FEATURES

REMAPPING SCIENCE

Researchers reckon with a colonial legacy

By **Elizabeth Culotta**, **Shraddha Chakradhar**, *and* **Rodrigo Pérez Ortega**
Graphics by **Monica Hersher**

Science—meaning the Western tradition of testing hypotheses and writing research papers—has its roots in the Enlightenment of 17th and 18th century Europe. When this new way to understand the natural world emerged, colonialism was already well established, with a handful of nations in Western Europe exerting political and economic control over distant lands and peoples. Eventually, just eight nations claimed more than half the globe (see map, below).

The colonizers enslaved millions and wrung precious metals, spices, and other wealth from colonies. They also extracted specimens that form the foundation of much of modern biology. The rich natural history collections in London and Paris were born of empire. Charles Darwin's revolutionary ideas about evolution sprang from travel aboard the *HMS Beagle*, a voyage intended to survey South America's coast to further British interests.

The scientific enterprise both fueled, and was fueled by, the colonial one. For example, 19th century European scientists isolated the antimalarial compound quinine from the bark of the cinchona tree, building on what local people in Peru already knew about its medicinal properties. Europeans then used quinine to boost the health of colonial troops.

Today, the smudged fingerprints of colonization still linger on the scientific enterprise. The lingua franca of research is English. Top scientists—those with the most cited papers—disproportionately work in former colonizing nations or in a few former colonies including the United States. For decades, researchers have benefited from dropping in on former colonies to study their flora, fauna, and sometimes people, often with little involvement by local scientists and little credit to their work or intellectual property (see Editorial, p. 581). Such "parachute science" is still with us: In 2019, for example, a study found that fewer than half of papers on infectious diseases in Africa had an African first author. Many paleontology papers from the past 34 years have no authors at all from the nations where fossils were unearthed (see Parachute paleontology, p. 594). The nomenclature is rife with names from a racist colonial past, and even recently bestowed names disproportionately honor people from the Global North (see Naming birds, p. 594).

Scientists around the world are slowly beginning to recognize—and rectify—this colonial legacy. They are repatriating specimens, building equitable partnerships, and expanding access to the latest technologies. Researchers in once-colonized nations are taking control, using local funding and talent to explore questions they care about. Indigenous scientists are demanding respect for their traditional knowledge.

During the past 500 years, **8 European countries** colonized **68%** of the world's countries.

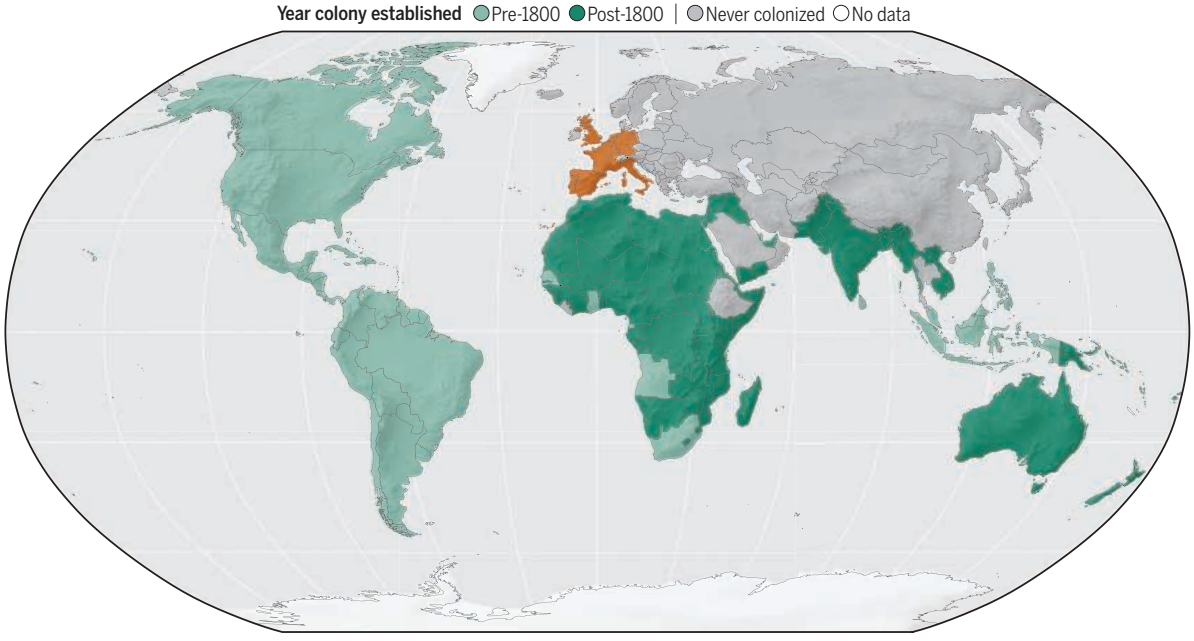
The following article is the first of an ongoing series of stories, written predominantly by writers with roots in the Global South, that will spotlight such postcolonial science. Confronting the colonial legacy, sometimes called decolonization, takes many forms around the world, and the series will explore that diversity. On p. 595, U.S.-based *Science* Staff Writer Jon Cohen and Nigerian science journalist Abdullahi Tsanni profile Christian Happi, a Cameroonian scientist who has built a world-class genomics center in Nigeria to track infectious diseases. Future stories will explore how science is shedding its colonial past in India, Brazil, and elsewhere.

Colonialism was an active force for 500 years, and shifting the axis of scientific influence won't happen overnight. It will require scientists in the Global North to commit to decolonizing their work and for those in the Global South to claim their rightful places in research. We hope the projects featured in this series will serve as inspiration as these global efforts continue.

This series is supported by the Heising-Simons Foundation.

A colonial world

Starting in 1462, eight Western European countries (●)—the United Kingdom, France, Germany, the Netherlands, Belgium, Spain, Portugal, and Italy—began to colonize other continents. By 1700, European powers occupied much of the Americas. By 1900, most countries in the Americas had gained independence, and European nations focused their colonial efforts on Africa and Asia. The legacy of this colonialism contributes to global inequities in many aspects of society today, including science.



Northern dominance

Scientific influence as measured by citations of research papers is concentrated in the Global North, including in many former colonizing nations. Researchers are considered top scientists if their citation records according to the worldwide scientific database SCOPUS put them in the top 100,000 scientists overall or in the top 2% of their specialty area.

WHERE TOP SCIENTISTS WORK

10% in Global South nations

1% in South America or Africa

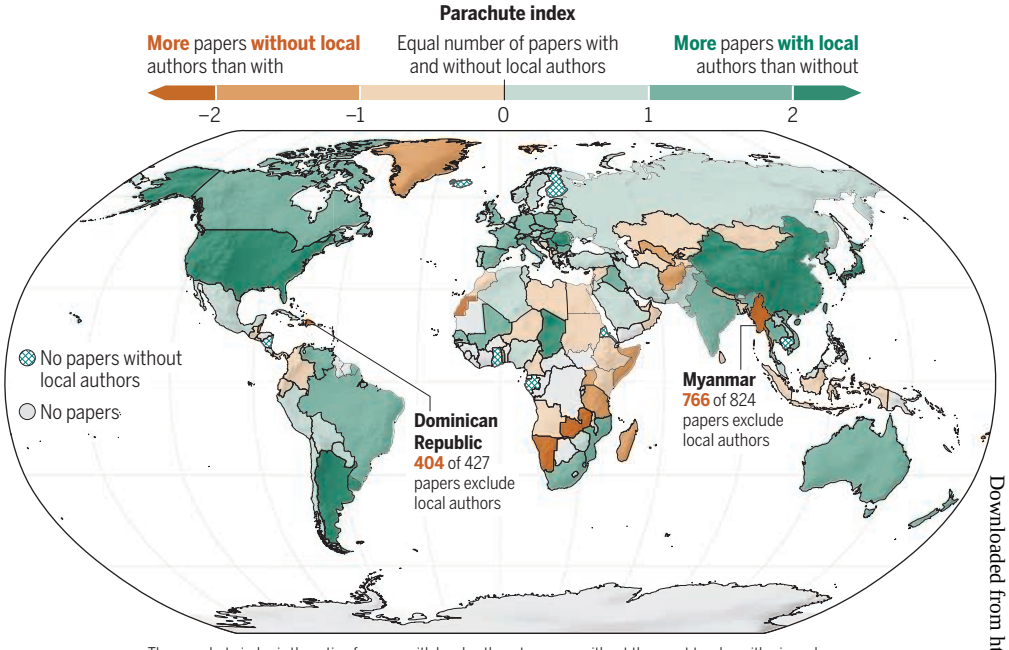
34% in Europe

25% in 8 Western European formerly colonizing countries

41% in the United States

Parachute paleontology

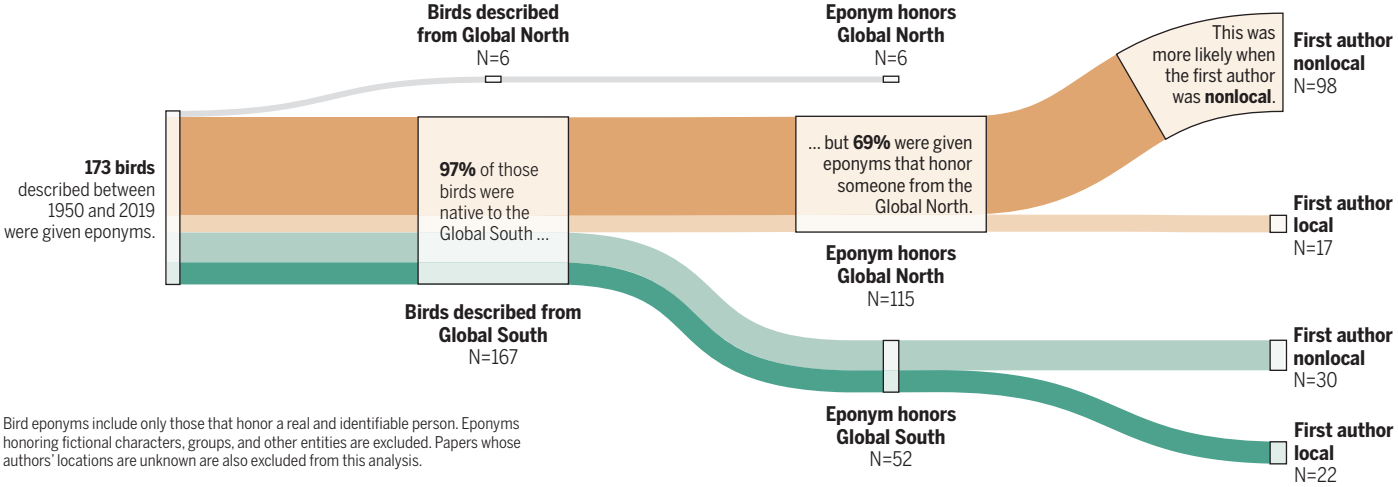
Parachute science—in which foreign scientists work in other nations without involving local researchers—still thrives in paleontology, according to an analysis of nearly 30,000 fossil occurrences published in the past 34 years and included in the Paleobiology Database.



The parachute index is the ratio of papers with local authors to papers without them, set to a logarithmic scale because ratios vary by several orders of magnitude among countries.

Naming birds

Of the 385 birds first described between 1950 and 2019, 95% are native to countries in the Global South. Many were given scientific names that honor people, often scientists, from the Global North. That happened most often when the first author of the paper describing the species was not local.



Bird eponyms include only those that honor a real and identifiable person. Eponyms honoring fictional characters, groups, and other entities are excluded. Papers whose authors' locations are unknown are also excluded from this analysis.

DATA

A colonial world Data reflect the 195 countries tracked in Bastian Becker's Colonial Dates Dataset as of September 2023. They are not a comprehensive tally of colonies around the world. Changes in country names were adjusted case by case. Becker's maximum aggregation strategy was used to determine the year of onset for each colony. **Northern dominance** A composite index ranks scientists according to all citation records, excluding self-citations, in SCOPUS between 1788 and 2022 as of 1 October 2023. Global South and North categorizations were assigned according to the United Nations's "developing" or "developed" classification as of May 2022. And 891 top scientists (less than 0.5% of all top scientists) were excluded from the calculation because 885 lacked an associated country and six were associated with a country that no longer exists. **Parachute paleontology** Data include all fossils listed in the Paleobiology Database between 1 January 1990 and 30 June 2024, as recorded on 30 June 2024. **Naming birds** DuBay *et al.* assembled a list of birds using sources including the *Handbook of the Birds of the World*, the BirdLife Taxonomic checklist, and *Bird Species New to Science: Fifty Years of Avian Discoveries*. Eponym honorees and author locations were hand coded.

CREDITS: (GRAPHICS) M. HERSHER/*SCIENCE*; (DATA, CLOCKWISE FROM LEFT) JPA. IOANNIDIS *ET AL.*, *PLOS BIOL.* 17, e3000384 (2019); N.B. RAJA *ET AL.*, *NAT ECOL EVOL.* 6, (2022); S. DUBAY *ET AL.*, BIORXIV 2020.08.09.243238