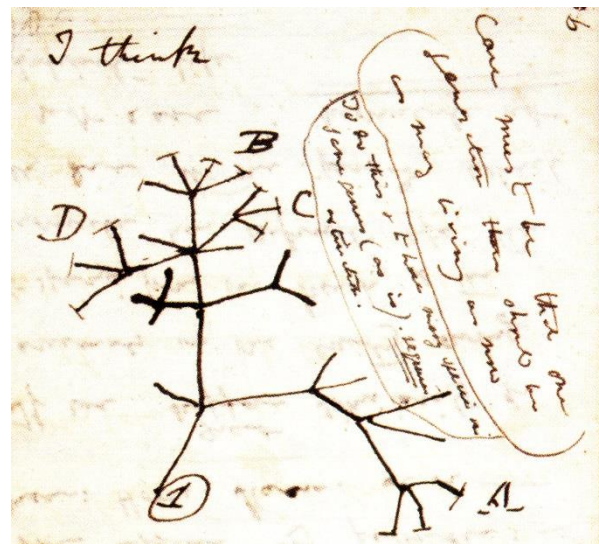
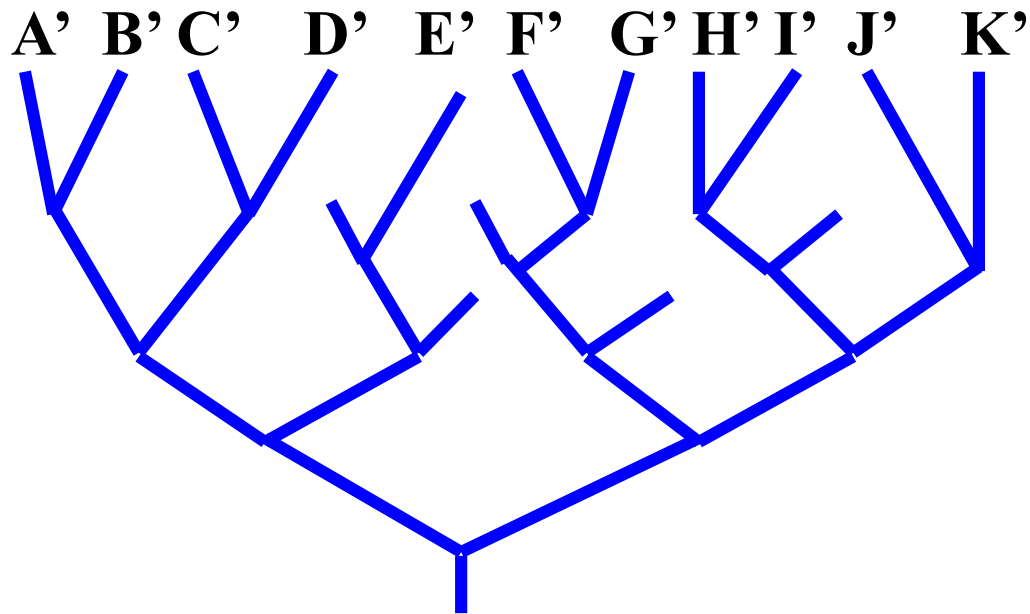
- 存在有益的变异
- 含有上述变异的个体在生存竞争中占优势，将被保留
- 这样的变异会被遗传给下一代



4. 性选择

- 选择最强壮、最适应、最能吸引异性的雄性

5. 生命之樹 (Tree of Life, speciation and extinction)



生物的起源： 单一
生物是否会灭绝： 是

本堂课小结

1. 拉马克提出了生物演化理论，认为生物是在不断变化的，但强调生物的主观作用，生物对环境的适应是主动的；“用进废退”、“获得性状遗传”；生命是多起源的
2. 达尔文在5年贝格尔号航行的基础上，系统地提出了生物演化的理论，认为生物是在不断缓慢变化的；自然选择会将那些拥有有利于生存和繁殖的变化的个体保留下来，这些个体将更适应环境；生命是单起源的

3. 拉马克和达尔文都是伟大的科学家

1,660,000 vs 68,200,000 (2006年)

1,200,000 vs 37,500,000 (2008年)

1,550,000 vs 53,000,000 (2009年)

4,530,000 vs 79,900,000 (2010年)

2,090,000 vs 99,800,000 (2011年)

4,540,000 vs 42,300,000 (2012年)

3,570,000 vs 40,400,000 (2013年)

评估一个人的成应考虑当时的社会背景

勇于挑战权威，善于普及自己的观点



思考题（课堂完成）

观看一段北大校园内红嘴蓝鹊的录像，并解释该动物的行为





參考文獻：

“生物进化”，张昀，第四章

“达尔文进化论全集” 第一卷，
达尔文自传与书信集 （上册）

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