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Advancing Ethical Research Across Disciplines

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10/6/2010

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ABSTRACT:

As digital environments engender new forms of research and collaboration, and as scientific discovery evolves, how can we equip scientists for the moral, ethical, and socio-political questions and dilemmas that this new landscape for research brings? Research ethics and the responsible conduct of research (RCR) will transform in tandem with this changing landscape over the course of the next ten years. This transformation is a grand challenge, not just to the disciplines of research ethics and RCR, but to all of science. This white paper will explore how RCR will change over the next ten years by observing the imperative questions and potential issues that RCR as a discipline must face, describing how infrastructure must facilitate learning and sharing across disciplines, how multiple parties are impacted by these questions, and how researchers both current and future will shape this new landscape.

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(1) INTRODUCTION

Increasingly, social, behavioral, and economic research is conducted in a digital and globalized context. As emerging, fluid, and constantly changing settings, digital environments introduce a range of new ethical and social challenges within science, technology, engineering, and mathematics (STEM). In addition, rapid globalization juxtaposes multiple cultures, legal systems, and environments amid more geographically decentralized science and engineering projects and brings researchers outside of their traditional disciplinary, professional, or departmental boundaries by encouraging multidisciplinary, multi-institutional, and internationally-focused projects. A globalized and increasingly technological 21st century calls for a renewal and invigoration of research ethics and responsible conduct of research (RCR) to better reflect the experiences and challenges of scientific and engineering practice and education.

Research ethics and RCR are faced with a number of fundamental questions: Does better ethics lead to better science? More precisely, how can better ethics promote better science? How do scientists, particularly those working across disciplines and across geographic borders, learn ethics and practical knowledge of RCR? What common dimensions of research ethics and RCR lie across disciplines? How might scientists and engineers work more effectively and ethically across cultures in increasingly interconnected, global scientific communities? These and similar questions indicate an urgent and important need for an interdisciplinary approach to responsible and ethical conduct of research. This interdisciplinary approach must both build capacity in terms of the physical infrastructure that propagates access to knowledge about RCR, education and practice, and, at the same time, build the capacity of the researcher to not only further their research in an ethical manner, but to train the next generation of STEM scientists in the RCR.

Currently, disciplinary approaches to ethics are the norm. Disciplines and professions exist in their own institutional contexts and are informed by the specificity of their professional associations, codes of ethics or conduct, and disciplinary practices. As a result, the state of RCR theory and practice is fragmented as disparate disciplines embrace different ethical philosophies, pedagogies, expectations, and realities and fail to create collaborative spaces for effective knowledge transfer across disciplines. Moreover, even cross-disciplinary entities such as the Project for Scholarly Integrity (PSI), an initiative of the Council of Graduate Schools (CGS); the U.S. Department of Health and Human Services, Office of Research Integrity (ORI); and the National Postdoctoral Association (NPA) define RCR differently. Core topics that shape RCR training tend to be based on a compliance model and stem from research misconduct guidelines for federally funded research. Yet, even across federal funding agencies, standardization of RCR definitions and practices varies.

Many RCR topics tend to paint a broad brush stroke over important ethics and RCR issues, and thus require renewed critique, refinement, and expansion in order to ensure an ethically responsible and aware 21st Century workforce (Bulger &

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Heitman, 2007; Schienke et al., 2009). One challenge of this need for an interdisciplinary approach to a deeper understanding of research ethics begins with ensuring appropriate RCR infrastructure.

(2) INFRASTRUCTURE

Infrastructure represents the ability for scientists to access information about research ethics and RCR that is both universal in nature and disciplinarily applicable, but at the same time advances the boundaries of research ethics and RCR. Paramount to effective infrastructure is the organization of existing RCR knowledge and best practices across disciplines within a digital and freely accessible environment that broadens and deepens definitions of RCR. A deepened conception of RCR better encompasses, for example, related social and behavioral theories and research, addresses RCR issues related to all forms of diversity, and more effectively fosters embeddedness, or enculturation, of RCR in science and engineering education and practice.

A difficult but vital first step toward creating effective infrastructure is a collective movement toward transparent policies and training programs and open sharing of research ethics materials. Infrastructure building must develop and sustain interactive, dynamic online repositories along with associated infrastructural capacities that will include materials and services for a wide range of audiences. It must also include research that expands and deepens the empirical knowledge of research ethics which furthers the development, deployment, and subsequent evaluation of RCR pedagogy. This infrastructure must also further the strategic development and management of outreach and dissemination platforms, services, and activities. Finally, this infrastructure must also include the development, implementation, and evaluation of diagnostic institutional assessments with a view to developing national standards and best practices.

Institutions are in very disparate places of RCR readiness, and most lack the capacity to internally and systematically evaluate, track, and benchmark their progress. This variation in self-regulation ranges from exemplary to rogue organizations. Moreover, insularity and lack of comparative information inhibits institutions from knowing and appreciating where they stand on this continuum. Appropriate targeting of educational interventions or organizational change initiatives to promote institutional self-regulation and research integrity requires the ability to collect reliable data on baseline conditions, to assess areas needing improvement, and to subsequently evaluate the impact of initiatives. Comparative data can help organizations “raise the bar” of expectations by both increasing transparency and leveraging an inherently competitive nature.

A multifaceted approach to RCR is necessary to meet the many needs of stakeholders. The comparative research methodological principle of equivalence states that research ethics may not translate or “travel” in a perfectly equivalent manner across disciplines, but researchers can and should examine and explain similarities and differences by systematically juxtaposing conditions, identifying areas of divergence and overlap, and analyzing the spaces or discourses in which these areas diverge or assimilate. Understanding the contextual factors of the

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disciplinary discourses will enable researchers across all disciplines to break down rigid boundaries and enter new transformative spaces of research integrity models. The infrastructure must come together as a transformative space for researchers who seek to understand and possibly contribute to an emerging science of ethics in sophisticated and pedagogically coherent ways between and among disciplines.

(3) PEOPLE

Diverse stakeholders represent both the contributors to and beneficiaries of the infrastructure described above, and should consequently participate in developing open and multidisciplinary infrastructure in different ways. Sharing of materials and practices begins with their creators: scientists, engineers, ethics education experts, and institutional administrators. When scientists and engineers produce and make publicly available training materials, they should license them to be more generally adapted or to be modified to reflect another discipline's practices. When administrators implement ethics training and education programs, they should make their local practices public. When researchers and professionals use existing materials, they should make their modifications and feedback public. This feedback will contribute to the development and refinement of the interdisciplinary field of research ethics. Open sharing by the creators and implementers of research ethics materials and practices will stretch the production investment made by researchers, will grant access to the under-resourced, and will avoid redundancies of effort.

Ultimate responsibility for information sharing should be placed not on the individual author, but shared among the institution or funding body. Both the institution and funding body should develop open access policies to support their researchers and to maximize their investment in research. One method by which institutions can facilitate knowledge sharing is through the development and promotion of digital libraries. Participation in an open infrastructure will enable better examination of existing and future research integrity models, which will contribute to a multi- and interdisciplinary approach.

Those who may see a risk in sharing local practices and training programs may be resistant to such open infrastructure. However, it is imperative that they share practices to avoid isolated program development and to prevent waste associated with duplicated effort across the nation. Additionally, resistance may come from faculty who have been called to teach and model research ethics. Many scientists and engineers do not see ethics as a primary research interest, and do not consider themselves experts on the matter. A foundational challenge for these individuals is teaching ethics itself, and little consideration is given to sharing their materials and practices. Yet, as workloads increase and resources are stretched thin, such instructors may be motivated by understanding that an initial investment in an open and interdisciplinary infrastructure for research integrity will benefit all science and engineering disciplines. This combined with the potential impact on the next generation of scientists—those who will mature as scientists in an open and interdisciplinary environment—are large incentives.

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Research projects exist which can serve as models for effective knowledge sharing and transfer. Increasingly, researchers are making their work broadly discoverable through institutional websites, repository software, or other digital resource sites. The work is diverse: some researchers are developing general RCR training and education materials, and some researchers are developing discipline-specific or inter- and multi-disciplinary materials. If leveraged, this kind of work will have a large impact on a deepened conception of RCR. A strong example of core RCR work is based at the University of Illinois Urbana-Champaign and led by Michael Loui and C.K. Gunsalus. Loui and Gunsalus created nine *Role-Play Scenarios for Teaching Responsible Conduct of Research* (NSF EEC 0628814). These scenario packets include provide teaching instructions and a discussion guide for role play scenarios between a professor and a student. Importantly, the packets are licensed to be modified with attribution, allowing others to adapt the materials to local needs. Another significant core research ethics project is led by Jorge Ferrer-Negron, William Frey, Efrain O'Neill-Carillo, Didier Valdes, and Carlos Rios-Velazquez of the University of Puerto Rico Mayaguez. This team has developed materials for graduate and faculty workshops in addition to learning modules through *Graduate Education in Research Ethics for Scientists and Engineers*, (NSF SES 0629377). Their materials are also licensed for modification. Many ethics projects set out to engage a multidisciplinary audience, including *Ethics Education for Participatory Urban Sensing* (NSF IIS 0832873), based at the University of California Los Angeles and lead by Deborah Estrin, Mark Hansen, and Jeffrey Burke. One component of this project was the development of an interdisciplinary participatory ethics for urban sensing curriculum for STEM undergraduate and graduates. In addition to curriculum development, best practices gleaned from the project will be disseminated broadly to technology education communities, where they can also be modified by users.

Documentation and stewardship of the emerging cross-disciplinary subfield of RCR are integral to any transformation of the discipline. A possible model for research ethics infrastructure is the University of Massachusetts Libraries partnership with the $16 million Center for Hierarchical Manufacturing (NSF CMMI-0531171) to create a national online resource, InterNano (www.internano.org.) The InterNano project team has worked to build a multidisciplinary community of scientists and engineers whose primary research area is often one other than nanomanufacturing. InterNano information specialists have created a taxonomy and directory of researchers; collected expert reviews and encyclopedia-like entries for topics in nanomanufacturing; gathered press releases, research announcements, citations, calls for papers, images, and events information. Through this organization of knowledge, InterNano has successfully defined a new and undocumented field. A similar approach to knowledge sharing and field documentation could be taken for RCR.

(4) CONCLUSION

A deeper understanding of core research ethics issues is necessary to sustain and enculturate ethics in research and to created an informed and engaged interdisciplinary RCR community. Within the transformation of RCR and research

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ethics, building resources and community across disciplines must be a strong focus. The challenge in this process is to use both the expertise and experience of collection specialists to reach out to the research ethics community for the betterment of science across disciplines and geoboundaries.

REFERENCES

Bulger, R. E., & Heitman, E. (2007). Expanding Responsible Conduct of Research Instruction across the University. *Academic Medicine*, *82*(9), 876-878.

Schienke, E. W., Tuana, N., Brown, D. A., Davis, K. J., Keller, K., Shortle, J. S., Stickler, M., et al. (2009). The Role of the National Science Foundation Broader Impacts Criterion in Enhancing Research Ethics Pedagogy. *Social Epistemology*, *23*(3-4), 317-336.

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