**Title page:** Overcoming language barriers in academia: machine translation tools and a vision for a multilingual future

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**Abstract**

Having a central scientific language remains crucial for the advancement and global sharing of science. Nevertheless, maintaining one dominant language also creates barriers to accessing scientific careers and knowledge. From an interdisciplinary perspective, we describe how, when, and why to more readily make scientific literature available in multiple languages through the practice of translation. We broadly review the advantages and limitations of neural machine translation systems and propose that translation can serve as both a short- and long-term solution for making science more resilient, accessible, globally representative, and impactful beyond the academy. We outline immediate actions that individuals and institutions can take to support multilingual science and scientists, including structural changes that encourage and place additional value on translating scientific literature. In the long term, improvements to machine translation technologies and collective efforts to change academic norms can transform a monolingual scientific hub into a more distributed, multilingual scientific network.

**Introduction**

The language in which science is primarily communicated has varied through time and space, cycling through Chinese, Sumerian, Egyptian, Persian, Greek, Latin, Arabic, German and French, to name a few (von Gizycki 1973, Montgomery and Crystal 2013). The use of English as the

scientific *lingua franca* began only 400 years ago alongside Great Britain's growing colonial empire. After the World Wars, it continued to expand with the increasing military, economic and technological clout of the United States (Canagarajah 2002, Gordin 2015). Since then, English dominance has extended across the entire globe, as no language has previously done. Today, 98% of peer-reviewed scientific publishing is in English (Ammon, 2012, Liu 2017) and English is the official language of most scientific events and international and indexed academic journals.

Having a common language benefits science by facilitating international scientific communication and creating a monolingual repository for publications and data (Montgomery and Crystal 2013). The maintenance of a common scientific language is also useful for the dissemination and recognition of research performed by scientists whose primary language is not widely spoken, as well as for facilitating communication between such scientists and the wider scientific community. Having a shared scientific language also facilitates international mobility and limits the number of additional languages required for international collaboration. However, despite the benefits of a common language, maintaining a single, universal scientific language creates barriers by requiring the majority of researchers in the world to become proficient in an additional language prior to engaging with the global academic community. Through its Recommendation on Open Science, UNESCO has called on scientific institutions to foster global, multilingual, and cross-disciplinary research programs in order to provide more equitable access to scientific knowledge and careers (UNESCO 2021).

Here, we summarize the costs of a single universal language in science and provide a set of practical approaches that individuals, academic societies, and institutions can take to help break down language barriers, focusing on machine translation tools and structural change that would better support a multilingual academy. Although the suggestions contained herein are built from and sometimes particularly pertinent to our research experiences in ecology, evolution, and conservation, these ideas may be useful to a broader scientific audience.

**The costs of a single universal language in science**

While maintaining a central language has its benefits (see above), it also stymies the advancement of science, creates barriers within academia, and complicates applying scientific evidence to real-world decision-making. For example, because academic knowledge is mostly communicated in English, scientists and other members of society often overlook knowledge generated in other languages, for example by only using keywords in English during literature searches (Pabón Escobar and da Costa 2006, Kirchik et al. 2012, Liang et al. 2013, Neimann Rasmussen and Montgomery 2018, Amano et al. 2021a). This effect can be amplified by

language biases in search engines (Rovira et al. 2021). Overlooking non-English studies can result in large gaps within global databases, which affects policy, management, and decision-making (Amano and Sutherland 2013, Amano et al. 2016, 2021a, Konno et al. 2020, Angulo et al. 2021, Kirpotin et al. 2021). For example, the exclusion of the many studies on conservation interventions published in languages other than English can reduce the evidence being considered during decision-making processes and lead to less-optimal natural resource management (Amano et al. 2021a). Biases in who contributes to science and makes these management decisions also reduce the credibility and global buy-in to these management practices (Baldi and Palotas 2021).

English proficiency also influences who participates in science at a global scale, which is detrimental to science because a diversity of perspectives bolsters the construction of robust and innovative scientific knowledge (Bennett 2013, AlShebli et al. 2018, Hofstra et al. 2020). Proficiency in English is often a requirement for professional advancement, such as publishing in high-impact journals, receiving international grants, or participating in international conferences (Hwang 2005, Clavero 2010, Huttner-Koros and Perera 2016, Ramírez-Castañeda 2020). Non-Anglophones are thus under constant pressure to improve their English language skills (Tardy 2004, Lindsey and Crusan 2011, Corcoran, James Nicholas 2015, Suzina 2021), which can be a source of anxiety and emotional burden (Ramírez-Castañeda 2020, Amano et al. 2021b). Moreover, this challenge is not experienced equally across English learners, but rather weighs particularly heavily on learners whose dominant language is highly divergent from English and on learners from regions where English-language instruction or media are not widely available, two issues that are not mutually exclusive. Language barriers can impose a severe financial burden on individuals, who may pay for English classes, proofreading, and translation services, thus reinforcing socio-economic inequity in science (Schofield and Mamuna 2003, Kieffer 2010, González Mellado et al. 2020, Ramírez-Castañeda 2020). Biases during peer review may lead non-Anglophones to publish in lesser-known journals or in regional journals that publish in other languages, making their research less discoverable (Mur Dueñas 2012). These burdens intensify the dependence of many non-Anglophone scientists on scientists with high English proficiency (Ordóñez-Matamoros et al. 2011). Ultimately, these barriers can impede non-Anglophones from obtaining jobs, tenure, or promotion (Moreno 2010).

Constraining diverse points of view to fit within the structure and vocabulary of a single language impoverishes scholarly discourse and observations of nature. For instance, language shapes how we perceive color (Siok et al. 2009), our understanding and memory of events (Fausey et al. 2010), and our ability to gauge the awareness or knowledge of others (Jara-Ettinger and Rubio-Fernandez 2021). When we write only in English, we limit our way of describing the relationships between ideas– a type of loss that has been analogized to the

creation of an “epistemological monoculture” (Martin 2009, Bennett 2013, Aguilar Gil and Aguilar-Guevara 2020). Moreover, constraining global scientific discussions to a single language can limit who builds, has access to, and communicates scientific knowledge to the broader public (Canagarajah 2002, Tardy 2004, Huttner-Koros and Perera 2016, O’Neil 2018), profoundly affecting the relationship between science and society. Scientific monolingualism may reduce the dissemination of science to non-English-speaking institutions and communities, which can leave new knowledge inaccessible to the people for whom it is most relevant, like those living near study sites, local public media, and regional policy makers (Márquez and Porras 2020). This is likely particularly impactful for people in countries with low English proficiency, who have reduced access to knowledge communicated exclusively in English (Amano et al. 2016, Saha et al. 2019), sometimes even to studies that feature these regions (Barath 2019). While disconnection between science and society is unfortunate for any scientific field, the cost is particularly high for applied sciences and crisis disciplines such as climate science, epidemiology, and conservation (Meadow et al. 2015, Saha et al. 2019, Amano et al. 2021a), where the rapid dissemination of new results makes a material difference to urgent decisions that must be made despite incomplete evidence.

The existence of a single universal language of science may currently serve to share new knowledge broadly and practically. However, those who bear the costs of a single language also tend to face additional barriers, for example those associated with colonialism, because the language that an individual speaks is tied to the history of their country and culture. Thus, maintaining a single language in science without providing adequate support to people who do not speak that language will continue to perpetuate historical imbalances. Attempts to create a more accessible centralized language (e.g., Esperanto) have not gained traction (Tonkin 1987) and while English may present some linguistic advantages (e.g., relatively simple and genderless grammar), it is not the only language with these attributes and its dominance can be attributed to historical factors mentioned above, in addition to its relatively simple grammatical structure. Therefore, we propose that science would benefit from integrating multiple languages. Multilingual science will also benefit our community by creating support systems that can facilitate potential future transitions, because although it may feel unlikely, history has shown that dominant languages are likely to continue changing over time.

**Short-term actions: translation and the promotion of multilingual science**

Science benefits from diverse viewpoints, and language is one of many of the axes of diversity (AlShebli et al. 2018, Hofstra et al. 2020). However, little structural support exists in the present to help non-Anglophones publish and advance professionally in English. Recently, Amano and collaborators (Amano et al. 2021b) highlighted some practical tips to overcome language barriers, such as promoting multilingual activities, being empathetic with those who face

language barriers, providing an English proofing network for preprints (Khelifa et al. 2022), and translating scientific literature (Amano et al. 2016, 2021b, Márquez and Porras 2020, Ramírez-Castañeda 2020). Multilingual publishing is another mechanism that actively promotes and places value on contributions in different languages. Machine translation tools can help scientists take concrete steps towards publishing in multiple languages, including in English.

**An overview of machine translation tools and how to improve them for scientific literature**

Modern translation tools, known as neural machine translation systems or machine translation tools, use artificial intelligence-based techniques such as machine learning (Forcada 2017). These techniques require developers to provide the machine translation system with many training examples of original source texts and their translations for the system to "learn". Therefore, translation tools are more easily tuned to widely-used languages or languages with more of these examples. Though not perfect, neural machine translation systems provide a more viable starting point than older machine translation systems, which relied on painstakingly programmed linguistic rules and very large bilingual dictionaries. The results of neural machine translation systems can be used for basic knowledge acquisition, or as a first draft that can then be improved (e.g., for academic writing; Parra Escartín and Goulet 2020). Increasing numbers of people are using neural machine translation tools because of their ease of use and free online availability (e.g., DeepL and Google Translate; Bowker 2021).

However, using machine translation tools still requires good judgment, which is why there is a need for machine translation literacy (Bowker and Ciro 2019, Bowker 2021). Machine-learning technologies are very sensitive to the quantity and quality of training data. To work well, machine translation systems need access not only to enormous quantities of previously translated texts and their corresponding original texts, but also to good quality texts that are relevant to the focal topic (https://arxiv.org/pdf/1806.00258.pdf [preprint: not peer reviewed]). For example, the language used in specialized fields contains many technical terms and constructions that are not part of everyday language. Thus, for a machine translation system to accurately translate texts in the field of biology, it would need to be provided with millions of examples of previously translated texts from this domain specifically. Moreover, these examples would need to cover all the desired language combinations (e.g., English and French, Chinese and Hindi, English and Chinese, etc.). In some cases, when a particular language pair has relatively few translated texts available, the lack of training data can be overcome by using a widely spoken language as a pivot language (e.g translating from Spanish to Chinese using English as an intermediary), although this approach may propagate errors (Kim et al. 2019; https://arxiv.org/abs/1909.09524 [preprint: not peer reviewed]). The recent COVID-19 pandemic rapidly increased the need for and use of online communication platforms that

provide closed-captioning in multiple languages. However, piping two imperfect technologies (machine translation and speech recognition) together can compound translation errors (Sulubacak et al. 2020), similar to problems arising from the use of pivot languages.

There are clear steps that scientists and machine translation tool developers can take to improve the implementation of technologies in scientific translation. A concerted effort towards providing open-access, human-verified, and high-quality translations of abstracts in scientific journals would significantly contribute towards generating the data necessary for training machine translation systems. At the moment, free online translation tools are trained mainly on general language data rather than on scientific jargon or specialized language. Researchers and tool developers could collaborate on open-access tools that train machine translation systems for specialized fields of research. Simultaneously, we could encourage scientists to develop or contribute to multilingual glossaries of specialized terminology, in part to help keep up with the constant generation of new scientific jargon (Nkomo and Madiba 2012, Wild 2021). For instance, Wikipedia is an excellent open-access platform for finding multilingual translations of technical and scientific topics, but it is currently underutilized by several scientific disciplines and it is underrepresented for several languages with large numbers of speakers such as Hindi and Turkish (Kincaid et al. 2020, Roy et al. 2021).

**When, why, and how scientific literature can be translated**

With the aid of translation tools, contributing translations of abstracts, keywords, and entire articles could become the norm for research programs that cross languages (figure 1; Amano et al. 2021b). Indeed, translating scientific abstracts is already a common practice for some journals in bilingual or (primarily) non-Anglophone countries (e.g., The Canadian Journal of Forest Research, Brazilian Journal of Biology). Beyond increasing access to scientific research for scientists, students, teachers, policy makers, journalists, and members of society at large, normalizing the practice of translation could also shift the work of translation to be more equally shared between native English speakers and those who speak English as an additional language. Additionally, translating abstracts will help substantially to improve the accuracy of machine translation for scientific texts, as described above.

We recommend that researchers consider translating articles (or, minimally, abstracts and keywords) when 1) the work is conducted in a region or country where the primary language is not English, 2) the team involves researchers whose primary language is not English, or 3) the research directly or indirectly affects a group of people whose primary language is not English (figure 1). Authors who speak the language selected for translation may wish to create a first draft using DeepL, Baidu, Naver Pagago, Yandex.Translate, Google Translate, or a similar tool,

which can then be manually edited. Authors who do not speak the additional language can work with journals to find reciprocal translation partners or other modes of support (Amano et al. 2021b; table S1) or they can search for reciprocal translation opportunities through forums such as ResearchGate or preprint servers such as bioRxiv (Khelifa et al. 2022). Because some aspects of translation are subjective (e.g., specific vocabulary choices or idiomatic translations), it is critical to reference the person or software that was used and whether machine translations (if done) were verified by a human. Importantly, creating a by-line for translation or language editing will normalize the acknowledgement of these critical services, provide scientists with an alternative option to exchanging authorship for editing assistance, and provide a language contact to whom translation questions can be directed (European Commission 2022).

Translations of previously published scientific articles (even by the authors themselves) often cannot be posted publicly because of copyright restrictions. Thus, researchers may wish to include a translation of a full manuscript as part of the supplementary materials when submitting their work for publication. Some journals publish open access articles with Creative Commons licenses such as CC BY, CC BY-SA, CC BY-NC, or CC BY-NC-SA, which allow translation without copyright infringement (BY means “Credit must be given to the creator”; SA means “Adaptations must be shared under the same terms”, and NC means “Only noncommercial uses of the work are permitted”; see creativecommons.org for more information); Creative Commons licenses with the ND term (“no derivatives”) would require written permission from the copyright holders to publicly post a translation, which is a type of derivative. If authors wish to conduct a translation once a paper has been published, and it is not published under one of these Creative Commons licenses, authors do have a few options, including: pay the copyright fee, obtain a fee waiver (not easy, in our experience), request an erratum to append a document to the supplementary files, or choose to publish a plain-language summary or reflection instead, perhaps as a blog or magazine article (table S1, figure 1). In the case of posting preprints before publication in a peer-reviewed journal, some servers permit authors to share information in languages additional to English (e.g., EcoEvoRxiv), although this is not the case for all (e.g., bioRxiv).

A contribution that all researchers and journals can make, regardless of their native language, is to prepare a plain language summary that is both reader friendly and translation friendly (Bowker and Ciro 2019). A text that is less structurally complex can still be rich in meaning, but it will be easier for readers to digest and for machine translation tools or human translators to translate. Because the goal of plain writing is simply to write as clearly as possible, the technique can be applied to any language. However, the specific approaches for reducing structural complexity or linguistic ambiguity may differ from one language to the next (see table

1 for examples that apply to English). More detailed information on how to write in an easy-to-translate style can be found in the plain language toolkit prepared for scientists by Evidence for Democracy (Qaiser 2021). One way that journals can help make papers better suited for machine translation and more accessible to readers with lower English proficiency is to soften word limits, as the methods to shorten sentence structure tend to introduce grammatical complexity and ambiguity. The advent of online-only journals has provided a great opportunity for journals to soften word limits without incurring production fees (table S1).

**The role of academic institutions in promoting translation efforts**

*Making scientific publishing and conferences more multilingual.* Journals and academic societies have the power to change norms, as they are important forums where scientists engage with each other and are recognized for their work. Journals can actively contribute to addressing language barriers and supporting multilingual science by providing clear guidelines regarding: when authors are expected to translate articles or abstracts (e.g., see figure 1), how translations can be included in published articles, how research in other languages should be cited, and how to search for journal content in languages other than English (see table S1 for additional suggestions and table S2 for examples). Societies or journals could also provide free translation services or promote mentorship within academic societies to provide English proofing (e.g., translatE project 2020; Khelifa et al. 2022). In addition, several recent papers have highlighted how individual scientists can reduce bias and improve the peer-review process for non-native English speakers when acting as reviewers or editors (Romero-Olivares 2019, Mavrogenis et al. 2020, Amano et al. 2021b).

The translation of titles, abstracts, keywords and full texts – which can greatly improve machine translation tools – could be facilitated if journals create a streamlined process for authors to add translations during or after publication and provide a clear statement of copyright policy regarding whether translations are subject to the same copyright restrictions as other use cases. Some journals already have systems in place for abstract translations (see table S2 for examples). Multilingual scientific literature and conference booklets would permit researchers and other members of society to use their primary language when scanning the literature or conference abstract books to find relevant articles and talks. Finally, author guidelines that encourage the inclusion of multilingual graphical abstracts (e.g., figure 1 in Chu et al. 2021) also increases accessibility, and plain-language abstracts or highlights have the additional benefit of being machine-translation friendly (see our long-term vision and Shailes 2017 for examples of plain-language summaries produced by journals, societies and other organizations).

The actions cataloged above could incur at least two types of burdens on journal staff and conference organizers: the financial burden of providing free translation services and the time needed to review translated texts. If a journal or conference cannot presently afford to freely translate their contributors' science, they (or a consortium of journals) might consider creating a forum on their website or via existing preprint servers (Khelifa et al. 2022) where contributors can identify reciprocal or volunteer language editing and translation partners. For example, Cochrane, a UK-based charitable organization, has a network of volunteers that translate their systematic reviews of medical literature from English to various languages (https://www.cochrane.org/join-cochrane/translate). One alternative to overcome the time needed to review translations is to require authors to label translations with standardized disclaimers, such as "manually translated by a fluent speaker", "machine-translated", or "machine-translated and manually edited for accuracy". Journals could simply note that these translations have not undergone peer review, as is already the case for most supplementary materials (e.g., see the Molecular Ecology journal guidelines for abstract translation in table S2).

*Institutional contributions*. Universities can promote efforts to overcome language barriers through both their educational role and their role in shaping research program priorities. For example, they could emphasize or recognize the importance of publications in (non-English) national and regional journals for tenure and promotion files, contract renewals, or degree requirements. Faculty and students often feel pressure to publish in English-language journals, as this boosts the rankings and impact factor of their institution, but national and regional publications play an important role in disseminating knowledge (Moreno 2010, Vaidyanathan 2019), which closely aligns with many university missions.

Importantly, because machine-translated texts are imperfect, machine translation literacy is essential (Bowker 2021). Universities can develop cross-disciplinary courses to teach and enact the practice of scientific translation, which is itself part of a vast field of study (Munday 2016). Universities can make machine translation literacy training part of a standard STEM curriculum, so that new researchers are acquainted with the strengths and limitations of translation technologies (Bowker 2021). Students are already widely using these technologies, but perhaps without an appreciation for how to work around their limitations (Bowker 2021). In addition, students in the sciences could be encouraged to study foreign languages, as is common in the humanities (Kellsey and Knievel 2004), especially if conducting research in non-Anglophone regions.

Many other institutions can do their part in improving scientific standards, making science more accessible and thus ultimately more globally impactful (table S1). Public databases, like GenBank or Online Mendelian Inheritance in Man (OMIM), are critically important resources,

and a multilingual approach to their online platforms, as demonstrated by the International Union for the Conservation of Nature (IUCN) or Fonoteca Zoológica (FonoZoo), would permit broader engagement with these resources. Funding agencies can include clauses that encourage or require researchers working internationally to include local scientists in their research and encourage budget items to support translating results and outreach that engages with local communities in local language(s). In addition, international funding agencies could permit the submission of grant/scholarship proposals in several languages, especially if these funds are focused on communities or students who do not necessarily speak English.

**Long-term vision: from a language hub to a language network**

At present, scientific publishing is largely centered around the English language, with relatively few languages receiving substantial input from the English hub (figure 2A), such that non-native English speakers must generally acquire English proficiency by their graduate career or else forego participation in the international scientific community (figure 2D). We envision that multilingualism is the outcome of a prolonged process of inclusion of languages brought about by improved translation technologies and changes in community norms. A first step that can be taken towards multilingual science is the creation of temporary secondary language hubs that can act as networking communities and knowledge centers for non-Anglophones (figure 2B), supporting these scientists throughout the launch of their early careers (figure 2E). For example, hubs for Mandarin, Hindi, or Spanish would establish practical information streams between the central English node, several sets of languages with many speakers, and additional languages pertaining to each language family. Efforts to facilitate the creation of these secondary hubs in science are already happening through multilingual conference activities, bilingual journals, and regional academic societies (Márquez and Porras 2020, Amano et al. 2021b; table S2). In the future, tertiary hubs could be established until greater multilingualism is achieved (figure 2C) and English proficiency is no longer requisite for participation in the international scientific community (figure 2F). Geographic proximity, political history, and language origin can be some of the strategies used to define a tertiary hub.

Most of Western society has accepted that a universal language is integral to the scientific enterprise (Aguilar Gil and Aguilar-Guevara 2020); therefore, we acknowledge how unreachable or unnecessary a multilingual future may appear. However, a multilingual vision encompasses more than academia; it also aligns with multidisciplinary and plurinational efforts to preserve languages, culture, and knowledge (UNESCO 2021). To reach such a long-term goal, we envision that accurate and readily available translation technologies as well as collective efforts supporting and integrating multilingual science will both play important roles. The ideas presented in this manuscript will require further discussion, and they are not exclusive,

universal, or definitive. We encourage the creation of discussion groups on this topic to generate new and innovative ideas to help solve language barriers.

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**References**

Aguilar Gil YE, Aguilar-Guevara A. 2020. Aa: Manifiestos sobre la diversidad linguística. Primera edición ed. Almadía.

AlShebli BK, Rahwan T, Woon WL. 2018. The preeminence of ethnic diversity in scientific collaboration. Nature Communications 9: 5163.

Amano T, Berdejo-Espinola V, Christie AP, Willott K, Akasaka M, Báldi A, Berthinussen A, Bertolino S, Bladon AJ, Chen M, Choi C-Y, Bou Dagher Kharrat M, de Oliveira LG, Farhat P, Golivets M, Hidalgo Aranzamendi N, Jantke K, Kajzer-Bonk J, Kemahlı Aytekin MÇ, Khorozyan I, Kito K, Konno K, Lin D-L, Littlewood N, Liu Y, Liu Y, Loretto M-C, Marconi V, Martin PA, Morgan WH, Narváez-Gómez JP, Negret PJ, Nourani E, Ochoa Quintero JM, Ockendon N, Oh RRY, Petrovan SO, Piovezan-Borges AC, Pollet IL, Ramos DL, Reboredo Segovia AL, Rivera-Villanueva AN, Rocha R, Rouyer M-M, Sainsbury KA, Schuster R, Schwab D, Şekercioğlu ÇH, Seo H-M, Shackelford G, Shinoda Y, Smith RK, Tao S, Tsai M, Tyler EHM, Vajna F, Valdebenito JO, Vozykova S, Waryszak P, Zamora-Gutierrez V, Zenni RD, Zhou W, Sutherland WJ. 2021a. Tapping into non-English-language science for the conservation of global biodiversity. PLOS Biology 19: e3001296.

Amano T, González-Varo JP, Sutherland WJ. 2016. Languages Are Still a Major Barrier to Global Science. PLOS Biology 14: e2000933.

Amano T, Rios Rojas C, Boum II Y, Calvo M, Misra BB. 2021b. Ten tips for overcoming language barriers in science. Nature Human Behaviour 5: 1119–1122.

Amano T, Sutherland WJ. 2013. Four barriers to the global understanding of biodiversity conservation: wealth, language, geographical location and security. Proceedings of the Royal Society B: Biological Sciences 280: 20122649.

Ammon, U. 2012. Linguistic inequality and its effects on participation in scientific discourse and on global knowledge accumulation – With a closer look at the problems of the second-rank language communities. Applied Linguistics Review 3: 333–355.

Angulo E, Diagne C, Ballesteros-Mejia L, Adamjy T, Ahmed DA, Akulov E, Banerjee AK, Capinha C, Dia CAKM, Dobigny G, Duboscq-Carra VG, Golivets M, Haubrock PJ, Heringer G, Kirichenko N, Kourantidou M, Liu C, Nuñez MA, Renault D, Roiz D, Taheri A, Verbrugge LNH, Watari Y, Xiong W, Courchamp F. 2021. Non-English languages enrich scientific knowledge: The example of economic costs of biological invasions. Science of The Total Environment 775: 144441.

Baldi A, Palotas B. 2021. How to diminish the geographical bias in IPBES and related science? Conservation Letters 14: e12786.

Barath H. 2019. Indian initiatives aim to break science's language barrier. Nature 571: 289–290.

Bennett K. 2013. English as a Lingua Franca in Academia: Combating Epistemicide through Translator Training. The Interpreter and Translator Trainer 7: 169–193.

Bowker L. 2021. Promoting linguistic diversity and inclusion: Incorporating machine translation literacy into information literacy instruction for undergraduate students. The International Journal of Information, Diversity, & Inclusion 5: 127–151.

Bowker L, Ciro JB. 2019. Machine translation and global research: towards improved machine translation literacy in the scholarly community. First edition ed. Emerald Publishing.

Canagarajah AS. 2002. A geopolitics of academic writing. University of Pittsburgh Press.

Chu C, Chen L, Fan P, He Z, Li Y, Liao J, Liu X, Niu K, Si X, Wang S, Xi X. 2021. Conceptual and theoretical dimensions of biodiversity research in China: examples from plants. National Science Review 8: nwab060.

Clavero M. 2010. "Awkward wording. Rephrase": linguistic injustice in ecological journals. Trends in Ecology & Evolution 25: 552–553.

Corcoran, James Nicholas. 2015. English as the International Language of Science: A Case Study of Mexican Scientists' Writing for Publication. University of Toronto, Toronto, Canada.

Croft J. 2021. Why translators should be named on book covers. The Guardian.

Fausey CM, Long BL, Inamori A, Boroditsky L. 2010. Constructing agency: the role of language. Frontiers in Psychology 1: 1–11.

Forcada ML. 2017. Making sense of neural machine translation. Translation Spaces 6: 291–309.

Fung IC. 2008. Citation of non-English peer review publications – some Chinese examples. Emerging Themes in Epidemiology 5: 12.

von Gizycki R. 1973. Centre and Periphery in the International Scientific Community: Germany, France and Great Britain in the 19th Century. Minerva 11: 479–494.

González Mellado CC, Lara Pineda FI, Lotito Bustos FC. 2020. Aprendizaje del Idioma Inglés en Establecimientos Educacionales y su Relación con Diferentes Contextos Socioculturales. Tesis. Universidad de Viña del Mar.

Gordin MD. 2015. Scientific Babel: How Science Was Done before and after Global English. University of Cicago Press.

Hofstra B, Kulkarni VV, Munoz-Najar Galvez S, He B, Jurafsky D, McFarland DA. 2020. The Diversity–Innovation Paradox in Science. Proceedings of the National Academy of Sciences 117: 9284–9291.

Huttner-Koros A, Perera S. 2016. Communicating science in English: a preliminary exploration into the professional self-perceptions of Australian scientists from language backgrounds other than English. Journal of Science Communication 15: A03.

Hwang K. 2005. The Inferior Science and the Dominant Use of English in Knowledge Production: A Case Study of Korean Science and Technology. Science Communication 26: 390–427.

Jara-Ettinger J, Rubio-Fernandez P. 2021. Quantitative mental state attributions in language understanding. Science advances 7: eabj0970.

Kellsey C, Knievel JE. 2004. Global English in the Humanities? A Longitudinal Citation Study of Foreign-Language Use by Humanities Scholars. College & Research Libraries 65: 194–204.

Khelifa R, Amano T, Nuñez MA. 2022. A solution for breaking the language barrier. Trends in Ecology & Evolution 37: 109–112.

Kieffer MJ. 2010. Socioeconomic Status, English Proficiency, and Late-Emerging Reading Difficulties. Educational Researcher 39: 484–486.

Kim Y, Petrov P, Petrushkov P, Khadivi S, Ney H. 2019. Pivot-based Transfer Learning for Neural Machine Translation between Non-English Languages. Paper presented at Proceedings of the 2019 Conference on Empirical Methods in Natural Language Processing and the 9th International Joint Conference on Natural Language Processing (EMNLP-IJCNLP). 2019, Hong Kong, China.

Kincaid DW, Beck WS, Brandt JE, Mars Brisbin M, Farrell KJ, Hondula KL, Larson EI, Shogren AJ. 2020. Wikipedia can help resolve information inequality in the aquatic sciences. Limnology and Oceanography Letters 6: 1–6.

Kirchik O, Gingras Y, Larivière V. 2012. Changes in publication languages and citation practices and their effect on the scientific impact of R ussian science (1993–2010). Journal of the American Society for Information Science and Technology 63: 1411–1419.

Kirpotin SN, Callaghan TV, Peregon AM, Babenko AS, Berman DI, Bulakhova NA, Byzaakay AA, Chernykh TM, Chursin V, Interesova EA, Gureev SP, Kerchev IA, Kharuk VI, Khovalyg AO, Kolpashchikov LA, Krivets SA, Kvasnikova ZN, Kuzhevskaia IV, Merzlyakov OE, Nekhoroshev OG, Popkov VK, Pyak AI, Valevich TO, Volkov IV, Volkova II. 2021. Impacts of environmental change on biodiversity and vegetation dynamics in Siberia. Ambio 50: 1926–1952.

Konno K, Akasaka M, Koshida C, Katayama N, Osada N, Spake R, Amano T. 2020. Ignoring non-English-language studies may bias ecological meta-analyses. Ecology and Evolution 10: 6373–6384.

Liang L, Rousseau R, Zhong Z. 2013. Non-English journals and papers in physics and chemistry: bias in citations? Scientometrics 95: 333–350.

Lindsey P, Crusan DJ. 2011. How Faculty Attitudes and Expectations toward Student Nationality Affect Writing Assessment. Across the Disciplines: A Journal of Language, Learning, and Academic Writing 8: 1–38.

Liu W. 2017. The changing role of non-English papers in scholarly communication: Evidence from Web of Science's three journal citation indexes. Learned Publishing 30: 115–123.

Márquez MC, Porras AM. 2020. Science communication in multiple languages is critical to its effectiveness. Frontiers in Communication 5: 31.

Martin P. 2009. ‘They have lost their identity but not gained a British one’: non-traditional multilingual students in higher education in the United Kingdom. Language and Education 24: 9–20.

Mavrogenis AF, Quaile A, Scarlat MM. 2020. The good, the bad and the rude peer-review. International Orthopaedics 44: 413–415.

Meadow AM, Ferguson DB, Guido Z, Horangic A, Owen G, Wall T. 2015. Moving toward the deliberate coproduction of climate science knowledge. Weather, Climate, and Society 7: 179–191.

Montgomery SL, Crystal D. 2013. Does science need a global language? English and the future of research. The University of Chicago Press.

Moreno A. 2010. Researching into English for research publication purposes from an applied intercultural perspective. Pages 59–73 in. English for Professional and Academic Purposes, vol. 22. Rodopi.

Munday J. 2016. Introducing Translation Studies: theories and applications. Fourth edition ed. Routledge.

Mur Dueñas P. 2012. Getting research published internationally in English: An ethnographic account of a team of Finance Spanish scholars’ struggles. Iberica 24: 139–156.

Neimann Rasmussen L, Montgomery P. 2018. The prevalence of and factors associated with inclusion of non-English language studies in Campbell systematic reviews: a survey and meta-epidemiological study. Systematic Reviews 7: 129.

Nkomo D, Madiba M. 2012. The Compilation of Multilingual Concept Literacy Glossaries at the University of Cape Town: A Lexicographical Function Theoretical Approach. Lexikos 21: 144–168.

O’Neil D. 2018. English as the lingua franca of international publishing. World Englishes 37: 146–165.

Ordóñez-Matamoros G, Cozzens SE, Garcia-Luque M. 2011. North-South and South-South research collaboration: What differences does it make for developing countries? - the case of Colombia. Paper presented at 2011 Atlanta Conference on Science and Innovation Policy. September 2011, Atlanta, GA, USA.

Pabón Escobar SC, da Costa MC. 2006. Visibility of latin american scientific publications: the example of Bolivia. Journal of Science Communication 05: A01.

Parra Escartín C, Goulet M-J. 2020. When the post-editor is not a translator: Can machine translation be post-edited by academics to prepare their publications in English? Page 18 in. Translation Revision and Post-editing, 1st Edition ed. Routledge.

Qaiser F. 2021. Let’s be clear(er): the language of science needs to be plain and simple. Evidence For Democracy. (11 January 2022; https://evidencefordemocracy.ca/en/content/lets-be-clearer-language-science-needs-be-plain-and-simple).

Ramírez-Castañeda V. 2020. Disadvantages in preparing and publishing scientific papers caused by the dominance of the English language in science: The case of Colombian researchers in biological sciences. PLOS ONE 15: e0238372.

Romero-Olivares AL. 2019. Reviewers, don't be rude to nonnative English speakers. Science.

Rovira C, Codina L, Lopezosa C. 2021. Language Bias in the Google Scholar Ranking Algorithm. Future Internet 13: 31.

Roy D, Bhatia S, Jain P. 2021. Information asymmetry in Wikipedia across different languages: A statistical analysis. Journal of the Association for Information Science and Technology 73: 1–15.

Saha S, Afrad MMH, Saha S, Saha SK. 2019. Towards making global health research truly global. Lancet Global Health 7: e1175.

Schofield P, Mamuna G. 2003. The relationship of socio-economic status and length/medium of English instruction with individual differences and English proficiency in Pakistan. Journal of Research (Faculty of Languages und Islamic Studies) 3: 1–28.

Shailes S. 2017. Plain-language Summaries of Research: Something for everyone. eLife 6: e25411.

Siok WT, Kay P, Wang WSY, Chan AHD, Chen L, Luke K-K, Tan L. H. 2009. Language regions of brain are operative in color perception. Proceedings of the National Academy of Sciences 106: 8140–8145.

Sulubacak U, Caglayan O, Gronroos S-A, Rouhe A, Elliot D, Specia L, Tiedemann J. 2020. Multimodal machine translation through visuals and speech. Machine Translation 34: 97–147.

Suzina A. 2021. English as lingua franca. Or the sterilisation of scientific work. Media, Culture & Society 43: 171–179.

Tardy C. 2004. The role of English in scientific communication: lingua franca or Tyrannosaurus rex? Journal of English for academic purposes 3: 247–269.

Tonkin H. 1987. One hundred years of Esperanto: A survey. Language Problems and Language Planning 11: 264–282.

translatE project. 2020. List of non-English-language journals in ecology and conservation. Version 1.

UNESCO. 2021. UNESCO recommendation on open science. Paper presented at General Conference of UNESCO, 41st session. 2021.

Vaidyanathan G. 2019. No paper, no Phd? India rethinks graduate student policy. Nature.

Wild S. 2021. African languages to get more bespoke scientific terms. Nature 596: 469–470.

Endangered Languages Project. Endangered Languages Project: supporting and celebrating global linguistic diversity. (12 January 2022; https://www.endangeredlanguages.com/).

## Tables and figures

**Table 1.** Plain language writing tips to reduce structural complexity and linguistic ambiguity in English, including ideas from Bowker and Buitrago Ciro (2019). Recommended, free online tools that can suggest how to accomplish these goals for a given piece of writing can be found at sites such as https://hemingwayapp.com/ and https://datayze.com/?category=writing.

| Action | Explanation | Example |
|---|---|---|
| Use shorter sentences | The longer the sentence, the more challenging it is to identify the relationships between the different elements. | Try to keep sentences under 25 words. |
| Use the active voice | It is easier to identify the agent in the sentence and to understand its relation to the other elements. | *We report the findings* instead of *The findings are reported* |
| Avoid long strings of modifiers | When connecting words (e.g., prepositions) are eliminated, readers and machine translation tools must infer the relations between the words. | liquid oxygen tank = a tank for liquid oxygen VS red oxygen tank = a red tank for oxygen |
| Include optional relative pronouns (that, which) | Relative pronouns (that, which) help readers to understand how different elements are related. Even though it is possible to omit them in some cases, it is better to include them to clarify the relationships. | MCPyV as well as Epstein-Barr virus, normally connected with humans under the form of subclinical infection,… VS MCPyV as well as Epstein-Barr virus, *which are* normally connected with humans under the form of subclinical infection,... |
| Use terminology consistently | All languages have synonyms, but it may be challenging to recognize that different words can refer to the same concept. Using terms consistently reduces confusion for readers and machine translation tools. | Instead of alternating between *amyotrophic lateral sclerosis* and *motor neuron disease*, choose one term and use it consistently. |
| Minimize the use of abbreviated forms | Abbreviated forms are challenging for machine translation tools, | MS could be a short form for *multiple sclerosis*, *master of* |

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| | which may try to recognize them as "words". They may also be difficult for speakers of other languages. Use sparingly. | *science*, *manuscript* or even a polite term of address for a woman, and a machine translation tool may choose incorrectly. |

**Figure 1.** An example decision tree that authors can use to decide when and how to translate their research output. Understanding that researchers are often limited by resources and time, we provide this diagram as a suggestion of when to prioritize translation, as translations may be useful in additional circumstances. Researchers may consider translating into languages that correspond to the conditions in Box 1 that apply to their research circumstances.

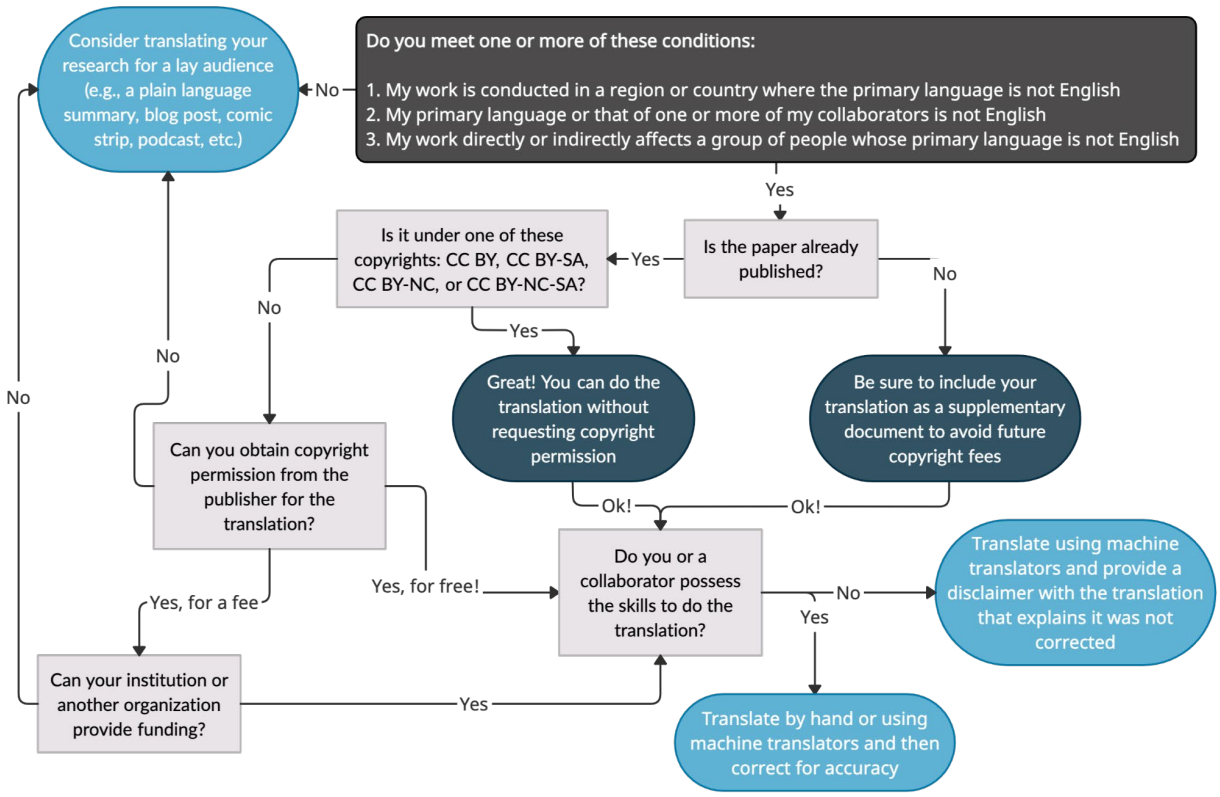
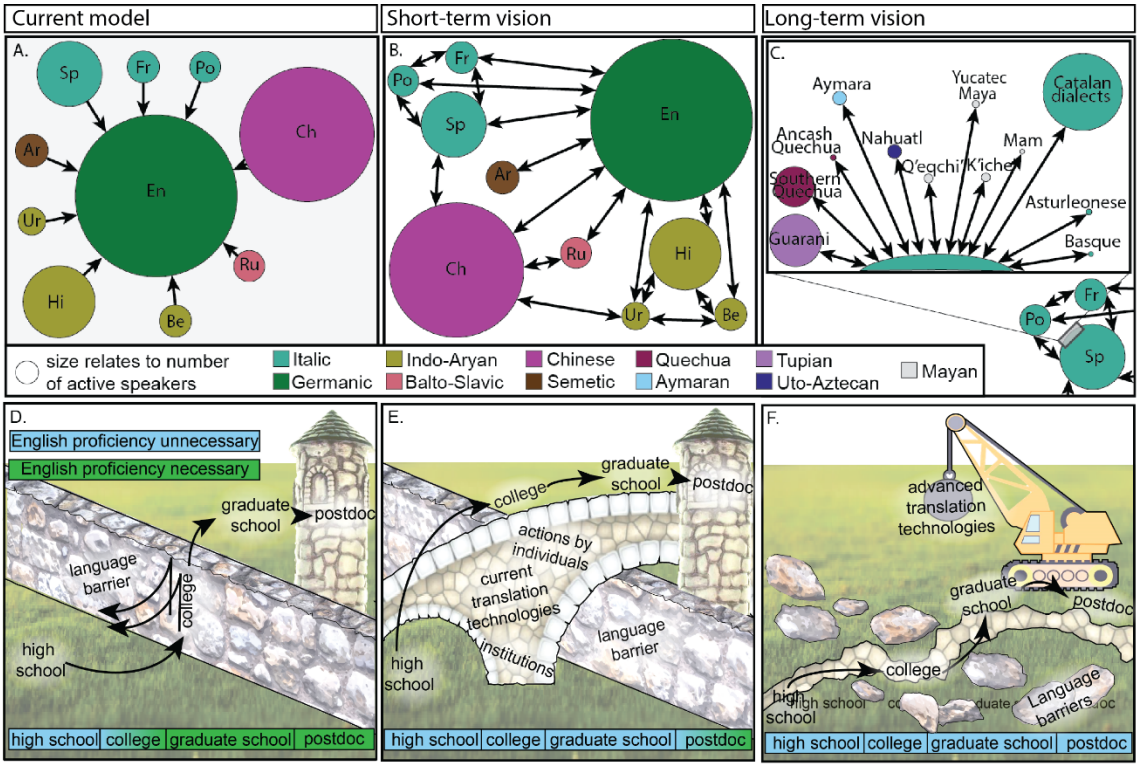



**Figure 2.** Two visual metaphors to describe breaking down language barriers and moving science towards multilingualism. (A) Today, English operates as a central hub for scientific communication, receiving much more input from speakers of other languages than vice versa

(only languages with >230 million active speakers are shown and are abbreviated as follows: En, English; Ch, Chinese; Sp, Spanish; Hi, Hindi; Fr, French; Ar, Arabic; Be, Bengali; Po, Portuguese; Ru, Russian; and Ur, Urdu). (B) In the short-term, machine translation tools and efforts by scientific communities can help form secondary language hubs (see main text) that create and disseminate scientific knowledge among all languages within each language family. For instance, Hindi may serve as a connector language, as science translated into Hindi can then be more easily translated from Hindi into other Indo-Aryan languages. (C) As machine translation technologies improve, greater exchange across language families will indirectly benefit speakers of languages with smaller numbers of active speakers (inset), who owing to geography or history often must learn a second language from one of these major families. For instance, the greater availability of texts translated to Italic languages will facilitate translation into languages historically and geographically associated with Spanish (ie indigenous languages of Iberia, South America, and Central America). (D) Currently, students must become proficient in English during or prior to their undergraduate studies if they wish to pursue science as a career, presenting a "language barrier" (a wall) to a scientific career. (E) In the short term, structural changes by institutions, actions by individuals, and machine translation tools can help students bridge the barrier. (F) In the long-term, advanced translation technologies and a more multilingual scientific academy will help demolish language barriers. Under this more accessible paradigm, scientists may be able to advance their careers and their English proficiency in parallel, rather than needing English proficiency as a prerequisite for a career.



**Supplementary information**

| **Table S1.** Summary of concrete actions that could help decrease language barriers in biological sciences (including ideas from Fung 2008, Ammon, 2012, Amano et al. 2021b, Bowker 2021 and the TranslatE project translatesciences.com). | | |
|---|---|---|
| **Institutional** | | |
| Journals | Structural changes | Include multilingual scientists on the editorial board |
| | | Create a by-line for translators or language editors |
| | | Provide free English language editing services or a forum for contributors to identify reciprocal translation partners or volunteer to provide translation services |
| | Revise author guidelines | Encourage authors to review literature published in languages other than English and state explicitly that papers in any language can be cited |
| | | Provide guidelines for how to cite sources in languages besides English (see Fung 2008) |
| | | Encourage and provide guidelines for the creation of plain language summaries, highlights, and graphical or video abstracts, especially ones that are multilingual |
| | | Encourage the submission of translated keywords and abstracts. Provide guidelines for when translations should be included (e.g., see Figure 1) |
| | | Encourage the inclusion of full-text translations in supplementary materials |
| | | Provide guidance on whether/how translations of previously published articles can be uploaded after publication |
| | | Detail the journal's copyright policy on translations of articles |
| | | Provide guidance on how to label translations with appropriate disclaimers, such as "manually translated by a fluent speaker", |

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| | | "machine-translated", or "machine-translated and edited for accuracy" |
| | | Soften word limits, which will permit less dense language which is both easier to understand and easier for machine translation tools to accurately translate (see table 1) |
| | Reviewer guidelines | Provide guidelines for professionally and constructively suggesting edits to English grammar or style (e.g., see Romero-Olivares 2019, Mavrogenis et al. 2020) |
| | Website | Tag articles that have translated content in a manner that enables search engines and users to easily identify articles by language(s) available |
| Societies | Structural | Include multilingual scientists in society leadership |
| | Conferences | Caption talks during conferences |
| | | Provide logistical and technical support for members who are translating their research (e.g., lists of high-quality machine translation resources, ways to connect with a reciprocal translation buddy during registration) |
| | | Translate conference abstracts or encourage contributors to submit translations in relevant languages (e.g., see Figure 1) |
| | Networking | Create networking events and mentorship programs that help connect members that speak languages other than English |
| Universities | | Provide translation and machine translation literacy training |
| | | Encourage the study of foreign languages as part of STEM curriculum |
| | | Foster multilingual collaborations and invite multilingual speakers |
| | | Place value on publications in non-English languages and in regional journals as part of tenure and promotion reviews and degree requirements |
| Public databases | | Provide translated content for users to view websites and databases in multiple languages |

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| Agencies funding work that affects communities that do not necessarily speak English | Permit and facilitate submissions in non-English languages |
| | Encourage budget items supporting the translation of results and outreach that engages with the languages of local communities |
| | Encourage the inclusion of scientists that speak the local language (see Figure 1) |
| Service acknowledgement platforms (e.g. Publons) | Provide tools to track and acknowledge translation and language editing work |
| **Individual** | |
| Join and bolster local scientific societies that operate in languages other than English | |
| Help peers promote their science in English as well as their primary language(s) | |
| Write in a translation-friendly way | |
| Prepare a plain-language summary of your research | |
| Look for a reciprocal translation partner to translate your research in forums such as ResearchGate | |
| Use constructive and professional language when conducting peer reviews | |
| Make an effort to read literature published in other languages, using machine translation tools as necessary | |

**Table S2.** Example language for promoting multilingual science in academic publishing and at international scientific conferences

| Item | Journal (link) | Text on website |
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| Author Guidelines: Abstract Translation | Molecular Ecology (https://onlinelibrary.wiley.com/page/journal/1365294x/homepa | All submissions must be written in English. However, we encourage authors to provide a second abstract in their first language or the language relevant to the country in which the research was conducted. The second abstract will be published with the online |

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| | ge/forauthors.html, accessed 6 October 2021) | version of the article and will not be included in the PDF. Please note that second abstracts will not be copyedited and will be published as provided by the authors, who take responsibility for the accuracy of the translation. Authors who wish to take advantage of this option should upload their second abstract alongside their submission, selecting the file type “Translated Abstract not for Review". |
| | American Naturalist (https://www.journals.uchicago.edu/journals/an/instruct, accessed 6 October 2021) | We encourage authors to upload secondary abstracts translated into the languages relevant to the areas in which research was conducted. These secondary abstracts will appear with the online full-text versions of articles and on the abstracts pages, which are open and searchable to anyone. |
| | Journal of Ecology (https://besjournals.onlinelibrary.wiley.com/hub/journal/13652745/author-guidelines, accessed 6 October 2021) | Translated abstracts in any language can be published alongside our accepted articles |
| | Journal of Mammalogy (https://academic.oup.com/jmammal/pages/General_Instructions, accessed 6 October 2021) | ● Abstract, ≤ 5% of the length of the text (Introduction through Discussion), with no subheading. Manuscripts reporting on research from Latin America MUST include a summary (usually a translation of abstract) in Spanish or Portuguese. For work from other non-English speaking countries, a foreign-language summary is encouraged and welcome. The translated summary should be placed after the English abstract and the key words in English.<br>● Key words, ≤ 10 words, alphabetized and separated by commas. If there is a foreign-language summary, also provide a separate list of < 10 foreign-language key words, alphabetized in the foreign language, after the summary. |
| Author Guidelines: Translation policy | Conservation Biology (https://conbio.onlinelibrary.wiley.com/hub/journal/15231739/homepage/forauthors.ht | After provisional acceptance, your paper will be edited and sent back to you for a response. When you submit your response to editing, you may upload a translation of the manuscript as an online appendix (i.e., supporting information). The translation should match the version of the manuscript you submitted in response to editing (all track changes removed). |

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| | ml, accessed 6 October 2021) | |
| Author Guidelines: English grammar editing | Journal of Mammalogy (https://academic.oup.com/jmammal/pages/General_Instructions#Pre-Submission%20Language%20Editing, accessed 6 October 2021) | ASM has a “Buddy System” that includes colleagues who have expressed willingness to assist authors with the presentation of their research. If English is not your primary language, you may request a ‘‘buddy’’ who will volunteer his or her time to assist you. Please follow this link for additional information about the ASM "Buddy System". Contact the Editor-in-Chief to be put in contact with a “buddy”. To gain access to the Buddy System, your manuscript must first be preliminarily reviewed by the Editor-in-Chief or an Associate Editor, and be considered suitable for JM. It is expected that any manuscript that receives assistance from the Buddy System will subsequently be submitted to JM.<br><br>Alternatively, you may find your own English language editing services. Language editing does not guarantee that your manuscript will be accepted for publication. Specialist language editing companies offer similar services and you can also use any of these, or others. Authors are liable for all costs associated with such services. BioOne, which aggregates content from ASM journals, has an agreement with Charlesworth Author Services, a language editing service, which provides a 10% discount to authors of the ASM journals. |
| | Society for the Study of Amphibians and Reptiles (https://ssarherps.org/publications/manuscript-review-service, accessed 10 October 2021) | English is the language of science communication and of the SSAR. Ironically, however, most of the animals that we study come from countries where English is not the first language. In order to promote the publication of research on amphibians and reptiles from those countries, the SSAR has started an editorial assistance program for herpetologists who do not speak or write English as their first language.<br><br>The following members of the SSAR community have offered to read and edit up to three English language manuscripts per year within their specific area of herpetological expertise. This is a free service provided to herpetologists whose first language is not English, but who are striving to publish their findings in peer reviewed English language journals.<br>If you would like to partake of this service, feel free to contact by email any of the following people. Please, though, keep these points in mind: |

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| | | ● Have a clear idea about where you want to submit your paper and have worked hard to format your paper according to your selected journal's "Direction for Authors."<br>● Tell the person to whom you are approaching for editorial assistance a bit about the focus of your paper and its size, before sending them your manuscript.<br>● Provide that person the option of receiving your paper as either hard copy by mail or as an electronic file appended to email. You should similarly give them the choice of either emailing you comments or mailing the marked up manuscript back to you.<br>● Allow the reviewer at least three weeks to get their comments back to you.<br>● The people on this list may decline your invitation for a variety of reasons; e.g., currently heavy teaching load, field work, high number of manuscripts already edited during the year etc. Please accept their declining to edit your paper on face value. Do not interpret a refusal from anyone on this list as a disinterest in either you or your work.<br>● The people who are volunteering to edit manuscripts are not formally working for the SSAR and their assistance is no guarantee that your paper will be accepted in the English language press. |
| | American Society of Ichthyologists and Herpetologists (https://www.asih.org/ichsandherps/instructions-to-authors, accessed 11 January 2022) | Authors are encouraged to contact the Editor at leo@ichsandherps.org with any questions or assistance needed. Ichthyology & Herpetology provides free, professional English editing for all accepted manuscripts and on request will provide editorial assistance to authors whose first language is not English or those with other language barriers prior to or during submission for manuscripts considered suitable for review. |
| Reviewer Guidelines: English grammar editing | International Journal of Primatology (https://www.springer.com/journal/10764/updates/17281556, accessed 6 October 2021) | Don't be rude to non-native English speakers. The dominance of English contributes to inequities in science. Writing in a second language is hard and editing and translation services are expensive. Concentrate on reviewing the science, not the English language. If the language obscures the science to the extent that you cannot review the manuscript, inform the editor. You are welcome to correct grammatical errors and help improve the writing, but this is not the major role of a reviewer. You may suggest that the English language needs revision but do not ask that the authors seek the |

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| | | assistance of 'a native English speaker', because speaking English as a native does not indicate proficiency in scientific English. |
| Multilingual conferences | Evolution 2021 (https://www.evolutionmeetings.org/international-participation.html, accessed 6 October 2021) | • For the faux-live and on-demand talks, you will have the option of presenting in either English or Spanish. All pre-recorded talks will be captioned in both languages.<br>• Live-streamed talks will be presented and captioned in English. After the scheduled presentation, all of the live and pre-recorded presentations can be viewed with English, Spanish, or no captions.<br>• During registration, attendees who are not native English speakers can request a bilingual mentor to help them prepare their abstract, talk presentation slides, and their recording.<br>• Bilingual attendees will be asked to volunteer to be mentors during registration. |
| Multilingual professional development | Genetics Society of America (https://genetics-gsa.org/online-events/multilingual-seminar-series/, accessed 7 October 2021) | The Multilingual Seminar Series is a panel/workshop discussion series aimed at multilingual and non-English speaking scientists. The goal of the series is to connect scientists and provide a platform for talking about science in a language other than English. Since the events will be held in their respective languages, they are accessible to those who do not speak English. |
| | Animal Behavior Society (https://www.animalbehaviorsociety.org/web/awards-student-grants.php, accessed 1 December 2021) | The Grant Language Editing Program program (GLEP) aims to provide support for research grant applicants who are interested in editorial assistance with English. The consultants will be invited from among the students who received ABS Student Research Grants (SRG) in the past two years, who are confident in English grammar and have strong editing abilities. The consultants will restrict their comments to grammar and word choice only, feedback on scientific content and merit of the proposal will not be provided through the GLEP.<br><br>The final version of the proposals must be submitted to the GLEP through the grant submission system one month in advance of the SRG deadline. Participants will receive their proposal with consultants' comments two weeks before the SRG deadline and will be responsible for proceeding with the submission through the grant system.<br>Important notes:<br>• Consultants will not comment on the scientific content of the proposal or overall grantsmanship. |

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| | | ● Proposals submitted to the GLEP must be a final (or nearly final) version.<br>● The GLEP and SRG have the same submission processes. |