

OPPORTUNITIES, CHALLENGES, AND ETHICS

MUNI
SCI

EVA CHOCHOLOVÁ

LABORATORY OF BIOLOGICAL AND MOLECULAR ANTHROPOLOGY

DEPARTMENT OF EXPERIMENTAL BIOLOGY

ETHICS REGULATION

- Unlike medical research, archaeological sources are excluded from oversight, no permission usually needed officially
- Palaeo-omics need to govern their own:
 - Professional organisation guidelines
 - Reviewers
 - Museums
 - Funding organisations
 - Collections
 - ...

MAIN ETHICAL ISSUES

- Consent
 - Destructive methods
 - Data access and sharing
 - Accountability to stakeholders
 - Engagement of stakeholders
-
- Environmental impact

There cannot be a single standard when it comes to the ethics of anthropological research, or even of aDNA research in anthropology. Because aDNA research generally falls outside the domain of institutional review boards, we must regulate ourselves, both through adhering to our field's sometimes contradictory ethical standards as best we can, and through serious case-by-case consideration and discussion among ourselves, our colleagues within and outside of anthropology, and other interested parties (stakeholders).

—Kaestle & Horsburgh (64, p. 109)

STAKEHOLDERS

ChatGPT:

- Individuals, groups, or organizations with an interest or influence in the research, application, or outcomes of palaeo-omics studies
- Scientists
- Research institutions
- Funding agencies
- **Indigenous and local communities, descendants**
- Museums, collections (curating and displaying)
- ...

EXAMPLES OF ETHICAL GUIDELINES

2002

Kaestle &
Horsburgh (64)

1. Does the application of the method address an anthropological question?
2. Are there nondestructive methods that can be used to achieve the result?
3. Do the conditions of the remains or other material suggest that ancient DNA is more likely to be present than not?
4. How will different stakeholders view the destruction of the remains in question?
5. What are the ethical, legal, and social implications of possible study results, if any, for living groups?
6. Has a reasonable attempt been made to define and receive informed consent from different stakeholders?

Annual Review of Genomics and Human Genetics Ethical Guidance in Human Paleogenomics: New and Ongoing Perspectives

Raquel E. Fleskes,^{1,*} Alyssa C. Bader,^{2,3,*}
Krystal S. Tsosie,^{4,5} Jennifer K. Wagner,⁶
Katrina G. Claw,⁷ and Nanibaa' A. Garrison⁸

EXAMPLES OF ETHICAL GUIDELINES

2003

Sealy (97)

1. Respect for the mortal remains of the dead shall be accorded to all, irrespective of origin, race, religion, nationality, custom, and tradition.
2. Respect for the wishes of the dead concerning disposition shall be accorded whenever possible, reasonable, and lawful, when they are known or can be reasonably inferred.
3. Respect for the wishes of the local community and of relatives or guardians of the dead shall be accorded whenever possible, reasonable, and lawful.
4. Respect for the scientific research value of skeletal, mummified, and other human remains (including fossil hominids) shall be accorded when such value is demonstrated to exist.
5. Agreement on the disposition of fossil, skeletal, mummified, and other remains shall be reached by negotiation on the basis of mutual respect for the legitimate concerns of communities for the proper disposition of their Ancestors, as well as the legitimate concerns of science and education.
6. The express recognition that the concerns of various ethnic groups, as well as those of science, are legitimate and are to be respected will permit acceptable agreements to be reached and honored.

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EXAMPLES OF ETHICAL GUIDELINES

2008

Hublin et al. (59)

1. The scientific question addressed should be important enough to justify invasive sampling of hominid remains and should not be answerable by any other means.
2. If abundant and/or less unique animal fossils are present at a site, the invasive techniques should be shown to be successfully applied to such remains before hominid fossils are sampled. Whenever possible, minimally destructive tests able to predict whether the planned analysis can be successful should be performed on the hominid specimen prior to the sampling.
3. The scientist suggesting invasive sampling must demonstrate a relevant publication record. The more unique a specimen is, the higher the standards should be. This applies in particular to type specimens. Envisioned protocol, equipment, long-term funding, and archival resources should all be considered in relation to the project suggested. A detailed application should be presented to the curators. If the institution curating the remains does not have adequate in-house expertise to judge the track record of the applicant and the research proposal, the application should be sent by the curators to external reviewers.
4. Both negative and positive results should be reported back to curators and published in papers and/or online databases.
5. Redundant (duplicate) sampling should be done only when scientifically absolutely necessary. Whenever possible, sampling should be minimized by performing different types of analyses on the same sample. Regarding specimens that yielded negative results, requests for renewed sampling should be granted only when new technologies or new sampling procedures are available.

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EXAMPLES OF ETHICAL GUIDELINES

2017

Claw et al.
(29)

1. Museums and federal agencies tasked with protecting Native American Ancestors should make determinations of culturally unidentifiable remains in consultation with tribal experts, respectfully granting equal weight to tribal ways of knowing and histories when evaluating cultural affiliation.
2. Museums and entities that manage archaeological collections should support the formation of intermuseum meetings and coordination to share best practices in tribal consultation.
3. All studies involving Native American Ancestors should consult with tribes, including not only those deemed to be culturally affiliated but also those with historical and geographical ties to the area.
4. Scientific journals and granting bodies should ensure that ethical research practices are followed before publication and throughout the research process by requiring evidence of meaningful tribal consultation, especially when Native American Ancestors are involved.

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EXAMPLES OF ETHICAL GUIDELINES

2018	Bardill et al. (10)	<ol style="list-style-type: none">1. In the absence of known descendant or culturally affiliated communities, which Indigenous peoples tied to land where Ancestors were buried will be consulted?2. Who is the appropriate community body (e.g., tribal council, tribal institutional review board, or Elders) or representative (e.g., tribal president or historic preservation officer) to initiate discussions about paleogenomic analyses?3. What are potential ethical pitfalls of this research or harms that could affect the community? What cultural concerns of the community, such as destruction of Ancestral remains, need to be considered?4. How will the community benefit from the paleogenomic research?5. How will the community provide input on study design and interpretation of results? How frequently does the community wish to be contacted during the project?6. When community members participate directly in the project (e.g., as advisers or laboratory technicians), will they coauthor research publications and presentations? How do communities and individuals wish to be recognized in research products?7. What happens after the project ends? Who will have access to the data generated? How will remaining samples from Ancestors be handled, stored, returned, or reburied?
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EXAMPLES OF ETHICAL GUIDELINES

Prendergast
& Sawchuk
(91)

1. *Getting started: developing a research project*
 - 1.1. Researchers must identify and listen to key stakeholders, while being specific about project goals and explicit about proposed sample destruction.
 - 1.2. Country- and institution-specific research and export requirements must be determined, and budgets must account not only for sampling but also for sample return and continued engagement with collaborating institutions.
 - 1.3. Archaeologists should not feel bound to any single laboratory or researcher, but rather choose appropriate laboratories and techniques based on research questions.
 - 1.4. It is imperative to avoid a “sample first, ask questions later” approach. An ethical approach identifies specific sites, contexts, and individuals required to meet defined scientific goals.
 - 1.5. It may be helpful to contact the excavators of targeted skeletons to obtain critical contextual or preservation information unavailable in publications or accession registers.
 - 1.6. Sampling teams must include appropriate specialists, ideally a bioarchaeologist or osteologist and somebody trained in aDNA sampling techniques (98).
 - 1.7. All parties should agree to terms of collaboration, ideally through a memorandum of understanding between or among institutions rather than individuals.
2. *Selection and documentation of tissue samples from collections*
 - 2.1. Sampling teams must establish protocols to minimize contamination at all stages of collection and to fully document sampling procedures for the benefit of curating institutions and future researchers.
 - 2.2. Researchers should minimize impacts on future bioarchaeological research by choosing samples that are less informative about the individual’s age, sex, disease, or life history.
 - 2.3. No more than two tissue samples per individual should be collected without consultation with curators and reasonable justification tied to research questions.

Prendergast
& Sawchuk
(91)
(continued)

3. *Research does not end in the laboratory: following through on collaborations*
 - 3.1. Researchers must adhere to plans for sample return and archiving within the minimum time necessary to ensure quality research.
 - 3.2. When samples are returned, electronic and paper documentation should be updated accordingly.
 - 3.3. Institutional collaborators should be involved in the interpretation and copublication of results, which may require in-person follow-up meetings.
 - 3.4. Researchers should reach beyond the scientific community to communicate findings to public audiences—for example, in pamphlet or poster format or through local presentations.
 - 3.5. Researchers should strive to maintain long-term ties with collaborators and colleagues and to build capacities by developing new research projects, mentoring, and cowriting communications.

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EXAMPLES OF ETHICAL GUIDELINES

2019

Austin et al.
(8)

1. Researchers should “consult with descendant communities at the earliest stage of project design” (p. 1472).
2. “Decisions about destructive sampling are based, in part, on the likelihood that the proposed analytical methods will yield the intended results and gain the most possible information from the sampled collections” (p. 1473).
3. Researchers should provide for “accessibility of raw data to ensure complete replicability of research and stable, open access to data deriving from collections” (p. 1474).

Sirak & Sedig
(99)

1. It is important to identify the research questions that will be addressed with paleogenomic data to determine the number of samples that are needed to meaningfully contribute to the resolution of these questions.
2. Researchers should be realistic about the likelihood of analytical success and consider how results will be disseminated.
3. Researchers should fully assess the chances of generating robust data from the petrous bone as opposed to other skeletal elements.
4. Raw sequencing data should be deposited in a publicly accessible repository, and all protocols used should be fully reported.

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EXAMPLES OF ETHICAL GUIDELINES

2020

Wagner et al.
(American
Society of
Human
Genetics)
(125)

1. Researchers should formally consult with communities.
2. Researchers should address cultural and ethical considerations.
3. Researchers should engage communities and support capacity building.
4. Researchers should develop plans to report results and manage data.
5. Researchers should develop plans for long-term responsibility and stewardship.

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EXAMPLES OF ETHICAL GUIDELINES

2021	Society for American Archaeology (102)	<ol style="list-style-type: none">1. Working with human remains is a privilege, not a right.2. Human remains should be treated with dignity and respect.3. Archaeologists should consult, collaborate, and obtain consent when working with human remains.4. It is the archaeologists' responsibility to understand and comply with the applicable law.5. Archaeologists should follow best practices and uphold the highest ethical standards when working with human remains.
	Alpaslan-Roodenberg et al. (1)	<ol style="list-style-type: none">1. Researchers must ensure that all regulations were followed in the places where they work and from which the human remains derived.2. Researchers must prepare a detailed plan prior to beginning any study.3. Researchers must minimize damage to human remains.4. Researchers must ensure that data are made available following publication to allow critical reexamination of scientific findings.5. Researchers must engage with other stakeholders from the beginning of a study and ensure respect and sensitivity to stakeholder perspectives.

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EXAMPLES OF ETHICAL GUIDELINES

Advancing the ethics of paleogenomics

Ancestral remains should be regarded not as “artifacts” but as human relatives who deserve respect

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THE SUMMER INTERNSHIP FOR INDIGENOUS PEOPLES IN GENOMICS (SING) CONSORTIUM [Authors Info & Affiliations](#)

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To aid the process of community engagement, we offer these guiding questions for paleogenomic researchers to consider:

1. In the absence of known descendant or culturally affiliated communities, which Indigenous peoples, tied to land where ancestors were buried, will be consulted?
2. Who is the appropriate community body (e.g., tribal council, tribal IRB, elders) or representative (e.g., tribal president, historic preservation officer) to initiate discussions with about paleogenomic analyses?
3. What are potential ethical pitfalls of this research or harms that could affect the community? What cultural concerns of the community, such as destruction of ancestral remains, need to be considered?
4. How will the community benefit from the paleogenomic research?
5. How will the community provide input on study design and interpretation of results? How frequently does the community wish to be contacted during the project?
6. When community members participate directly in the project (e.g., as advisers or laboratory technicians), will they coauthor research publications and presentations? How do communities and individuals wish to be recognized in research products?
7. What happens after the project ends? Who will have access to the data generated? How will remaining samples from ancestors be handled, stored, returned, or reburied?

REPRESENTATION

- Different institutions
- Different countries
- Different regions
- Quality vs availability

Ensure equal access to ancient DNA

Research on ancient DNA relies on the availability of rare bone specimens from archaeological excavations. We consider that access to and research on these specimens should be more ethical and stringently regulated.

DNA is exceptionally well preserved in the petrous bone of the inner ear (R. Pinhasi *et al. PLoS ONE* 10, e0129102; 2015). Competition for these rare specimens promotes hoarding, which, along with the destruction of samples for DNA analysis, makes it hard to replicate findings. It also hinders research by scientists who are not connected to the few groups who dominate access to such samples.

Moreover, these specimens are usually exported to a few centres in Europe and the United States from countries that are not supported by costly laboratory infrastructure. This impoverishes those countries' cultural heritage through loss of scarce genetic material from local and sometimes extinct populations.

Organizations concerned with the ethics and regulation of cultural heritage and of past biological diversity need to remedy this. Ethics standards should be backed by regulations following the Nagoya Protocol (www.cbd.int/abs). A central facility to extract ancient DNA from petrous bones and to curate and store at least half of the material for replicability and accessibility purposes was recently set up in Israel (see go.nature.com/2ujxatj).

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REPRESENTATION

- Different institutions
- Different countries
- Different regions
- Quality vs availability
- Co-authorship, involvement of local scientists

REPRESENTATION

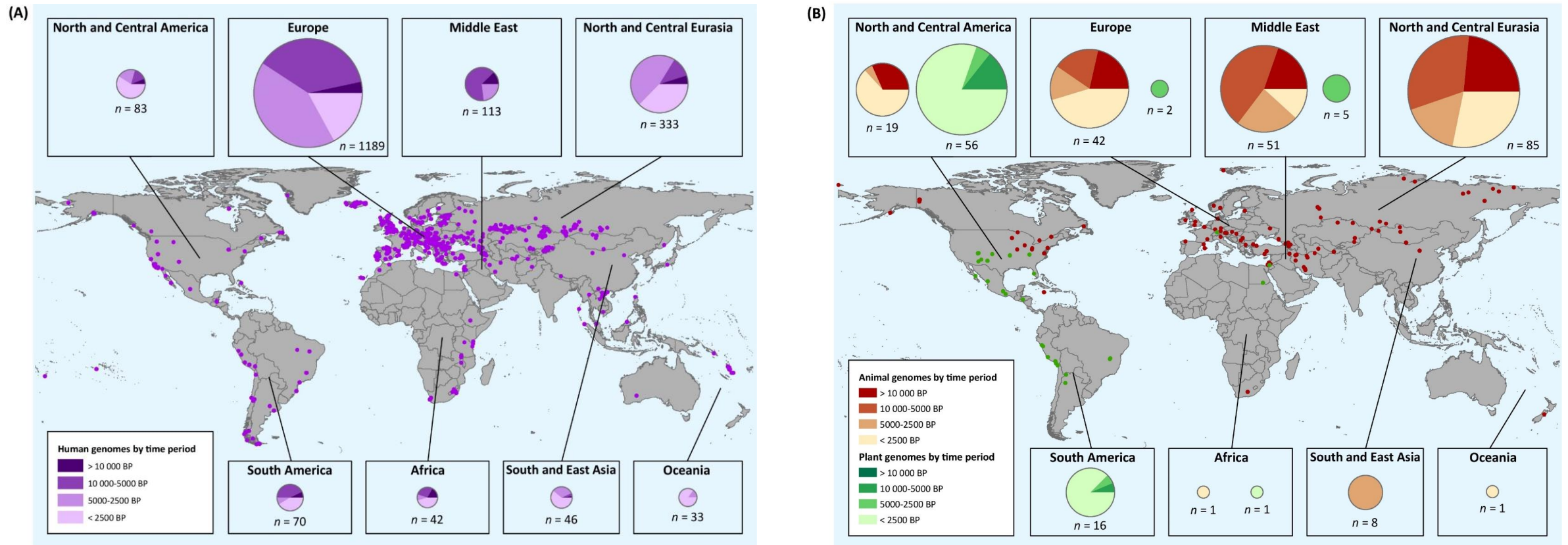
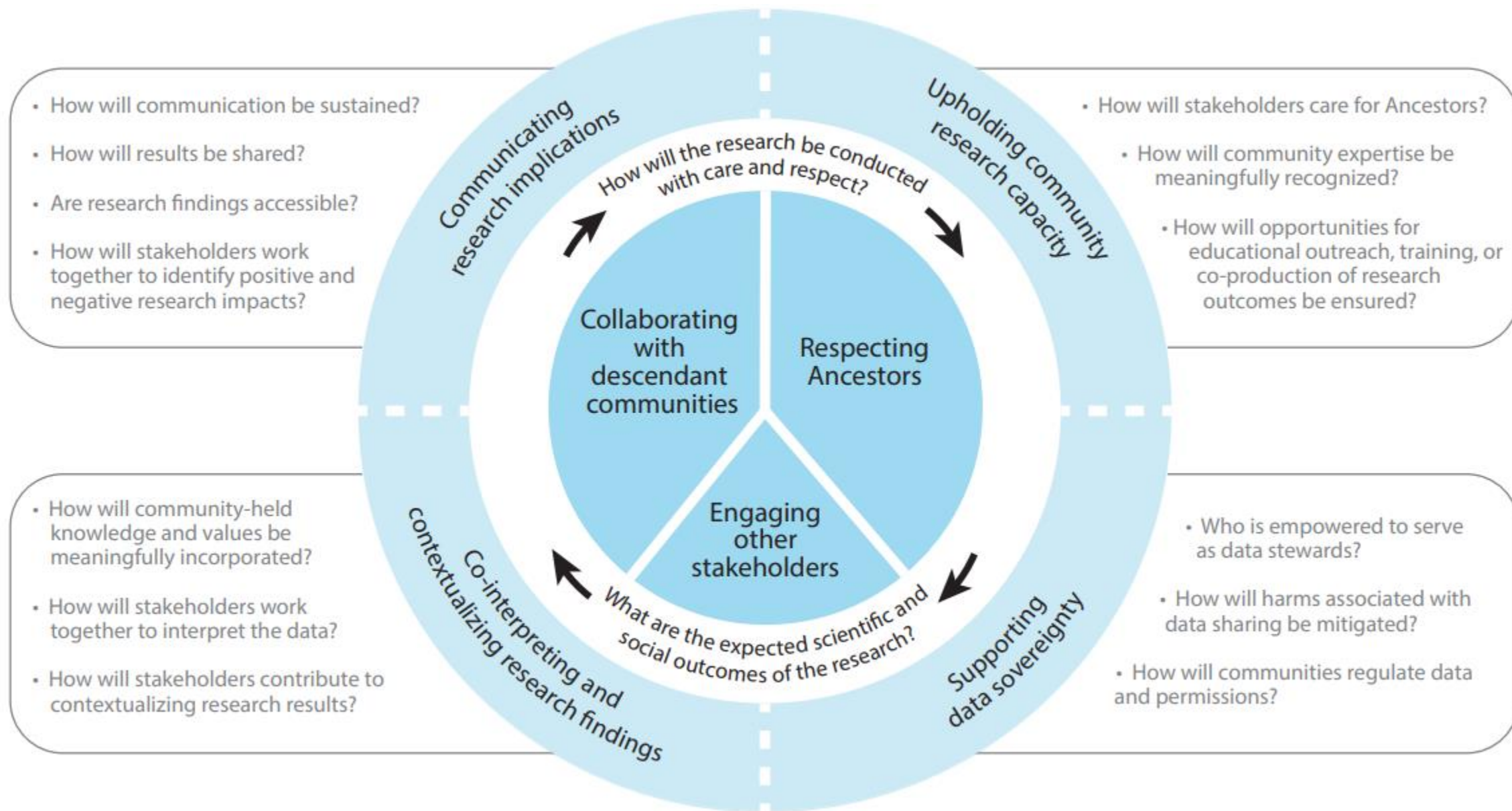


Figure 1 Geographic and Temporal Distribution of Ancient Genomes Published through December 15, 2018. Marciniak and Perry [3] previously reported a map of published human sequences. Here we generate an enhanced version of this figure, that reports both published genomic data from (A) human individuals (points in purple, updated from Marciniak and Perry, $n = 1909$), and (B) non-human animal (red, $n = 207$) and plant (green, $n = 80$) species. For the human samples, we restrict to individuals with $>0.025X$ coverage on a genome-wide set of informative single nucleotide polymorphism positions. For animals and plants, we restrict to samples in which multiple autosomal loci have been characterized. Samples with only mitochondrial or chloroplast genomes are not included. Data can be found in the online supplementary data. Maps drawn by Miriam Rothenberg in ArcGIS.

REPRESENTATION

- Different institutions
- Different countries
- Different regions
- Quality vs availability
- Co-authorship, involvement of local scientists
- Interdisciplinary cooperation and respect
- Various groups represented vs protected



HAVASUPAI TRIBE VERSUS THE ARIZONA BOARD OF REGENTS

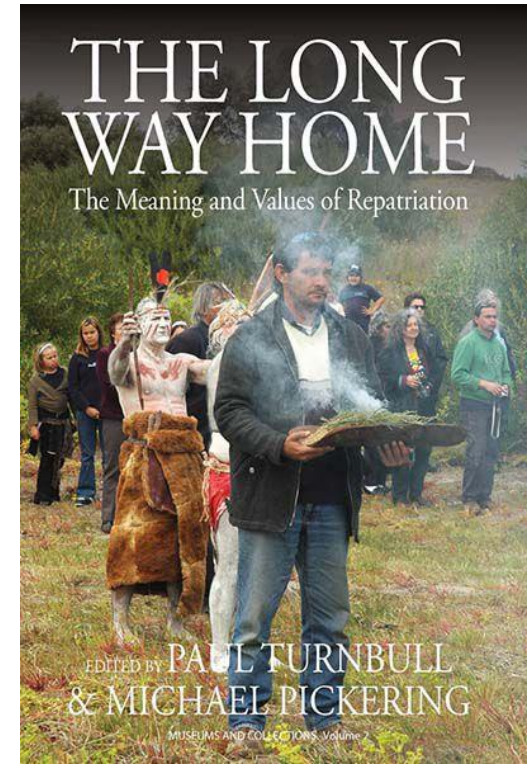
Researchers at Arizona State University initially consented members of the Havasupai Tribe to study genetic associations related to increasing type 2 diabetes rates in their community (46). However, the tribe later learned that their members' DNA was used without additional consent to conduct potentially stigmatizing genetic studies. In addition to studying mental conditions such as schizophrenia, researchers published population migration narratives that were culturally inconsistent with the tribe's origin stories, using terms such as inbreeding to inaccurately depict population reductions due to colonial factors. In 2004, after discovering the unconsented use of their data, the Havasupai Tribe filed a lawsuit against the Arizona Board of Regents, which serves as the governing body for the university, for violations of informed consent. The lawsuit was settled in 2010 with monetary compensation and return of DNA samples to the community (35). The repercussions included increased caution by tribes about participating in research (2) and hesitance by researchers to engage Indigenous peoples in genetic research, raising important questions about justice and inclusion of underrepresented peoples in research (46). This seminal lawsuit also reflects the pitfalls of broad consent and demonstrates the importance of continually engaging Indigenous peoples to avoid research harms (48).

THE GENOGRAPHIC PROJECT

In 2005, the National Geographic Society launched the Genographic Project, a genetic anthropological study to map ancient migratory patterns using DNA and create an open source research database (13, 128). The Indigenous Peoples Council on Biocolonialism immediately lambasted the project for its scientific objectivism of Indigenous peoples, destruction and desecration of Ancestors, and sustained bioethical and cultural concerns that recall similar issues raised by the government-funded Human Genome Diversity Project (57). Additionally, the project's aims to scientifically reify African diaspora hypotheses using problematic phrases such as "we are all African," "genetic science can end racism," and "Indigenous peoples are vanishing" perpetuated controversial racial and colonial notions that pervade genetic research and contribute to erasures of Indigenous peoples' histories, knowledges, and sovereignties (105). The privately funded project fueled ongoing concerns that collectivizing Indigenous peoples' DNA in open databases would lead to biocommercialism and exploitation of their genomes for little or no benefit, but with disproportionate risks, to Indigenous communities. The aftermath of the project has further contributed to a divide between Indigenous peoples and scientists (55, 62). Hence, paleogenomicists should consider the importance of appropriate consultation and regard for risks to Indigenous peoples and pursue anticolonial models of engagement.

REPATRIATION AND REBURIAL

- Who should own and curate an artifact? Remains?
 - Locals?
 - Discoverer?
 - Descendants?
 - ...?
- Identification often complicated or impossible
- Protection of repatriated artifacts – refusal in cases where the display and technology is insufficient
- Often artifacts acquired during war or colonialism/imperialism





ENVIRONMENTAL IMPACT

- Energy consumption
- Waste generation
- Carbon footprint

Article

Increasing sustainability in palaeoproteomics by optimizing digestion times for large-scale archaeological bone analyses

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Trypsin digestion in ZooMS
Plates vs microtubes

ENVIRONMENTAL IMPACT - CONSERVATION

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Opinion

Ancient and historical DNA in conservation policy

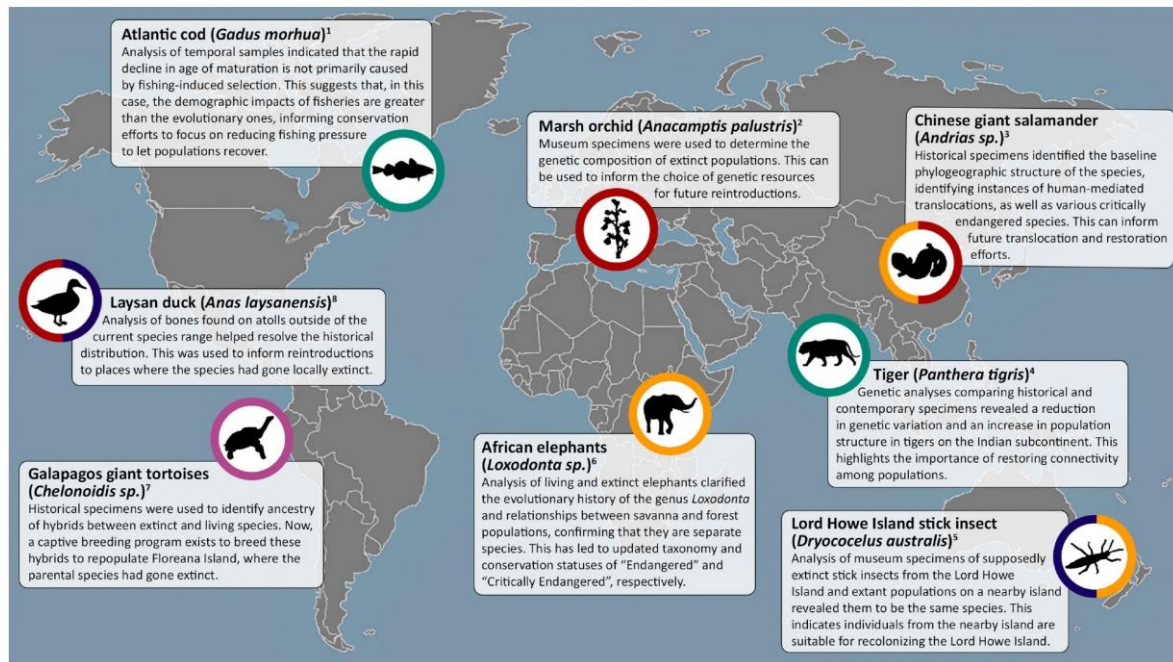
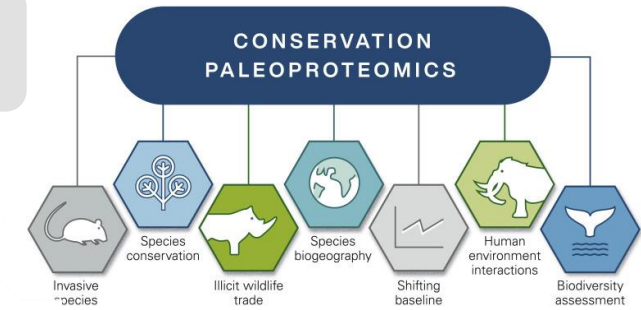
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Review

Leveraging palaeoproteomics to address conservation and restoration agendas

Carli Peters¹, Kristine K. Richter², Jens-Christian Svenning³, Nicole Boivin^{1,4,5,6}




Trends in Ecology & Evolution



WHERE TO GO FROM HERE

- To go
- Not to go

- 
- Reporting of negative results
 - Underrepresentation
 - Humane approach as much scientific