

# A Code of Ethics for Evidence-Based Research With Ancient Human Remains

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## ABSTRACT

As clinical research constantly advances and the concept of evolution becomes a strong and influential part of basic medical research, the absence of a discourse that deals with the use of ancient human remains in evidence-based research is becoming unbearable. While topics such as exhibition and excavation of human remains are established ethical fields of discourse, when faced with instrumentalization of ancient human remains for research (i.e., ancient DNA extractions for disease marker analyses) the answers from traditional ethics or even more practical fields of bio-ethics or more specific biomedical ethics are rare to non-existent. The Centre for Evolutionary Medicine at the University of Zurich solved their needs for discursive action through the writing of a self-given code of ethics which was written in dialogue with the researchers at the Institute and was published online in Sept. 2011: <http://evolutionäremedizin.ch/coe/>. The philosophico-ethical basis for this a code of conduct and ethics and the methods are published in this article. *Anat Rec*, 298:1175–1181, 2015. © 2015 Wiley Periodicals, Inc.

**Key words: medical ethics; research ethics; human remains; personal rights**

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Ancient mummies are of value to historians, archaeologists and anthropologists. Mummies—defined as human remains where soft tissue has been preserved—may even have a large impact on clinical research. As a research object, a mummy reunites two important aspects of research: the historical and the evidence-based scientific. While their existence, their place of burial, their type of mummification and so forth is important to the historian, their physical and physiological making is becoming that much more important to the doctors or basic scientists.

Within the relatively new field of evolutionary medicine, mummies offer an important part of the puzzle of how diseases and medical conditions evolve through time. The past can contribute to finding solutions for present and future medical problems. This means that mummies are more than just historically fascinating. Their preserved tissue incorporates the potential to learn about the development of pathogens such as viruses and bacteria and thus the development of diseases. This in turn is profitable for the present and the future because it can help improve disease prediction and further their prevention. Evolutionary Medicine and its evidence-based research is thus an important and special field of clinical and medical

research and this specialty is mainly due to the fact that it depends on resources that are in themselves unique: human remains.

## MOTIVATION FOR AN ETHICAL FRAMEWORK

The relevance of evidence-based research and its constant need to improve and develop its methods, as well as the fact that our investigation objects are historical human remains motivated us to take the ethical dimension of evidence-based research into focus, as it is practised on historical human remains today.

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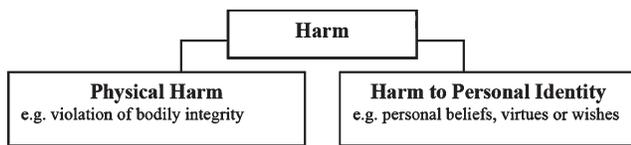


Fig. 1. Forms of harm.

Within the very act of researching with and on human remains the question about personal rights of the dead is raised at a very basic level and thus includes a certain responsibility of the researcher to reflect, consider, and accommodate ethical questions and concerns.

An ethical discourse on the scientific practice concerned with research on historical human remains is only slowly establishing itself (Kaufmann 2010) in a domain where such a discourse was focused on more specific contexts of exhibition or excavation (Museums n.d.). Kaufmann and Rühli<sup>1</sup> were to understand the specific pressure in clinical studies on historical human remains and opted for the stakeholder approach as a possible starting point for an ethical exchange and reflection.

Still, the concept of a field of applied ethics for human remains is supported by well-established work in medical ethics, as for example the regulatory set of ethical principles for the medical community in the Declaration of Helsinki (Goodyear and Krleza-Jeric, 2007). Intended to function as a voluntary guideline, it is widely regarded as the cornerstone document of research ethics (Christie 2000). Although directed at medical practitioners and the science of the living human being, the declaration of Helsinki includes elements and suggestions relevant for researchers dealing with humans after their death—the actual human remains.

As the Declaration of Helsinki aims foremost to improve patient treatment and respect of the person within a clinical research setting, its focus on the living person reveals the empty ethical category of a person after death, that is, its missing consideration of the treatment of a person after death. Research with historical human remains merits special ethical consideration, not least because it is a fast moving and developing field of investigation (e.g., evolution of imaging techniques).

To do this properly, a solid reflection on terminology (e.g., basic concepts of consent, harm, and bodily integrity) is just as essential, as a first outline of possible ethical standards for use in everyday work at a research lab.

To meet both these objectives, but avoid obvious pitfalls—such as being either too prescriptive and thus restrictive, or too open and thus insignificant through cultural relativism—, our goal is to introduce a theoretical background of posthumous interest and present a set of standards as a guiding tool for researchers and affiliates of the Centre of Evolutionary Medicine (ZEM; now: “Institute of Evolutionary Medicine IEM”), at the University of Zürich.

These standards aim to address ethical issues relevant to the context of research with historical human remains and are intended as a stimulus for further ethical discussions, also within the broader scientific community of

evolutionary based research be it in medical sciences or adjacent fields such as anthropology.

The argument is set out in three parts. In the first part we provide theoretical insights addressing the value of human remains as still specifically human and the concepts of posthumous harm, posthumous interest, and thus posthumous rights. On the basis of a discursive approach, we introduce our own working definition of ethics as it applies to the factual situation of researchers dealing with human remains. In the second part we bring insights to practical cases and show in which context posthumous interests are at stake. This is followed by the discussion of our ethical framework, which is based on the aforementioned theoretical rationalisation and attempts to delineate critical issues and implications for ethical conduct. We conclude with indicating further steps needed to continue the ethical discussion on research with human remains, including the need for future research and the discussion of its limitations.

## THEORETICAL FUNDAMENTALS

In analogy to medical ethics where the primary aim is the protection of a person’s rights as patients and research subjects, the discussion of research ethics when using human remains should follow a parallel path of investigation, led by the main question: can a dead person still be harmed or not<sup>2</sup>?

A possible positive answer to this leading question automatically implies a set of duties towards the dead. The nature of the harm and the emerging duties for the researcher however need further clarification.

In general, “to harm someone” means to invade someone’s interests (Levenbook, 1984). In turn, “to invade someone’s interests” can refer to various interests, avoiding threats or violation of one’s body (interest to protect the physical) or the protection of more personal interests, concerning personal beliefs, virtues, or wishes (interest to protect the personal identity) being the two most important ones [Fig. 1 below, see also (Wilkinson, 2002)]. Both these interests, as they are attributed to a deceased person, imply a duty of the living to protect these interests. These duties can be multi layered. Showing respect for the human remains that are representative of the person that they once belonged to, but also becoming a safeguard of the fulfilment of their posthumous interests, represents the fundament for any subsequent evaluation of the impact of possible posthumous interests. Furthermore, a high need for constant evaluation of these possible interests and the resulting duties will prove to be a solid way to protect any kind of

<sup>2</sup>The question is not as simple as it might appear: while in the clinical, medical setting the problem is absent, in a purely theoreticophilosophical setting it would even be laughable – at best – since philosophers are interested in persons and persons as such only exist while living. Thus the question whether a person can be harmed after death is a proper contradiction in terms for most theoreticians. Cf. The absence of an entry ‘harm’ (let alone posthumous harm’) from the big encyclopaedias of philosophy, such as the Stanford Encyclopaedia of Philosophy <http://plato.stanford.edu/archives/win2002/contents.html> or the Routledge Encyclopaedia of Philosophy 2000; or cf. the article ‘Death’ by Steven Luper in the 2002 online version <http://plato.stanford.edu/archives/win2002/entries/death/>

<sup>1</sup>Kaufmann *op. cit.*

research results that will result from invasive techniques and studies on historical human remains.

The main question needs to be: do (a) the interest of protecting the physical integrity and (b) the interest of protecting the personal identity also concern the deceased/dead? Are these interests the same post-mortem and ante-mortem?

### Posthumous Interests: Bodily Integrity

With regards to bodily integrity one can argue—on the basis of the tradition of grave protection for example, found across human history in almost every culture in different shapes or forms and founded in different attitudes (Collier, 2003)—that the right of bodily integrity does not automatically end with death (Cantor, 2010).

Bodily integrity—as stipulated by the general bodies of rights, such as the Universal Declaration of Human Rights (Nations, 1948) and the International Covenant of Civil and Political Rights (Nations, 1966)—consists of the fundamental right of a person to decide the treatment of their own body. Put in simple terms: it is a right that prohibits any kind of abusive, inhumane, cruel or punishable treatment on another person. Now, even though this concept was formulated for the living, one could argue that it can go further, namely that it can be applied after death and thus give a person the right to peace in death (i.e., undisturbed graves). If one was to accept this stipulation, then research on historical human remains leaves the fairly simple sphere of ‘historical’ and immediately becomes something of higher ethical importance. With this added importance, even something as basic as the Hippocratic Oath—as it is still used by the World Medical Association since the declaration of Geneva in 1948, and in many other countries ever since (Association n.d.)—warns against an unwarranted disturbance of a corpse<sup>3</sup> and asks to respect the secrets confided in them, even after the patient has died. This point is particularly revelatory, as it already assumes a certain level of harm to a person’s identity even after death.

We are of course aware that this is a special case, since the research object “historical human remains” is fundamentally different from “treating a patient” or “undertaking clinical research” and thus requires a different approach. Nevertheless, useful parallels can be drawn from another application of clinical research and training such as current body donations for science, where a person will cede their right to bodily peace in death for scientific research and a potential gain for all of humanity. The legal parameters within which such body donations (or even tissue and organ donations) are possible today are extremely strict and they apply both to the donation itself and to tissue of any kind already been removed and thus cannot be declared a part of a particular person’s body anymore (Sciences, 2008).

Although these guidelines and legislations rely on the most fundamental elements of all, that is, the consent of the person donating parts of themselves or their body after

death, there is a certain kind of equivalence between modern body donation and the use of historical human remains for medical research. This equivalence is particularly interesting when it comes to the transferred consent by stakeholders<sup>4</sup> or proprietors of said historical human remains however, because such a consent is always a permission for the use of one thing—the body—for a specific purpose—a dissection course in anatomy for instance. The legal parameters that usually apply are a clear indicator of this. They resemble much more a “permission to use”<sup>5</sup> rather than an “informed patient consent” which we would aim for. One could even go as far as to state, that the absence of this last kind of consent is a prerequisite for any kind of ethical consideration involving the research of human remains. Because it is ultimately this absence of consent that leads to a continued reflection on the posthumous interests involved. Nobody else can give consent for the use and potential destruction of historical human remains in terms of bodily integrity. The consent will always be in terms of the remains being a cultural heritage, in terms of kinship or possession. However, the researcher, by becoming aware of the posthumous interests they are ignoring and consciously accepting this premise in order to gain medical knowledge and contribute to saving lives in the future, is assuring an ethical standard of a higher level that cannot be achieved otherwise.<sup>6</sup> Only through this can one balance the particular interest of the research object and the societal impact of research (e.g., educational mandate vs. research mandate) and thus provide a more responsible foundation for research itself.

In conclusion, we would argue that there is such a thing as posthumous harm and that not only does one, in a scientific research setting, need to constantly evaluate the different posthumous interests of a set of human remains before, during and after research samples have been taken, but we also accept the invasiveness of any kind of research done on historical human remains where no consent can be construed from stakeholders or proprietors, as a given.

### Posthumous Interests: Personal Identity

With regard to personal identity, the invasion of someone’s interests after their death is defined as “breaking a promise,” “destroying someone’s reputation,” or “undermining someone’s achievements.” Yet, to detect promises, wishes, reputational characteristics or achievements, requires a certain level of knowledge about the deceased person. For researchers dealing with historical human remains such knowledge is—in most cases—not accessible. In the particular case of artificial mummification of human bodies throughout different cultures and regions, for example, in South-America (Ican), Asia (Chinese and Thai), and Northern-Pacific (Aleutian), contextual information about culture, religion and

<sup>4</sup>Kaufmann *op.cit.*

<sup>5</sup>When dealing with mummies this becomes evident, because research such as biopsies or scanning needs a permission by the owner (i.e. a museum) to use the remains.

<sup>6</sup>It is with this in mind that the authors have formulated the basic concept of balancing the invasiveness of a procedure against its appropriateness in the Code of Ethics of the Centre for Evolutionary Medicine at the University of Zürich. <http://evolutionaermedizin.ch/coe/>

<sup>3</sup>I will not use my medical knowledge to violate human rights and civil liberties, even under threat; and „I will practise my profession with conscience and dignity;“and “I will respect the secrets that are confided in me, even after the patient has died;“, cf. <http://www.wma.net/en/30publications/10policies/g1/index.html>

traditions linked to posthumous wishes together with the fact of mummification might allow to reasonably reconstruct certain personal interests of the dead. One would be hard pressed nonetheless, to elevate such knowledge above the status of beliefs about the person we can reconstruct. All that the researcher is left with are a set of human remains and what written history will allow them to recreate. In terms of personal identity, this knowledge is per definitio fragmented<sup>7</sup> at best.

The researcher is then faced with the same vacuum as before when dealing with the posthumous interest of bodily integrity and the absence of consent. Only in this case, the results of invasive medical research could harm a person's reputation after death and thus undermine their achievements. For instance, publishing the kinship analysis of Egyptian Pharaoh mummies and revealing a certain level of co-sanguinity or hereditary health conditions may in some cases damage this particular family's reputation and achievements at least from our modern standpoint?

Just as before, we cannot resolve this absence, but would rather argue that it is this vacuum and the continued reflection which in turn leads to consciousness of the posthumous interest and the potential harm, that will assure the ethical aspect of any medical research on historical human remains.

### Posthumous Harm

The two-folded concept of posthumous interests (bodily integrity and personal identity) culminates in the idea of posthumous harm (physical harm and harming the personal identity), the protection from which is attributed to the researcher. As such, the concept of posthumous interest must be translated into more practical oriented standards and applied to particular cases in order to gain a general standard or greater understanding of the ethics involved (and implied theoretical assumptions that need to be made apparent).

With regard to the latter we assume a certain minimal consent by the persons whose human remains we investigate. While we certainly cannot provide any kind of proof of such a basic consent, as individual members of the human species we all have a certain interest not only in the preservation, but also in the progress of the human species in general. Evidence-based research—as invasive as it may be—, will, for example, through its link with the medical field, help the advancement of science on a very real level and thus, we can assume that it is a common goal of human beings past, present and future to contribute to that progress, alive or deceased. This is what we would like to call a minimal consent. With this, doing research on historical human remains becomes parallel, but not the same, to modern body donations, without attributing any kind of voluntary value to the historical person that is being investigated.

### Methodology

In addressing the absence of a specific discourse in this matter, one can nevertheless draw on an already

established body of literature for the more general ethics—for example, moral philosophy in general (Rawls and Herman, 2000), applied ethics in particular (Frey and Wellman, 2003) and formulated theories on ethical conduct (Dawson, 1994) or ethical decision making (Ford, 1994)—, and discursive approaches in specific (Habermas and Habermas, 1994).

As it is our attempt to design the ethical discussion by integrating all relevant ethical interests, we are in favour of ethical rationalisation that takes into account the complete chain of actions, as opposed of being focused on either the outcome (i.e., the potential gain) or the consequences. Moreover, we are faced with the problem of universal validity. As already stated, we do not claim to present a universally valid code of conduct. This means that instead of publishing universal truth, we would rather argue for rightness and appropriateness of the developed standards for our researchers and affiliates, while at the same time keeping the discussion open to anyone who would be interested in engaging in the ethical discussion of research with human remains. Our understanding of ethics and the question of how we should define proper conduct with human remains is based on a discursive approach to determine standards for such conduct. Standards developed and presented throughout this work are based on a participative discussion at the ZEM and are in accordance with the consent and arguments of all attendants. This discursive process is lead by the voluntary commitment of setting the bar high for sustainable and qualitative research, with an increased consciousness about the responsibility of dealing with and protecting human remains as objects of investigation among scholars in modern science.

## PRACTICAL APPLICATIONS

To illustrate the reality of posthumous harm and to accentuate the responsibilities of doing research with human remains, the next section develops three practical examples. These are especially revelatory of critical issues concerning the balance of appropriateness versus invasiveness, difficulties in sampling and processing, and lastly, data generation and publication. [All cases in this section are based on actual issues encountered through research done at the ZEM—Centre for Evolutionary Medicine at the University of Zürich.]

### Appropriateness versus Invasiveness

The issue of appropriateness versus invasiveness is one central to all research projects where historical human remains are involved and its main focus is the possible appropriateness of invasive research in general and on the repetitiveness of invasive procedures due to methodological/technological progress.

This is also the case for the Ptolemaic mummy of Scherit-Min (300-200 B.C.), originally found in Achmim, Egypt and brought to Switzerland by André Bircher 1886 (Küffer and Siegmann, 2007) first X-ray was done in 2005, and results basically report on tooth damages and abrasions, and damages of the nasal septum; the latter likely due to the embalming ritual and special methods to remove the content of the brain cavity (Rühli et al., 2007)

<sup>7</sup>The only possible exception would be obtaining a written will by the person, of course.

Since the first CT scans, the technology has taken a huge step and the sector of digital 3D-reconstruction based on CT scanning relies particularly on the latest protocols for smaller sliced which in turn allow for a better digitalisation of the scanned mummy. This would permit precise knowledge of particular teeth pathologies and oral cavities (Seiler et al., n.d.) for instance.

The issue to be resolved is as follows: if technological progress and new methods in medical imaging suggest that scanning human remains (i.e., a mummy) in small temporal intervals can bring new insights, is it still appropriate? Does the invasiveness and the theoretically possible destruction of ancient DNA base pairs warrant the potential insights and diagnostic results in terms of scientific progress? Although such repeated scanning would meet the requirements of being minimal invasive (e.g., by using imaging technologies which are potentially destructive, but less than for example, a histological examination would be), these technological advancements are being studied for their destructiveness on a molecular level over extended periods of time at current (Wanek et al., 2011).

### Sampling

The process of sampling, that is, the actual process of taking any kind of detaching small parts of any kind of tissue, often sees the researcher being present.

Taking the special case of sampling on a digging site, a whole set of preparations precedes the travel which involve the theoretical basis detailed above. Travel documentation, permissions and the setting up of a collaboration network of local researchers and stakeholders on the ground are vital. Assessing the right amount of samples (i.e., taking enough without taking too much) and deciding which samples (bone, muscle, skin, hair; parts that are already compromised as opposed to areas that are completely intact) to take in relation to future procedures are the first steps of sampling per se. Following the right protocols to avoid contamination while taking the sample, might seem unimportant when concerned with ethical issues, but a heavy contamination may mean new sampling in the future and may very well spike the level of invasiveness needlessly. The sample size as such is something that needs a special focus, as made obvious with the ongoing research on the Iranian Salt Mummies from Chehrabad where especially ancient DNA researchers can dispose of a large number of samples, but are starting to become alarmed about the actual sample size which sometimes is not enough to actually do any DNA typing. In this case, sampling procedures need to be discussed and possibly revised to avoid needlessly raising the number of samples.

Another huge issue is the transporting of these samples of human remains where a maximum of traceability (either by keeping the samples with them at each time or by sending the through an international carrier transport with a tracking number and appropriate insurance) would be recommended.

### Data Processing and Publication

Scientific work includes proper presentation and publication of research results on a scientific level, but also an appropriate presentation to the general public. Thus,

apart from publication in scientific journals cooperation with the public press is important. The main ethical issue that may arise with such non-scientific publications is that they incorporate a subliminal danger of vulgarisation. In the specific case of mummy studies, this is due to a more lurid language, which aims to sell research with mummies as something “mystical” and “sensational.” For instance if an article were to invent a setting or a scene that never actually took place in order to dramatize the set up of an evocative picture showing a medical researcher sampling a wrapped mummy hand. This can obviously still be accepted. If the suggestion was that the photographer was touching the mummy hand in question to set up the picture, the dramatization suggests an inappropriate use of the human remains, the possibility of untrained persons handling remains and so forth and would have to be contested.

Another issue is of course the publication of questionable graphical material in general, either by needlessly showing faces or the genital region of a mummy for instance.

## THE CODE OF ETHICS

Based on these short practical illustrations, the next section focuses on the formulation of guidelines that are favouring a sustainable way of research with and on human remains, now and in the future. These guidelines contained in a first code of ethics for research with human remains that was developed for internal use at the Centre of Evolutionary medicine (ZEM) of the University of Zurich (Centre for Evolutionary Medicine, University of Zurich n.d.).

The code of ethics was structured following the three main problematic areas already outlined in this article under the section practical application: 1) the relation between the researcher and the object under investigation and the main problem of balancing posthumous rights versus scientific progress, 2) sampling and processing with regards to the appropriateness versus the level of invasiveness, but also the issue of transport and storage, and finally 3) data generation, interpretation and publication. For each area (1–3) the code provides background information to render apparent the ethical dimension of the issue. In another step, it outlines a recommended standard that is of practical help for the researcher that applies it.

### Agent and Object

The first area of concern deals with conceptual and theoretical issues, since it considers all questions related to the agent, for example, questions concerning the subject under investigation and the researcher’s responsibility for the investigation of the same.

The researcher is *prima facie* always faced with unknown historical human remains, either in its completeness as a whole body or simply with parts of a human body. Is the object of their study a whole body, then we stipulate that any kind of sampling (destructive or not) could be considered as a violation of the aforementioned right to bodily integrity. This represents a more severe ethical issue, than the use of (a) parts that have already been separated naturally or from a former sampling, or (b) are damaged to a point where the part will soon separate itself from the whole

body. Even though this strict view would suggest that any kind of invasive research or sampling is impossible, we argue that this is a non sequitur. To the contrary, with a discourse about guidelines—to which our code of ethics is a starting point—that are oriented to the actual needs of a research institute, we wish to further an awareness that allows for a constant balancing between the degree of invasiveness (or destruction) and the appropriateness.

Let's put this in an imagined example: while a rare mummy is limited in the numbers of samples that it can provide to research before being completely destroyed or inaccessible for future generations of researchers or historians, a series of mummies in an extended excavation site presents a larger set of possibilities. In this example, the ethically appropriate sample size for a certain ancient DNA analysis will vary according to the rarity of the historical human remains and it will also influence the number of protocol verifications that can be considered appropriate.<sup>8</sup>

Going back to the dichotomy of researcher and object, after sampling, the researcher is facing a part or several parts of human remains (i.e., samples of any size). The socio-cultural origins that might help in further identifying the nature of their mummification (if the object of research is indeed a mummy), their ownership, conflicting interests and aspects of preservation, and so forth may or may not be known to them.

Hence the first standard we propose with regards to the agent-object relation that reflects as accurately as possible the identification of the object (part/full) under investigation through the accumulation of information (continued movement from “unknown” to “known”) as varied as the type of mummification or human remains or the socio-cultural context. The idea is to come as close as ever possible to reconstructing the person behind the remains. The process of “information preparation” should act as the reference point for all members of the research institute and plays a key role not only at the beginning of research, but also for the subsequent processes (e.g., communication of research results). This point is particularly stringent when adding the prerequisite of a process of specific qualification that allows one to work with human remains. Such qualification includes continuous education, communication and publication of research results, and finally to lead by example.

## CONCLUSION

Evolutionary based medicine using historical human remains is a promising field of medical research with great potential for clinical implications. Reliant on human remains and all unique in itself, questions of responsibilities and concerns for this source of research are obvious. For the foremost this is always dealing with the overall question of invasiveness versus appropriateness, which is derived from the even more fundamental question of posthumous harm and posthumous interests versus the importance of scientific progress.

This contribution was attempted to pick up these issues that are so much of importance from an ethical point of view, and further decisive for the future directions of research. The presented categorization of the connective part, introducing the relation of agent and object, and the more practical part, reflecting on sampling and data processing, is one further step towards the development of an ethically motivated guideline for research with human remains. It thus contributes not only to the lacking discussion of posthumous harm and posthumous interest, but from a practical point of view even more important, starts to carve out specific problems of research and to develop possible answers or standards researchers can follow. Therewith it advances the ethical discussion of excavation and exhibition matters (Green, 1984) and is also beyond the specific discussion of ethical concerns of ancient DNA analysis (Kaestle and Horsburgh, 2002). So far we can only present a first draft of ethical standards that is certainly confronted with limitations and thus in need of future discussion. This includes for example, any issues arising from new methodologies (with a different level of “invasiveness”), changes in general research policy, samples of various cultural background or the issue of public exhibition of human remains.

Mummy research—within a framework of ethical constraints and guidelines—shall be just as sustainable and thus of long-term benefit to modern science as any kind of research on human remains and human tissue is in our modern society today.

## APPENDIX

### ZEM/IEM Code of Ethics

### LITERATURE CITED

- Association WM. WMA Declaration of Geneva World Medical Association, ed. wma.net. Available at: <http://www.wma.net/en/30publications/10policies/g1/index.html>.
- Cantor NL. 2010. *After we die*. Washington: Georgetown Univ Press.
- Centre for Evolutionary Medicine, University of Zurich ed. Code of ethics—new principles for an ethical base of research on human remains. Available at: <http://evolutionarymedicine.ch/coe/>
- Christie B. 2000. Doctors revise declaration of Helsinki. *BMJ* 321:913.
- Collier C. 2003. Tradition, modernity, and postmodernity in symbolism of death. *Sociol Quart* 44:727–749.
- Dawson AJ. 1994. Professional codes of practice and ethical conduct. *J Appl Philos* 11:145–153.
- Ford RC, Richardson WD. 1994. Ethical decision making: a review of the empirical literature. *J Business Ethics* 13:205–221.
- Frey RG, Wellman CH. 2003. *A companion to applied ethics*. Oxford: Wiley-Blackwell.
- Goodyear M, Krleza-Jeric K. 2007. The declaration of Helsinki. *BMJ* 335:624.
- Green EL. 1984. *Ethics and values in archaeology*. New York: Free Press.
- Habermas J, Habermas J. 1994. *Justification and application*. Cambridge: The MIT Press.
- Kaestle FA, Horsburgh KA. 2002. Ancient DNA in anthropology: methods, applications, and ethics. *Am J Phys Anthropol* 35:92–130.
- Kaufmann I, Rühli FJ. 2010. Without “informed consent?” Ethics and ancient mummy research. *J Med Ethics* 36:608–613.
- Küffer A, Siegmund R. 2007. *Unter dem Schutz der Himmelsgöttin: Ägyptische Särge, Mumien und Masken in der Schweiz*. Zürich: Chronos Verlag.
- Levenbook B. 1984. Harming someone after his death. *Ethics* 94:407–419.

<sup>8</sup>Can a lactose-intolerance test be considered appropriate? Even when the sample size is minimal and the potential result of the test not as such realised within a larger set of tests and well-defined project for instance?

- Museums ICO. PREAMBLE—code of ethics—ICOM. [icom.museum](http://icom.museum/who-we-are/the-vision/code-of-ethics.html). Available at: <http://icom.museum/who-we-are/the-vision/code-of-ethics.html>
- Nations GAOTU. 1966. International Covenant on Civil and Political Rights. Available at: [www2.ohchr.org](http://www2.ohchr.org).
- Rawls J, Herman B. 2000. Lectures on the history of moral philosophy. Harvard: Harvard Univ Press.
- Rühli FJ, von Waldburg H, Nilles-Vallespin S, Böni T, Speier P. 2007. Clinical magnetic resonance imaging of ancient dry human mummies without rehydration. *JAMA* 298:2618–2620.
- Seiler R, Zink A, Rühli F. Dental pathologies of the Iceman. 2nd Bolzano Mummy Congress, Mummies from the Ice, Oct. 20th–22nd, 2011.
- Swiss Academy of Medical Sciences. 2008. Guideline on the use of human bodies or parts of bodies in medical research with an educational focus. Bern: Swiss Academy of Medical Sciences.
- UN General Assembly. 1948. Universal Declaration of Human Rights adopted by General Assembly resolution 217 A (III) of December 10, 1948. Available at: <http://www.un.org/en/documents/udhr/index.shtml>.
- Wanek J, Székely G, Rühli F. 2011. X-ray absorption-based imaging and its limitations in the differentiation of ancient mummified tissue. *Skeletal Radiol* 40:595–601.
- Wilkinson T. 2002. Last rights: the ethics of research on the dead. *J Appl Philos* 19:31–41.