从达尔文到威尔逊

——两位博物学家的故事

周忠和

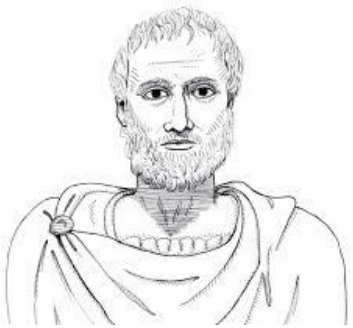
博物学 Natural History

这里的“history”并没有历史的含义

Natural history主要指的是对自然的记述、系统的解释（description or systematic account）

博物学家 Naturalist

著名的博物学家



亚里士多德

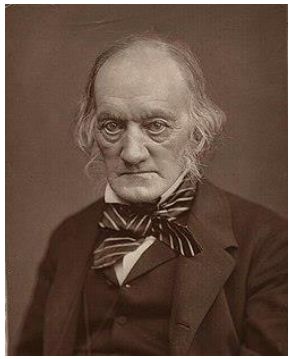
大约在17世纪才有了博物学家这一称谓，而到了19世纪，经典的博物学家大量涌现，在维多利亚时代达到了巅峰；也是在19世纪，博物学不仅催生了生命科学、地球科学等现代科学的学科分支，同时也深刻影响了文学、艺术的发展。虽然博物学如今多被看着是一个“过时”的学科，但博物学的跨学科思维仍有重要的意义。

林奈

布封

拉马克

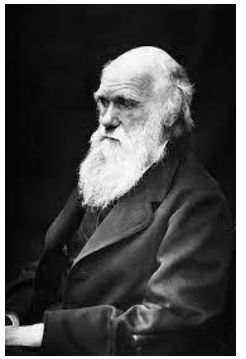
洪堡



欧文

法布尔

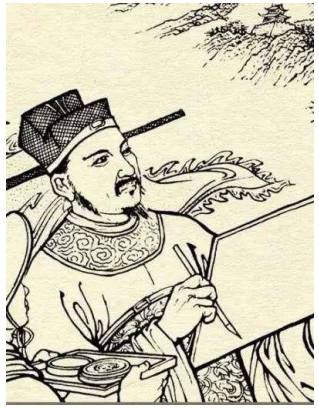
华莱士



达尔文

中国的博物学家

郦道元



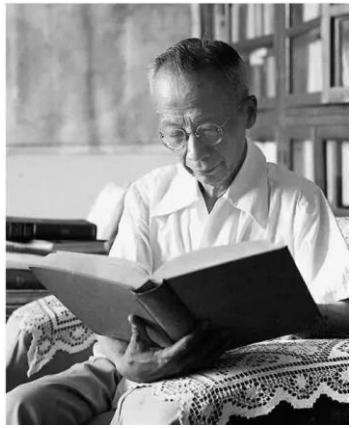
沈括

李时珍

徐霞客

丁文江

地质学、地图学、人类学等



竺可桢

气象学、地理学等

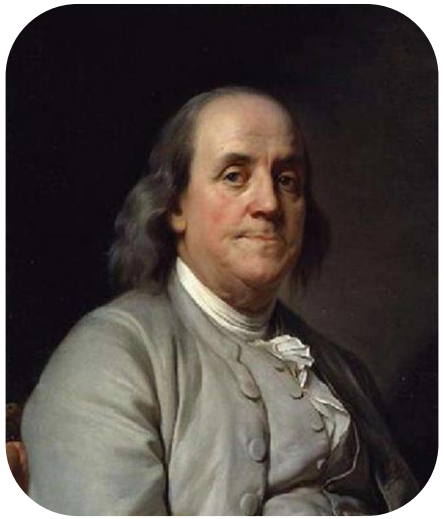
他们也是博物学家

牛痘疫苗的发明人——詹纳

哺乳动物、鱼类、鸟类、植物、化石等

遗传学之父——孟德尔

昆虫学、气象学等



美国开国元勋——富兰克林

物理学、数学、气象学、海洋学等

从达尔文说起

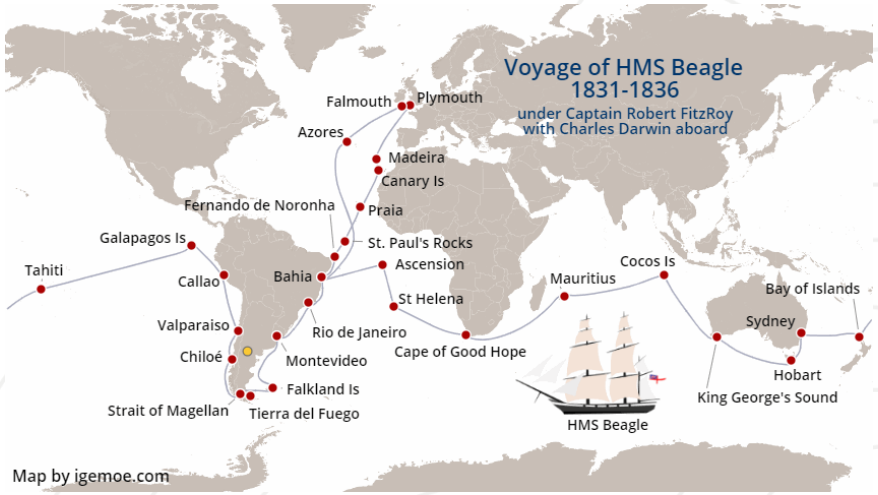
生物学家达尔文

达尔文雀

1838年—1843年，编纂五卷巨著《贝格尔号航行期内的动物志》

1846年—1854年，专心致志地研究海生甲壳类节肢动物————藤壶，

完成四卷专著，获得了英国皇家学会金奖



地质学家达尔文

《珊瑚礁的结构与分布》(1842年)

《火山岛屿的地质考察》(1844年)

《南美洲的地质考察》 (1846年)

加拉帕戈斯群岛

珊瑚礁

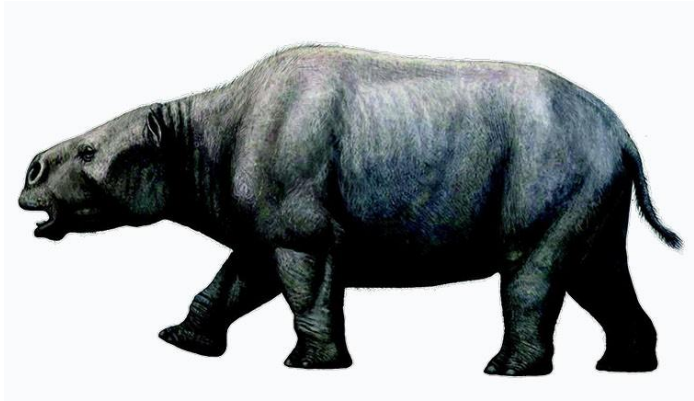
1859年被伦敦地质学会授予英国地质学界的最高奖励——沃拉顿斯奖章

达尔文与古生物

采集的化石

他对南美古哺乳动物化石的研究，启发了他对地球历史上生物灭绝现象以及物种可变性的正确理解

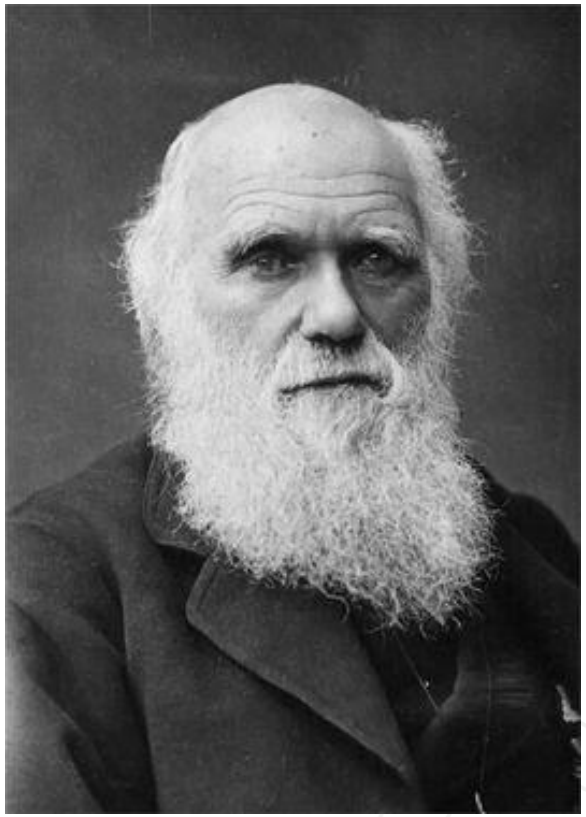
大地懒



箭齿兽

达尔文思想三部曲

达尔文为整个人类提供了新的世界观，并因此成为近代历史上最伟大的科学家和启蒙思想家之一。



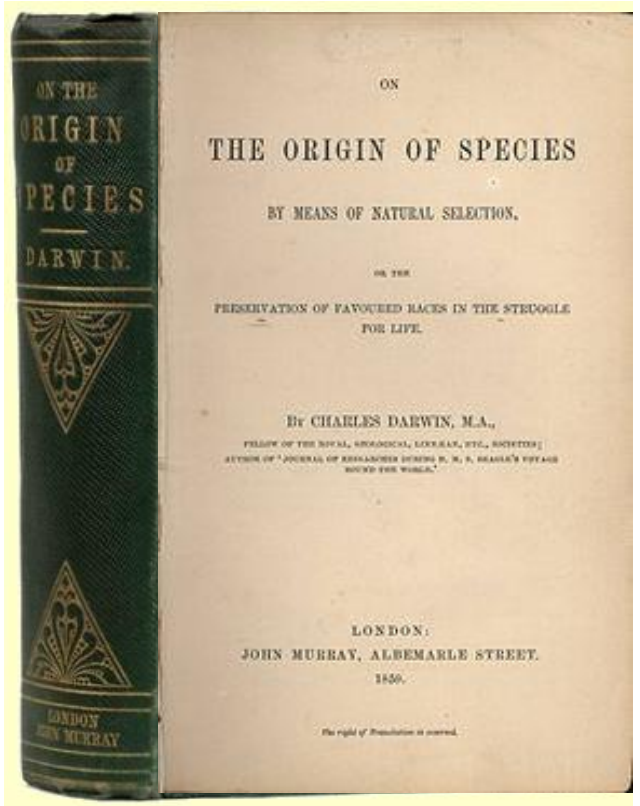
老年达尔文

《小猎犬号航海记》——《物种起源》——《人类的由来及性选择》

1839　　1859　　1871

1859年，《物种起源》出版

《论依据自然选择，即在生存斗争中保存优良族群的物种起源》



《物种起源》的内容

本书第一版问世前，人们对物种起源认识进程的简史

绪论
第一章　家养下的变异
第二章　自然状态的变异
第三章　生存斗争
第四章　自然选择
第五章　变异的法则
第六章　理论的诸多难点
第七章　本能
第八章　杂种现象
第九章　**论地质记录的不完整性**
第十章　**论生物在地史上的演替**
第十一章　**地理分布**
第十二章　**地理分布（续）**
第十三章　生物的亲缘关系：形态学、胚胎学、发育不全的器官
第十四章　复述与结论

内容涵盖：博物学、地质学、古生物学、生物学、生态学、生物地理学、胚胎学、行为学等。

《物种起源》的核心知识与思想

生物不是创造出来的，而是自然演化的结果

自然选择是生物演化的机制，前提条件是可遗传的变异

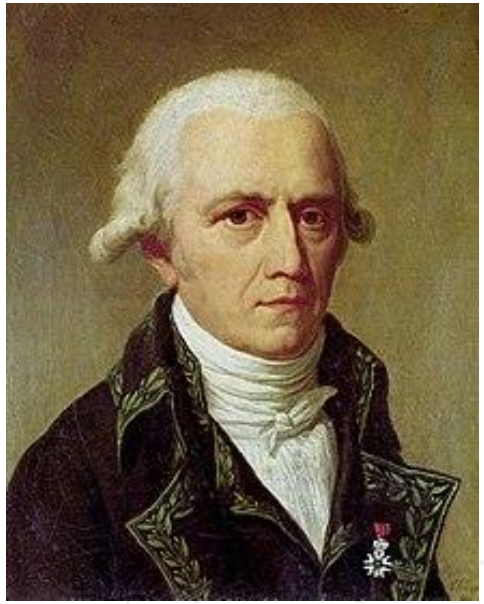
具有影响生存与繁殖能力，以及可遗传差异的个体

虽然在达尔文之前已有人意识到演化的存在，但正是他首先以**精细的观察**和**严密的推理**证明了演化事实的存在。

——龙漫远

进化思想的萌芽

达尔文之前，法国的拉马克（1744—1829）是最重要的进化论者。他认为生物是进化的，但机制搞错了，犯了直觉的错误。遗憾的是，今天我们很多人还在犯一样的错误。



拉马克

- 生物变异是环境变化所诱发的 ❌
- 环境变化所诱发的变异是可遗传的❌?
- 简单的生命形式不断自生并自动向更高级形式发展❌

科学很多时候是违反直觉或反常识的

达尔文与拉马克的主要区别

拉马克：环境诱导变异；生物主动适应环境

达尔文：变异是内在的；生物被动适应环境

达尔文主义不是社会达尔文主义

“物竞天择，适者生存”

原本是一种科学理论的演化论，从19世纪末20世纪初开始化身为中国人救亡图存的指导思想和政治口号

——龙漫远

公众对进化论的常见误区

除了混淆达尔文
与拉马克之外

进化=适者生存

生存斗争=弱肉强食

进化=进步

。。。。。。

常见的曲解 1——“适者生存”

自从严复先生将进化论引进到中国，“适者生存”一词，就变得广为流传，简直成了达尔文的进化论的代名词，事实上，这是很不准确的。生物学意义上的“适应”，与我们日程生活中理解的主动的“适应”不是一回事，严格来说是被动的过程。或者说，是自然选择造就了适者。而且，适应都是相对的，今天适应，明天或许就不适应；此处适应，别处可能就不适应；因此，适应是一项特定环境条件下的综合指标。

严复

强按到达尔文头上的标签

英国哲学家赫伯特·斯宾塞（“社会达尔文主义之父”）提出“Survival of the Fittest”，把自然选择片面地解释为适者生存。达尔文《物种起源》第五版开始才把这一表述借用到自己的著作中，被学术界普遍认为是一个败笔。

常见的曲解 2——“生存斗争”

“我应首先说明，我是在广义与隐喻的意义上使用“生存斗争”这一名词的，它包含着一生物对另一生物的依存关系，而且更重要的是，也包含着不仅是个体生命的维系，而且是其能否成功地传宗接代……**沙漠边缘的一株植物，委实可以说是为抗旱求存而斗争，虽然更恰当地说，应当把它称之为植物对水分的依赖。**”

“在这几种彼此相贯通的含义上，为方便计，我使用了生存斗争这一普通的名词。”

—— 达尔文

常见的曲解 3——“进化=进步”

维多利亚时代（1837-1901），是达尔文进化论的诞生与早期发展的重要时期。太平盛世的英国社会思想开放，坚信社会的不断进步，也比较容易地接受了达尔文的进化学说，但也为“生物演化的不断进步论”埋下了伏笔。然而，《物种起源》一书从未表达或暗示过生物演化是越来越进步的，这与达尔文的自然选择理论本质上是不相符合的。

说一种动物比另外一种动物高级其实是很荒谬的

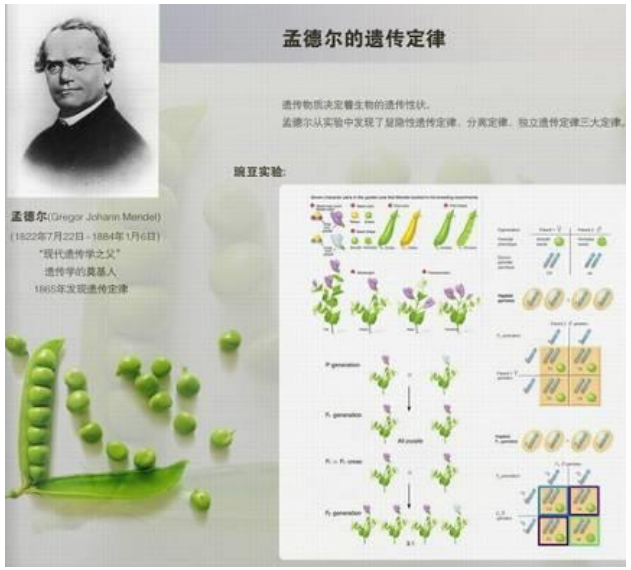
——达尔文

现代综合进化学派

“新达尔文主义”

孟德尔（G. J. Mendel）开启的遗传学

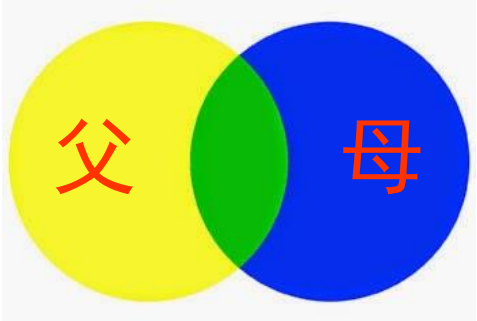
√

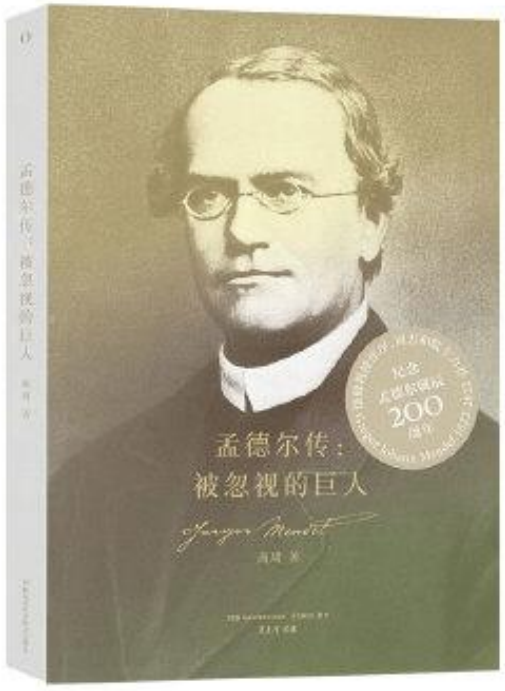


分离定律（Law of Segregation）

自由组合定律（Law of Independent Assortment）

x



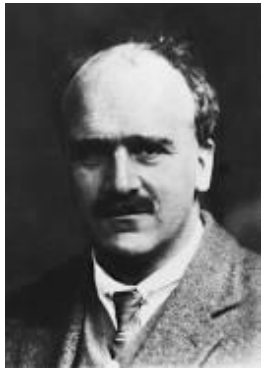


遗传学的发展

1920s-1930s

摩尔根

费歇尔



霍尔丹

赖特

解释了达尔文无法理解的变异的机理问题

提出了一个重要的概念：演化发生的随机性

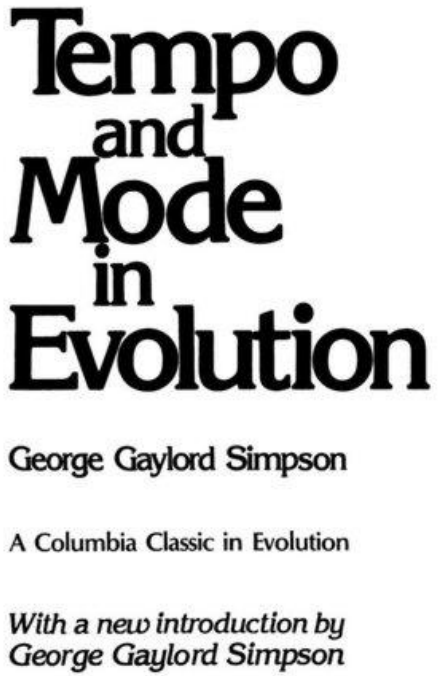
“现代综合进化学派”的诞生

辛普森（GG Simpson）—古生物学的贡献

遗传学家杜布赞斯基

演化生物学家赫胥黎

自然选择 + 遗传学 + 古生物学

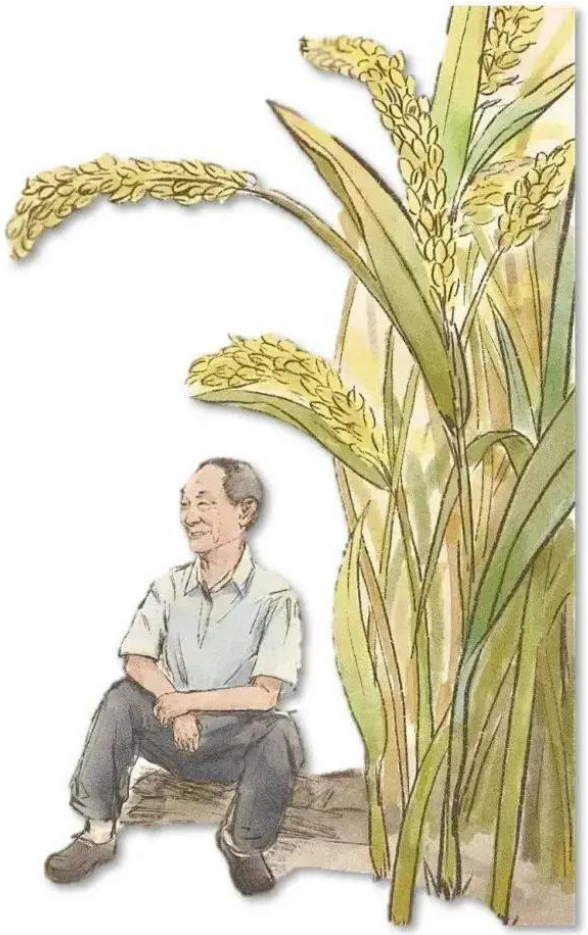


1944

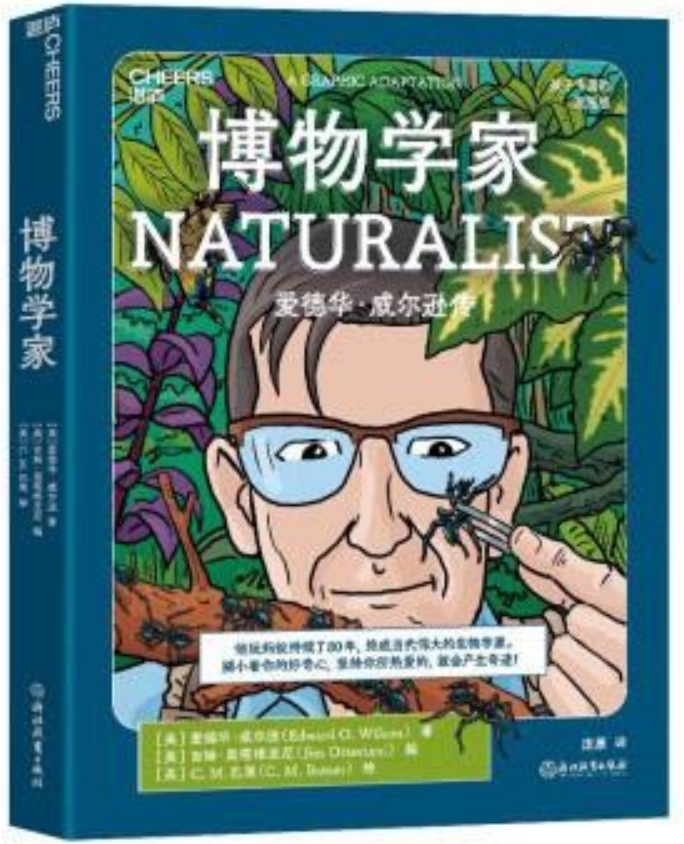
历史的教训

前苏联时期的李森科否定经典遗传学，推崇拉马克、米邱林的获得性遗传，片面强调环境作用，使得前苏联的遗传学倒退了几十年，对农业生产也造成了巨大的损失。

五十年代初我国也受到了一定影响，然而**袁隆平先生**具有可贵的科学精神（特别是质疑精神），坚信孟德尔、摩尔根的遗传学说，最终在杂交水稻领域取得伟大的成就。



“当代达尔文”威尔逊



Nature

Obituary

Edward O. Wilson

(1929–2021)

Naturalist, conservationist and synthesizer who founded sociobiology.

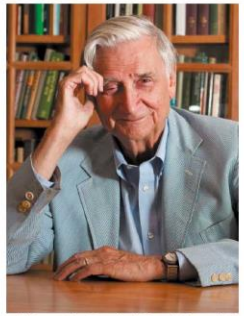
Edward (Ed) Wilson began by exploring the systematics, geographical distribution, social organization and evolution of ants. He became one of the great scholarly synthesizers, winning two Pulitzer prizes. A superb naturalist who enjoyed challenging dogma, he fought for conservation, brought ideas of biodiversity into the mainstream and set ecology on a rigorous conceptual footing. He has died aged 92.

Wilson's book *Sociobiology*, published in 1975, was the first to address the evolution and organization of societies in organisms ranging from colonial bacteria to primates, including humans. The final chapter, on human social interaction, ignited controversy. Wilson argued that human behaviour, although adaptable to environmental conditions, is rooted in a genetic 'blueprint'. Opponents claimed that nothing in human behaviour is grounded in genetics, except sleeping, eating and defecation. In a letter to *The New York Review of Books*, a group of academics including evolutionary biologists Stephen Jay Gould and Richard Lewontin associated Wilson's view with racism and genocide. Wilson responded with elegance and humour; in my view, most scholars now agree that he won this argument.

Wilson was born in 1929 in Birmingham, Alabama, and grew up, as he admitted in his 1994 autobiography, *Naturalist*, "mostly insulated from its social problems". After studying biology at the University of Alabama in Tuscaloosa, he did graduate studies at Harvard University in Cambridge, Massachusetts. He felt its Museum of Comparative Zoology, with the world's largest ant collection, was his "destiny".

In 1955, he obtained his PhD on the systematics of the ant genus *Lasius*, which includes the widespread black garden ant. Systematic biology and the study of biodiversity remained his mission, but he made significant contributions to other fields, such as animal behaviour and chemical ecology. His early work on chemical communication in animals, particularly social insects, inspired a generation of scientists to explore a new area in behavioural physiology.

In 1954, Wilson set out for Melanesia, including New Guinea, to study ant taxonomy and biogeography. On the basis of his data, he elaborated the critique that he and his Harvard colleague William Brown had previously developed on the idea of subspecies. They argued that the distinctions between species should be more clearly defined, allowing for variability



within species. Equally influential was their thinking on character displacement – when similar species in the same area diverge genetically to avoid competing for resources.

Through his fieldwork in Melanesia and later in the Caribbean, Wilson drafted a principle of biogeography that he called the taxon cycle. Species evolve back and forth between being able to live in marginal habitats, and thus disperse widely, and restricting their distribution to species-rich habitats in island interiors. He held on to the dream of a unifying theory." He developed a theory of adaptive demography – that certain kinds of social structure might increase reproductive fitness – and the evolution of division of labour between castes, such as insect queens and worker groups. First brought together in *The Insect Societies* (1971), these concepts were elaborated in *Caste and Ecology in the Social Insects*, with mathematical biologist George Oster, in 1978.

> **"Wilson wondered about ways to understand the evolution of social organization."**

Sociobiology was a much more far-reaching synthesis on the evolution of social systems. The furore that ensued stimulated Wilson to write an even more provocative book, *On Human Nature* (1978). This garnered his first Pulitzer. His highly original book *Biophilia* (1984) was the first to use the term to mean human empathy for the natural world. He argued that pleasure in being surrounded by diverse living organisms is a biological adaptation. These books prepared the ground for *Consilience* (1998), which one reviewer called a biologist's dream of the unity of knowledge. It proposed the kind of intellectual annexation that occurs when one field can be explained in terms of a more fundamental discipline, and received a mixed response.

To his and my utmost surprise, in 1990, the huge monograph *The Ants*, on which we worked for years, won another Pulitzer. Wilson continued to publish on human evolution and humanity's relationship with the planet into his 90s. *Half-Earth* (2016) is a passionate plea to leave half of our world to nature.

Ed was not a team builder. He preferred to work alone, although in a few cases he found colleagues who complemented his abilities. He thrived on controversy. In the past two decades, he had rejected the theory of inclusive fitness – the idea that the reproductive success of an individual increases when it helps to raise the offspring of its close relatives – that he once propagated. This led to heated debates, and I opposed some of his views. When we reached a compromise and submitted the manuscript of our book *The Superorganism* (2009), Ed's concluding remark was: "Bert, there is one thing we agree on 100%. That is: my co-author is wrong." One could disagree with Ed over scientific issues and remain good friends.

tested this and other original hypotheses in the Florida Keys in the 1960s, in collaboration with his former student Daniel Simberloff. With ecologist Robert MacArthur, he proposed that species maintain their populations through trade-offs between number of offspring and quality of parental care (the concept of *r*/*K* selection). Their 1967 book *The Theory of Island Biogeography* had far-reaching effects on studies of evolution and conservation.

From early in his career, Wilson wondered about ways to understand the evolution of social organization, from primates to social insects (such as honeybees and ants). "A congenital synthesizer," he wrote in his autobiography, "I

Bert Hölldobler holds the Robert A. Johnson Chair in Social Insect Research and is Regent's Professor in the School of Life Sciences at Arizona State University, Tempe. He began working with Wilson in 1970.

Science

RETROSPECTIVE

Edward O. Wilson (1929–2021)

Pioneering naturalist with far-reaching insights

By **Stuart Pimm**

Edward Osborne Wilson, who wrote extensively on ants and popularized the field of sociobiology, died on 26 December 2021 at age 92. Ed vigorously promoted the idea of biodiversity and understood that the concepts of island biogeography apply to the fragmented habitats pervading much of the world. He titled his autobiography *Naturalist* and proudly considered himself to be one. Ants were his first love, and he used the insights he gained from studying them to understand the living world and the place of humans in it.

Ed was born in Birmingham, Alabama, on 10 June 1929, and he always celebrated his southern heritage. An early fishing accident left him blind in one eye. Because of this deficit, he was at greatest ease when studying small things, and ants quickly became his passion. He earned his BS and MS degrees in 1950, studying biology at the University of Alabama. After that, at the University of Tennessee, his professors recommended he move to Harvard University, which he did. He received his PhD in 1955 in biology. In 1956, he joined the Harvard faculty, and he remained there for the rest of his career.

Ed's earliest papers were on the natural history and taxonomy of ants. His work ranged in geography from Puerto Rico to New Guinea. It covered ant geographical distributions, their social behavior, and how they communicate using pheromones. His prolific subsequent writing includes a taxonomic revision of the genus *Pheidole* in 2003 and his only novel, *Anthill*, in 2010. His last book, *Tales from the Ant World*, published in 2020, was also autobiographical.

In 1963, Ed published his equilibrium theory of island geography with ecologist Robert MacArthur. They observed that smaller oceanic islands and those that are farther from mainland have fewer species. The "equilibrium" refers to the hypothesized processes that explain these patterns—the extinction of small island populations and the recolonization from individuals of species that make it to the island. Ed and his then-graduate student Dan Simberloff set out to test the theory on small mangrove islands in Florida Bay. Their work not only confirmed their predictions but also initiated an era of ecological experiments.

The influential equilibrium theory extended beyond oceanic islands to "habitat islands"—forest patches left behind by human actions. Ed anticipated, and later large-scale experiments initiated by ecologist Thomas Lovejoy in the Amazon confirmed, that the smaller a habitat fragment, the more species will die out and the more quickly they will do so. Globally, habitat loss

and fragmentation drive biodiversity loss, a term Lovejoy coined and Ed promoted. They both advocated reconnecting habitats with restoration, a practical solution that undoes the habitats' island nature and slows biodiversity loss.

In his 1975 book *Sociobiology: The New Synthesis*, Ed reported a monumental survey of the wide range of animal societies, including our own. That natural selection might shape human behaviors was questioned by some. Many critics made ad hominem attacks, which were short on scientific content. Ed responded vigorously, noting that the adaptive value of animal behaviors was not in dispute, however disturbing this might be to political philosophies. During this time, someone famously threw water onto Ed at a meeting—the amount involved grows with every telling of the story. When Ed told it, it was with a twinkle and an appreciation of this unique honor.

Ed's accolades were many. He was awarded the US National Medal of Science in 1977 and top environmental prizes in Europe (such as the Crafoord Prize in 1990), North America (the Tyler Prize in 1984), and Asia (the International Cosmos Prize in 2012). *On Human Nature* and *The Ants*, co-written with Bert Hölldobler, both earned him a Pulitzer Prize (in 1979 and 1991, respectively).

I met Ed in the mid-1970s at a scientific meeting, and we talked often thereafter. On one memorable afternoon about a decade ago, he called to talk about ants (of course). He asked me about the evolution within and the natural history of the Hawaiian Islands, where I had worked extensively. They were, originally at least, ant-free. Ed considered ants to be "the little things that rule the world," and he wondered aloud what would happen where they did not rule and how species might have evolved differently. This conversation exemplified his boundless curiosity. Ed was always asking new questions. Not all of them paid off. Those that did changed biology.

"Oh, to be 80 again!" Ed said to me a few years back. But in the past two decades, his energy for writing books was astonishing. Ed was known to many through his popular writings. Who cannot be enchanted by the following declaration: "Anywhere I am in the world I love it when the air is warm and moist, and heat bounces off the sunlit earth, and insects swarm in the air and alight on flowers"? But the book in which this quote appears, *A Window on Eternity* (2014), an account of his first trip to Africa, is no mere travelogue. As he celebrates biodiversity—even the Matabele ant that bites him—he makes a passionate plea for the future of our planet. Current actions, he writes, will lead to a further "slide into extinction [and] will turn the Anthropocene into the Eremocene, the Age of Loneliness."

Ed described his vision for our human future in his 2016 book *Half-Earth*. We must protect biodiversity, celebrate it, be fascinated by it, and protect at least half of nature, giving species a chance to survive and preserving our mental well-being. It is a safe limit, and it is an aspiration for all whom he inspired. And they are legion. Since his death, social media brims with photos of Ed signing books and linking arms with students and younger colleagues and with tales of how much he helped them. He enjoyed those interactions with students above all. ■

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10.1126/science.abn9848

PNAS

RETROSPECTIVE

博物学家

Edward Osborne Wilson, Naturalist (1929–2021)

Bert Hölldobler[a,1]

In January 1980, at the commencement of a new decade, the journal *Harvard Magazine* asked several Harvard professors what they consider to be the major problems for humanity in the future. Edward O. Wilson replied (1):

> The worst that can happen—will happen—is not energy depletion, economic collapse, limited nuclear war, or conquest by a totalitarian government. As terrible as these catastrophes would be for us, they can be repaired within a few generations. The one process ongoing in the 1980s that will take millions of years to correct is the loss of genetic and species diversity by the destruction of natural habitats. This folly our descendants are least likely to forgive us.

Indeed, we have hardly begun to understand the significance of the diversity of life on our earth. Many of the species, which go extinct, will never be known to mankind because the study of biodiversity long has been the "stepchild" in biological sciences. That this irresponsible negligence, this dangerous ignorance concerning the complex and fragile texture of nature in which we live, finally became part of public awareness is largely due to the writings—and yes, preaching—of Edward Osborne Wilson, who died on December 26, 2021.

Ed Wilson was not an extrovert or flamboyant person who thrives when standing in the limelight of public attention. Just the contrary: He was a scientist and scholar, most happy in the library or at the desk in his study, or in the tropical rain forest, cutting up rotting wood searching for little known ant species that specialize in hunting mites. But during his almost 70 years of scientific work, Ed Wilson witnessed the human-made habitat destruction and mass extinction of life forms, which finally drove him to become a chief advocate for the new field of conservation biology and the study of biodiversity. His pioneering work provided the intellectual foundation for this advance.

Edward Osborne Wilson was born on June 10, 1929, in Birmingham, Alabama. He described his childhood as "blessed," saying, "I grew up in the

Ed Wilson during a visit to Arizona State University in 2009.

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Author contributions: B.H. wrote the paper.
The author declares no competing interest.

[1]Email: Bert.Hoelldobler@asu.edu.

Published January 21, 2021.

New York Times，*Washington Post*，BBC，AP 等世界知名媒体进行了报道与评论

达尔文传人

当代达尔文

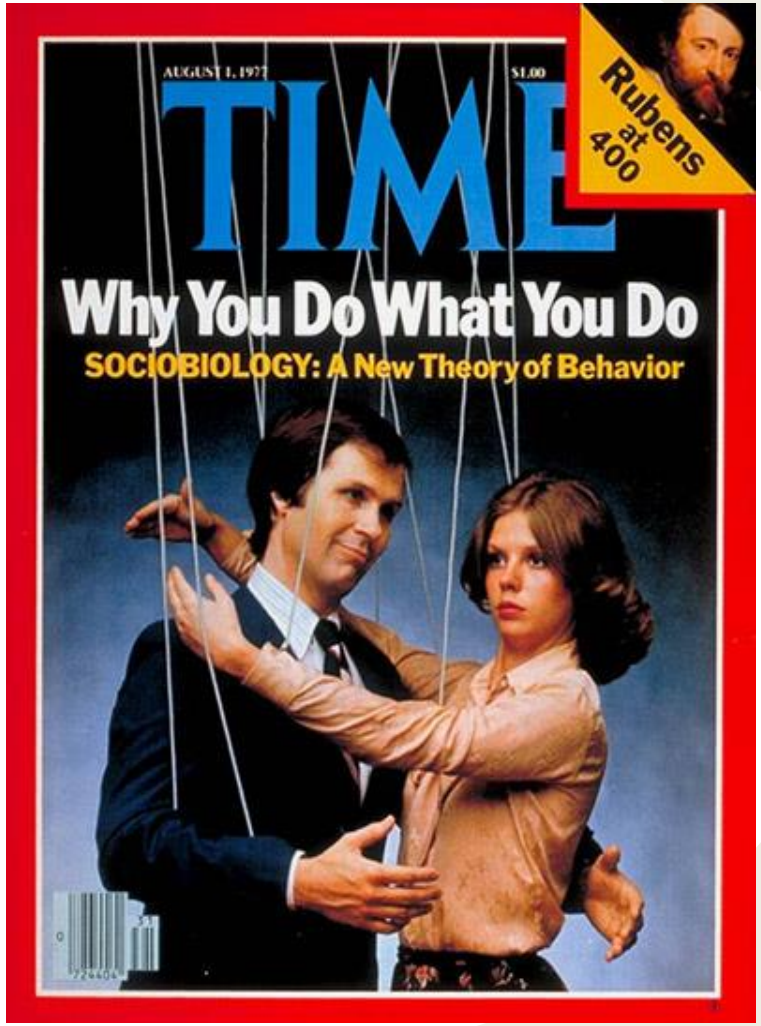
二十世纪的达尔文

蚁人

博物学家

社会生物学之父

生物多样性之父



1996年 被《时代》杂志评为25位最具影响力的美国人之一，《自然》评论他：“不仅是一位世界级的科学大师，还是一位伟大的作家”。

巨大的科学成就

美国国家科学奖、克拉福德奖、泰勒环境成就奖、世界自然基金会金质奖章、两届普利策奖得主

工作狂，著作等身；和蔼可亲，彬彬有礼，但对很多人而言，却是一个有争议的人物

从蚂蚁开始的科学生涯

1929

出生于美国

在Alabama州，因为童年时期的一次事故，他的右眼失去了视力，影响了他对脊椎动物的观察，从而专注蚂蚁

1946

亚拉巴马大学

专攻昆虫学

1955

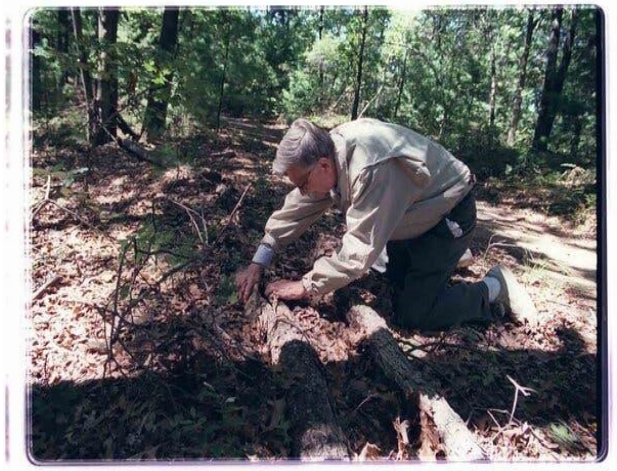
哈佛大学

获得博士学位

1956-

入职哈佛大学

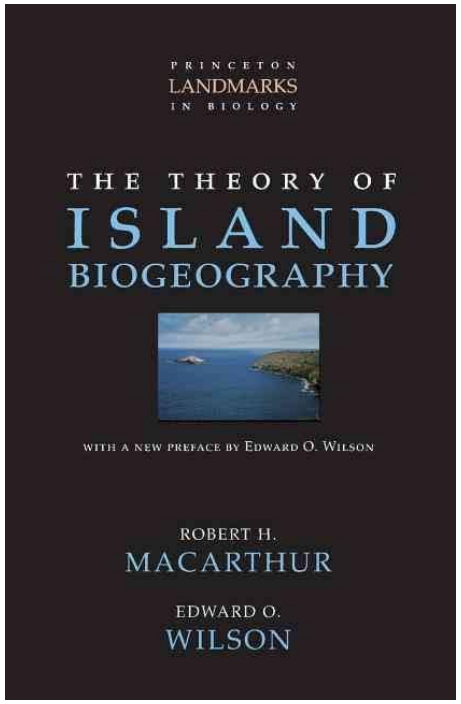
一生发现了400多种蚂蚁。通过与化学家和数学家的合作，破解蚂蚁交流的化学密码Pheromones（外激素，或信息素）



威尔逊在他的自传《博物学家》中写道：

“每个孩子都有一段喜爱昆虫的时光，而我始终没有从中走出来。”

岛屿生物地理学理论

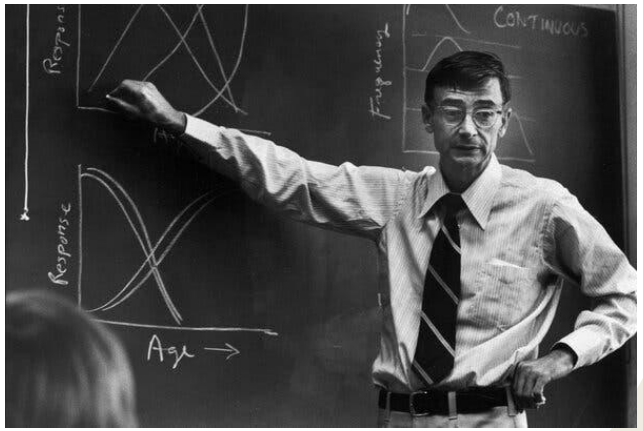


岛屿生物地理学理论成为现代保护生物学的基础，也推动了景观生态学的发展

1967

1969

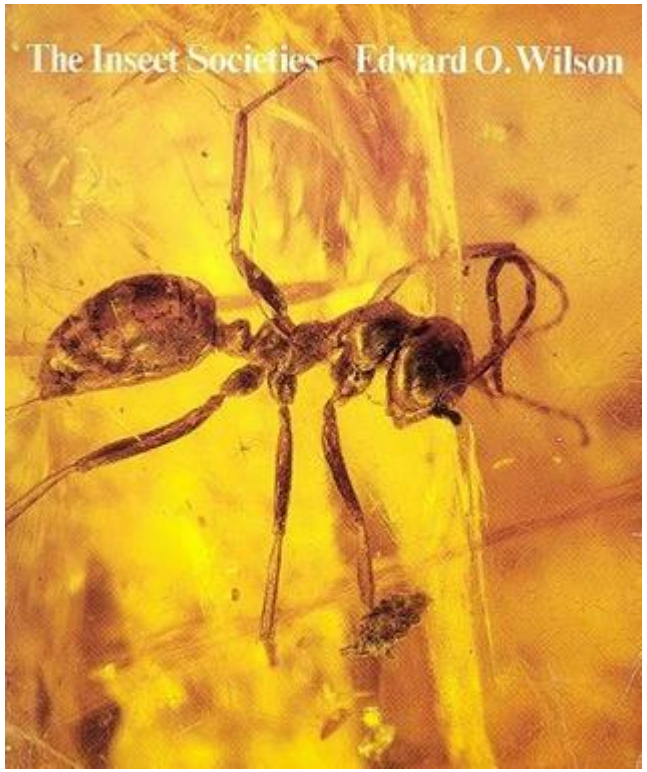
NATIONAL ACADEMY OF SCIENCES



40岁

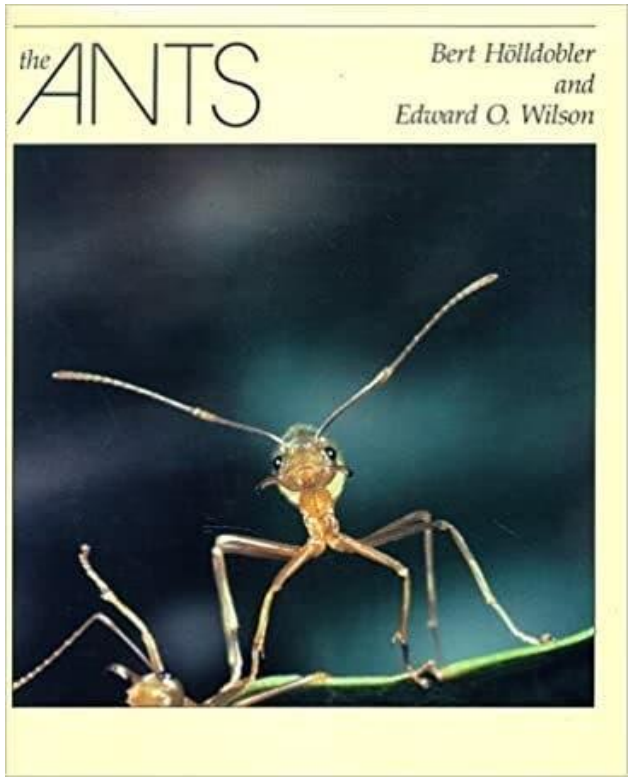
当选美国国家科学院院士

1971



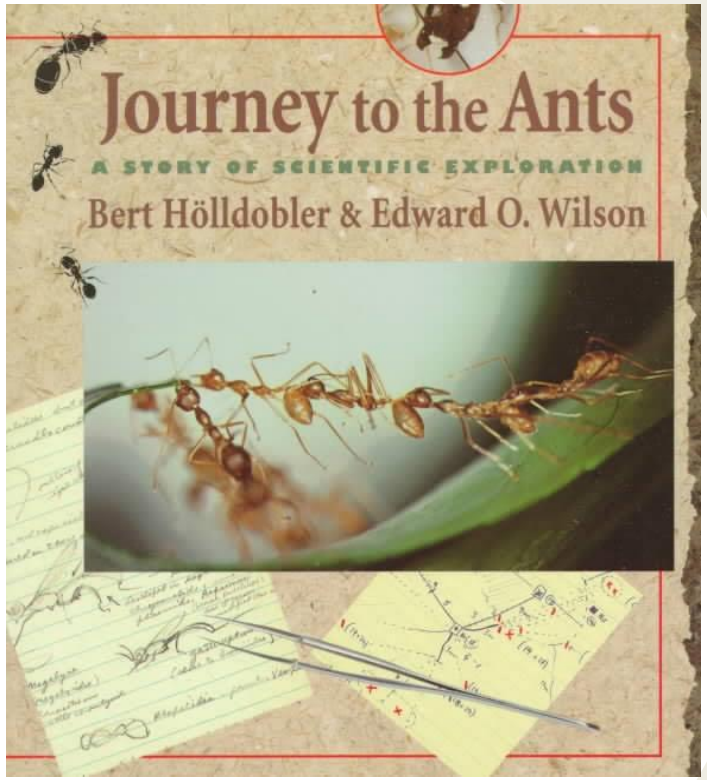
《昆虫社会》获得美国国家图书奖提名

1990



《蚂蚁》

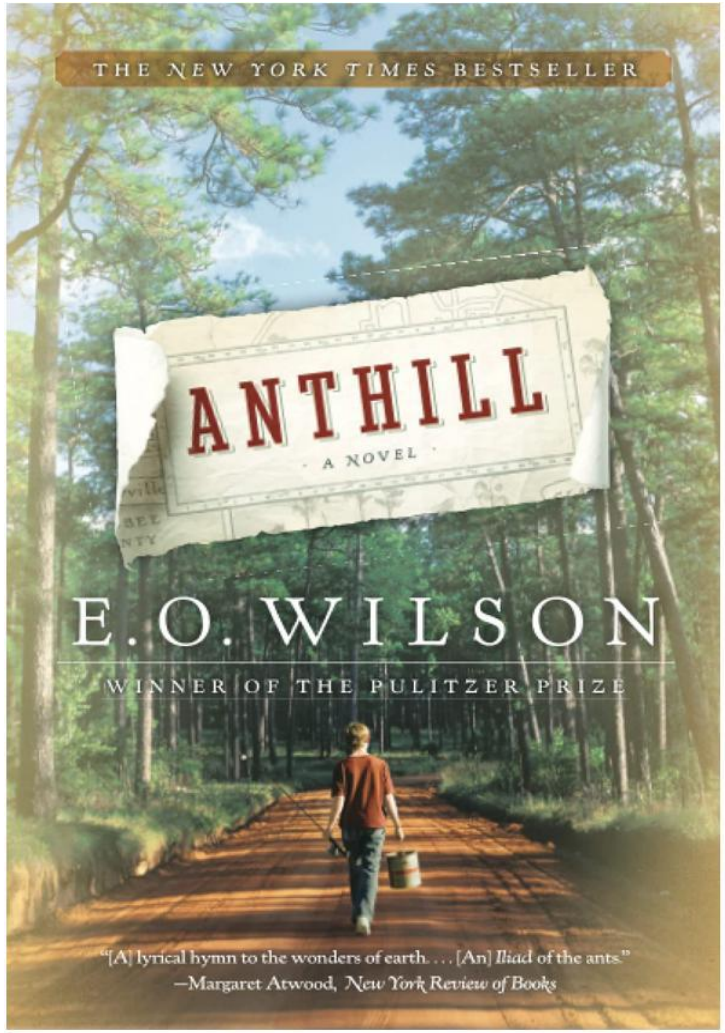
1994



《蚂蚁之旅：科学探索的故事》

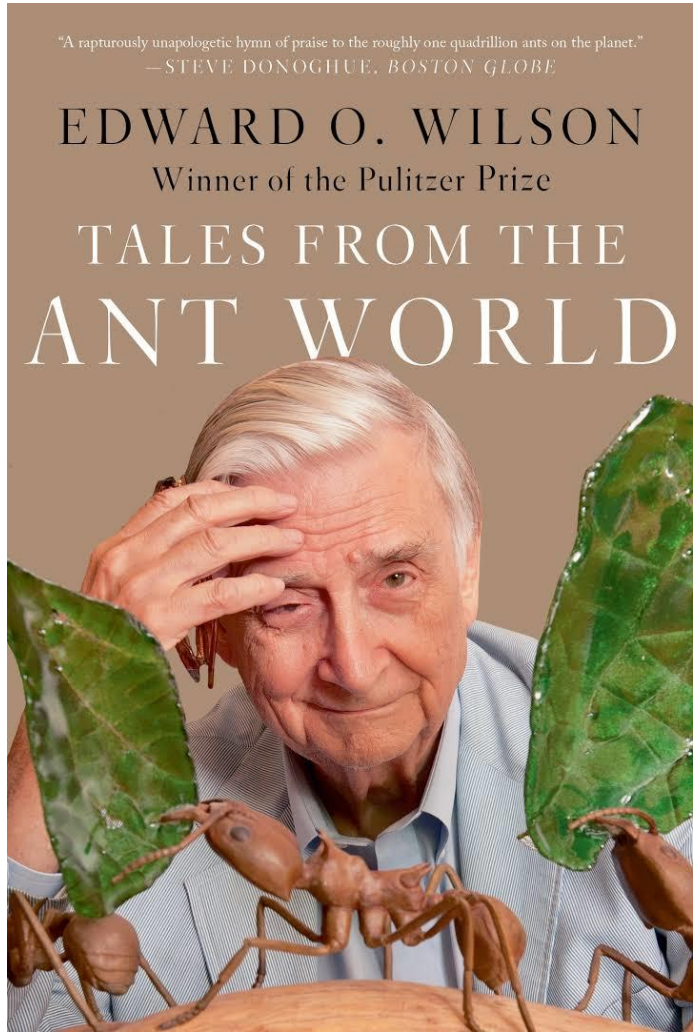
威尔逊的首部虚构作品

2010



《蚁丘》

2020

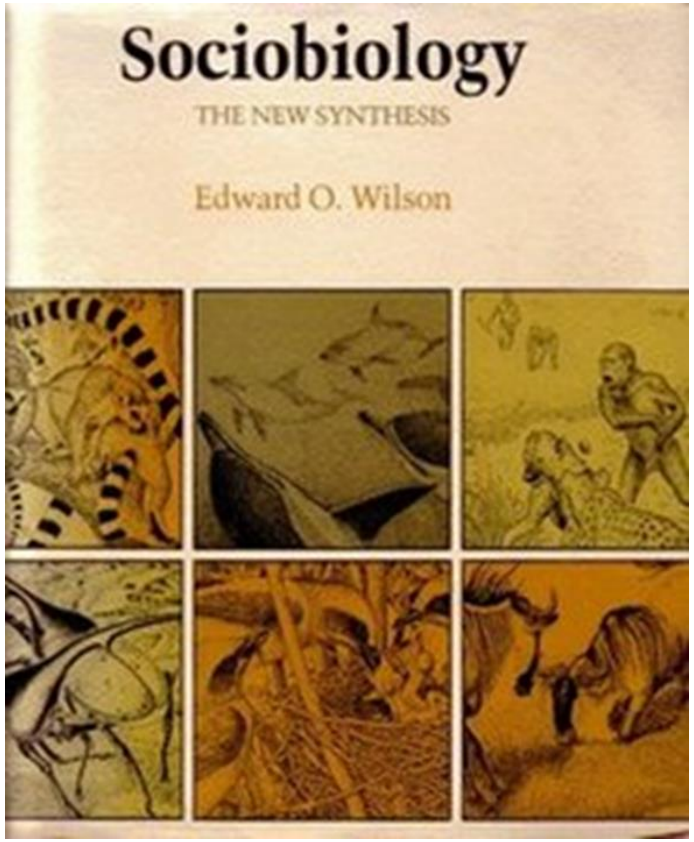


《蚂蚁的故事》

社会生物学：新的综合

《社会生物学》首次提出并命名社会生物学，
这又催生了进化心理学

1975



最后一章引发争议
“MAN: FROM SOCIOBIOLOGY TO SOCIOLOGY”

“人类许多社会行为（包括侵略性、自私性，乃至于性爱、道德伦理和宗教等方面），都是源于对物种的生存有益，因此通过自然选择筛选、保留而演化出来的，这跟其他生物没有本质上的差异。”

1976

获得美国国家科学奖章

“FOR HIS PIONEERING WORK ON THE ORGANIZATION OF INSECT SOCIETIES AND THE EVOLUTION OF SOCIAL BEHAVIOR AMONG INSECTS AND OTHER ANIMALS.”

哈佛同行的反对

RICHARD LEWONTIN

(1929 – 2021)

克拉福德奖得主

纽约书评专栏作家

STEPHEN J GOULD

(1941 – 2002)

间断平衡理论的提出者

著名科普作家

毫不夸张地说，他们不喜欢人性具有任何遗传基础的思想。

—— Wilson 1999

“泼水事件”

‘Wilson,’ They Said, ‘You’re All Wet!’

The scientist Edward O. Wilson was pilloried in the 1970’s, he says, for linking biology and behavior.

NATURALIST

By Edward O. Wilson. Illustrated. 300 pp. Washington: Shearwater Books/Island Press. $24.95.

By Helen Fisher

Edward O. Wilson in 1990 with a sculpture of the South American ant Eurocryptocerus, one of his favorite species.

Whoops, There Goes Another Rubber Tree Plant

THE NEW YORK TIMES BOOK REVIEW

纽约时报报道该事件

在1978年美国科学促进会上演讲时，威尔逊被贴上了“种族主义和优生学”的标签，一位年轻女士拿起一罐冰水从背后泼在威尔逊的头上，还说了句一语双关的话：

“Wilson, you are all wet”

“20世纪70年代初，本书出版的时候，是一个激烈的政治争论时期，其中大部分与越南战争、民权和对经济不平等的愤怒有关。”

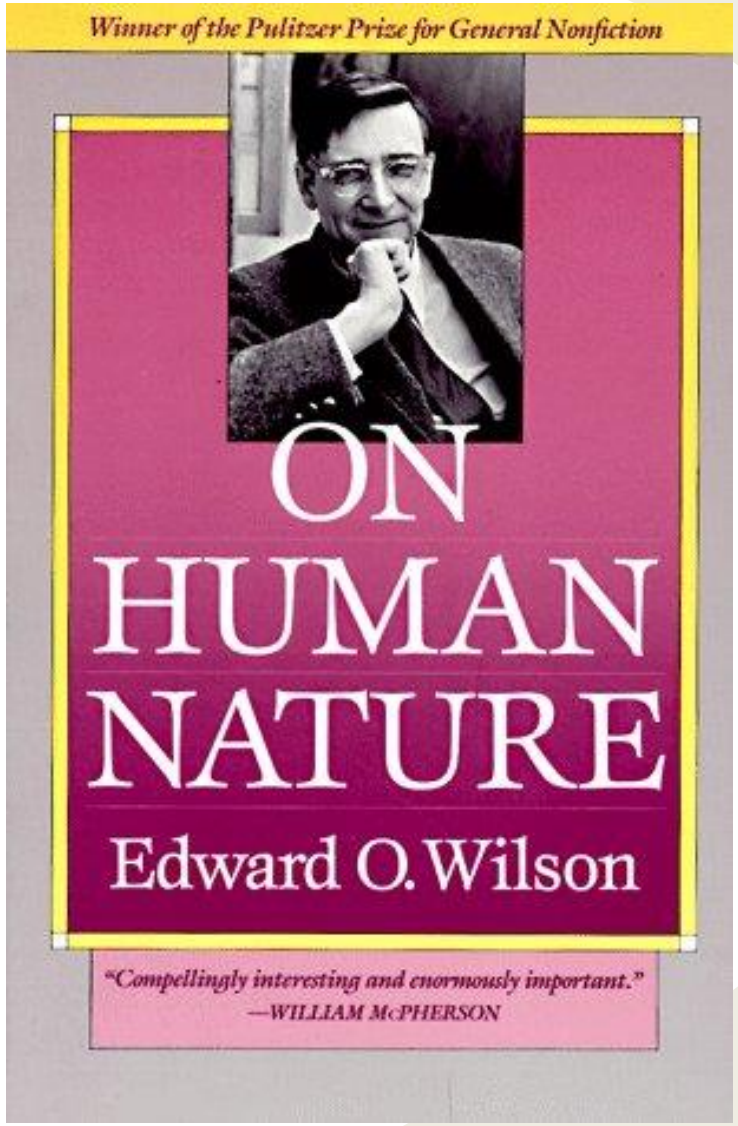
—— Wilson

1995年，《社会生物学》被国际动物行为学会评选为继 **达尔文著作**之后：

有史以来最重要的动物行为学著作

科学与人文的知识大融通

1978



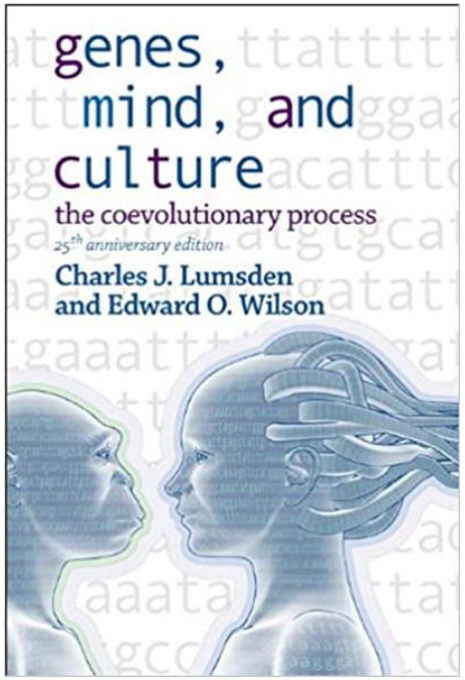
“《论人的本性》研究了真正基于进化论对人类行为所作的解释必定会给社会科学和人文科学带来的影响。”

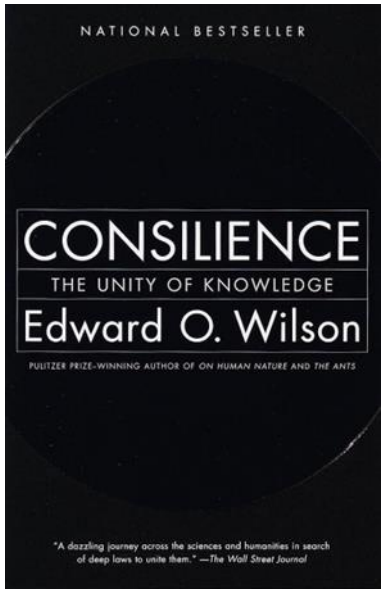
本书在社会生物学引发争议的背景下，从进化生物学的角度讨论了人类的攻击、性、利他行为、宗教等

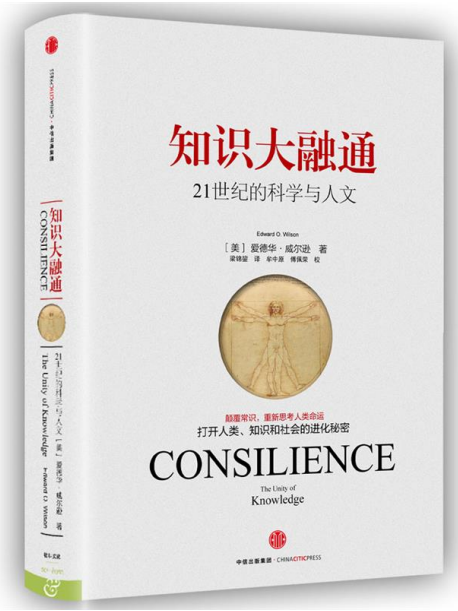
建立了“基因-文化协同进化”理论，来解释人性的产生和本质

“文化来自基因，并且永远具有基因的痕迹”

1981





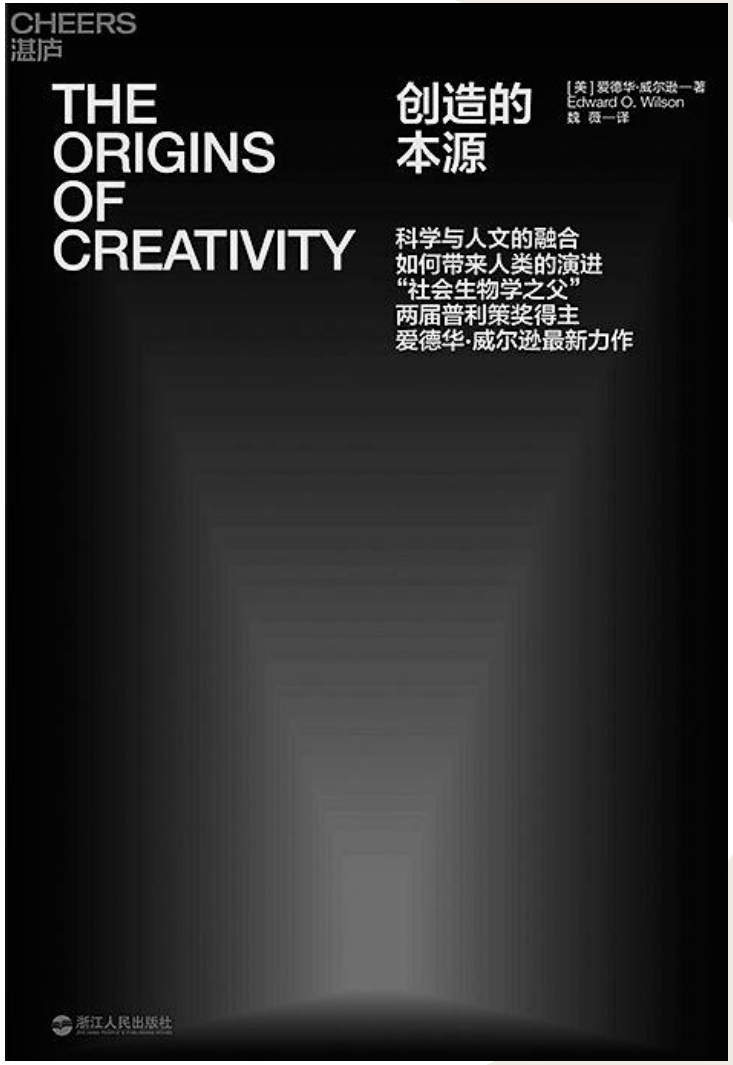


1998

涵盖了广阔的知识领域：物理学、人类学、心理学、哲学、宗教、伦理与艺术等，力图建立统一的知识体系

“人文诞生于符号化语言。**而人类仅凭借符号化语言这一种能力，就将人类自身和其他物种鲜明地区分开来。**语言与大脑结构共同进化，将人类思想从动物大脑中解放出来，拥有了创造力，并由此进入不受时空限制的想象世界之中。人文与语言起源和演化的重要节点，从食植物到食肉的适应性转化、狩猎、火的使用与制造工具，及至围篝火烤肉及夜话时的“扯闲篇”（gossip）和“讲故事”（storytelling）。”

“五大学科（**古生物学**、**人类学**、**心理学**、**进化生物学**和**神经生物学**）的大融合，是科学蓬勃发展的基石，是人文忠贞不二的盟友。”



2016

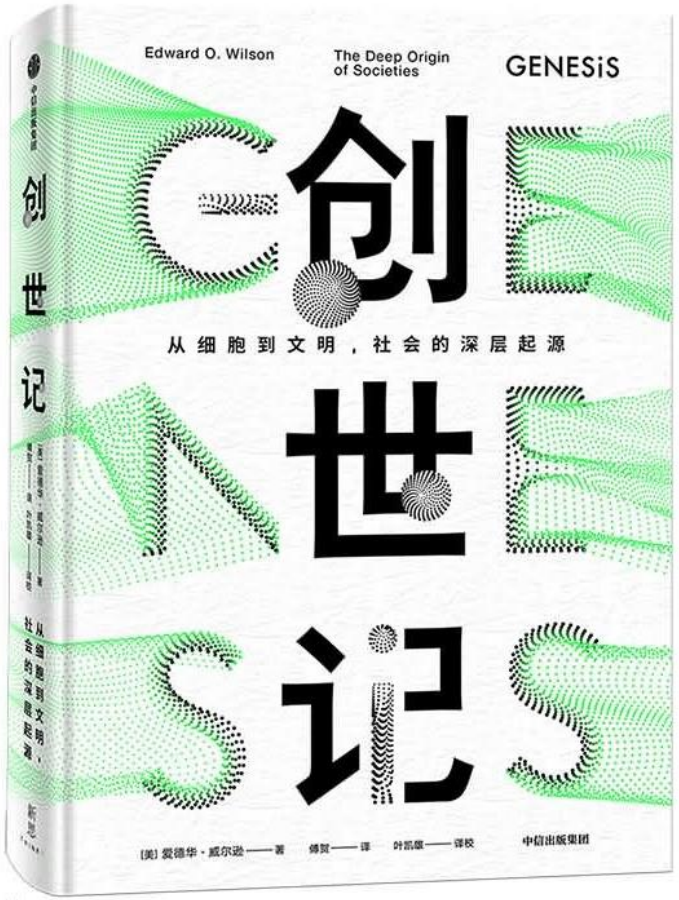
“我写过的最重要的书之一”

“Genesis: The Deep Origins of Society”

“事关人类处境的一切哲学问题，归根结底，只有三个：我们是谁？我们从哪里来？我们最终要到哪里去？要回答第三个问题，我们必须对前两个问题有准确的把握。”

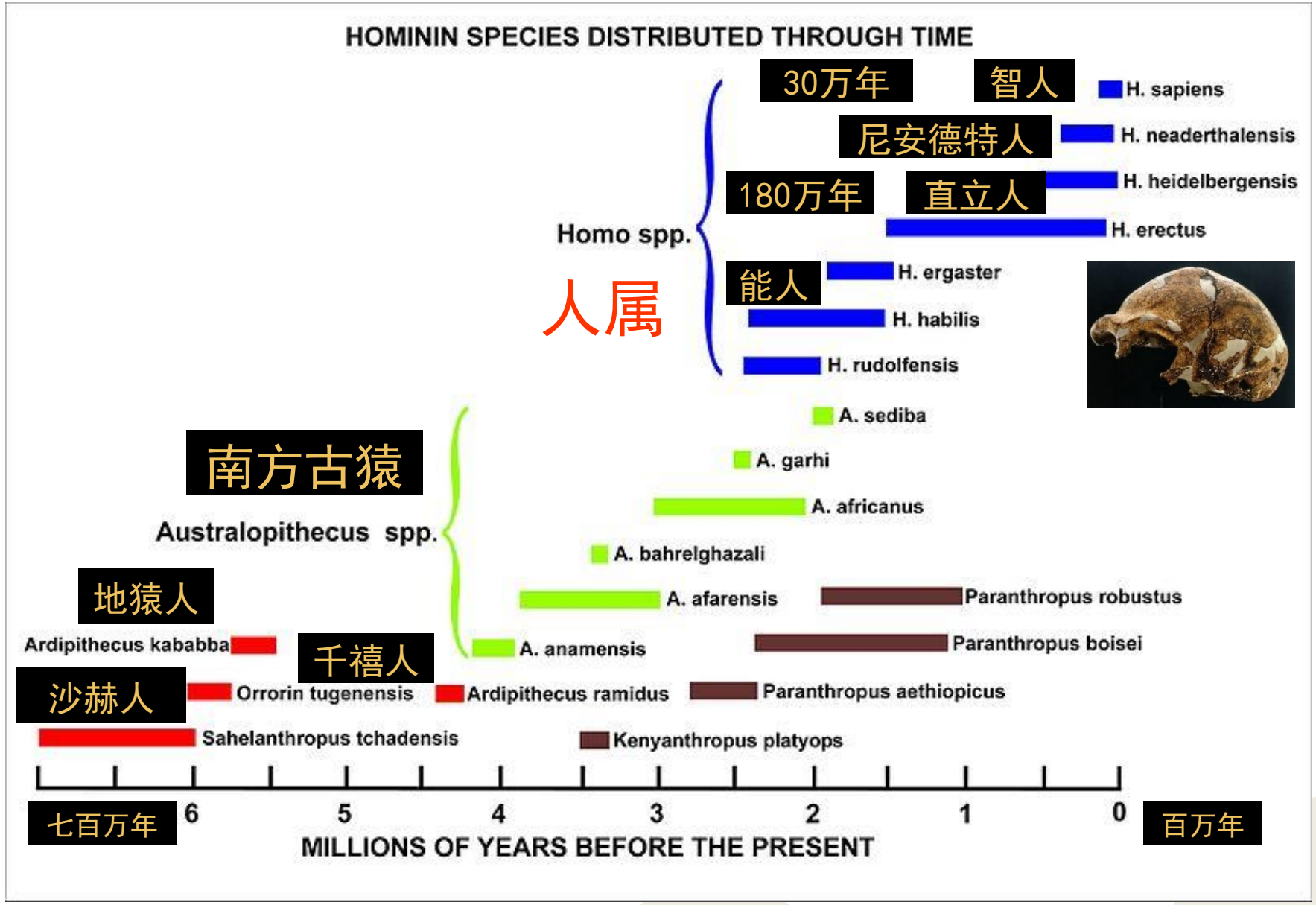
“演化史上的大转变：1.生命的起源；2.复杂（真核）细胞的出现；3.有性繁殖的出现；4.多细胞生物体的出现；5.社会的起源；6.语言的起源。”

“在生物演化史上，每一次从较低的生物组织水平迈向更高的生物组织水平，都离不开利他主义。”



2019

我们从哪里来?


HOMININ SPECIES DISTRIBUTED THROUGH TIME
30万年
智人
H. sapiens
尼安德特人
H. neaderthalensis
180万年
直立人
H. heidelbergensis
H. erectus
Homo spp.
人属
能人
H. ergaster
H. habilis
H. rudolfensis
南方古猿
A. sediba
A. garhi
A. africanus
Australopithecus spp.
A. bahrelghazali
地猿人
A. afarensis
Paranthropus robustus
Ardipithecus kababba
千禧人
A. anamensis
Paranthropus boisei
沙赫人
Orrorin tugenensis
Ardipithecus ramidus
Paranthropus aethiopicus
Sahelanthropus tchadensis
Kenyanthropus platyops
七百万年
6
5
4
3
2
1
0
百万年
MILLIONS OF YEARS BEFORE THE PRESENT

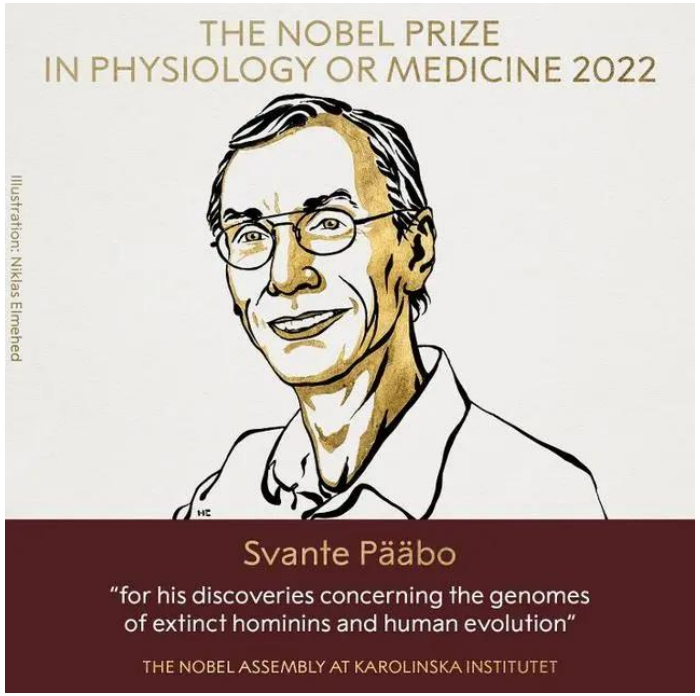
我们从哪里来？

来自古DNA的证据

Bae et al. 2017. Science

2022年诺贝尔生理学或医学奖

在百年诺奖历史上，研究进化的学者第一次获得诺奖



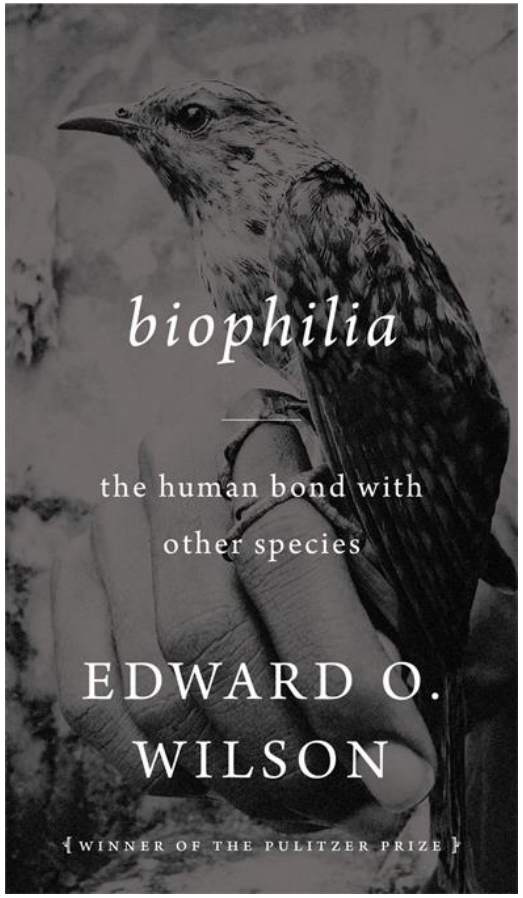
Breakthroughs of 2010

现代欧洲、亚洲人含有2%左右的尼安德特人基因。

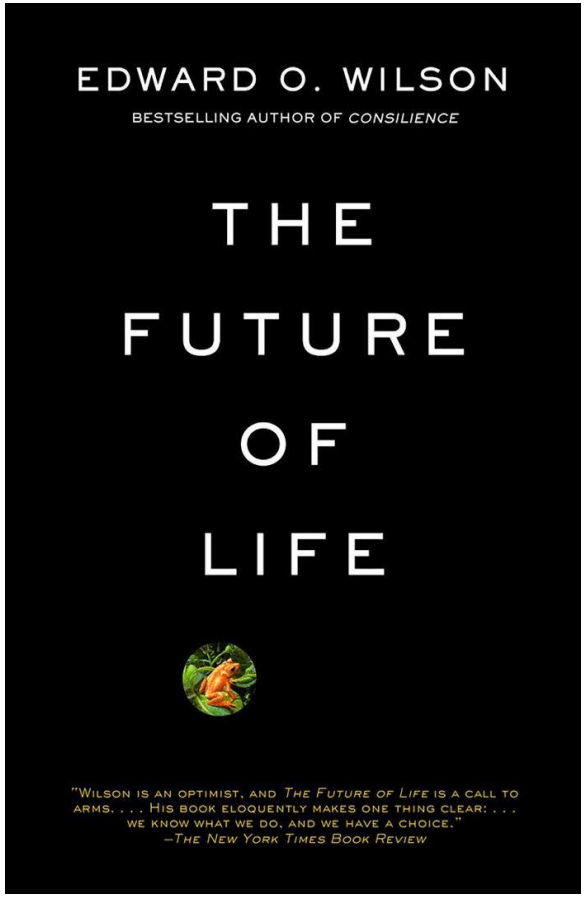
生物多样性保护

生物多样性是认识生态系统的基础

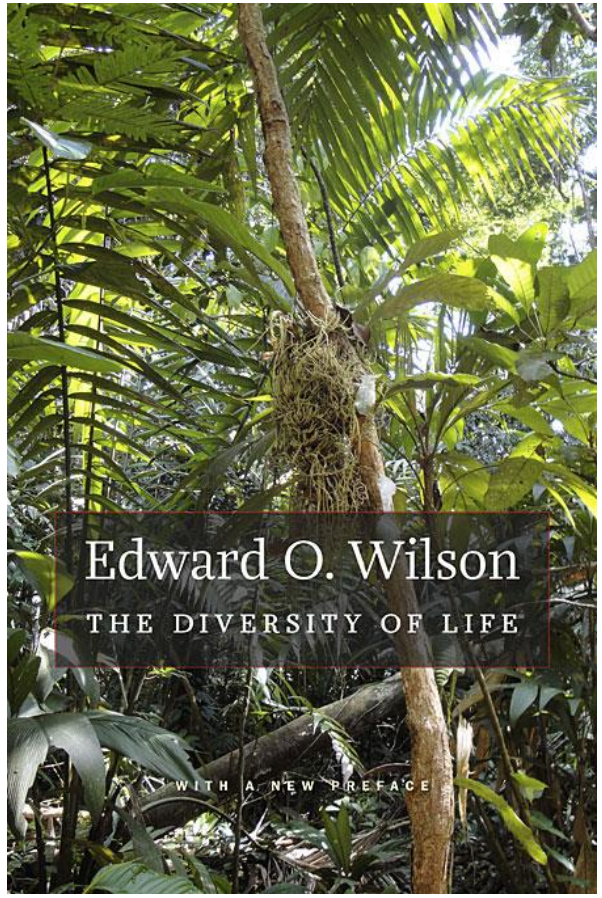
《亲生命性》 “人类有一种与生俱来的生物学需要，即融入大自然，并与其他生命形式相关联。”



1984

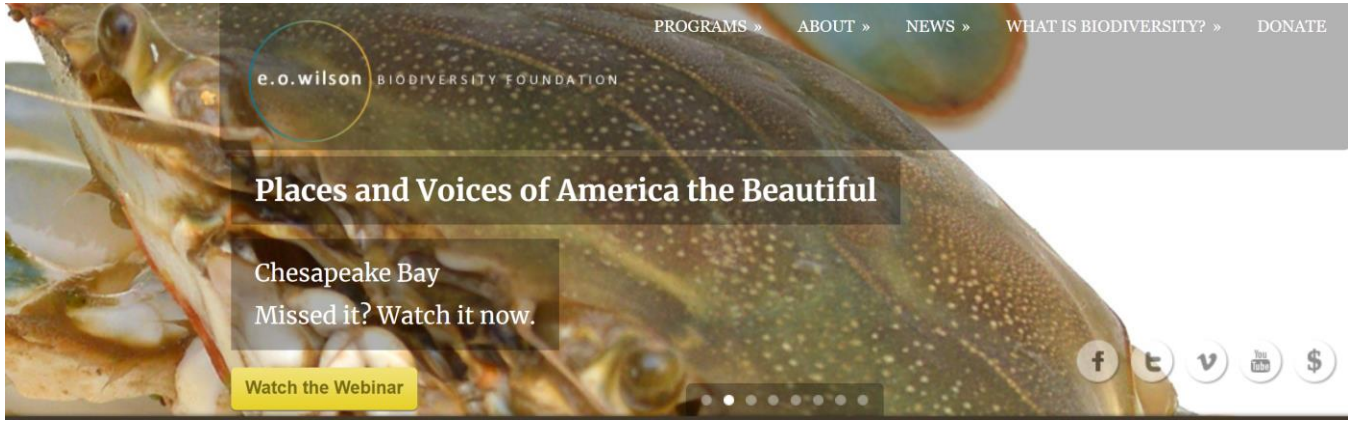


1992

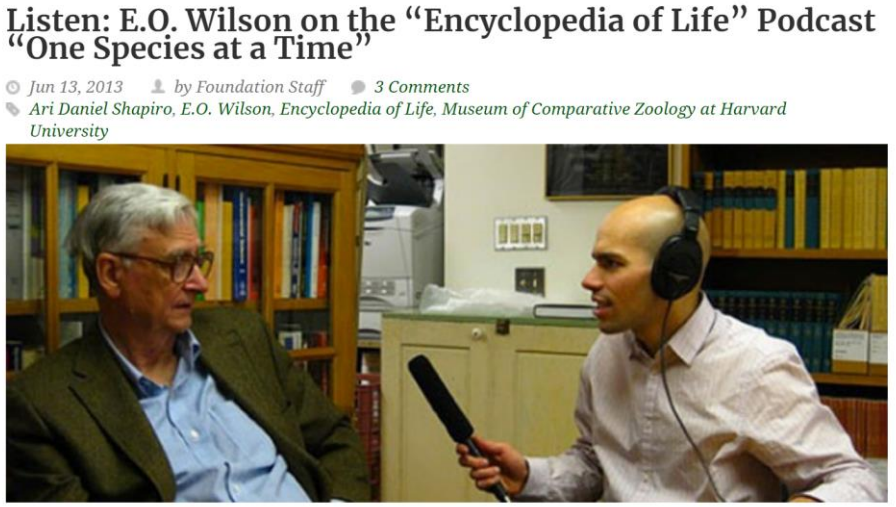


2001

威尔逊生物多样性基金会 2005

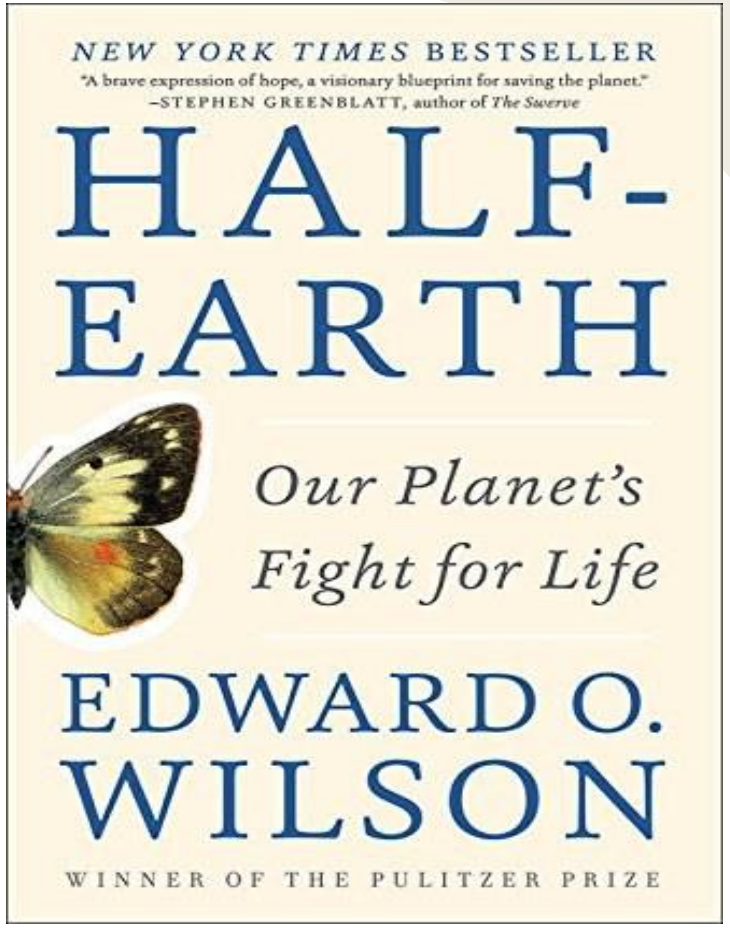


“生命百科全书（Encyclopedia of Life）” 2008



《半个地球：人类家园的生存之战》2016

“每一个物种本身都是一个奇迹，是值得我们拜读的漫长而精彩的史话，是经过数千万年的挣扎最终出现在我们这个时代的赢家，是最优中的最优者，是其所生存的自然栖息地中身怀绝技的专家。就象我们人类一样，它们掌握着在所处生态系统中生存的独门绝技。”



第六次生物大灭绝?

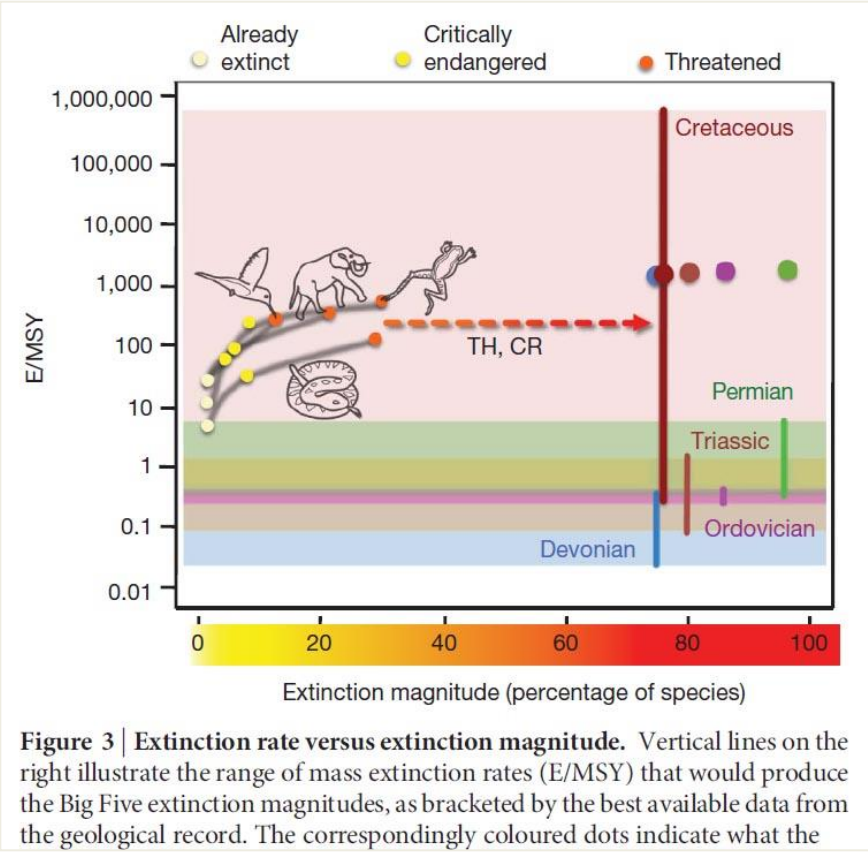
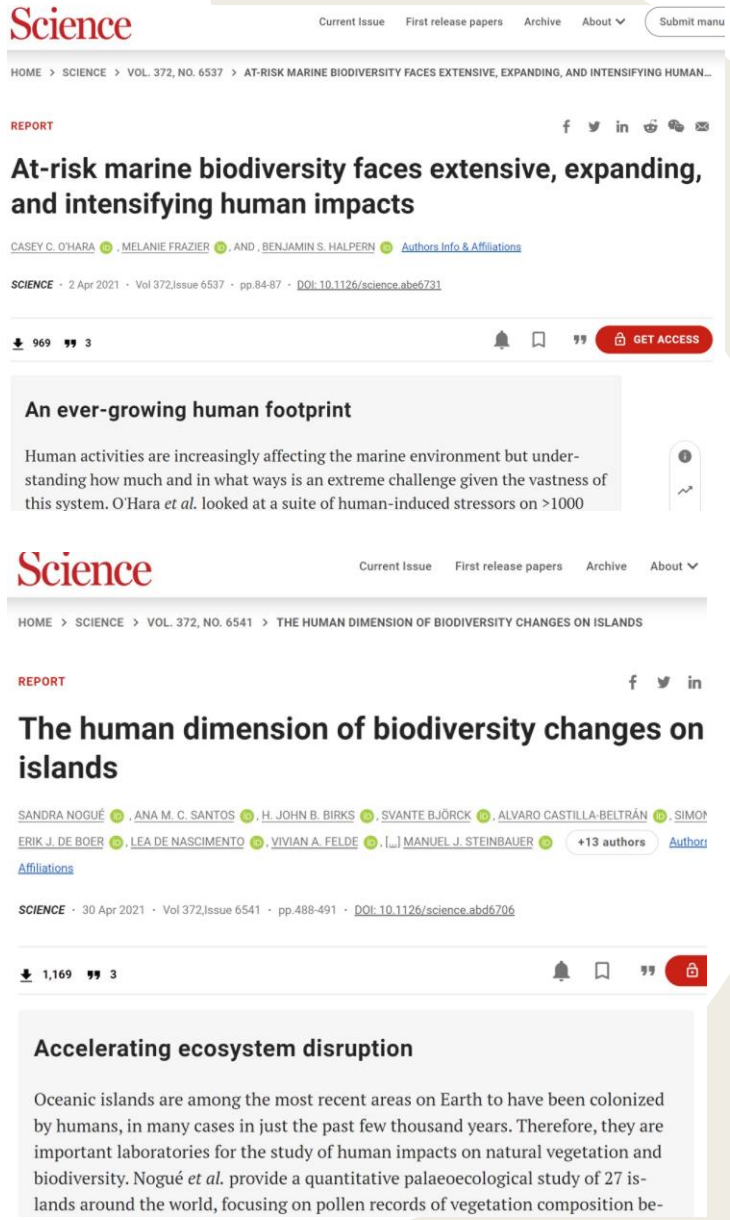


Figure 3 | Extinction rate versus extinction magnitude. Vertical lines on the right illustrate the range of mass extinction rates (E/MSY) that would produce the Big Five extinction magnitudes, as bracketed by the best available data from the geological record. The correspondingly coloured dots indicate what the

2011. Nature

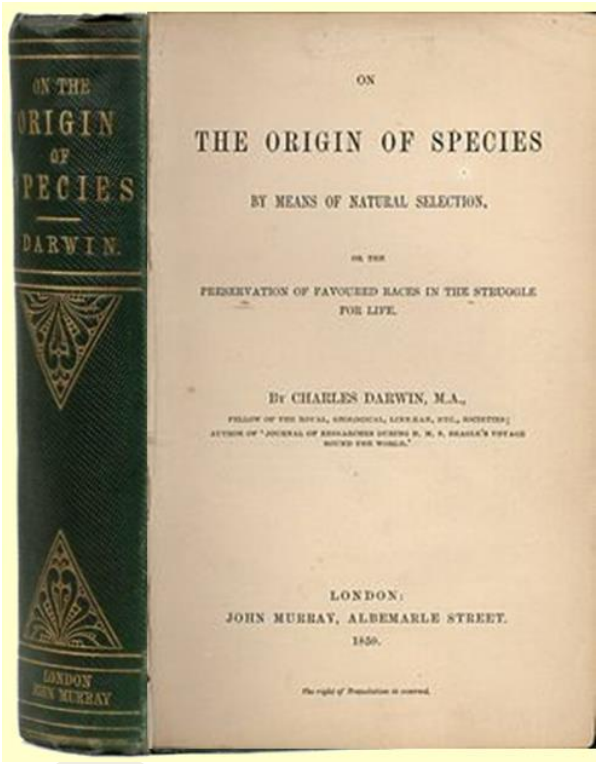
2020. PNAS

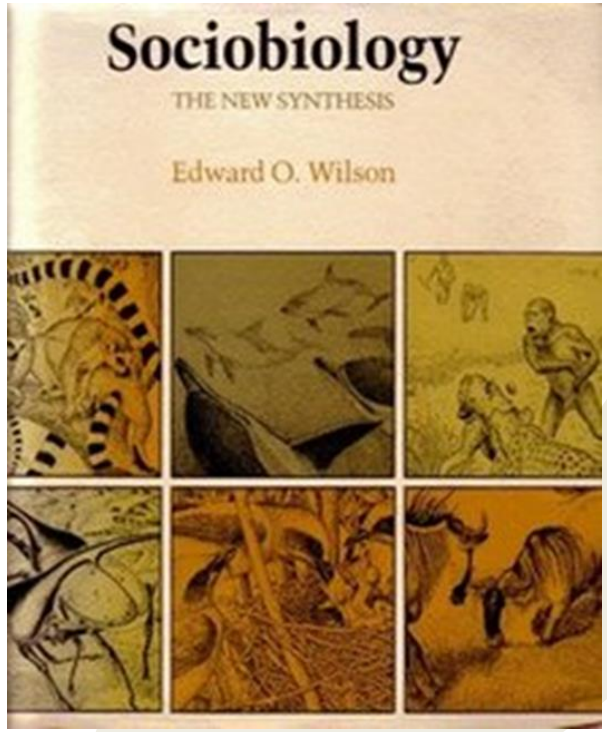


2021. Science

达尔文vs当代达尔文

- 研究领域从生物延伸到人类，并引起争议，影响超越了自然科学领域
- 意志坚定，细心观察的博物学家，基于野外考察的生物地理学研究，优雅的作家
- 学习思考过程中对宗教信仰的改变
- **都拥有强烈的好奇心**





揭示了人类的“卑微” 身世

揭示了人类天性的“卑微”基础

揭示了生物多样性形成的机制

提出了生物多样性保护的逻辑基础

谢 谢!