women, with 55 and 54 articles, respectively. “A big mark of sexism in science is that women’s health became a field of study considered scientific when it began being researched by men. Female culture and wisdom about their own health ~~was~~ **were** ignored,” affirms Hoppen. According to her, gender inequalities are evident in scientometrics, the field that analyzes quantitative aspects of science. “In most fields of knowledge, men ~~are able to~~ **can** pu than women and appear to res ollaborations. Th he ranking of researchers who publish the most—which corroborates the need for affirmative actions for women in science,” she affirms.

SCIENTIFIC DIFFUSION

COMMUNICATION BARRIER

Study outlines the disadvantages faced by authors of scientific articles who do not speak English as a native language and ways to overcome them

Fabrício Marques

A team of researchers from 10 countries analyzed the publication policies of 736 biological science journals and identified barriers faced by authors who do not speak English as their native language. Some of these obstacles are well known. Because English is the lingua franca in science, journal editors commonly suggest that authors hire specialist services to edit or translate their scientific texts to ensure that the content of the manuscript is expressed clearly and follows the norms of the English language. Hiring such specialists increases the costs of publication, which most strongly affects authors from low-income countries.

There are also less tangible barriers. Of the 736 journals analyzed, only two (*Nature* and *Nature Plants*) categorically state in their guidelines that a paper will not be rejected solely because the authors have not expressed themselves satisfactorily in English—these journals indicated that the relevance and quality of the content was most important. In addition to analyzing publication rules, the group interviewed the editors-in-chief of 262 journals and found that only 6% of them instructed reviewers not to immediately reject articles in English with grammar, clarity, or fluidity problems. Approximately half of the editors suggested that authors use free online English editing services to correct grammar or referred them to online tutorials. Only 1% of the journals offered assistance through free mentoring programs. This study, which was shared on the EcoEvoRxiv preprint server and not yet peer-reviewed, was the first to highlight examples of journals that support researchers whose manuscripts require language improvements. Journals published by scientific societies tend to be more inclusive in this regard. The U.S.-based Society for the Study of *Evolution* has an English mentoring program to support authors who submit papers to its journal, Evolution. For no fee, authors can request that editors with experience in scientific writing suggest small changes and talk to them directly about ways of making their manuscript clearer. They can ask for support before submitting the article or during the review process.

Another example is the *Journal of Field Ornithology*, linked to the Association of Field Ornithologists, an American scientific organization that connects authors who do not speak English as their first language with volunteers who can help them improve their papers. The American Society of Mammalogists has created a free partnership scheme called the ASM Buddy System, through which zoologists help improve the English level of manuscripts, while the British Ecological Society's *Journal of Ecology* offers a free AI proofreading service called Writefull. The support for the authors is well received. Germana Barata, a researcher from the Laboratory for Advanced Journalism Studies at the University

of Campinas (UNICAMP), told *Nature* about her positive experience publishing in English in the journal *Cultures of Science*. "The corrections and edits did not change my ideas, the essence of what I write, or the style at all," she says. "That is not true with many other titles." The article makes a series of recommendations to address language barriers, such as a public commitment by journals to fairly evaluate the content of all papers, including those with language problems, or free services to make articles describing important findings more readable in English.

"Our research concluded that journals can fulfill a dual role. Although they are a source of language barriers, they can also help authors to overcome them," said Brazilian biologist and co-author of the article, Pedro Albuquerque Sena, technical coordinator of the Northeast Environmental Research Center (CEPAN), a private research institution based in Recife. Sena is part of a community of ecologists on X (formerly known as Twitter) that shares and discusses embarrassing situations suffered by scientists from developing countries when submitting their papers to high-impact journals. Complaints often relate to linguistic errors but also to feelings of injustice and discrimination in the process through which reviewers disqualify studies as poorly written in English or unoriginal. Sena found an invitation on the social network for researchers interested in surveying and analyzing the publication policies of ecology journals and decided to join the project, together with colleagues from countries such as Australia, the UK, the USA, Indonesia, and the Czech Republic.

Environmental science researchers whose first language is not English took twice as long as native English speakers to prepare work in the language

The team was assembled by the study's lead author, Tatsuya Amano, a Japanese biologist from the Center for Biodiversity and Conservation Science at the University of Queensland in Brisbane, Australia. Amano is interested in the topic of linguistic bias because he feels affected by it himself. He left Japan in 2011 to work in the UK and then in Australia, where he was challenged to produce science exclusively in English. Even today, he says he has difficulty writing articles, preparing lectures, and, in particular, giving presentations at conferences in English. "It takes me a lot of time and effort to do everything in English," he told the Australian Broadcasting Corporation in an interview. "Language barriers create anxiety, discomfort, embarrassment. You need to be really brave."

In another article published in the journal *PLOS Biology* in July, Amano and colleagues interviewed 908 environmental science researchers. Those whose native language was not English took up to twice as long as native speakers to write articles or prepare presentations in English. Their work was also 2.5 times more likely to be rejected by journals, and the likelihood of being asked to make revisions before publication was 12.5 times greater. Due to a lack of confidence in communicating in English, one-third of the participants said they had stopped attending international conferences—of those who continue to go, half said they had avoided giving oral presentations.

The damage is not limited to the mental health of the scientists. Amano's primary research activity aims to improve conservation strategies by finding data to fill gaps in biodiversity knowledge. He points out that this knowledge is produced in many different languages and that current publishing practices restrict its communication. "The planet needs input from all scientists, no matter what their fluency in English," he says.

Sigmar de Mello Rode of São Paulo State University (UNESP), president of the Brazilian Association of Science Editors (ABEC Brasil), says that in recent years, Brazil's scientists and journals have been challenged to publish increasingly in English and have had to create strategies to address linguistic difficulties. "Whether we like it or not, English has become the language of science, and scientific results have to be disseminated in the language. If the target audience of a study

Brazilian journals that publish in English ask authors to send their articles to specialist review services that provide certificates guaranteeing linguistic quality

is in Brazil and Latin America, the solution has been to also publish versions in Portuguese and Spanish," he explains.

He says that scientific journals in Brazil have adopted similar strategies to international journals to ensure the linguistic quality of their content. "Many titles ask authors to send their articles to specialist English proofreading services that provide certificates confirming the text is well written," he explains. Some even recommend specific companies, such as Enago, which charges upwards of US$90 to correct the grammar and style of a 1,500-word text. Publishers such as Springer Nature offer their own services. A 1,500-word article costs US$243 for the Silver service, which involves a review by an editor who specializes in the manuscript's topic and includes a certificate; the Gold service costs US$484, which includes adaptations to give the text a more professional and natural style.

Rode says that in his experience as a researcher, he saw signs of prejudice toward science produced in developing countries through criticisms of the level of English in the manuscripts. A few years ago, he carried out a test: he wrote an article in English and had it reviewed by a professional service before submitting it to an international journal. He deliberately did not attach the revision certificate. "The article was returned immediately with a warning that there were issues with clarity and grammar and that it needed a review. I contacted the editor to tell him that the manuscript had been revised. I sent him the certificate and asked him to point out the problems he had found so that I could speak to the company and ask for my US$120 back. The editor apologized, saying he had made a mistake and that a revision was not really necessary," he says.

Brazilian biologist Marcia Triunfol, a former *Science* editor who specializes in scientific writing, sees a degree of exaggeration in the way English proficiency is demanded of Brazilian authors. "Once, in a workshop I organized in São Paulo, an American scientist said that until Brazilians learned the difference between *show* and *demonstrate*, they would not be able to write good articles in English. I was shocked, because I do not see how this relates to the quality of an article in any way," says the biologist, who is also the founder of Publicase, a company that started in 2007 to offer article translation and review services, as well as scientific writing workshops and training courses for researchers and students. She currently lives in Portugal and says she does not see the same demands or concerns in regard to European authors for whom English is a second language.

Triunfol believes that the most complex challenge is not increasing English proficiency, which has been improving in recent years, but training students and young scientists in scientific writing. "During the pandemic, we held virtual training sessions via Zoom for postdoctoral fellows at Harvard University. The questions they had about how to write a scientific article were the same as those raised in workshops for Brazilian scientists." According to her, the training offered by universities is often improvised. "Ideally, there would be professors who specialize in science communication techniques and not just researchers sharing their experiences with students."

Triunfol believes that the problem will be less severe in the near future. In her opinion, AI-based translation and editing tools could play a central role in adjusting the writing of non-English-speaking scientists. "In recent years, with the introduction of translation software, I have seen an improvement in the quality of scientific writing. More recently, because of ChatGPT, I noticed a drop in demand for translation and proofreading services from my company, which I consider positive." The publisher says it is possible to use AI to correct scientific writing in an ethical way. "Since the objective is to correct and improve a text already written by the researcher themself, there is no real danger of these tools leading to plagiarism," she states. ■