



Research Integrity

A Guide for Research Postgraduate Students
at The University of Hong Kong



A publication of the Graduate School



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Research Integrity:

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Introduction

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The University of Hong Kong

Our modern, globalized, society relies on the translation of research findings into useful new knowledge and products. Therefore, research that is well-designed, well-conducted, and ultimately trustworthy is essential. As Asia's premier university, it is imperative that integrity is integral to all research conducted at The University of Hong Kong. While robust research compliance systems, a well-managed Graduate School, an expert Research Services team, and dedicated academic supervisory staff all exist to facilitate ethical conduct of research by staff and students, additional resources are necessary to ensure that all members of the HKU research family are well versed in research integrity. This booklet is intended to reinforce the notion of research integrity for research postgraduate students.

Our motto—*Sapientia et Virtu*—reminds us all that wisdom is not possible without virtue. The purpose of this booklet is to provide background knowledge about the virtues necessary to attain and produce knowledge vital to the success of individual students, the University, Hong Kong, and our global society.

Preface

“... higher levels of civilization must depend even more heavily on a conscientious respect for the importance of honesty and clarity in reporting the facts, and on a stubborn concern for accuracy in determining what the facts are. The natural and social sciences, as well as the conduct of public affairs, surely cannot prosper except insofar as they carefully maintain this respect and this concern. The same holds for both the practical and the fine arts” (Harry G. Frankfurt, On Truth, p. 16-17).

The Graduate School at The University of Hong Kong (HKU) commissioned this booklet for research postgraduate students and their supervisors. Intended as a tool for use in teaching and learning about research integrity, this text may be useful for others in the HKU research community.

This book is an introductory text, written to provide a general overview of research integrity and related themes as well as offer some practical advice for the good conduct of academic research. This text cannot replace the intensive formal and informal teaching and mentorship that comes from effective supervision of research and/or research collaboration. We hope this work augments these existing relationships.

Ideally, this text will be used as part of an integrated course on research integrity. An explanatory chapter on the concept of research integrity precedes the thematic chapters and the author and reviewers recommend that this chapter be used in conjunction with thematic chapters. Otherwise, the chapters in this text can be read and used in any order, as suits the disciplinary needs of the teachers and learners.

Chapter One

What is Research Integrity?

Summary

Becoming an excellent researcher means more than just learning technical and analytical skills. Excellent researchers are technically and analytically competent as well as sensitive to the ethical, legal, social, and environmental implications of their research. Research postgraduate students should aspire to master the “hard” (technical and analytical) and “soft” (integrity and resource management) skills necessary to become an excellent researcher during their period of postgraduate study.

Intended Learning Outcomes

By the end of this chapter, readers should be able to

- Differentiate the concepts Research Integrity and Responsible Conduct of Research
- Generalize principles of Research Integrity to their discipline
- Describe the application of Responsible Conduct of Research practices in their discipline

Case One

Jane feels overwhelmed. She began her MPhil programme a month ago and she still feels like she does not know what is expected of her. She is the newest student to join the large group of students under the guidance of their famous supervisor. Although she knows how to assist with data collection, perform analyses, and help guide tutorial sections, she is sure she knows very little about what it means to be studying for a research degree. All of the more senior students in the group seem so confident, well poised, and studious. She is afraid that if she tells people how she feels, they will think her silly or uneducated. Jane wonders what they know that she does not know yet and how she can learn all of these things as fast as possible. The post-doctoral fellow in the group is holding a lunchtime talk tomorrow about the soft-skills of research, including research integrity and collaboration. Jane wonders if she should go... soft skills probably will not help her much to become a better researcher, she needs more “hard” skills. She just wants to know what to do and how to do it better! Now!

- Would you recommend that Jane go to the lunchtime talk?
- To whom would you send Jane for more advice?
- Is what Jane is going through just a normal part of research postgraduate study?

“The value and benefits of research are vitally dependent on the integrity of research. While there can be and are national and disciplinary differences in the way research is organized and conducted, there are also principles and professional responsibilities that are fundamental to the integrity of research wherever it is undertaken” (Singapore Statement on Research Integrity, 2010).

Our society is built on trust of one another. The society of academic researchers—whether academic or professional staff, post-doctoral fellows and postgraduate students, undergraduate students and research assistants—all must trust one another’s results in order to facilitate progress in the accumulation of knowledge. To trust one another, we must believe in the integrity of our research partners’ work and the veracity of their results. Integrity in research is so essential that our profession cannot stand without it.

What does it mean to have integrity? We often define integrity by referring to the qualities we believe a person with integrity possesses. Honesty, accountability, fairness, diligence, equity, and professionalism are all traits commonly associated with integrity. While we might say that a person who is honest possesses and expresses the single characteristic of honesty, a person possessing the characteristic of integrity must possess and express multiple traits in an integrated fashion. Having integrity means both possessing and presenting a certain “wholeness” or a complete complement of good values and virtuous practices. Knowing that a person has integrity allows us to trust them. Knowing that a researcher has integrity allows us to trust their research conduct and research results.

Box 1.1: Principles of Research Integrity

Honesty: Respecting the essential value of truth and trustworthiness in research by reporting clearly, fully, and accurately all relevant aspects of one’s research

Accountability: Duty to answer truthfully about the motivations and conduct of one’s activities as well as the duty to accept praise or blame for one’s choices

Fairness: Non-discrimination of others in the research environment, whether on the basis of age, gender, race, ethnicity, sexual orientation, nationality, and/or religion

Diligence: Conducting research tasks—including performance of experiments, literature reviews, research compositions, and research presentations—with attention to detail and accuracy sufficient to permit verification and replication of the work.

Equity: Treating members of the research group as equals according to their roles

Professionalism: Adhering to the standards and practices normative for a “good professional” in the appropriate discipline and as a member of the University. Also, maintaining a spirit of collegiality in professional communication.

The public and the scientific community expect that researchers are, at the least, honest, accountable, courteous to their fellow professionals, fair, and are good stewards of research materials and research funds (Singapore Statement on Research Integrity, Principles). These general norms of good conduct applied to a research setting can be measured by evaluating the actions of a researcher. When examining the actions of our fellow research professionals, we should look for the practical application of Research Integrity principles, known as Responsible Conduct of Research Practices.

Responsible Conduct of Research does not require any special set of skills. It requires a sense of individual responsibility, duty, and plain good judgment to perform research work diligently, accurately, efficiently and honestly, according to the prevailing norms in the field that one works. Individuals who are responsible researchers should be eager to perform their research in an open, transparent way that demonstrates to others the practices of good scholarship.

Box 1.2: Responsible Conduct of Research Practices

- Preventing and, if necessary, Reporting Research Misconduct
- Submitting required Research Compliance documents for conduct of Human Participants Research, Animal Subjects Research, and Research with Biohazardous or Radioactive Materials
- Maintaining a safe laboratory or other research space
- Engaging in good Data Acquisition and Data Management practices
- Ensuring integrity and collegiality in Collaborative Research
- Providing and participating in Mentorship programmes
- Avoiding and, if necessary, disclosing Conflict of Interests or Conflict of Commitments
- Engaging in Ethical Authorship practices
- Conducting oneself ethically in Peer-Review
- Respecting Intellectual Property rights
- Engaging mindfully in Technology Transfer and Knowledge Exchange
- Adopting an attitude of Social Responsibility
- Practicing Environmental Stewardship

Research Integrity is not only an individual matter, though. No researcher learns to conduct research well independent of the help of others. Integrity in research is a community affair that thrives when both individuals and institutions aspire to the principles. Without the patient tutelage of teachers, coaches, and teammates, and plenty of practice and hard work, no one excels at the skill of their craft. Learning to become an excellent researcher requires support from others—mentors, institutional leaders, colleagues—to learn the rules, laws, and policies that are imperative to follow and understand informal norms, guidelines, and habits that should be followed by those that wish to be part of a research team.

This booklet contains information about the concept of Research Integrity and the practices of Responsible Conduct of Research. You will learn more about how the values of Research Integrity are supported by Responsible Conduct of Research practices and how Research Compliance programmes help to ensure that research is conducted responsibly in accordance with international and local norms. You will also learn how Research Misconduct undermines both the faith and trust that the community of researchers place in one another and the trust that the public must have for the research that their tax contributions support and upon which their lives and well-being may depend.

Readers who are curious to learn more about the principles of Research Integrity and/or the practices of Responsible Conduct of Research should consult the “Resources for Further Learning” included here.

Discussion Questions:

- Which of the Research Integrity Principles is most important?
- What other practices would you include as Responsible Conduct of Research?
- Who should be in charge of checking that researchers practice Responsible Conduct of Research?
- How can we tell if a researcher has Integrity?

What is Research Misconduct? What is Questionable Research Practice?

Quick Summary

Some behaviours fundamentally contradict the aims of Research Integrity. The term Research Misconduct identifies four such behaviours that directly undermine the trustworthiness of research. The incidence of these four behaviours is rare. However, some problematic behaviours might also decrease the likelihood that others can trust the veracity of research. Problematic behaviours that complicate the veracity and, thus, trustworthiness of research are defined as Questionable Research Practice (QRP). The incidence of Questionable Research Practices is unknown, but thorough education and training in proper research technique and practices of Responsible Conduct of Research are believed to mitigate the incidence of both QRP and Research Misconduct.

Intended Learning Outcomes

By the end of this chapter, readers should be able to

- Define clearly the term research misconduct
- Differentiate fabrication, falsification, plagiarism and non-compliance and identify how each is an instance of research misconduct
- Distinguish Research Misconduct and Questionable Research Practice
- Extrapolate a definition for Questionable Research Practice in the students chosen discipline

Case Two

Andi is under pressure. Her supervisor asked her to produce a poster presentation on her Ph.D. research for the annual Research Post-Graduate Student Conference. But, her research has not been going well. Her hypothesis that the disease she is studying has a genetic basis that can be seen as a pattern of triplet repeats seems not to be the case. In preliminary work provided by another laboratory, she did see the expected repeats in the expected location. But, in her own repeat analyses, these preliminary results were not confirmed. She is worried that showing null findings in her research at such an early stage might lead her supervisor and others to believe she is not a good researcher, particularly since the partner lab did find results. She firmly believes her hypothesis to be correct and believes she will find evidence soon, but not soon enough to produce the poster. She is contemplating presenting the data and photos of the other lab's analyses as the findings of her own repeat analyses. "The research was done, and I'm sure I'll find the same results, what harm could there be?" she wonders.

- If Andi presents the research this way, has she engaged in research misconduct? QRP?
- What should Andi do?
- What should she tell her supervisor about the poster?

Case Three

Alan and Ali are Ph.D. students whose research involves the use of human subjects for participation in interviews or surveys. Both also work as tutors for a large Common Core Course. One of their tasks as tutors is to issue course related announcements to the students via email and updating the course's Facebook page. They routinely use an email distribution list the course coordinator provided them with for this purpose.

Alan and Ali are considering using the email distribution list for the course to recruit participants for their research. They already have access to email addresses (and more, if they use the new Student Information System access) through their role as tutors, but can they use this data to recruit subjects from a course they tutor? Alan believes they should consult the course coordinator prior to doing this. Ali disagrees and plans to email the students tomorrow morning.

- Should Alan consult the course coordinator?
- What sort of problems may arise from Ali's intended use of this data?
- What sorts of University policies and regulations should both students be concerned about?

To benefit society and the individual researcher, research must be well-designed, conducted responsibly, and, ultimately, verifiable and trustworthy. The majority of researchers will conduct their research in a responsible manner that demonstrates integrity. A very small percentage of researchers, however, will engage in nefarious practices in order to deceive other members of the research community. Individuals or groups who intentionally obfuscate the research record to deceive members of the scientific community or the general public about their research results are said to engage in Research Misconduct. Individuals or groups whose research practices are not intentionally deceptive, but who create research output that cannot be verified, replicated, or that demonstrably wastes resources can be said to have engaged in Questionable Research Practices.

The United States Office of Research Integrity defines Research Misconduct as "fabrication, falsification, or plagiarism in proposing, performing or reviewing research, or in reporting research results" (U.S. Office of Research Integrity 2009). To this definition of Research Misconduct, the University of Hong Kong also adds "unauthorized use of data" and "other practices that seriously deviate" from common practice to the list of intentionally deceptive practices that might constitute research misconduct.

"Other practices that seriously deviate from those that are commonly accepted" include non-compliance with requirements of University Research Compliance committee requirements. Students are reminded that, "In conducting research, a candidate shall not engage in any misconduct which shall include, but not limited to, *fabrication; falsification; plagiarism; infringement of another person's intellectual property rights; misleading ascription of authorship including the listing of authors without their permission, attributing work to others who have not in fact contributed to the research, or the lack of appropriate acknowledgement of work primarily produced by another person; and other practices which seriously deviate from those commonly accepted within the academic community for proposing, conducting or reporting research*" (*emphasis added*; read: The Graduate Handbook, 2010-2011, Appendix XXIV).

Box 2.1: Definitions of Research Misconduct

" **'Misconduct in research' or 'misconduct'** (as appropriate) is taken here to mean fabrication, falsification, plagiarism, unauthorized use of data, or other practices that seriously deviate from those that are commonly accepted within the academic community for proposing, conducting, or reporting research" (HKU Research Services, 2011).

"Fabrication" is creating data or results without conducting research and reporting the data as gathered through accepted research practices.

"Falsification" is manipulating research materials, equipment, processes or altering data in order to misrepresent the research record as something other than what is true.

"Plagiarism" is defined as the unacknowledged use, as one's own, of work of another person, whether or not such work has been published" (Gardner, 2006, 1).

"Unauthorized use of data" is intentional theft of data, ignoring or infringing upon the data ownership rights of other, or using data from human participants research for a purpose to which the original participants did not consent.

"Non-compliance" is intentionally avoiding, deceiving, or attempting to deceive, through commission or omission, research compliance committees such as the Institutional Review Board or Committee for Use of Live Animals in Teaching and Research.

This definition of research misconduct outlines behaviours that are forbidden in a research environment. Misconduct violates clearly the Research Integrity principles of honesty, accountability, diligence, fairness, equity, and professionalism. This definition does not cover other behaviors, widely considered illegal, professionally unacceptable, or poorly-judged practices, such as sabotage, discrimination, harassment, or financial fraud. However, illegal and questionably professional behavior in a research environment is likely to also correlate with poor research practice.

As members of the Hong Kong community, researchers are expected to conform to the laws and ordinances of Hong Kong, as they pertain to the conduct of research and university life. For example, individuals handling identifiable persona data in their research or in the context of their employment at HKU must abide by the provisions of the Personal Data Protections Ordinance (Chapter 468). Researchers who work with live animals must follow the stipulations of the Animals (Control of Experiments) Ordinance (Chapter 340). Likewise, students and staff who work with radioactive materials must abide by the stipulations of the Radiation Ordinance (Chapter 303). And, all members of the research community are obligated to ensure that their professional conduct does not breach requirements in the Race Discrimination Ordinance (Chapter 602) or Sex Discrimination Ordinance (Chapter 480). Failure to abide by laws and ordinances of Hong Kong may not constitute Research Misconduct, but any illegal behaviors undertaken while engaging in research related work is still illegal and is likely to constitute Questionable Research Practice.

Box 2.2: Hong Kong Ordinances Pertinent to the Research Environment

- Animals (Control of Experiments) Ordinance (Chapter 340)
- Radiation Ordinance (Chapter 303)
- Personal Data Protection Ordinance (Chapter 468)
- Chinese Medicine Ordinance (Chapter 549)
- Human Reproductive Technology (Licensing) Regulation (Chapter 561A)
- Copyright Ordinance (Chapter 528)
- Race Discrimination Ordinance (Chapter 602)
- Sex Discrimination Ordinance (Chapter 480)

Questionable Research Practices are more difficult to define than Research Misconduct or illegal behaviour in a research context. The United States National Academies of Science define Questionable Research Practices as "...actions that violate traditional values of the research enterprise and that may be detrimental to the research process" (NAS 1992). Steneck identifies misrepresentation, inaccuracy and bias as three examples of Questionable Research Practices. Misrepresentation of one's own accomplishments or research results; failing to check errors of analysis, citation and quotation, or description; and/or allowing personal preferences or prejudices to influence the conduct or reporting of research may all sully the research record. However, these practices are unlikely to "directly damage the integrity of the research process" (Steneck 2006, 59-61).

Differentiating Research Misconduct from Questionable Research Practices requires establishing, through the conduct of an investigation, whether there is a "preponderance of the evidence" to suggest that those who engage in Research Misconduct intended to deceive others about their research results—to lie, whether by willful commission or omission. Differentiating Research Misconduct from Questionable Research Practices may depend on the facts of the situation. Shamoo and Resnik (2009, 149-150) offer the following examples to illustrate the blurry line between Questionable Research Practice and Research Misconduct:

- Enhancing digital images... This could be fabrication or falsification, depending on the facts of the situation.
- Excluding data from an article or presentation without a good statistical, technical, or methodological reason
- Performing a statistical analysis in a deliberately dishonest way. This could be fabrication or falsification, again, depending on the facts.
- Not giving credit to someone who has assisted with a research project by providing ideas, helping to collect data, or developing processes or techniques. While this might seem to be an authorship matter, it could fit the definition of plagiarism, depending on the facts of the situation.

What might induce a researcher or research team to engage in Research Misconduct?

Factors such as pursuit of fame and prestige, desire for promotion, pressures to perform, poor training, conflict of interest, research collaboration complexity, and inadequate supervision, are all believed to contribute to the incidence of Research Misconduct and Questionable Research Practices (Shamoo and Resnik 2009, 152). Fortunately, many of these factors can be mitigated through concerted efforts on the part of individuals, groups, and research institutions.

This booklet and the compulsory course on Research Integrity for research post-graduate students provides a first defense against Misconduct—that is, through education. A well-known Research Misconduct Policy may also dissuade those considering engaging in fabrication, falsification, plagiarism or non-compliance. The Research Misconduct policy for the University of Hong Kong is available via the Research Services Website.

At HKU, Research Misconduct and Questionable Research Practices are addressed through the following mechanisms. A student or staff member is permitted to lodge a complaint, in writing, to the Registrar, within one month's time of the incident or evidence of the incident coming to the attention of the complainant. The Registrar will inform the Vice-Chancellor of the complaint and the Vice-Chancellor will determine whether a charge is to be brought against the student to the Disciplinary Committee. The Disciplinary Committee will investigate and determine whether any offence has been caused and may levee any of the penalties listed against the student—reprimand, fine, withdrawal of academic privileges, suspension, or expulsion from the university (Graduate School Handbook 2010-2011, Appendix XXVII).



Discussion Questions:

- Should Research Misconduct be illegal as well as unethical?
- Are there other practices that should be included as Research Misconduct?
- Who should be in charge of monitoring research outputs for signs of Research Misconduct?
- Other than education, how might University of Hong Kong prevent Research Misconduct among staff and students?

What is Research Compliance?

Conducting Research with Human Participants

Summary

Research resources include material and human resources. The use of some research resources must be vetted through peer-review mechanisms, such as research compliance committees. Research conducted with living human beings, communities, or identifiable personal data must be reviewed by appropriate supervisory committees. At HKU, there are two research compliance committees for human participants research — the Institutional Review Board of HKU and Hospital Authority--West Cluster, and the Human Research Ethics Committee for Non-Clinical Faculties.

Intended Learning Outcomes

By the end of this chapter, readers should be able to

- Describe the relationship between the concepts Research Integrity, Research Misconduct, Questionable Research Practices, and Research Compliance
- Define Research Risk and Minimal Risk
- Recognize components of a definition of human participants research
- Recognize components of a definition of a data subject
- Summarize the eight principles for the conduct of human participants research
- Discuss the importance of informed consent to human participants research
- Explain clearly the distinction between the Institutional Review Board and the Human Research Ethics Committee for Non-Clinical Faculties
- Identify practices for Good Clinical Practices for clinical research

Case Four

Liu is confused and scared. This morning his supervisor called him into her office and gave him a stern talking-to. Apparently, he did need to fill out the human participants for research form. His supervisor has said some very frightening things to him—perhaps he may not be allowed to continue his study, perhaps he may not be able to use the data he has already collected, and that he may be subject to disciplinary action by the university! All he wanted to do is to speak with local teachers about their science education backgrounds and video-record their demonstration of a basic science experiment for their classrooms. When he was a secondary school teacher, a number of researchers came to his classroom and he did not recall any of them giving him a consent form or indicating that any university body had approved their research. Why did he need to do this now if others could have researched him in the past without going through such a cumbersome process? Why is this so important that it could jeopardize his academic standing?

- How would you explain human participants in research review processes to Liu?
- Has Liu done anything wrong?
- What ought Liu to do now?

Research Integrity principles frame the good practices for Responsible Conduct of Research. Demonstrable conduct according to the practices of Responsible Conduct of Research assures others in the community that we conduct our research well, avoiding the pitfalls of Questionable Research Practices and Research Misconduct. One of the components of Responsible Conduct of Research is Research Compliance or abiding by legal and institutional requirements to have some forms of research prospectively vetted by a peer-review committee charged with reducing risk associated with the conduct of certain projects.

Research Compliance committees may have many discrete functions, but their primary purpose is to ensure that data is collected ethically and that the risk of harms associated with the conduct of research is minimized. Research Risk is the product of the probability and magnitude of harms that could come to direct or indirect participants in research. Research compliance committees concern themselves with the reduction of risk to direct and indirect participants in research. Direct participants in research include human participants in research and researchers themselves. Indirect participants in research include the family of participants, the community with whom research is conducted, and the university under whose name the research is conducted. Harm from research may include physical harms from intervention or interaction with research materials or processes, psychological or social harms from participation in research or from breach of confidentiality of data, or even economic harm from the release of toxic or noxious agents that interrupt lives and livelihoods.

Research Compliance committees oversee many types of research, but conduct of research with human participants is of particular concern to universities and the general community. Due to the wide variety of human participants research that takes place at HKU, the University elects to have two types of human participants research compliance review committees. The Institutional Review Board of HKU/ Hospital Authority Hong Kong—West Cluster reviews research projects that involve a Principal Investigator from the Faculty of Medicine or Dentistry or Hospital Authority patients. The Human Research Ethics Committee for Non-Clinical Faculties reviews research projects that involve a Principal Investigator from all other faculties at HKU. The goals of human participants research compliance committees is to ensure the ethical collection of data using informed consent, to see to it that consent is properly documented and that there is peer review and approval of data collection processes before data collection is begun.

Human participants research comes in many forms. Researchers from fields as diverse as biomechanical engineering to early childhood education may conduct research with human participants. Human participants research, also known as human subjects research, is defined as "... a systematic investigation, including research development, testing, and evaluation, designed to develop or contribute to generalizable knowledge" that involves one or more "living individual(s) about whom an investigator (whether professional or student) conducting research obtains (1) data through intervention or interaction with the individual, or (2) identifiable private information" ('The Common Rule', 45CFR46.102(d),(f).)

In recent history, egregious abuses of individuals in the name of research have occurred around the world. Abuses of prisoners in concentration camps and prisoner of war camps during World War II are but one example. Such abuses prompted the international community of medical professionals, along with national governments and other professional and academic organizations, to formulate principles and codes of practice for the ethical conduct of research with human participants. Major codes, which all human participants researchers should be familiar with, include the Declaration of Helsinki (2004), Nuremberg Code (1949), Belmont Report (1979), the Council for International Organizations of Medical Sciences Guidelines (2003), and the International Council on Harmonisation, Good Clinical Practice Guidelines (1996).

Protecting human participants in research is an important part of the culture of academic research. The codes listed above and the select principles for conduct of research with human participants listed below should be part of the vocabulary of all university students and faculty.

Box 3.1: Principles for Conduct of Research with Human Participants

Scientific Validity: Research protocols should be scientifically well designed; experiments should yield results that are replicable and statistically significant. Researchers should strive to eliminate biases and should disclose and/or avoid COIs [Conflict of Interests]. Research personnel should have the appropriate scientific or medical qualifications. Research institutions should have the appropriate resources, procedures and safeguards.

Social Value: Researchers should conduct experiments that have scientific, medical or social worth; they should not use human beings in frivolous or wasteful research.

Informed Consent: Subjects should make an informed choice to participate in research. When subjects lack the capacity to make such decisions, researcher should obtain informed consent from a legally authorized representative. Subjects should be able to withdraw from a study at any time for any reason.

Respect for Persons: Researchers should respect the privacy, dignity, and rights of research subjects.

Beneficence: Researchers should use various strategies and techniques to minimize harm to research subjects and maximize benefits to subjects and society. The risks of research should be commensurate with the expected benefits. Researchers should not conduct experiments that have a high probability of causing death, nor should they harm subjects in order to benefit society. Researchers should be prepared to end experiments in order to protect subjects from harm. Researchers should monitor data to protect subjects from harm.

Equitable Subject Selection: Researchers should promote a fair and equitable distribution of benefits and harms in research. Subjects should not be excluded from participation in research without a sound moral, legal, or scientific justification.

Protection for Vulnerable Subjects: Researchers should use appropriate safeguards to protect vulnerable subjects from harm or exploitation.

Independent Review: An independent committee should review the scientific and ethical aspects of the research.

(Adapted from Shamoo and Resnik 2009, 251-252)

Obtaining informed consent from participants is a cornerstone of ethical use of human participants in research. Informed consent processes require that subjects receive all necessary information about the proposed research project so that they can comfortably volunteer their consent to participate. Informed consent is a process by which researchers provide potential participants with information, including potential risks and benefits to the participants' physical, psychological or social state, in a clear, direct, and respectful manner that allows the participant to consider their participation in the project. In many cases, written documentation of participants informed consent—an individual's signature on an informed consent form—is preferred. However, written documentation of informed consent may not always be a culturally appropriate or practicable method for obtaining consent. Instead, audio, video, or electronic signature records of consent may be obtained from participants. Irrespective of the type of informed consent process that the researcher wishes to implement, informed consent documentation must be reviewed and approved by the appropriate human participants research compliance committee.

Research that uses human participants frequently produces data that includes private information about the participants. In Hong Kong, researchers who engage in human participants research need to be aware of their obligations to protect the privacy of information for their participants, which are defined under the Personal Data Protections Ordinance (PDPO). Human participants in research are also "data subjects" whose "personal data" or other "data" might include a "personal identifier" that will be used in research. A " 'data subject' ... means the individual who is the subject of the data". " 'Data' means any representation of information (including an expression of opinion) in any document, and includes a personal identifier". A " 'personal identifier' means any data- (a) relating directly or indirectly to a living individual; (b) from which it is practicable for the identity of the individual to be directly or indirectly ascertained; and (c) in a form in which access to or processing of the data are practicable" (Privacy Commission for Personal Data 2001, Part I, section 2). Researchers should be aware whether the data they collect is likely to directly or indirectly identify the participants in their projects.

While both compliance committees at HKU expect that researchers abide by the highest ethical principles in the conduct of their research, those who engage in research in a clinical setting—and, thus submit their work to the Institutional Review Board—should be aware that the International Council for Harmonisation- Good Clinical Practice Guidelines also guide the ethical conduct of their research.

Box 3.2: Principles of Good Clinical Practice

- The ethical principles of the Declaration of Helsinki, Good Clinical Practice guidelines and local regulations should guide conduct of clinical trials
 - A risk-benefit analysis should be conducted prior to initiating a trial and the expected benefits outweigh the expected risks
 - “The rights, safety, and well-being of the trial subjects are the most important considerations and should prevail over the interests of science and society” (2.3).
 - All trials must be supported by prior scientific evidence
 - A clear, sound, and detailed protocol must be written and followed for all trials Trial protocols must be approved by the relevant institutional ethics review body
 - Appropriately trained and qualified personnel should administer necessary medical/dental care to research participants
 - All individuals involved in a trial should be adequately educated, trained, qualified, and experienced to perform their appointed tasks
 - “Freely given informed consent should be obtained from every subject prior to clinical trial participation” (2.9).
 - All data associated with the trial should be recorded, manipulated and retained in a way that allows others to validate its accuracy
 - Confidentiality of information from research subjects should be protected as required by local regulations
 - All investigational products or devices should be produced or used in compliance with the protocol and Good Manufacturing Practices
 - Quality review, possibly including a Data Safety Monitoring Board, should be implemented for all trials
- (Adapted from the ICH Harmonised Tripartite Guideline, Guideline for Good Clinical Practice, E6 (R1))

Research postgraduate students should be mindful that their interaction with human participants in research is a privilege that comes with significant obligations. Students should know the codes and principles for conduct with human participants in research that prevail in general academic research and in their disciplines, should liaise with their supervisors prior to developing or implementing any human participants research, and should seek approval from the appropriate human participants research compliance committee prior to conducting their research. If students have questions or concerns about the conduct of research with human participants, they should seek advice from their supervisors, experienced human participants researchers, and the chairpersons of the relevant research compliance committee.

Discussion Questions:

- Why should human participants research be reviewed before the research plan is implemented?
- Who is a human participant in research?
- What are the researcher’s obligations to participants?

What is Research Compliance? Animal Care and Use in Teaching and Research

Summary

Use of live animals in teaching and research obligates researchers to accept responsibility for the care of the animals and requires researchers to be attentive to relevant territorial law and HKU policies. Use of live animals in teaching and research should be guided by sound research design and adherence to the “Four R’s”: Respect, Reduce, Refine, and Replace. Animals must be housed, used, and treated according to the highest standards of animal care and veterinary practice. Use of animals must be scientifically justified with minimal numbers used for each project. Welfare of the animals must always be considered. Procedures inducing pain or distress must be minimized to the lowest possible level that allows for production of valid results and must be carried out using anaesthesia and analgesia appropriate to the species and the respective procedure.

Intended Learning Outcomes

By the end of this chapter, readers should be able to

- Enumerate the obligations of animal care and use according to the “Animals (Control of Experiments) Ordinance” (Hong Kong Capitation Ordinance 340)
- Explain the obligations of researchers under the “Code of Practice for Care and Use of Animals for Experimental Purposes” of the Hong Kong Agriculture, Fisheries and Conservation Department
- Apply the “Four R’s” principles to the design of animal research
- Define the concept of Research Risk and apply it to animal use
- Describe the concepts “conscientious objector” and “humane end-point” in his or her own words.

Case Five

Brendan is excited to start his Ph.D. research as soon as possible. His research focuses on the use of animal therapy for treatment of social anxiety amongst primary school age children with Asperger’s syndrome. For his research, he will bring children to the animal interaction laboratory for structured play with small dogs. His research was granted approval by the appropriate human participants in research committee, but he is frustrated with the animal ethics committee. The committee has had his protocol for six weeks, and in his second round of protocol revisions, has expressed concerns that the animal interaction laboratory is an inappropriate facility for housing dogs, and has recommended that he use fewer animals. Brendan has recruited a first round of human participants who are supposed to come to the animal interaction laboratory starting tomorrow. He already has approval to use human participants and it is unlikely that any animals will be harmed through play with the children. He is contemplating beginning his research without the committee’s approval.

- Whom should Brendan speak to before beginning his research?
- Would Brendan be doing anything wrong by beginning his research without approval?
- Would Brendan be violating any of the 4 R’s if he began his research tomorrow?

Case Six

(adapted from the book “Scientific Integrity: An Introduction Text with Cases” by Francis L. Macrina [2000])

A graduate student is working on his MPhil project involving adult rats which has already got the approval from CULATR. The project involves oral feeding of a herbal extract by gavage needle. His supervisor one day asks for a meeting to discuss the progress of his project. The supervisor suggests a new series of experiments (testing a new technique) which will hopefully clear up a problem he has encountered. The new experiments will involve surgical operations on both hind-limbs (i.e. creation of a bone defect in the femur followed by filling up the defect area with a herbal extract). The student goes through the CULATR-approved protocol and realizes that no surgeries are required. The student asks the supervisor about submitting an amendment application to CULATR before starting the new experiments. The supervisor says he does not wish to go through the trouble if the new technique is not going to be useful. He suggests the student to try a few experiments first and, if the procedure looks like it is going to work, he can submit an amended protocol at that time.

- What would you do if you were the graduate student?
- What would you do if you were the Technician-in-charge of the animal facility (where the new surgical experiments were performed without CULATR approval) and one day you found one cage holding a rat under the said project with surgical wound on both hind-limbs and signs of mild paralysis?
- What would you do if you were the CULATR member who discovered this non-compliance during a bi-annual site inspection (e.g. you came across an animal with surgical wound on both hind-limbs and mild signs of paralysis)?

“People who use animals for experimental purposes have an obligation to treat them with respect and consider their welfare as an essential factor when planning and conducting projects” (Agriculture, Fisheries and Conservation Department 2004, 2.4). Unlike human beings, who have the opportunity to consent to participate in research, live animals, whether vertebrate or invertebrate, are involuntary participants in research. A “Harm-Benefit Analysis” must be carried out to ensure that the “Expected Harm” done to animals will be as low as possible and greatly outweighed by the “Anticipated Benefits” of their use. Given the non-voluntary nature of animal use in research, extra care must be taken to ensure that the animal subjects of research are cared for at the highest level throughout the duration of the project.

Researchers who use animals have obligations that stem from moral concern for use of animals as well as legal principles governing adjudication of animal cruelty prevention, regulation of threatened species and biodiversity, and ordinances governing the housing, daily care, and transport of live animals. As with human participants research, animal research is governed by international and national regulations, such as the Council for International Organizations of Medical Sciences—International Guiding Principles for Biomedical Research Involving Animals. Unlike human participants research, animal research facilities, including animal care facilities, are eligible for accreditation by international bodies, such as the AAALAC (Association for Assessment and Accreditation of Laboratory Animal Care International). In Hong Kong, the Agriculture, Fisheries, and Conservation Department has established a “Code of Practice for Care and Use of Animals for Experimental Purposes” that outlines principles and acceptable practices for use of live vertebrate animals. Licensure requirements spelled out in the Animals (Control of Experiments) Ordinance (Chapter 340) suggest that this Code be adhered to when conducting animal experiments. This code and the regulations included in the Animal (Control of Experiments) Ordinance are reinforced through HKU policies, and review of animal use projects by the Committee on the Use of Live Animals in Teaching and Research (CULATR).

The AFCD Code of Practice establishes three general principles for the use of animals in justifiable experiments. A justifiable experiment will advance new knowledge of physiology, life saving or prolonging techniques, or alleviation of suffering in humans or animals, and/or will replicate for confirmation the knowledge gained in previous studies conducted for one of these purposes. Justifiable experiments will abide by the Three R’s (Reduce, Refine, Replace) introduced by Russell and Burch (1959) and researchers ensure that Respect for the lives of animals is consistently maintained throughout the experiment, particularly when an animal’s life must be taken as part of an experimental procedure.

Box 4.1: Four R's of Ethical Use of Animals in Research

Replacement: Animals should only be used when other methods are not scientifically suitable for testing the relevant hypotheses. The term includes absolute replacements (i.e. replacing animals with inanimate systems such as computer programmes) as well as relative replacements (i.e. replacing animals such as vertebrates with animals that are lower on the phylogenetic scale).

Reduction: The total number of animals used should be kept to the minimum that is necessary to secure valid results. It involves strategies for obtaining comparable levels of information from the use of fewer animals or for maximising the information obtained from a given number of animals (without increasing pain or distress) so that in the long run fewer animals are needed to acquire the same scientific information.

Refinement: It refers to modifications of experimental procedures or husbandry methods to enhance animal well-being and minimise or eliminate pain and distress. The optimum level of techniques for intervention, interaction, or care should be used at all times.

Respect: The welfare of animals must be kept foremost in the minds of researchers using animals, from the point of acquisition up to the point of euthanasia and disposal.

In implementing the “4Rs” principles for ethical animal use, researchers are obligated to submit their animal use protocols to the Committee on the Use of Live Animals in Teaching and Research (CULATR), which is given the authority to make the decision whether an experiment is justifiable and will be conducted according to ethical norms. The CULATR ensures that Research Risks (i.e., Expected Harms done to the animals) will be balanced by the expected benefits of the research, whether to humans or to animals. Since it is expected that some harm will come to the animals through the conduct of the research, the CULATR must ensure that experimental procedures minimize harms to the lowest possible levels. Review of protocols by CULATR also checks that those that use animals have appropriate Cap. 340 licenses, endorsements, and permits secured from the Department of Health.

Box 4.2: Procedural Guidelines for Use of Animals in Experiments

- Principle Investigators (PIs) must seek prior approval from the CULATR for any experimental procedures or changes to on-going experiments. If animal experiments also involve infectious or toxic agents, radiation, recombinant DNA, or human-animal interaction studies, approval must also be sought from appropriate authorities like the Safety Office and University Health Service.
- Accurate and complete records of all animals acquired and used must be kept throughout the duration of the project and required annual reports on animal use must be submitted according to the Department of Health (i.e., Animals [Control of Experiments] Ordinance) and the CULATR requirements.
- Proper surgical records must be maintained for all procedures.
- All experiments must be conducted in a way that minimizes to the lowest possible level any pain, discomfort, or stress to the animals. If induction of pain, discomfort or stress is an inevitable part of the experiment, appropriate analgesia or anaesthesia should be administered. If unnecessary suffering or pain of animals becomes apparent, the PI must terminate the study. Post-operative care should be administered as necessary to maximize the animal's continued welfare.
- The health and welfare of the animals must be monitored daily. Professional veterinary opinion should be sought if questions about an animal's health or well-being arise.
- Humane end-points should be established and animals should be monitored closely to ensure that no additional suffering is brought before the point of inevitable death. If animals must be euthanized, they shall be euthanized in the most humane manner using appropriate sterile and pain-mitigating techniques.

(Adapted from the “Guidelines for the Use of Experimental Animals”, The University of Hong Kong Committee on the Use of Live Animals in Teaching & Research: <http://www0.hku.hk/facmed/images/document/04research/culatr/culatr.pdf>)

The Experimental Endpoint of an animal study occurs when the scientific aims and objectives have been reached. In some cases, animal experimentation may require the post-experimentation euthanasia of animals when the human endpoint is reached. The Humane Endpoint is the point at which pain or distress in an experimental animal is prevented, terminated or relieved. The use of humane endpoints contributes to refinement by providing an alternative to experimental endpoints that result in unrelieved or severe animal pain and distress, including death. Euthanasia is the act of humanely killing animals by methods that induce rapid unconsciousness and death without pain and distress. In evaluating the appropriateness of methods, the criteria that should be considered include: ability to induce loss of consciousness and death with no or only momentary pain, distress, or anxiety; reliability; irreversibility; time required to induce unconsciousness; appropriateness for the species and age of the animal; compatibility with research objectives; and the safety of and emotional effect on personnel. Techniques and agents for euthanasia of animals must be approved beforehand by the CULATR as part of the experimental protocol. In the event that euthanasia is prescribed, it should be done humanely at the earliest verifiable end-point. The International Council for Laboratory Animal Science "International Harmonization of Animal Care and Use" establishes indicators for humane endpoints and euthanasia.

When live animal experimentation may be used as part of a course, it is understood that some students may object to participation in projects requiring intervention or interaction with laboratory animals for personal moral reasons. HKU has a "Conscientious Objection Policy" which must be respected. Conscientious objectors to animal use in teaching in research should not be penalized for their views on the morality of animal use. Research postgraduate students serving as tutors in courses requiring animal use should be aware that students may object and should work actively with the course instructor or coordinator to ensure that suitable alternatives are developed for objecting students.

Discussion Questions:

- What does it mean to respect animals?
- Given that animals cannot consent to participate, is it ethical to use animals in research?
- Is it ethical to euthanize animals as a normal part of research procedure?
- What could we use to replace animal use in research?

What are Data Integrity and Management?

Summary

Our data are the chief product of our research efforts. Without quality data, proposals, publications, and other academic outputs will cease. To create quality data, whether quantitative or qualitative, we must employ both our ingenuity and principles of ethical data acquisition and management. Broadly, these principles are the *data integrity principle*, *data access and sharing principle*, and *data stewardship principle*.

Intended Learning Outcomes

By the end of this chapter, readers should be able to

- Relate concepts of Research Misconduct and Questionable Research Practices to principles and practices of ethical data acquisition and data management
- Define and differentiate concepts of “data stewardship”, “data integrity”, “data access”, “data sharing”, “data protection”, “privacy”, “confidentiality”, “data sharing”, “data ownership”, and “personal data”
- Understand what constitutes illicit manipulation of data and images
- Explain how ethical data acquisition and management relate to the publications process and patenting process

Case Seven

A few months ago, Dr. Xu proudly recommended his star student, Qian, to a post-doctoral programme at a prestigious overseas university. Since Qian left, Dr. Xu’s new post-doctoral fellow, Joh, has been working hard to catch up on Qian’s research in order to move forward with tests of a new, exciting, hypothesis, based partly on Qian’s previous work. Joh, however, is having great difficulties. Qian claimed that she left the laboratory notebooks in the filing cabinets, but an extensive search has turned up no notebooks. To add to his frustrations, Joh has been working with the Computer Centre to “unlock” the soft copies of Qian’s data and some of her earlier write-ups, which are stored on the main hard-drive for the research group. This morning, Joh received “unlocked” files from the Computer Centre, but his quick scan of the data and related documentation show some unusual patterns, large holes, and some of the documentation Qian claimed was there seems not to exist at all. Joh wonders how Qian could have produced her results with the data that is available. Qian is no longer answering emails and phone calls as she claims she is exceptionally busy with her new duties. Dr. Xu asked Joh to give him a progress report on his efforts during the research groups’ weekly lunch meeting, which will be today. Joh has only his frustrations and some incomplete data to show Dr. Xu and the others. What should Joh do?

- Should Joh tell Dr. Xu his concerns?
- What should Joh report to the research group?
- Should Joh attempt to contact Qian again?

Case Eight

Anton and Qi are working hard on their Primary Investigator's General Research Fund (GRF) project, which involves building a comprehensive dataset from three existing data sets and the PI's newly gathered data. To perform their duties, the two students must integrate the four datasets as well as create some new variables. The students divided the workload so that Anton works on checking the existing data for errors and building the documentation for the comprehensive dataset, and Qi works on creating the required new variables per the PI's instructions. This morning, the PI asked the two students to provide him a preliminary copy of the data and the codebook for distribution to a co-I. Anton asked Qi to bring all of his notes on the data work he performed. Qi came to their meeting empty handed, suggesting that it was Anton's job to build documentation based on what he thinks the PI wants, not what Qi has done. Anton is upset that Qi has no documentation of his work thus far. Qi is upset that Anton expected him to keep independent records when the documentation is his job. The two realize they will not be able to meet their PI's request.

- What should Qi and Anton do now?
- What principles of data integrity have the two students failed to meet?
- What data management techniques might help the two students avoid this problem in the future?

Accurate and defensible results are crucial to the advancement of the sciences and arts. Trustworthy results depend upon the data upon which the interpretation, analysis, and reporting rest. The central importance of data indicates that proper management of the data, whether in the acquisition, cleaning, analysis, interpretation, reporting, or even sharing stages of research, may be the most important element for ensuring the integrity of research.

"Data" is a term used in many ways in a comprehensive research intensive university, such as HKU. Given that all disciplines, from geophysics to social anthropology, use data of some form or another, it can be difficult to offer a single definition of data. In general, data are the symbols, numbers, texts, photos, videos or other pieces of information that we use to produce our research results.

Box 5.1: Four Definitions of Research Data

- "Information used in scientific, engineering, and medical research as inputs to generate research conclusions".
- "Data are facts, numbers, letters, and symbols that describe an object, idea, condition, situation, or other factors".
- "A reinterpretable representation of information in a formalized manner suitable for communication, interpretation, or processing. Examples of data include a sequence of bits, a table of numbers, the characters on a page, the recording of sounds made by a person speaking, or a moon rock specimen" .
- "Any information that can be stored in a digital form, including text, numbers, images, video or movies, audio, software, algorithms, equations, animations, models, simulations, etc. Such data may be generated by various means including observation, computation, or experiment".

(Adapted from Committee on Science, Engineering and Public Policy & Committee on Ensuring the Utility and Integrity of Research Data in a Digital Age 2009, 22-23)

Research data come in many forms and many sizes, from a single byte to petabytes. Irrespective of the form or size of a dataset, our data are valuable only to the extent that we can have reasonable confidence that they are complete, accurate, verified, described in sufficient detail, replicable, and gathered according to accepted professional standards (Committee on Science, Engineering, and Public Policy & Committee on Ensuring the Utility and Integrity of Research Data in a Digital Age 2009, 26). To the extent that our data have each of these qualities, we can say that our data have integrity. Data integrity means that we, as researchers, take responsibility for ensuring that our data are whole and unbiased, complete and accurate, sufficiently described and suitably verified, acquired and available for replication according to the accepted practices of our disciplines.

Data integrity is central to the reliability and trustworthiness of research results. Data that lacks integrity invites negative evaluation of the researcher(s) and research. If our data cannot be verified or replicated, we open ourselves to challenges to our research practices or even accusations that we engaged in Research Misconduct. Many of the problems described as Questionable Research Practices—such as sloppy conduct of experiments or other data gathering techniques, inadequate documentation of data gathering processes or procedures, or inaccurate presentation of analyses—relate to improper management of data. Improper data management can also constitute fabrication and/or falsification of research data, two of the four egregious violations of professional practice identified as Research Misconduct. To prevent allegations of Research Misconduct or Questionable Research Practices, researchers should adopt good data management practices. Yet, researchers with integrity aspire to more than mere avoidance of allegations. Ideally, all members of the research community will aspire to principles of data integrity, data access and sharing, and data stewardship.

The three principles of data integrity, like Research Integrity, recommend various good practices for the conduct of research. These practices govern the acquisition, processing and transformation, analysis, reporting, securing, and sharing of research data.

Box 5.2: Data Integrity Principles

Data Integrity Principle: Ensuring the integrity of research data is essential for advancing scientific, engineering, and medical knowledge and for maintaining public trust in the research enterprise. Although other stakeholders in the research enterprise have important roles to play, researchers themselves are ultimately responsible for ensuring the integrity of research data.

Data Access and Sharing Principle: Research data, methods, and other information integral to publicly reported results should be publicly accessible.

Data Stewardship Principle: Research data should be retained to serve future uses. Data that may have long-term value should be documented, referenced, and indexed so that others can find and use them accurately and appropriately.

(Committee on Science, Engineering, and Public Policy & Committee on Ensuring the Utility and Integrity of Research Data in a Digital Age 2009, 120)

Good Practices for Data Acquisition:

Quality data begin with a sound research design. Good research designs include clear objectives and hypotheses that are grounded thoroughly in the relevant literature. These objectives should be met using methods that are well known to the researcher and well documented throughout the data gathering process. Throughout the conduct of experiments, fieldwork, interviews, surveys, or action research, accurate and complete “laboratory notebooks” should be maintained as a repository of raw data and related records (Shamoo and Resnik 2009, 40-44).

Acquisition of good data requires attention to detail. Fieldwork, experiments, interviews, and other observations should be well planned from the start. Contingency plans should be discussed as part of the research development process. Procedures for checking the data and verifying the accuracy of any calculations should be established before the research commences.

Good Practices for Data Processing and Transformation:

All transformations to a data set should be performed on a secondary copy of the data, not the original. Original files should be maintained in unaltered format. When using data provided by others, transformations should be performed only within the boundaries of previously arranged use agreements. All techniques used to “clean the data” or “reduce noise” should be documented step-by-step, including the software type and edition used to do so. Any transformations made to a variable should be documented in an updated codebook. Processing and transformation of data sets is not complete until appropriate metadata², such as codebooks, are also composed.

Good Practices for Data Analyses:

All techniques used in the analysis of research data should be clearly and completely reported to the reader. Methods used for analysis should be selected according to sound judgments of their appropriateness based in the literature appropriate to the discipline. When researchers are unsure of appropriate methods for analysis, they should seek consultation with statisticians or other relevant experts.

Good Practices for Data Reporting:

Research is not complete until it is publicized. Our data must be reported to the research community. Data should be reported in such a way that the sequence of discovery is accurately revealed and the findings of data analyses are revealed without bias, inflation, or omission of results.

One way that data might be reported to the community is through use of images. Representation of research data in images does not mean that researchers have any fewer obligations to ensure accurate reporting. For example, if images are enhanced to promote ease of understanding for readers (e.g., brightness/ contrast adjustments), these should be revealed. Otherwise, manipulation of image-based representations of data without indicating what manipulations were used may constitute falsification of data.

Good Practices for Data Security and Storage:

Research data are a valuable resource that should be stored in a secure fashion for use in future research projects. Data should be protected from theft or loss, whether intentional or unintentional. Any hard copies of data ought to be backed up with soft copies and all soft copies should be backed up regularly and stored on a secondary media. Any relevant samples, necessary materials for analysis, original notebooks, photos, videos or other recordings should be stored in a way that prevents degradation over time. For example, the UK Data Archive recommends the following best practices: “storing data in non-proprietary or open standard formats”, checking the integrity of and migrating data to new media at regular intervals, using two forms of data storage, creating “digital versions of paper documentation”, developing a clear filing system for stored data, and placing data storage material in a physically secure location (Van den Eynden et al, 2011, 18).

Data security requires attention to physical security, network security, and security of computer systems and files. Particularly when personal data is to be stored, even for short-term use, a higher standard of data security should be applied. Simple security measures, such as facility security (e.g., locked doors), password protection, and encryption should be used for all research data (Van den Eynden et al, 2011, 19-20).

Good Practices for Data Sharing:

The research community relies on cooperation amongst its members. One way that researchers cooperate is by sharing data. Many research grant organizations require that researchers archive their data with the organization. Some journals require that original data be made available to reviewers for analysis within the process of peer review. HKU is currently developing standards and practices for data sharing and archiving within the university. In the case of publicly funded research projects, data may be subject to freedom of information requests. Researchers should prepare and store their data with the prospect of data sharing in mind.

² Metadata “summarize data content, context, structure, interrelationships, and provenance (information on history and origins). They add relevance and purpose to data, and enable the identification of similar data in different data collections” (Committee on Science, Engineering, and Public Policy & Committee on Ensuring the Utility and Integrity of Research Data in a Digital Age 2009, 24).

Before any data can be shared, the ownership of the data and the rules governing its dissemination should be clarified. Data owners may include the university, grant, or contract funding organizations, the PI, the research team, or the individual researcher. The permission of the owner of the data must be obtained before data are shared with third parties. In cases of contract research, data use, including for academic publication, should be established prior to the conduct of research. Ownership of the data may take the form of physical ownership of data storage media and copyright of the data itself or software necessary to create or analyze the data. Before sharing any data with other researchers, those whose work involves data from identifiable human participants should ensure that data sharing conforms to what subjects are informed of in informed consent procedures, or that permission is sought to share the data, or that all potential identifiers are stripped irretrievably from the data. If in doubt about the confidentiality or anonymity of a data set to be shared, researchers should seek advice from an appropriate resource or body.

Researchers should be mindful of the preservation of data integrity in order to facilitate the publication, or even patenting, of their research. Many journals now require that potential authors make their data available to reviewers. For individuals and groups whose research has potential commercial applications, data integrity is imperative. If a researcher wishes to seek a patent for an invention, s/he must be able to provide "... full and complete instructions regarding the claimed inventions: how to make or use it, its useful purposes, and, to an extent, how it functions" (Mays 2005, 225-226). To meet this standard, those seeking patent rights must be able to demonstrate their eligibility to claim the newness, novelty and non-obviousness of the invention. Proper data management ensures that the trail of invention is clearly preserved.

Special Considerations for Research Data:

Social scientists, education researchers and other researchers that gather data from human participants have special responsibilities for data management. Many researchers need not use data that would identify an individual person, for example in the context of survey research or observation of public behaviour. These researchers may promise confidentiality to their participants. Confidentiality means that data gathered for the purpose of the specified research project will not be shared with a third party. Researchers may be obligated to transform their raw data that includes a personal identifier (e.g., a name, email address, address, ID number) into processed data that does not include this information. What a researcher strips from a data set should be recorded and an original copy of the data including identifiers should be retained in a secure medium. The purpose of promising confidentiality and maintaining a secure record of identifiable data is to protect the privacy of human participants. Privacy means that we can reasonably believe that information revealed as a result of a relationship will not be shared with an audience outside of the relationship in question, in this case, researcher and research subject.

Some research projects, particularly those funded by government or military organizations, or those that make use of "dual use technology" may produce data with implications for national security. "The term dual use technologies refers to research and technology with the potential both to yield valuable scientific knowledge and to be used for nefarious purposes with serious consequences for public health or the environment" (Pustovit and Williams 2010, 17). The materials, technologies, and artefacts considered "dual use" vary by nation and researchers whose work has potential military applications or governmental and military funding should be aware of the dual use policies in their nation.

Discussion Questions:

- Do data integrity principles apply equally to all disciplines?
- Is data sharing important for all disciplines?
- What does it mean to be a data steward?

Chapter Six

What is Safety in the Research Setting?

By: Dr. Mike Mackett, Dr. Edmund Hau and Dr. Sara Jordan

Summary

The University of Hong Kong is committed to ensuring the safety and health of all its employees, students and visitors. Researchers often work with materials that pose a threat to the welfare of the researcher, others in the research community, or even the public and a successful safety and health management programme demands a positive commitment from all University employees and students. Risks from potentially hazardous work are overseen and controlled via the University management chain from Vice-Chancellor through Heads of Department to PI and students assisted by advice from the Safety Health and Environment Committee, and the Safety Office. Researchers who work with potentially hazardous materials are obligated to ensure that they are properly trained to use the materials/ equipment and that they take all reasonable precautions to keep themselves and others safe in the conduct of their work.

Intended Learning Outcomes

By the end of this chapter, readers should be able to

- Define and enumerate safe (general) laboratory practices.
- Define the principles and purposes of Biosafety, Biosecurity and the concept of “dual use”
- Distinguish the roles of the Institutional Biosafety Committee, Radiation Protection Officer, and Safety Office

Case Nine

Windy is worried and dismayed. She is the newest member of a large veterinary microbiology laboratory working with some highly pathogenic bacteria. Being new to these laboratory facilities, she was not sure how to operate all of the equipment. She was reluctant to ask too many questions during her laboratory orientation, fearing that her new colleagues would think her unqualified. She has seven years of previous experience in a lab and has never had an exposure incident, but today was different. While opening the centrifuge, she accidentally unseated two tubes, which fell to the counter and broke, spilling the contents, which are normally only handled in a biological safety cabinet. No one else was in the laboratory at the time, and Windy believes she has successfully cleaned the mess so that no one else might notice anything except two fewer tubes. Only rarely does this bacterium infect humans through inhalation and she is reluctant to report the incident to the laboratory supervisor. She is very worried the lab supervisor and the PI will think she is clumsy and a liability.

- Should Windy report the incident? If so, to whom?
- Windy does not report the incident, has she done anything wrong?
- Would not reporting this incident compromise the research in any way?

Case Ten

Ji is stumped. He finished his final assays of the new soil-isotope samples last night around 8pm. When he arrived to the lab early this morning — around 6am — he could not find his samples or his laboratory note books. And, some of the equipment and furniture in the lab seemed out of place. Because he knew he would return so early this morning, he did not fully lock the laboratory, as is the habit amongst the group. He has been searching the lab for the samples and the notebook, but he can hardly believe he could have been so absent minded to have misplaced both! While walking down to get a cup of coffee, he recalled that another research post-graduate student was terminated this past week after failing to produce a satisfactory candidacy proposal for his MPhil. Standing in line, Ji begins to feel sick — what if leaving the lab unlocked allowed someone to steal the samples and the data?

Was the former post-graduate student to blame? Ji and the student were friends...perhaps the PI will find Ji to blame. Ji wonders whether he should replicate the physical notebook from his soft-copies and claim that the new samples never arrived — the PI would be very upset to have to report loss of radioactive material to the Safety Office!

- If Ji does not report the incident, might he have violated any University Policies?
- The samples emit negligible amounts of radiation. Should Ji be concerned about their loss?
- What other concerns might be raised by Ji's considerations?

Data gathered under questionably safe conditions is likely to be questionable data in general. Although it is commonplace to see signs reminding workers “safety first” outside of the University, this maxim applies to researchers as much as construction workers. Safety should be considered as important a part of the research training process as learning to master appropriate data acquisition.

The practices of Responsible Conduct of Research implore researchers to protect the subjects of research — whether humans or animals. However, researchers themselves are also at risk from the work they perform. Researchers work with a variety of hazardous materials and equipment that may pose threats to their health and safety. It is paramount that, prior to engaging in any work in a research environment — whether a biological or chemical laboratory, an engineering laboratory, an architecture studio or even where musical instruments are fabricated — all relevant personnel should receive adequate and appropriate training carry out their jobs safely.

Box 6.1 What are the major hazards in a laboratory?

- Mechanical injuries (e.g. from small hand tools and power equipment)
- Electric Shock
- Heat/Cold from Autoclaves, Freezers, Liquid N₂
- Pressure (positive and negative) –e.g. Gas cylinders
- Musculo-skeletal - Manual Handling, computer use
- Glassware, sharps/ knives, needles
- Chemicals – Fire, Burns, Toxicity, Carcinogenicity
- Biological agents - Infection
- Radiation
- Noise e.g. from machinery
- Slips, Trips, Falls

Training for safety in the research environment will vary widely depending on the needs of the researchers. General laboratory safety, chemical safety, biosafety, and radiation safety are likely to cover the needs of many laboratory based workers. However, those working with lasers, nano-materials, and specialized equipment may need further detailed training.

To know what forms of safety training are necessary for individual research environments, the expertise of the Safety Office of the University of Hong Kong should be sought. There is a wealth of information on their website at <http://www0.hku.hk/safety/index.html>. The Safety Office helps departments to ensure that laws and regulations pertinent to occupational safety are followed, along with conducting risk assessments and helping members of the University to obtain training necessary to maintain a safe and hygienic research environment. However, safety is everyone's concern, not just that of the Safety Office. "A successful safety and health management programme demands a positive commitment from all University employees and students. All individuals have the responsibility to ensure that they do not create risks for themselves or others and to take reasonable steps to protect themselves and others from any foreseeable risks..." ("Statement of Safety and Health Policy of the University of Hong Kong", 1.5).

The Safety, Health and Environment Committee (SHEC)

The Safety, Health and Environment Committee (SHEC) is responsible to Council for overseeing the management of risks to safety and health at the University.

These responsibilities include: (a) formulating policies, procedures and standards for adoption by the University community; (b) implementing, evaluating, monitoring, and auditing safety and health practices at the University; (c) reviewing Faculty and Departmental safety and health policy statements, standards and procedures; (d) receiving reports on safety and health programmes implemented by departments; (e) reviewing the University's accident experience; (f) establishing sub-committees or specialist risk advisory groups, as appropriate, to deliver advice and guidance on specialist policies and to monitor risk control in affected areas; and (g) developing effective communication channels with students and staff.

Work with biologically hazardous materials, including work with biological toxins, carcinogens, teratogens and recombinant DNA work, is overseen by the Biosafety Committee, a sub-committee of the Safety, Health and Environment Committee. The Biosafety Committee may review risk assessments of proposed research and provides analyses and recommendations to relevant University personnel and committees concerning the appropriate control measures (Hong Kong University Biological Safety Policy and Guidance Document 2009, 3.4). However, implementation of biosafety principles and good practices for work with hazardous biological materials is "the duty of the Deans of Faculties" and the responsibility of Heads of Departments, PI's and students alike.

General Laboratory Safety

One of the key principles of Research Integrity is diligence. Attention to detail is important to the acquisition of good data and the continuation of a safe working environment. In general, a safe laboratory is one in which the facility is kept in a clean, orderly condition. This is particularly important because many departments have limited space leading to cramped working conditions.

A laboratory can be a hazardous place and basic guidelines should be followed to promote safe working. This includes:

- Observing the warning signs and symbols.
- Learning about the Dos and Don'ts of the laboratory.
- Assessing risks before starting work.
- Knowing the location of and how to use the emergency equipment.
- Always being alert to unsafe conditions and actions and call them to the attention of a supervisor. Safety is the responsibility of everyone - don't expect someone else to sort it out.
- Not consuming food, beverages, smoking or using make-up in the laboratory.
- Use equipment only for its designed purpose.
- Always wash your hands with soap and water before leaving the laboratory area.
- Knowing the types of personal protective equipment available and using them e.g. lab coats, gloves, goggles and respirators.

All personnel should receive training in general safety (e.g., fire evacuation) as well as in the specialist technical areas relevant to their work and laboratory. Policies and procedures for the management of accidents and “near misses” should be established, taught, and frequently reviewed with all research staff. Post-graduate students should ensure that they are well-versed in the safety practices associated with materials and equipment that they will use in their research.

Biosafety

As defined by the United State’s Centers for Disease Control in the Biosafety in Microbiological and Biomedical Laboratories, 5th Edition, “A fundamental objective of any biosafety program is the containment of potentially harmful biological agents. The term “containment” is used in describing safe methods, facilities and equipment for managing infectious materials in the laboratory environment where they are being handled or maintained. The purpose of containment is to reduce or eliminate exposure of laboratory workers, other persons, and the outside environment to potentially hazardous agents” (200X, 22). The level of containment necessary to achieve biosafety depends largely on the level of risk associated with use of a particular pathogen but it is also important to take into account the procedures being undertaken.

Box 6.2: Biosafety Risk Group Levels and representative agents

Risk Group 1: “Agents that are not associated with disease in healthy adult humans”
e.g. E.Coli K12, Saccharomyces cerevisiae, Adeno-associated virus, Bacillus subtilus, Baculovirus

Risk Group 2: “Agents that are associated with human disease which is rarely serious and for which preventive or therapeutic interventions are often available” Adenovirus (all 50+ human serotypes), Corynebacteria diphtheria, Staphylococcus aureus (including MRSA), Ringworm, Most virus vectors used for molecular analysis and gene expression.

Risk Group 3: “Agents that are associated with serious or lethal human disease for which preventive or therapeutic interventions may be available (high individual risk, low community risk” Vibrio cholera, Hepatitis B and C viruses (HBV, HCV), Human Immunodeficiency Virus (HIV).

Risk Group 4: “Agents that are likely to cause serious or lethal human diseases for which preventive or therapeutic interventions are not usually available (high individual and high community risk)” Hemorrhagic fever viruses such as:- Rift Valley Fever, Marburg, Ebola; or other highly pathogenic viruses such as Smallpox.

Biosecurity

“Biosecurity can be defined as the protection of high consequence pathogens or toxins, or critical relevant information, against theft or diversion by those who intend to pursue intentional misuse” (“Hong Kong University Biological Safety Policy and Guidance Document”, 3.6). Although Deans and Heads of Departments bear primary responsibility for ensuring that a security risk-assessment and plan is in place, those who work with organisms that may present a biosecurity risk should also be aware of biosecurity risks. Some threats include: “ (a) theft of pathogens and toxins or related equipment, documents or data; (b) sabotage including vandalism and tampering; (c) break-in and intrusion; (d) labour issues and disputes; (e) workplace violence;... (h) acts of terrorism” (“Hong Kong University Biological Safety Policy and Guidance Document”, 3.6). Ensuring biosecurity is not difficult, however. Locking doors, ensuring only authorized personnel have access to facilities, and maintaining accurate entry and exit records are simple measures that promote security for all laboratories.

Dual Use Concerns

Research is generally a peaceable exercise of intellectual curiosity. However, some research has applications to activities of national military or irregular military (i.e., terrorist) organizations, as well as peaceful applications. For example work on a vaccine for anthrax could be used for defensive or offensive purposes. The Hong Kong SAR government has implemented its obligations under the biological and chemical warfare convention by passing regulations (Chapter 60) which puts import and export controls on “dual use” materials or technologies. The advice of the University’s Biological Safety Officer should be sought whenever “dual use” biological agents, their toxins or other listed chemicals or equipment is being considered for research use.

Radiation Safety

Conditions for working with radioactive materials and irradiating apparatus's in Hong Kong are detailed in Chapter 303 the Radiation Ordinance (<http://www.hkllii.org/hk/legis/en/ord/303/>). The University of Hong Kong, in the "Radiation Safety" policy, section 11, establishes outline laboratory practice (to minimize radiation hazards), which should be followed by any individual working with radioactive substances or radiation emitting apparatus in the university. Radiation workers should actively work to implement the ALARA principle in the conduct of their every day work—radioactivity and exposure to radioactivity should be minimized to as low as reasonably achievable. Workers should account for time, distance, and shielding when working with, storing or disposing, or transporting radioactive materials.

The Safety Office must be notified of all work with radiation well in advance, for arrangements to be made to comply with the legislation.

Diligence and care should be taken with any radioactive substance, and "Any unplanned happening which may introduce a radiation hazard is considered to be an ACCIDENT or an EMERGENCY" and should be reported at once (emphasis in original; "Radiation Safety" 2008, 11.6).

Chemical Safety

Many chemicals are poisonous, irritating, flammable or corrosive, they can be carcinogenic, pyrophoric, or explosive. Some can have more than two of these properties. Chemicals that may be relatively safe when used alone can become dangerous when mixed with other substances, either in a planned experiment or by accident. Therefore, personnel who handle chemicals must consider the hazards and use appropriate controls and procedures.

In Hong Kong, the storage and use of dangerous chemicals are regulated by the Fire Services Department under the Dangerous Goods Ordinance. Personnel exposure to chemicals is regulated by the Labour Department while the disposal of chemical waste is regulated by the Environmental Protection Department.

Perhaps foremost amongst the concerns for chemical safety is that all materials, whether in an original or a prepared state, are clearly and accurately labeled. Chemicals should only be stored in quantities that can be readily used and in containers suitable for the purpose of storing the particular chemical. All chemicals in the lab, whether for direct research purposes or ordinary daily-use materials, should have a Material Safety Data Sheet readily available for reference. All workers should know what to do in the event of an accident and how to use the chemical spill kits available in the laboratory.

Mechanical and Electrical Safety

Equipment should be maintained in proper working order or repaired as soon as possible, moving parts should be guarded where required and all users trained in the safe operation of the machinery. Repairs to equipment should only be made by qualified personnel using appropriately sourced parts. Other necessary equipment and supplies, such as personnel protective equipment (e.g., goggles, gloves) should be readily on hand for all members of the lab and visitors.

Special Safety Concerns: Lasers, and Nano-materials:

Laboratory safety evolves with the accumulation of new technologies. Responsible researchers will seek to ensure that they protect the public, the facility, and research workers when using new technologies and techniques. Adaptation of containment practices, personal protective equipment requirements, or shielding standards from safety requirements in established fields can be a useful step for researchers working in innovative areas.

Lasers:

Whether working with pulsed or continuous wave lasers, those whose research requires laser use should be attuned to safe practices for laser use. A designated and well-signed area should be established as the Laser Controlled Area. Only authorized and trained personnel should be permitted into the Laser Controlled Area. The University Safety Office should be notified of any new or modified laser equipment for use at University of Hong Kong facilities.

The Safety Office can assist in the development of the required Standard Operating Procedures and user training programmes necessary to ensure safe use of the laser equipment (“Code of Practice on the Use of High-Power Lasers”, University of Hong Kong).

Nano-materials:

Nano-scale materials have different properties than those of related bulk materials. Workers using or fabricating nano-materials (e.g., carbon nanotubes) should be aware that the toxicology, flammability, and catalytic chemical properties of nano-materials is not firmly established. When engaged in nanomaterials work, researchers should ensure adequate ventilation and filtration, waste disposal, and attention to personnel protective equipment and practices as is standard for good laboratory practice. The Safety Office should be consulted for facilities planning, development of Standard Operating Procedures, and implementation of other safety precautions associated with nano-materials use (“Interim Guidelines on the Safe Use of Engineered Nanomaterials”, University of Hong Kong).

Discussion Questions:

- Who bears the most responsibility for safety in a research setting?
- When should a researchers' personal safety come before obtaining results?
- Is it ever right to put ourselves in danger for our research?

Chapter Seven

What is Integrity in Collaborative Research?

Summary

The contemporary research environment is highly collaborative. Collaboration is a purposeful and mutually beneficial partnership among colleagues designed to lead to better, more complete and more complex projects than an individual could achieve alone. Because of the interdependence of collaborators, it is important that the purposes, practices and principles governing collaboration be outlined before the project begins and revisited along the way to address the changing needs and relationships between partners.

Intended Learning Outcomes

By the end of this chapter, readers should be able to

- Integrate the concepts of Research Integrity and Responsible Conduct of Research into a definition of Collaborative Research
- Identify types of Collaborative Research and suggest Research Integrity challenges for each type
- Outline principles for Integrity in Collaborative Research and apply these principles to collaborative projects in your discipline

Case Eleven

Raj is very excited. His supervisor has asked him to join a semester long research trip to three other universities in the region. Raj, his supervisor, and a post-doc from a related group will be performing original data collection at each location using a new technique they all have worked very hard to develop and refine. Raj hopes that some of the data they gather might form the basis of one or more of his thesis chapters. Menal, Raj's roommate is happy for Raj, but is also concerned. Menal reminded Raj that some collaborative projects might have prohibitions on the sharing of data within the project. Raj does not know whether he could use the data from this project. Raj is now wondering what else he should investigate about this project? He trusts that his supervisor knows all of the logistics already, and does not want to offend her by asking too many questions, but Raj is concerned that, if he can't use the data, he would effectively waste a semester of his PhD research time.

- What sorts of questions should Raj ask his supervisor?
- What concerns about working collaboratively might Raj reasonably have?

Case Twelve

Li is a new PhD student in a well-respected, large laboratory. The PI for this laboratory is well known for her work with prestigious engineering firms and, yesterday, she asked Li if he would be willing to work with her on a recently signed contract research arrangement with a new firm. Li is quite happy to do the work and is even thinking of changing his research topic to align more closely with the work he will do for the next year. If he is truly diligent in his work and a little bit lucky, perhaps he could find a job with the firm after graduation! This morning, though, he found in his pigeonhole a set of documents that he is unsure of: a non-compete agreement, a document demanding the project be held in strict confidentiality, and a data ownership agreement. A note atop the documents asks Li to sign the documents, retain a copy for his records, and remit them to her by noon today. Li is quite unfamiliar with these types of documents and is not sure what to do.

- What should Li do?
- Whom should Li speak to about these documents?
- What concerns might Li reasonably have?

The Human Genome Project, the International Hap-Map Project, the International Space Station, and the Large Hadron Collider are just a few examples of large collaborative research projects that have changed the landscape of our society. Fruitful collaboration between researchers across disciplines, institutions, or national borders helps to advance academic research at a faster pace than would be seen if researchers worked alone. Collaborative research enhances the research landscape only if it is done in a way that preserves the integrity of the research performed.

General principles for building a fruitful collaboration include cooperation, trust, collegiality, fairness, and accountability. Research collaborations could be undermined by exploitation, self-serving behaviour, neglect, discrimination, abuse or exploitation, favouritism, and Research Misconduct. Ideal collaborations begin with clear and frank discussions of the expectations that partners have of the collaboration. The principles of Research Integrity are universal to academic research, but different disciplines and organizational cultures will prioritize particular principles over others. Ascertaining which principles are emphasized by each partner in a collaboration is necessary for the collaborators to meet on common ground.

Prior to beginning any collaborative arrangement, researchers should ask one another many questions. Particularly for students and junior scholars, knowing the appropriate questions to ask up front can be difficult and relevant questions may arise throughout the conduct of the project. Collaborative arrangements should be revisited periodically to adapt to changing circumstances and to ensure that all members of the project are satisfied.

Box 7.1: Questions for Collaborative Research Projects

- What is the extent of the collaboration?
- How many members are part of the team?
- What responsibilities does each member of the team have?
- From where and with what restrictions will the funding come?
- How will resources (e.g., equipment and data) be owned, managed, and shared?
- Where and in what format will results be shared?
- What pertinent deadlines are there?

- Are there national or state laws and university regulatory structures that compel members of the team to attend to other requirements?
- Who will be an author? What is the appropriate order of authors? How will authorship tasks be divided?
- Is there an intent to patent or copyright the materials? Whose responsibility is the application?
- Who will be responsible for training new members, including students?

(Adapted from Shamoo and Resnik 2009, 70-71)

Types of collaborations—“collaboratories” (Wulf 2008, ix)—vary according to project needs, funding arrangements, and project purposes. Each type of “collaboratory” presents its own unique Research Integrity concerns. Even simple collaborations, such as group research among students, or research projects shared by supervisors and students, may present concerns for the fair allocation of work, credit, and even compensation.

How these issues will be managed will vary according to the needs and capabilities of the collaborators as well as the institutional arrangements in place to govern the collaboration. Research students involved in collaborative research should be mindful of the purpose of the collaboration they are part of as this may determine, in part, what they can expect to take away from the collaboration.

Box 7.2: Eight Types of Collaboratories

Shared Instrument: Collaborative use of scarce equipment, whether in a single location or via remote access, in order to advance individual or community wide research objectives.

Community Data Systems: Distributed, community-wide, creation, maintenance, standardization, or refinement of a data resource for use by the discipline or field.

Open Community Contribution System: Public access and public contribution based effort to solve a defined problem, often through development of an open-use dataset.

Virtual Community of Practice: Web-based research and information sharing community that may support, but does not conduct or lead, definite research projects.

Virtual Learning Community: Web-based community designed to contribute to training or knowledge acquisition amongst its members.

Distributed Research Centre: Discipline or field specific “university research centre, but at a distance” that brings together resources not available to any one member.

Community Infrastructure Project: Development of discipline or field wide resources, such as software, instruments, large datasets, or methods that advances work in that discipline or field.

Academic-Industry Collaborations: Business or University led, often problem specific, endeavours to answer a research problem that has mutually beneficial outcomes for each (e.g., patents, reputation, funding).

(Adapted from Bos et al 2008, 58-68 and Shamoo and Resnik 2009, 81-98)

Academic-Industry Collaborations can be worrisome from the perspective of Research Integrity. While the values of honesty, responsibility, fairness, diligence, equity, and professionalism are shared between the academic and business worlds, the emphasis placed on each value differs in the respective arena. The mechanisms in place to ensure that business partners adhere to these rules are also different from the mechanisms in place for ensuring Research Integrity.

Establishing clear expectations of academic-industry collaborations, including specification of values to be followed, is necessary for successful collaboration. Prior to entering into a partnership with an industry collaborator, the Technology Transfer Office should be consulted for expert advice. Clarification of value statements should be followed by establishment of clear procedures and arrangements for sharing of data, time, equipment, funding, and allocation of responsibility for supervision of students and technical workers.

Researchers, including students, working on projects funded by industry sponsors should be prepared to encounter documents such as non-compete agreements, materials transfer agreements, non-disclosure agreements, and data-sharing or data confidentiality agreements. A non-compete agreement may bar the signatory from performing similar work for a period of time or within a defined area. A materials transfer arrangement may include a number of provisions that restrict researchers' final claim to a commercially valuable product, such as restrictions on who may apply for a patent based upon the research. Some research may be funded by government sponsors and have national-defence applications. Other research may be of significant commercial value. In either case, the sponsor may require that all parties to the project hold it in strictest confidentiality, which means that the project cannot be discussed with any party outside of the contract arrangement. Non-disclosure may extend to who may use the data for what purposes; if a project is confidential it may mean that no data collected or methods used to collect the data may be reported in the academic literature, including theses and dissertations, whether for a period of time or in perpetuity. As stated in HKU Policy for Ethical Practice in Research, "Secrecy may be necessary for a limited period in the case of contracted research. However, that need must be clearly stated in the contract and fully understood by all parties. Where a research student is involved in working on such a contract, the researcher concerned must ensure that the party sponsoring the research understands and accepts unequivocally that the thesis will not be restricted from publication, though there may be scope for not releasing certain types of data confidential to the sponsor. Consultation with the Policy Board of Postgraduate Education should be undertaken before any restrictive agreement is reached." (Policy for Ethical Practice in Research 2011, 2.5)

Discussion Questions:

- What types of collaborative research might research postgraduate students engage in frequently?
- What might business people value that academic researchers might not?
- How ought responsibilities be allocated in collaborative research?

Chapter Eight

What is Mentorship for Research Integrity?

Summary

Basic skills and techniques to perform research can be taught, but learning to become an excellent researcher requires mentorship into the vocation of research. Research Integrity is a set of principles and practices (Responsible Conduct of Research) that individuals learn through formal and/ or informal mentorship, as well as through classroom-based teaching. Academic mentorship is a caring, developmental relationship between a senior, experienced, researcher and a junior researcher. Mentorship may also occur between student-peers with differing skills sets and relevant interests.

Intended Learning Outcomes

By the end of this chapter, readers should be able to

- Summarize independently the idea of research as a vocation
- Identify the principles and practices of ethical mentorship
- Enumerate some threats to effective academic mentorship
- Relate concepts of mentorship and training to Research Integrity and Responsible Conduct of Research projects in your discipline

Case Thirteen

Sasha has a secret and a problem. She and her supervisor, a well-known senior researcher, have been in a romantic relationship for almost six months now. Sasha enjoyed the relationship for a while, but she is now concerned that it is affecting the way that her supervisor treats her. The other students in the research group are beginning to avoid Sasha and some have started rumours that she is involved romantically with the supervisor. Sasha is concerned that, if she breaks off the relationship, she may lose out on a valuable resource—the supervisor has already introduced her to many other senior academics that the other students have not met—and may anger her supervisor so much that it negatively affects her research progress. However, if she stays in the relationship, her peers may not view that she received her degree due to her competence or intellect. As theirs is a small, interdisciplinary, field, Sasha worries that the longer this relationship lasts, the greater the likelihood that she will not be viewed as an independent scholar.

- What ought Sasha do?
- What should Sasha be concerned about?

Case Fourteen

Eliph feels depressed. As a new, international, postgraduate student, she feels quite alone and isolated. She speaks English well, but with a strong accent. She speaks neither Putonghua nor Cantonese, although she enrolled in private Putonghua lessons recently. There are no other students from her home country in her faculty or at the HKU. While she knows her supervisor is impressed with her work thus far, sometimes she fears that he does not understand what she says to him and she is afraid that the students do not like her. She is contemplating leaving the University after only 6 months and returning to her home country. Her supervisor at her former university has arranged for her to visit a colleague of his at one of the other local universities. She is afraid that if she goes to speak about her problems with another professor that her supervisor will find out and will dismiss her. She does not want to give up so soon, but she is not sure if speaking to someone is a good idea either.

- What would you recommend for Eliph? Should she meet the professor from the other University?
- What should Eliph tell her supervisor?
- Do you have any recommendations for Eliph to get better acquainted with her fellow students?

Learning to practice science as a vocation requires training in the techniques of academic research, but also training in knowing how to apply those techniques within the confines of externally derived definitions of “good research”. Knowing what is good research and teaching others about how to do good research is the role of mentors.

Being a researcher is more than merely having a job in a university or a laboratory or a lecture hall—being a researcher is a way of life. Max Weber, a famous sociologist, wrote in “Science as a Vocation”, that being an academic requires a passionate devotion to specialization in the pursuit of knowledge for its own sake, assisted by imagination, frenzied inspiration, luck, and a willingness to submit oneself to the infinite march of progress in the field, which will certainly eclipse his best efforts. A researcher is a person who lives for the sake of the questions s/he will answer but does so with the spirit of “plain intellectual integrity” (Weber 1958, 134).

“The canons of scientific integrity derive their life from effective mentoring in graduate training programs. Mentors inform, instruct, and provide an example for their trainees. The actions and activities of mentors affect the intellect and attitude of their trainees. The educational transfer process may be obvious or subtle, but the effects are rarely in dispute: trainees emerge from their programs with an intellectual and ethical framework strongly shaped by their mentors. Indeed, trainees often assume the traits and values of their mentors. Thus, mentors are the stewards of scientific integrity” (Macrina 2005, 40).

Mentors are teachers, advisors, confidants, guides, and, sometimes, friends. A good mentor’s actions are guided by an ethic of care. Care requires sympathy, empathy, sensitivity, responsibility, and responsiveness to the needs and emotions of those with who we are in a dependent relationship. Like the principles of Research Integrity, good mentorship is apparent in the practices that mentors employ when working with their mentees. Ideally, a caring mentor will teach students how to perform research responsibly and will constructively critique their efforts, will guide students through the regulations and policies that govern their research and will instruct students in the tenets of Research Integrity, and will assist students in negotiating the difficult task of practicing research as a vocation while balancing the many commitments of modern life, inside and outside of the university. Mentors ensure that students become “well-rounded” researchers and individuals with integrity.

The professional relationship between a mentor and a mentee is one wherein the mentor typically has more power, knowledge, and skills than his or her guide. The relationship should be one characterized by care, non-exploitation, and fairness on the part of the mentor, while the mentee should ensure that he/she is respectful, honest, and diligent. Exploitative behaviour can threaten the relationship and both parties should be aware of the possibility of exploitation, such as taking ideas without providing due credit, overburdening or overworking, discrimination or harassment, favouritism, or intentionally offering misinformation or bad advice.

At HKU, students seeking advice on how best to conduct their research should liaise with their supervisors and other members of their department/division/centre/faculty. However, in the event that students are in need of other resources for coping with the stress of academic life, they are encouraged to reach out to Centre of Development and Resources for Students (CEDARS). In situations in which advice on how to cope with an exploitative mentorship or supervisory situation is necessary, students should seek assistance from CEDARS and/or the Deans office of the appropriate faculty.

Discussion Questions:

- What characteristics does a good mentor have?
- What obligations do students have to their mentors?
- Other than direct supervisors, who else could provide mentorship for research postgraduate students?

Chapter Nine

What are Conflicts of Interest and Conflicts of Commitment?

Summary

Objectivity and neutrality are two goals prized in the pursuit of research. Even in cases in which academic research may be used for advocating social change, it is hoped that the conduct of research is not compromised by the research's advocacy goals. When our personal desires for wealth, fame, prestige, career advancements, or other external inducements threaten the objectivity or neutrality of our research, we may have a conflict of interest. Personal desire may not be the only factors that compromise the quality or trustworthiness of our research. We may be compromised by a conflict of professional commitments as well.

Intended Learning Outcomes

By the end of this chapter, readers should be able to

- Distinguish between a conflict of interests and a conflict of commitments
- Relate the purpose of disclosure of conflict of interests to the concept of Research Integrity
- Identify instances of conflict of interests and/ or conflict of commitments in their own research areas
- Summarize the importance of disclosure for managing conflicts of interest

Case Fifteen

Roland is blessed to have such great and accomplished friends! Roland, himself a Ph.D. in inorganic chemistry, runs a small chemical supply and disposal company. His best friend since primary school and former hall mate, Kai, just began his second post-doctoral fellowship in the laboratory of their former inorganic chemistry professor's lab. Kai, who is in now charge of budgeting and resources for the lab has been talking to their former professor about Roland's firm. Their professor, who sits on the University's committee in charge of contracting environmental services, recently mentioned that they would be taking bids for new contractors. Kai immediately called Roland to tell him of the good news. Putting the phone down, though, Kai has a sinking feeling. Was telling Roland about the bidding process early wrong? Is this a conflict of interest? A conflict of commitment?

- Has Kai done anything wrong?
- What responsibilities does Kai have to his supervisor? To his friend?

There are many points of pressure upon researchers in the contemporary research environment. Personal desires, such as wanting more time with family or a higher salary, and professional conflicts, such as a clash between teaching duties and administrative or research obligations, stalk researchers throughout their careers. From postgraduate students to chair professors, management of conflicts of interests and conflicts of commitments is an important part of the daily life of responsible researchers.

Both conflict of interests and conflict of commitments may damage the integrity of research. Researchers with a conflict of interest or commitment may be unable to maintain objectivity, fairness, diligence, or even honesty in their work. A conflict is also likely to damage the credibility or reputation of a researcher found to be in conflict after the fact.

Distinguishing between a conflict of interest and a conflict of commitment may be difficult as conflict of interests and conflict of commitments may often coincide. In general, an individual has a conflict of commitment or interest when a personal desire or obligation competes for the same resources, whether time, money, passion, or obligations, as another professional duty.

Box 9.1: Defining Conflict of Interest and Conflict of Commitment

As outlined in the HKU Staff Handbook for Professorate Staff (2007, 196), “A **conflict of interest** situation arises when the personal interest of an appointee competes or conflicts with the interest of the University. Such a situation can lead to divided loyalty and can tarnish the University’s reputation or even result in corruption”.

As defined in the Duke [University] Faculty Handbook (5.2.2.2), “A **conflict of commitment** can be said to exist when a member of the University community has a relationship that requires a commitment of time or effort to non-University activities, such that an individual, either implicitly or directly, cannot meet the usual obligations to the University. In addition, the distribution of a faculty member’s effort among, for example, research, teaching, committee responsibilities, and outside consulting may raise issues of conflict of commitment” (<http://www.ors.duke.edu/orsmanual/conflict-commitment>).

HKU cautions employees, which would include research postgraduate students, to avoid situations where “an employee’s loyalty to the University conflicts with his [sic] loyalty to: (a) his family and other relatives; (b) his personal friends; (c) the clubs and societies to which he belongs; (d) another university or tertiary institution, or any organization at which he has taken up a visiting/honorary professoriate position with a management/administrative role; (e) his professional colleagues in other organizations; or (f) any person to whom he owes a favour or is obliged in any way”. (HKU Staff Handbook for Professorate Staff 2007, 196)

Major sources of interest conflicts stem from either financial or personal relationships. Of particular concern are financial relationships between researchers and industry sponsors or partners. While researchers should benefit from the fruits of their labours, whether by obtaining patents or by receiving royalties, a desire for these remunerations should not prevent a researcher from reporting results as accurately as possible or from using the best resources available. In cases where a possible financial conflict of interest arises, such as when an investigator works for a company in which s/he owns shares, the very appearance of a conflict of interest may render the results of the research suspect.

Personal relationships may also provoke a conflict of interests. Relationships between colleagues, research associates, or even competitors may inhibit the ability of researchers to offer objective reviews of research proposals or papers, for example. Romantic entanglements between researchers, in particular between students and supervisors, may provoke conflicts or even accusations of harassment. HKU advises that persons in a position of authority, which means exercises an “evaluative or supervisory role, regardless of whether that role takes the form of grading, examining, promotion, assigning duties, funding, short-listing for awards and scholarships, and any similar activities”, should avoid any “amorous or sexual relationships with either... (a) students of all kinds for whom one has pedagogic, supervisory or evaluative responsibility, or (b) staff of all kinds for whom one has supervisory or evaluative responsibility” (HKU Staff Handbook for Professorate Staff 2007, 123). Research postgraduate students who feel that a romantic relationship with a supervisor, staff member, or other member of their faculty might adversely affect their studies should seek the assistance of CEDARS and the Dean’s office of their faculty. Similarly, any research postgraduate student with supervisory or tutoring duties should be mindful when engaging in a romantic relationship with subordinates or students.

Conflict of interests is of serious concern to the research community. However, just because a conflict of interest causes concern does not make it “bad” to have a conflict. Conflicts simply need to be managed well. To alleviate concerns about conflicts that may compromise the objectivity of research, many funding agencies, journals and book publishers require submitting authors to submit a “Conflict of Interest” declaration or disclosure form. To disclose a conflict of interest means to bring the sources of the conflict to light by clarifying the actors involved, the nature of the relationship, and the duration of the relationship. Disclosure of a conflict of interest gives readers information necessary to interpret the results of a publication.

Discussion Questions:

- What types of conflict of interests are research postgraduate students likely to encounter during their studies?
- What types of conflict of commitment are research postgraduate students likely to encounter during their studies?
- Other than disclosure, how might we manage conflict of interests?

Chapter Ten

What is Ethical Authorship?

Summary

Although the importance of publication to the career of researchers is clear, the standards governing good authorship practices are not clearly understood. Who qualifies as an author, how authorship tasks ought to be allocated, and how authorship credit ought to be allocated amongst a group of co-authors are all questions that make determination of authorship a problematic task. As different disciplines have unique norms and practices for designation of authorship credit, it is not possible to establish a set of universal guidelines for “good authorship” practices for all. However, alternative models of authorship and contributorship might fit a variety of disciplinary needs as well as acknowledge clearly the work of all actors in the research process.

Intended Learning Outcomes

By the end of this chapter, readers should be able to

- Explain the types of unethical authorship designation
- Contrast authorship and contribution and explain the purpose of an acknowledgements section
- Apply the authorship criteria to publications practices in their discipline
- Enumerate examples of unethical practice in publication

Case Sixteen

Mandy, Lok, and Wing are working hard on a poster presentation for a prestigious conference. Each feels honoured to have the chance to present their research and each is hoping that this presentation will help them when applying for Ph.D. programmes or Post-Doctoral positions. Unfortunately, their good fortune and enthusiasm is leading to tension—each feels that they ought to be “first author”. Mandy claims that, since the project is part of her Ph.D. thesis and was originally her idea, and she has done the majority of the writing, she ought to be first. Lok believes he should be first author because he took charge of data analysis and has designed the layout of the poster. Wing believes she should be first author because she made many of the tables, figures, and other graphics for the poster as well as edited the material. As the conference is two weeks away and the team will need to book space and materials for the department’s colour printer soon, they must decide authorship order. None of the students is willing to change his or her position.

- How might these students resolve this problem?
- What standards of authorship might they be able to use as guidance to resolve their problem?

Case Seventeen

Jackson is too busy. He defends his Ph.D. thesis in two weeks, is applying for post-doctoral positions overseas, and is adjusting to life as a new father of twin sons. Many of the post-doctoral positions he is applying for require a newly composed and lengthy research proposal, which he is struggling to find time to compose. He hopes to extend some of his earlier research, done in his MPhil and PhD programmes, during his post-doctoral fellowship. In fact, there is substantial overlap between some of the sections of his dissertation and thesis and the required sections for his post-doc proposal. Awake at 3am to tend to his children, and fearing the uncompleted applications due today, Jackson decides he should copy and paste the problem statement, literature review, and data and methods sections from his thesis into his new post-doc proposal. He has already written these and, in fact, some of this material is used in a forthcoming article. The article is not out yet, his thesis is not published, and he figures no one will know if he simply copies and pastes these sections.

- Would Jackson be doing anything wrong to copy and paste from his own work?
- What should Jackson do?

Publication is how researchers demonstrate their skill and contribution to the community. Since publication is our primary currency and method of publicizing our work, adhering to the principles of Research Integrity, particularly honesty and diligence, is imperative in the publications process.

Good publications begin with quality research conducted according to Responsible Conduct of Research practices. If a researcher has engaged in Research Misconduct, such as plagiarism, it is a foregone conclusion that his/her publications will ultimately be damaging to the integrity of research in the discipline. Plagiarism in publications is clearly an example of unethical conduct in publication. Appropriating the work of others and submitting it as one's own is an act of deception and constitutes lying. Self-plagiarism or republishing one's own work without acknowledging that the work has been published in another venue is also an act that obscures the true research record, and may constitute copyright infringements if the copyright to the original document is not held by the author personally. In general, all material from sources not composed by the author(s) for the occasion of the piece at hand should be cited as per the style rules of the journal or publisher.

Good conduct in publication practices takes a central role in research-community wide statements on Research Integrity, such as the Singapore Statement on Research Integrity. For example, points six and seven remind readers that,

“Researchers should take responsibility for their contributions to all publications, funding applications, reports and other representations of their research. Lists of authors should include all those and only those who meet applicable authorship criteria”, (Singapore Statement on Research Integrity, 2010).

Researchers should acknowledge in publications the names and roles of those who make significant contributions to the research, including writers, funders, sponsors, and others, but do not meet authorship criteria”, (Singapore Statement on Research Integrity, 2010).

Clarifying authorship criteria is important for researchers aspiring to meet these expectations of Research Integrity. A key question to ask when probing the matter of authorship credit is: who can take responsibility for this publication? Accepting responsibility for a publication means that an individual can explain their contribution to the development of the idea, data, analysis, interpretation, and/ or composition of the document. If an individual cannot publicly accept responsibility for the content of a paper, poster, or presentation, particularly if there are errata in the document, then they are unlikely to meet the expectations of authorship.

A commonly used set of criteria for establishing authorship credit comes from the International Council of Medical Journal Editors (ICMJE), who suggest that

“Authorship credit should be based only on: 1) substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data, 2) drafting the article or revising it critically for important intellectual content, and 3) final approval of the version to be published. Conditions (1), (2), and (3) must all be met. Acquisition of funding, the collection of data, or general supervision of the research group, by themselves, do not justify authorship” (ICMJE 2001; quoted in Albert and Wager 2003, 32).

The ICMJE criteria help to establish what qualifies as “earned authorship” versus “honorary authorship” or “unearned authorship”. An individual has earned authorship if s/he has contributed meaningfully to the idea; literature review; research design; data gathering, analysis or interpretation; composition and editing of the manuscript; and correspondence through the publications process. An individual has not earned authorship to the extent that s/he has not played a role in completing these tasks.

There are four types of unearned authorship that are, unfortunately, found with some frequency in the research literature. Unearned authorship undermines the integrity of research by misrepresenting the research record. The “by line” of a publication is either falsified or fabricated to satisfy needs of individuals that are unrelated to the clear presentation of the true research.

Box 10.1: Four Types of Questionable Authorship Designation

Gift Authorship: Giving undue credit due to true authors' sense of obligation

Ghost Authorship: Failure to list those deserving authorship, e.g., employees of clinical trial sponsors

Guest Authorship: Inflation of by-lines by additional experts or those owed a favour

Pressured Authorship: "Guest" or "Gift" inclusion of a (senior) individual on a by-line because of undue pressure

Assigning authorship is problematic in the contemporary collaborative research environment. Many individuals may contribute to the research reported, but might not meet authorship criteria. Individuals who contribute to research but do not meet authorship criteria include those who provide funding, leadership, space, consultation (including statistical consultation), editing, or materials (e.g., bacterial strains) but do not contribute meaningfully and directly to the manuscript. These individuals or groups ought to be listed by name, along with their contribution, in an "Acknowledgements" section of the manuscript. The "acknowledgements" section gives appropriate credit to those without whom the finished product would not exist in its current form.

Research Misconduct, improper authorship assignment and inattention to appropriate acknowledgements is only part of the picture of unethical authorship practices. Unethical authorship practices also include manipulation of the substance of the publication to yield more publications than might be warranted by the extent or significance of the research. These practices include data torturing (continuing to analyse the data until you find a significant result when the initial results are not statistically significant), least-publishable unit publication (also known as "salami slicing"), publication "by press release," and multiple submissions.

Box 10.2: Five Types of Questionable Authorship Practices

Misrepresentation of the sequence of discovery: Underreporting the procedures for discovery; Underreporting or obscuring the analytical or interpretive techniques used to reach the declared results; Eliminating problematic cases from the data without disclosing reasons

Misrepresentation of the significance of the research: Overstating the significance of marginal findings, failing to report null findings

Least-Publishable Unit/ Salami Slicing: Breaking up a single project into the greatest number of publications that can be submitted and not constitute self-plagiarism or multiple submissions. Also, publishing the results of a single experiment as if it were multiple experiments.

Publication by Press Release: Publicizing research results without appropriate peer review by using popular media outlets

Multiple Submission: Submitting a substantively similar work to multiple venues without acknowledging this, even if in two different languages

As publications are the primary currency of researchers, it is imperative that all members of the research community strive to maintain the principles of honesty and diligence in reporting their research findings. Unfortunately, disputes over authorship are likely to occur during the careers of most researchers. The key to managing disputes over authorship order is to begin speaking about authorship expectations and assumptions at the beginning of the project and revisit these themes throughout the research development process. As Albert and Wager suggest to new researchers, "start discussing authorship when you plan your research," and "decide authorship before you start each article" (2003, 32-33). Open and frank discussions of authorship expectations may reveal that what appears to be a dispute is a matter of interpretation or poor communication, not misconduct. Ensuring that all members of the research team "speak the same language" about authorship may be difficult as disciplinary norms and personal expectations may colour the way that concepts or practices are interpreted. Discussion of some of the ideas and concepts listed in Box 10.3 may allow all members of the team to come to a consensus position for the group.

Box 10.3: Key Authorship Terms and Definitions

Acknowledgements: Recognition of individuals who contributed to the work, but do not meet authorship criteria

Appeals: Request by an author to an editor to have their name included or excluded from an existing publication

Contributorship: List of the tasks or roles that authors filled for the completion of the submitted work that is submitted to an editor for either editorial consideration or publication

Corresponding Author: “The person who receives the reviewers’ comments, the proofs, etc. and whose contact details are printed on the article so that readers can request reprints or contact the research group” (Albert and Wager 2003, 33).

Dispute: Disagreement between earned authors about the assignment, number, or order of assigned authors

First and Last Authors: Disciplinary variations determine whether the first or last author is the most senior, first in alphabetical order, or has made the greatest contribution. In many cases, the corresponding author will be listed last. Assumptions that the first author has made the greatest contribution may be incorrect, particularly in interdisciplinary research.

Group Authorship: Assignment of authorship to a research group, usually accompanied by a statement of individual contributorship

Guarantor: An individual author who can “...take responsibility for the integrity of the work as a whole, from inception to published article” (Albert and Wager 2003, 34).

Instructions to Authors: Description of a journal or publisher’s expectations for how an article should be composed and, in some cases, authors assigned

Order of Authors: Authors may be assigned according to seniority, reverse seniority (most junior first), alphabetical order, contribution, or might be designated as having contributed equally to the piece. A description of the mechanism for selecting order of authors should be available for editors upon request.

(Adapted from Albert and Wager 2003)

Research postgraduate students, particularly those interested in pursuing an academic career, need to be mindful that their need for publications does not tempt them to engage in unethical authorship practices. Similarly, research postgraduate students should ensure that they are duly credited in publications that stem from collaborative projects in which they are involved. Finally, students should be aware that their theses and dissertations may be web-published as part of the requirements for completing their thesis or dissertation. In cases where theses or dissertations are published, even on the web only, this will limit the student’s ability to publish directly sections or the complete version of their thesis or dissertation in another venue.

Discussion Questions:

- What types of unethical publication practices do you believe are most common in your discipline?
- Why are the four types of unethical authorship considered wrong?
- Is self-plagiarism truly harmful?

Chapter Eleven

What is Ethical Peer-Review?

Summary

Peer review of applications and publications is common practice in the contemporary research environment. Publication and grant acceptance depends on the generosity, collegiality, expertise, and ethicality of reviewers. The peer-review process requires reviewers to attend to the multiple values of Research Integrity as well as practices such as preservation of confidentiality. Misconduct among peer-reviewers undermines the trust that members of the academic community must have for one another.

Intended Learning Outcomes

By the end of this chapter, readers should be able to

- Describe the role of peer-reviewers in the publication process
- Enumerate the practices of ethical peer-review
- Apply the practices of ethical peer-review to the system of academic journal review in their discipline.
- Explain the role of reviewers vis-à-vis Research Integrity

Case Eighteen

Ming is stunned. Right before his eyes are the results of his research. But, it was not his hand that wrote the results! Early this week, Ming was pleased to receive an article for review from a good journal in his discipline. Although just a Ph.D. student, Ming is well versed in the problems and methods of his disciplinary field and knows what a breakthrough this research represents. Looking over the article in front of him, he now realizes the incorrect path that his own research had been on for three months now. Armed with the findings in this article in front of him, Ming believes he could make an even better contribution. Ming wonders: if he reviews this article and it is published, won't these results dampen the effect of his own research findings? Ming is considering pretending he did not receive the article and neglecting to review it, hoping that it will stall the publication for just long enough to send his own article out.

- Is Ming doing anything wrong?
- What are Ming's options here?

Case Nineteen

Dr. Chan invited Starry, a post-doctoral fellow in her research group, to be a co-Investigator on a big grant project. To complete their application, each investigator must complete a form declaring their affiliations with the reviewers proposed in their application. Starry has worked for three labs in the area and is well-connected. She knows that a few of her former colleagues are likely to give their application a favourable review, which would greatly benefit Starry's career. While reviewing the terms of reference for the declaration form, she realizes she could creatively omit some information on her relationships. It is unlikely anyone will know this and unlikely that the reviewers will be able to check.

- Would Starry be doing anything wrong by not disclosing her relationships?
- Who should Starry talk to about this?

Peer-review is essential for maintaining the quality and overall integrity of research. Reviewers should strive to maintain Research Integrity principles in the largely unseen work of research review as stringently as they maintain these in the visible work of publication and teaching. These principles include objectivity, honesty, fairness, diligence, accuracy, and collegiality.

Reviewers have responsibilities to three groups in the research community—authors whose work they review, editors who rely upon their reviews, and readers who rely on reviewers' role as quality assurance monitors. Reviewers' primary responsibility toward authors is to provide a non-biased, collegial, and timely assessment of the merit of the work. Reviewers must also ensure that the manuscript is kept confidential, particularly if blind peer review is the expectation of the journal or publisher.

To editors, reviewers should strive to provide “a thoughtful, fair, constructive and informative critique of the work” (“White Paper”, Council of Science Editors, 2008). Reviewers, more so than editors, who often have editorship duties on top of their ordinary teaching, research, and administration duties, have the opportunity to identify Research Misconduct in documents that they review. As those on the “front line” of cutting-edge research, reviewers assure the integrity of research by properly reporting irresponsible research practices. As suggested in the Singapore Statement on Research Integrity, “Researchers should report to the appropriate authorities any suspected research misconduct, including fabrication, falsification or plagiarism, and other irresponsible research practices that undermine the trustworthiness of research, such as carelessness, improperly listing authors, failing to report conflicting data, or use of misleading analytical methods” (2010).

To the community of readers, reviewers serve as quality control on what is published in the disciplines. Serving this role is a privilege that reviewers should recognize as such.

Box 11.1: Self-Evaluation Questions for Peer-Reviewers

When engaged to perform a review, reviewers should ask themselves

- Am I technically competent to review this piece?
- Am I sufficiently familiar with the substance of the article to review it well?
- Do I have sufficient time and resources to review the piece?
- Have I any conflicts of interest that inhibit me from offering an objective review?
- Can I complete the review in the time allotted?

Reviewers, like authors, should be aware of the potential for misconduct in performance of their task. Types of reviewer misconduct include intentionally delaying reviews, perhaps for the purpose of preventing being “scooped”, using material from pieces under review without permission, breaching confidentiality when expected, or not disclosing a (known or suspected) personal conflict of interest. Reviewers who engage in these practices breach the trust of those who submit their articles to journals and the trust of editors who rely on the good faith and effort of reviewers to ensure the quality of publications in their journal.

Research postgraduate students are often at the forefront of their disciplines and may make competent reviewers. However, learning to write a review of an article is a skill that may best be taught by a mentor. Research postgraduate students invited to be reviewers should check with their supervisors about serving in this role.

Discussion Questions:

- Other than authors, editors, and readers, to whom are reviewers obligated?
- When ought a reviewer decline to review a piece?
- Is peer-review important for all disciplines? Why or why not?

Chapter Twelve

What is Intellectual Property?

Summary

Research work does not generate products in the same way that work in commercial industries may. Types of intangible or intellectual property that may be produced in the course of research include patents, copyrights, trademarks, and trade secrets. Researchers who will publish their results need to be aware of copyrights restrictions, while those who will also attempt to create products or processes of commercial value will also need to know the requirements and implications of patenting. For all research products, integrity in their production should be maintained throughout the development process.

Intended Learning Outcomes

By the end of this chapter, readers should be able to

- Distinguish between the four types of intellectual property
- Describe the role and importance of the copyright in publication
- Articulate in their own words the relevance of intellectual property considerations to Research Integrity

Case Twenty

Renee wants to help his friends, but he is not sure whether it would be right for him to do so. Renee's supervisor recently upgraded the statistical software on his computer using funds from an external grant. Renee can now run sophisticated analyses in less time than his companions can and they are jealous. His friend Wai has asked him to give him access to his computer so he can copy the software for the rest of the department's research postgraduate students. Renee is sure that he agreed to only a single-user license when uploading the software. But, Renee thinks his friends should get the new software as well as it would really help them to get their research done faster. He should not get special privileges just because his supervisor won additional funding.

- Would it be wrong for Renee to give Wai access to his computer?
- Would it be wrong for Wai to copy and distribute the software?
- To whom should Renee and Wai speak if they want to get the new software for the rest of the students in the department?

HKU expects all staff, students and visitors to respect the intellectual property claims of the University community and the research community in general. Publications of research manuscripts, datasets, artistic representations, and software are protected as intellectual property. Intellectual property claims that may be found in academic arenas may include copyrights, patents, trade secrets, and trademarks. As described in the HKU Intellectual Property Rights Policy,

Intellectual Property Rights means any and all intellectual and industrial property rights now in force or that come into force in the future in any part of the world whether or not registered or registerable and includes all applications and rights to apply for registration (and renewals and extensions of any registration) of such rights as well as any rights of action and remedies in relation to past infringements including rights in or in connection with: a) Confidential information, business or trade secrets, know-how; b) Inventions, Patents (including supplementary protection certificates); Copyright (including the rights to secure Copyright renewals and extensions of Copyright, Copyright not yet in existence in the future and all other rights of a like nature by law in force in any part of the world); d) Trade marks, service marks, business or trade names; and e) Design rights, topography rights together with all other rights of a similar or corresponding character or nature (Intellectual Property Rights Policy 2011, section 2).

Staff, students and visitors to HKU are required to understand Intellectual Property Rights [IPR] issues and policies at the institution. Of keen importance is the role that the university will play in the ownership of IPR, even those claims made by students. Although the university “shall own all Intellectual Property Rights in works generated by employment with the University” for staff, for students, the University “may assert ownership of Intellectual Property Rights generated by Students in the course of study” (Intellectual Property Rights Policy, sections 4.1.1 and 4.1.2). When working in conjunction with their supervisors, students should be aware of the terms of the Intellectual Property Rights Policy that pertain to the ownership of IP developed in a supervisor- student(s) team. Prior to joining a research project, whether unfunded or internally or externally funded, students should consult their supervisors and the Intellectual Property Rights Policy, specifically sections 4.3, 4.4 and 4.5, for information on the possible IPR concerns that may arise from the project.

Box 12.1: Four Types of Intellectual Property Vehicles

Copyright: “means a collection of rights relating to original literary, dramatic, musical, and artistic works, films, broadcasts, cable programmes and the typographical arrangement of published editions. For the avoidance of doubt, ‘literary work’ includes software and digital publications” (Intellectual Property Rights Policy 2011, section 2).

Patent: A patent gives the patent holder exclusive rights to a product or process; it does not confer ownership of the product or process to the holder. “A patent conveys the grant (permission) to an individual or group of individuals the legal right for a defined period of time to exclude all others from making, using, or selling the invention as claimed” (Mays 2003, 225).

Trademark: “means a distinctive name, sign, logo or indicator used by an individual, business or other legal entity to distinguish its goods and/ or services” (Intellectual Property Rights Policy 2011, section 2).

Trade Secret: “Legally defined, a trade secret means information, including a formula, pattern, compilation, program, device, method, technique, or process, that (i) derives independent economic value, actual or potential, from not being generally known, an not being readily ascertainable by proper means by other persons who can obtain economic value from its disclosure or use, and (ii) is the subject of efforts that are reasonable under the circumstances to maintain its secrecy” (Mays 2003, 216-217).

Of keen interest to researchers who will publish their results is the mechanism of the copyright. The copyright protects the rights of the author to be duly recognized for their unique expressions contained in the piece. Recognition of ideas or an author does not mean direct ownership of the ideas. In fact, when publishing in an academic journal, for example, authors may be asked to assign the copyright of the document to the journal or society that publishes the journal. When assigning copyright to the journal, the journal receives rights to distribution of the article while the author retains the right to identification as an author and any rights to other forms of intellectual property described in the article (e.g., patents).

Many types of materials that support academic research are also protected by a copyright. One key example is software. Proprietary software programmes are copyrighted materials that should not be “cracked” or copied by the end-users. Further, images and other representations found on the internet may also be protected by copyrights that prohibit copying by third parties.

The norms of Research Integrity and the practices of Responsible Conduct of Research explicitly prohibit the appropriation of another's work as one's own through the concept of plagiarism. "Plagiarism is copying the work of another person without proper acknowledgement" (Gardner 2006, 1). In some cases, plagiarizing another's work or even one's own published works may also constitute an infringement of copyright.

Patents, or "a grant by a national sovereign government to an applicant for a specific and limited period of time during which the grantee has a legal right to exclude others from making, using, or selling his or her claimed invention in exchange for the grantee's providing a full disclosure as to how the invention may be made, may be used, or functions (Mays 2003, 225). Researchers whose projects may have commercial applications will need to bear in mind the requirements of disclosure for a patent. Above all, though, it is imperative that the data and explanations gathered to support a patent application meet expectations of Responsible Conduct of Research, particularly data acquisition and management. Researchers interested in applying for patents or trademarks on their research products should address their concerns to the Technology Transfer Office at HKU.

In the event a postgraduate student has questions about Intellectual Property Rights (IPR), s/he should seek advice from the University Intellectual Property Rights Policy, their supervisor, and, if necessary, the Technology Transfer Office.

Discussion Questions:

- What types of intellectual property claims are commonplace for your discipline?
- Why is intellectual property an important concept for researchers to understand?
- Other than intellectual property claims, do researchers have any other property claims upon their research products?

What are Technology Transfer and Knowledge Exchange?

Summary

The role of the university in society is to contribute to the growth of knowledge that benefits humankind and the environment. Two mechanisms that contemporary universities use to fulfil this role is “knowledge exchange” and “technology transfer”. Knowledge Exchange and Technology Transfer are special types of collaborative arrangements that may have Research Integrity problems unique to them.

Intended Learning Outcomes

By the end of this chapter, readers should be able to

- Define and differentiate Knowledge Exchange and Technology Transfer
- Describe threats to Research Integrity from Knowledge Exchange or Technology Transfer arrangements
- Identify the roles of the Knowledge Exchange and Technology Transfer offices at HKU

University research fulfils functions for the university, the researchers, and society. To manage the multiple functions that research fulfils, many universities, including HKU, have developed resources that assist researchers and the university to transfer their knowledge to the society and to reap the benefits of that transfer. At HKU, these resources include the Knowledge Exchange Office and Technology Transfer Office. Both the Knowledge Exchange Office and Technology Transfer Office assist researchers who wish to make their research known to the community. The Technology Transfer Office does this by facilitating applications for obtaining intellectual property vehicles necessary to protect and promote commercializable research interests. The Knowledge Exchange Office does this by facilitating other forms of communication of research, such as community outreach and community development programmes.

Knowledge Exchange is a mutually beneficial arrangement between a university and community organizations or partners wherein the expertise of the university is used to contribute to social, cultural, technological, and economic development, preservation, and/or progress. Technology Transfer may refer to the translation of scientific research into economically valuable products or processes. Technology Transfer may also refer to the legal or contractual arrangements made by industry and/or government and university partners to generate valued products or processes.

Box 13.1: Definitions of Knowledge Exchange and Technology Transfer

Knowledge Exchange: “Sharing the benefits of the new knowledge we create with industry partners and the community” (The University of Hong Kong, Knowledge Exchange Office)

“...the two-way exchange of skilled people, knowledge and expertise between the scientific community and those who use science” (Thorpe n.d., National Environment Research Council- UK, 1)

Technology Transfer: assignment of intellectual property rights associated with research findings developed at a university to another commercial entity. “The Technology Transfer Office manages the Intellectual Property Office of HKU. One of its objectives is to help the University and its researchers/inventors obtain intellectual property protection by applying for and maintaining patents and trademarks in different countries. It also acts as a bridge between the academia [sic] and the industry in the technology transfer process and commercialization of research results by adopting the appropriate strategic approaches (e.g., licensing, establishing a joint venture, forming start-ups, etc.) (<http://www.tto.hku.hk/>).

The dissemination of research results to the community is a laudable goal that all researchers should strive for at an appropriate time in their careers and research development. However, speedy communication of research results should not be overtaken by goals to produce sound research obtained through Responsible Conduct of Research practices. Researchers should ensure that their work is suitably reviewed by peers in the community before imparting their knowledge to the lay public, regardless of which channel they will use. For example, publicizing one's research results by press release or media exposure rather than or before peer assessment in appropriate disciplinary venues should be avoided.

Technology Transfer or Knowledge Exchange opportunities present many of the problems and promises of other types of collaborative research. Collaboration with community or industry partners may invite incidences where conflict of interests or conflict of commitments may arise. When partnering with organizations external to the university, researchers should be mindful of the goals and values of their partners and work to achieve a mutually beneficial consensus on the bases of their shared work. Research postgraduate students should be aware that knowledge or technology exchange efforts that they or their supervisors undertake could place restrictions on their time and/or use of data and results in their theses or dissertations. Advice from the Knowledge Exchange or Technology Transfer Offices should be sought before, during, and even after a collaborative exercise is undertaken.

Researchers whose Knowledge Exchange work involves advocating policy solutions should ensure that their results can be supported by analysis and interpretation commensurate with that used to publish results in conventional research venues. Researchers should confine their outreach and exchange activities to those in which they have recognizable substantive expertise. As put forth in the Singapore Statement on Research Integrity, point 10, "Researchers should limit professional comments to their recognized expertise when engaged in public discussions about the application and importance of research findings and clearly distinguish professional comments from opinions based on personal views".

Research postgraduate students' contact with the Knowledge Exchange and Technology Transfer offices may be infrequent. However, students whose projects and/ or supervisors are involved in Knowledge Exchange activities or Technology Transfer arrangements should be certain to determine what data, materials, or applications they may use towards completion of the degree. Students involved in such projects or supervisory arrangements must ensure that their research is of the highest integrity as the communication of their results may affect the public's perception of research or even directly affect public policy and commercial choices.



Discussion Questions:

- Do researchers have an obligation to participate in Knowledge Exchange?
- What interests of researchers does Technology Transfer serve?

What is Social Responsibility in a Research Setting?

Summary

Universities are an important part of the social and economic landscape of the community in which they are situated. While the conduct of research brings vast benefits to local and global society, these benefits must be balanced against an assessment of the short and long-term risks the research could present. Researchers should be aware of the impact of their activities on their workplace, the local and regional economy, local communities, global communities of researchers, and local and international politics.

Intended Learning Outcomes

By the end of this chapter, readers should be able to

- Articulate a definition of social responsibility for their discipline
- Identify a principle for socially responsible research

Case Twelve

Lasha is frustrated. He is seeking permission to replicate a controversial study — Laud Humphrey's Tea Room Trade — in a conservative Central Asian nation. Lasha's MPhil research showed a remarkable similarity in terms of public perceptions and values towards homosexual behaviour in this nation and America at the time that Humphrey's wrote his study. He believes that replicating Humphrey's study — serving covertly as a look-out in public restrooms while others engage in casual sexual contact, then recording the participant's vehicle details, and recontacting (using a vehicle registries list) and interviewing the participants about their health risk behaviour — will help to clarify attitudes towards sexuality in this nation. But, Lasha is meeting with resistance — his supervisor is concerned that he does not have enough fieldwork experience in this nation, his department head is concerned that Lasha's research may endanger him personally, the human participants research ethics board is concerned about the use of deception in the study and the overall risk to participants, and the funding agency he is working with will not release the funds until each of these parties sign off on the research plan. To Lasha, all of these concerns are secondary to both performing good science via replication and to exposing prejudice and problems in society. He believes that conducting the research, despite the risks, is the socially responsible thing to do.

- What are Lasha's social responsibilities as a researcher?
- What ought Lasha do to minimize risks in his proposed research?

The Singapore Statement on Research Integrity reminds researchers “that they have an ethical obligation to weigh societal benefits against risks inherent in their work” (point 13). In short, researchers have an obligation to beneficence. As defined in the Belmont Report, “the term ‘beneficence’ is often understood to cover acts of kindness or charity that go beyond strict obligation.... Two general rules have been formulated as complementary expressions of beneficent actions in this sense [of obligation]: (1) do not harm and (2) maximize possible benefits and minimize possible harms” (1979, section B2).

Some forms of research are directly harmful to the public, while others may put the public at risk from indirect harm. Direct risk to the public is presented from any form of Research Misconduct. With particular reference to human participants or animal subjects research, any research where the outcomes of the research are shown to have been fabricated, falsified, plagiarized, or produced out of compliance with the standards of local law and research ethics is a direct threat to the public's trust in science, if not the safety and well-being of the research subjects. Misconduct in research also poses a threat to public health, safety, and well-being if fraudulent results are used to establish clinical, engineering, educational, or public policy standards. Indirect harm to the public, in the form of wasted financial or human resources, is also a consequence of Research Misconduct that must be avoided.

Apart from avoiding any incidences of malfeasance, such as Research Misconduct, and seeking to eliminate any Questionable Research Practices from their craft, researchers should strive to practice socially responsible research. To be socially responsible "implies a public posture toward society's economic and human resources and a willingness to see that those resources are used for broad social ends and not imply for the narrowly circumscribed interests of private persons and firms" (Frederick 1960, 60; quoted in Carroll 1999, 271). This "public posture", can be seen as being a "good neighbour". "Good neighbourliness" is a concept that "involves two phases. On one hand, it means not doing things that spoil the neighbourhood. On the other, it may be expressed as the voluntary assumption of the obligation to help solve neighbourhood problems" (Eilbert and Parker 1973, 7; quoted in Carroll 1999, 278). A socially responsible researcher considers the consequences to the local neighbourhood and the global community of researchers when articulating his/her research question, designing his/her research, using public funds and other resources, and publicizing his/her results.

One of the key values of Research Integrity is accountability, or accepting the "Duty to answer truthfully about the motivations and conduct of one's activities as well as the duty to accept praise or blame for one's choices". Socially responsible researchers will ensure that their research is well-designed, planned, and executed; is compliant with human, animal, or hazardous materials research regulations; and answers questions of broad social utility. As the acquisition of useful basic and applied scientific knowledge as well as knowledge of the humanities and arts is a valued social goal, social responsibility can be an encompassing concept that compels researchers to think of the public's role in their research. Irrespective of the responsibility assumed in the conduct of the research, socially responsible researchers will ensure that their results are made public through reputedly produced publications, demonstrations, and knowledge exchange.



Discussion Questions:

- What obligations do you believe researchers have toward society in general?
- Does the public have any obligation to support research?

What is Environmental Sustainability in a Research Setting?

Summary

Research is a resource intensive exercise. Some resources used in contemporary research projects, such as animals and human participants are scarce, while others, such as radioactive materials and biohazardous substances, may pose a threat to researchers or the wider community. Other resources, such as paper and common reagents, may seem abundant, but need sustainable management in order to protect the environment that we all share. Researchers should recognize environmental stewardship of research resources as one of their social responsibilities.

Intended Learning Outcomes

By the end of this chapter, readers should be able to

- Articulate a definition of environmental stewardship for their discipline
- Enumerate the principles of sustainable research
- Describe methods for reducing waste or inefficiency in their own research environments

Case Twenty-Two

Lai is tempted. He needs to obtain materials for his research project fast. But, Lai has a problem. His research, a study of musical instrument making techniques in an indigenous community, involves use of materials (wood and resins) from an endangered species of tree. To get the required materials legally, Lai would have to apply for special permits via the Customs and Excise Department. These permits are expensive and the time for approval is lengthy. Surfing the web, Lai has found a website that claims it can supply him the materials without permits if he travels to another country in the region and brings it back covertly. Lai would like to get his materials as quickly as possible and the company website seems reputable.

- If Lai purchases the materials this way, has he done anything wrong?
- What Research Integrity concerns are provoked by this case?

Researchers have special obligations to protect the public from direct harms that might result from their research. For example, researchers working with hazardous materials must ensure that they control access and disposal of these materials. However, all researchers, regardless of the nature of their work, have an obligation to ensure that their research is conducted in an environmentally responsible manner.

In a research setting, environmental stewardship requires making conscious choices — even seemingly small choices — to minimize the impact that the conduct of our research projects has upon the natural environment. To the extent that we take responsibility for protection of the quality of the living environment that surrounds the research venue, we can be said to engage in sustainable research. Sustainable research is any type of research practice that takes meaningful and measurable steps to reduce the environmental footprint of necessary exercises to the lowest possible to conduct valid research. The environmental footprint of research includes use of resources including basic, structural, facilities such as electricity, water, paper and other materials necessary for the conduct of teaching, research writing and administration; travel and transport facilities; selection of goods and services providers; waste disposal facilities (including recycling); and research-specific resources such as animals.

Sustainable Research and Environmental Stewardship are essential in an institutional environment that promotes Research Integrity. Principles such as diligence and honesty motivate researchers to avoid waste and abuse of scarce resources in their daily practices. Institutional policies that educate and encourage researchers to minimize use of resources to sustainable levels help to foster diligence in research practices. The Singapore Statement on Research Integrity suggests that “Research institutions should create and sustain environments that encourage integrity through education, clear policies, and reasonable standards for advancement, while fostering work environments that support research integrity” (Singapore Statement, point 13).

Box 15.1: Practices of Environmental Stewardship in a Research Setting

- Minimize use of electricity by turning off lights and maintaining air-conditioning at levels necessary to ensure comfort and adequate environmental control for research equipment
- Minimize use of water, reagents, and other chemicals through careful measurement to only what is necessary to perform experiments
- Minimize use of paper, copying, and printing to what is necessary for communication. Consider using scanned documents rather than paper copies for dissemination
- Maximize efficiency of research design to minimize wastage of supplies and resources
- Reduce the number of animals and/or hazardous substances used in research to what is scientifically necessary
- Use electronic means of communication, such as email and/or tele-conferencing, to reduce transportation costs and environmental impact of travel
- Minimize wastage due to lengthy storage by using a just-in-time supply model
- Procure resources from sustainable outlets when available

Research postgraduate students are in a unique position to assist their research groups and departments to create a culture of Sustainable Research. Principal Investigators and supervisors should ensure that postgraduate students are well-trained in the procedures and methods for the conduct of their research. Postgraduate students performing or conducting experiments, whether individually or in concert with technical staff and research assistants, can monitor the use of resources directly and ensure that procedures are followed diligently to reduce waste.

Discussion Questions:

- What special obligations to the environment do researchers have that are not shared by the general public?
- Are there environmentally unfriendly practices that you see at HKU? How would you eliminate these?

Conclusion

At the end of this course, students should have learned the principles and practices of Research Integrity and should be more aware of the problems associated with Research Misconduct and Questionable Research Practices. The end of this course and the close of this guidebook is an invitation for students to apply what they have learned in this course and this text to their own research. Research post-graduate students are the heart of a research university like University of Hong Kong. The creativity and passion of post-graduate students and other young researchers preserves a bright future for academic research in Hong Kong and the region. Yet, creativity, passion and technical skill should be met with equal amounts of Honesty, accountability, fairness, diligence, equity, and professionalism. Without integrity, our research will not stand up to the scrutiny of the global research community.

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CHAPTER 10

Resources for Further Learning:

Useful websites:

The Committee on Publication Ethics (COPE) has many resources available on their website at: <http://www.publicationethics.org/>

Other Resources:

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CHAPTER 11

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The Society for Neuroscience publishes "Responsible Conduct Regarding Scientific Communication" that includes a section on responsibilities of Reviewers of Manuscripts. <http://www.sfn.org/index.aspx?pagename=responsibleConduct>

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CHAPTER 12

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Useful Websites:

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The University of Hong Kong Intellectual Property Rights Policy can be found at the research services website: <http://www3.hku.hk/rss/index.php/contracts/ipr>

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CHAPTER 13

Resources for Further Learning:

Useful Websites:

Association of University Technology Managers' website has many resources for academics and technology transfer professionals: http://www.autm.net/Tech_Transfer.htm

Association of University Technology Managers. 2010 Better World Report: The Positive Impact of Academic Innovations on Quality of Life. Association of University Technology Managers. <http://www.betterworldproject.org/>

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CHAPTER 14

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Singapore Statement on Research Integrity

Preamble. The value and benefits of research are vitally dependent on the integrity of research. While there can be and are national and disciplinary differences in the way research is organized and conducted, there are also principles and professional responsibilities that are fundamental to the integrity of research wherever it is undertaken.

PRINCIPLES

Honesty in all aspects of research
Accountability in the conduct of research
Professional courtesy and fairness in working with others
Good stewardship of research on behalf of others

RESPONSIBILITIES

1. Integrity: Researchers should take responsibility for the trustworthiness of their research.

2. Adherence to Regulations: Researchers should be aware of and adhere to regulations and policies related to research.

3. Research Methods: Researchers should employ appropriate research methods, base conclusions on critical analysis of the evidence and report findings and interpretations fully and objectively.

4. Research Records: Researchers should keep clear, accurate records of all research in ways that will allow verification and replication of their work by others.

5. Research Findings: Researchers should share data and findings openly and promptly, as soon as they have had an opportunity to establish priority and ownership claims.

6. Authorship: Researchers should take responsibility for their contributions to all publications, funding applications, reports and other representations of their research. Lists of authors should include all those and only those who meet applicable authorship criteria.

7. Publication Acknowledgement: Researchers should acknowledge in publications the names and roles of those who made significant contributions to the research, including writers, funders, sponsors, and others, but do not meet authorship criteria.

8. Peer Review: Researchers should provide fair, prompt and rigorous evaluations and respect confidentiality when reviewing others' work.

9. Conflict of Interest: Researchers should disclose financial and other conflicts of interest that could compromise the trustworthiness of their work in research proposals, publications and public communications as well as in all review activities.

10. Public Communication: Researchers should limit professional comments to their recognized expertise when engaged in public discussions about the application and importance of research findings and clearly distinguish professional comments from opinions based on personal views.

11. Reporting Irresponsible Research

Practices: Researchers should report to the appropriate authorities any suspected research misconduct, including fabrication, falsification or plagiarism, and other irresponsible research practices that undermine the trustworthiness of research, such as carelessness, improperly listing authors, failing to report conflicting data, or the use of misleading analytical methods.

12. Responding to Irresponsible Research

Practices: Research institutions, as well as journals, professional organizations and agencies that have commitments to research, should have procedures for responding to allegations of misconduct and other irresponsible research practices and for protecting those who report such behavior in good faith. When misconduct or other irresponsible research practice is confirmed, appropriate actions should be taken promptly, including correcting the research record.

13. Research Environments: Research institutions should create and sustain environments that encourage integrity through education, clear policies, and reasonable standards for advancement, while fostering work environments that support research integrity.

14. Societal Considerations: Researchers and research institutions should recognize that they have an ethical obligation to weigh societal benefits against risks inherent in their work.

The Singapore Statement on Research Integrity was developed as part of the 2nd World Conference on Research Integrity, 21-24 July 2010, in Singapore, as a global guide to the responsible conduct of research. It is not a regulatory document and does not represent the official policies of the countries and organizations that funded and/or participated in the Conference. For official policies, guidance, and regulations relating to research integrity, appropriate national bodies and organizations should be consulted. Available at: www.singaporestatement.org



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