AL-FARABI KAZAKH NATIONAL UNIVERSITY
FACULTY OF BIOLOGY AND BIOTECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY

Lecture 8

ETHICAL ASPECTS OF SCIENTIFIC RESEARCH

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Aim of the Lecture

To develop students' understanding of ethical principles in scientific research, including research integrity, responsible data management, plagiarism prevention, and the ethical treatment of human and animal research subjects.



Expected Learning Outcomes

By the end of this lecture, students will be able to:

1. Explain the fundamental ethical principles of scientific research.
2. Identify ethical issues related to research involving humans and animals.
3. Recognize plagiarism, data fabrication, and falsification in scientific research.
4. Apply ethical principles to data collection, analysis, and publication.
5. Demonstrate an understanding of academic integrity and responsible research conduct.

Agenda & Structure

Ethical frameworks for scientific inquiry: foundations, research practice, and emerging technologies.

Foundations of ethics	Historical milestones	Belmont framework	IRBs and oversight
Human subjects	Informed consent	Vulnerable groups	Animal ethics and 3Rs
Data ethics and FFP	Open science	Authorship and COI	Peer review ethics
AI and biobanking	Global and societal	Workshop task	References

Foundations Of Research Ethics

Research ethics establishes moral principles and professional standards for responsible scientific research.

It is based on three key principles:

1. Research Integrity – honesty, transparency, and accuracy.
2. Public Trust – credibility and accountability in science.
3. Social Responsibility – protecting society and avoiding harm.



These principles guide researchers throughout the research process, from study design to publication.

Historical Context & Ethical Milestones

Scientific abuses in the 20th century led to the development of international research ethics guidelines.Key Ethical Milestones:

1. Nuremberg Code (1947)
2. Declaration of Helsinki (1964)
3. Belmont Report (1979)
4. Common Rule (1991)



These milestones established essential principles of informed consent, risk assessment, participant protection, and ethical research practices.

Care Ethical Principles: The Belmont Framework

The Belmont Report (1979) established three foundational principles to protect human research participants.

Respect for persons	Beneficence	Justice
Recognise autonomy; obtain informed consent; protect vulnerable groups.	Maximise benefits and minimise harms; protect participants from unnecessary risk.	Distribute burdens and benefits fairly; prevent disproportionate risk or exclusion.

Institutional Review Boards (IRBs) And Ethics Committees

Institutional Review Boards (IRBs) are independent committees that evaluate research involving human participants.

Main responsibilities:
Protect participants' rights and safety.
Assess potential risks and benefits.
Ensure ethical research practices.

Review Process:
1. Submit protocol.
2. Review and revise.
3. Approve and monitor.



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Informed Consent: Mechanics And Standards

Informed consent is an ongoing process that ensures participants understand the study before taking part.

Key Elements:

- Clear explanation of the research.
- Disclosure of potential risks and benefits.
- Voluntary participation.
- Right to withdraw at any time without penalty.



1. Explain the study

2. Voluntary consent

3. Right to withdraw

Protecting Vulnerable Populations

Some groups require additional ethical protection in scientific research.
Key Vulnerable Groups:

- Minors – parental consent and child assent.
- People with impaired decision-making capacity – additional safeguards.
- Terminally ill patients – careful consent procedures.
- Economically disadvantaged groups – protection against exploitation



Deception And Debriefing In Social Sciences

Temporary deception may be used in social science research only under strict ethical conditions.

Key Requirements:

- Significant scientific value.
- No suitable alternative method.
- Minimal risk to participants.
- Full debriefing after the study.
- Opportunity to withdraw data.

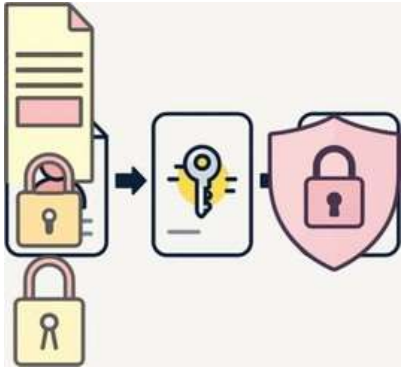


Debriefing ensures transparency and protects participants' rights.

Privacy, Confidentiality, And Anonymization

Researchers must protect participants' personal information throughout the research process.
Key Concepts:

Confidentiality: Restricting access to personal data.
Pseudonymization: Replacing personal identifiers with codes.
Anonymization: Removing identifiers to prevent re-identification.



Data Protection Measures:

Secure data storage.
Restricted access.
Data minimization.
Compliance with privacy regulations.

The 3rs Principle In Animal Research

The 3Rs principle promotes the ethical use of animals in scientific research.

1. ReplacementUse alternative methods, such as cell cultures and computer models.
2. ReductionMinimize the number of animals used in experiments.
3. RefinementReduce pain, suffering, and distress by improving research procedures.

Goal: Ensure animal welfare while maintaining scientific quality



Animal Welfare Committees (IACUC / AWERB)

Animal welfare committees ensure the ethical treatment of animals in scientific research.

Key Responsibilities:

1. Pain Management – Appropriate anesthesia and analgesia.
2. Housing & Enrichment – Suitable living conditions.
3. Humane Endpoints – Prevent unnecessary animal suffering.
4. Veterinary Care – Continuous professional monitoring.

Goal: Protect animal welfare and ensure responsible research practices.



Field Research And Ecological Ethics

Field research requires responsible environmental practices to protect biodiversity and local ecosystems.

Key Ethical Principles:

1. Minimize habitat disturbance.
2. Avoid introducing invasive species..
3. Obtain research permits and approvals.
4. Respect local and Indigenous communities.

Goal: Protect ecosystems and ensure responsible field research.



Research Misconduct: FFP Definitions

Scientific integrity.

Three Major Types (FFP):

1. Fabrication – Inventing data or results.
2. Falsification – Manipulating data or research results.
3. Plagiarism – Using others' ideas or work without proper acknowledgment.I

mpact: Undermines scientific credibility and public trust.



Image & Data Manipulation Policies

Acceptable practices	Misconduct and violations
Uniform adjustments applied consistently across an entire image are generally acceptable when they do not alter or misrepresent scientific information. Acceptable practices include: • Adjusting brightness and contrast uniformly. • Modifying colour balance consistently. • Cropping images without removing relevant information. Applying linear adjustments while preserving original data.	Selective or misleading image manipulation is considered research misconduct. Prohibited practices include: • Enhancing, obscuring, or removing specific image features. • Combining images from different experiments without disclosure. • Selectively adjusting contrast to hide or emphasize results. • Duplicating or deleting image regions to misrepresent findings. All image modifications must preserve scientific accuracy and research integrity.

Plagiarism And Self- Plagiarism Mechanics

Type	Description
Direct plagiarism	Copying text without citation
Mosaic plagiarism	Combining copied phrases
Paraphrasing plagiarism	Rewriting without attribution
Idea plagiarism	Using ideas without credit
Self-plagiarism	Reusing previously published work



Open Science And Data Sharing Protocols

Open Science promotes transparency, accessibility, and reproducibility in scientific research. Sharing research data and codes enables independent verification, improves collaboration, and accelerates scientific discovery.
However, data sharing must respect participant privacy, confidentiality, and intellectual property rights.
Key Principles of Open Science:

- Preregistration: Registering study design and hypotheses before data collection.
- Open Data: Depositing research data in accessible repositories.
  Open Code: Sharing analytical scripts to support reproducibility.
- Transparent Peer Review: Making the research evaluation process more transparent.



Dual-use Research Of Concern (DURC)

Dual-use research refers to scientific studies that can provide significant benefits but may also be misused to threaten public health, safety, or national security.Research involving dangerous pathogens, infectious diseases, and gain-of-function experiments requires careful ethical assessment and appropriate biosafety measures.

Key Ethical Considerations:

- Scientific Benefits: Advancing knowledge and developing vaccines or treatments.
- Biosecurity Risks: Preventing the misuse of research findings.
- Risk Assessment: Evaluating potential harmful applications before publication.
- Risk Mitigation: Applying restricted access, responsible communication, and institutional oversight.

Responsible research requires balancing scientific progress with public safety.



Ethical Authorship And Credit Allocation

Authorship conveys both credit and accountability. The ICMJE criteria define who qualifies as a legitimate author, preventing ghost authorship and gift authorship: All four ICMJE criteria must be met to qualify as an author.

Contributors who meet fewer criteria should be acknowledged, not listed as authors.

Noncompliance undermines research integrity.

Substantial Contribution
Final Approval
Critical Drafting
Accountability



Conflicts Of Interest (COI) Disclosures

A conflict of interest occurs when personal, financial, or professional interests may influence the objectivity of scientific research.

Key Requirements:

1. Disclose financial relationships and funding sources.
2. Declare personal and professional affiliations.
3. Report potential conflicts to journals and institutions.
4. Maintain transparency throughout the research process.

Importance: Protecting research integrity and public trust.



Ethics In Peer Review

Peer review is essential for maintaining scientific quality and integrity.

Ethical Responsibilities of Reviewers:

1. Confidentiality – Protect unpublished manuscripts.
2. Objectivity – Provide fair and unbiased evaluations.
3. Timeliness – Submit reviews within agreed deadlines.
4. Disclosure – Declare potential conflicts of interest.
5. Integrity – Never misuse unpublished data or ideas.

Importance: Ensuring fairness, transparency, and scientific quality.



Predatory Publishing And Ethical Journals

Legitimate journals	Predatory publishers
• Conduct rigorous peer review. • Maintain transparent editorial policies. • Follow recognized publication ethics standards. • Provide clear information about publication fees. • Ensure proper indexing and editorial accountability	• Charge publication fees without proper peer review. • Provide misleading information about indexing. • Have unclear editorial policies. • Promise unrealistically rapid publication. • Lack transparency and scientific quality control.

Whistleblowing And Handling Misconduct

Whistleblowing involves reporting suspected research misconduct to protect scientific integrity.

Key Stages:

1. Allegation – Reporting suspected misconduct confidentially.
2. Initial Inquiry – Assessing whether a formal investigation is necessary.
3. Formal Investigation – Examining evidence and relevant documents.
4. Corrective Action – Implementing corrections, retractions, or disciplinary measures when appropriate.



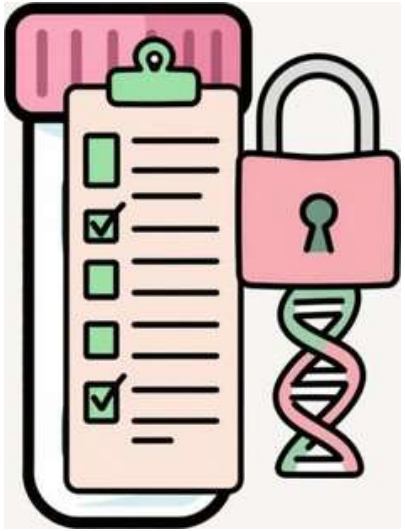
Key Principle: Protect whistleblowers from retaliation and ensure fair investigations.

Ethics In Biobanking And Genetic Data

Biobanks store biological samples and genetic data for current and future scientific research.

Key Ethical Considerations:

- Informed Consent: Obtaining permission for sample collection and future use.
- Privacy Protection: Safeguarding personal and genetic information.
- Data Security: Preventing unauthorized access and data misuse.
- Access and Sharing: Ensuring responsible use of biological materials.
- Benefit Sharing: Promoting fairness and protecting donors' rights.



Key Principle: Balancing scientific progress with individual rights and privacy.

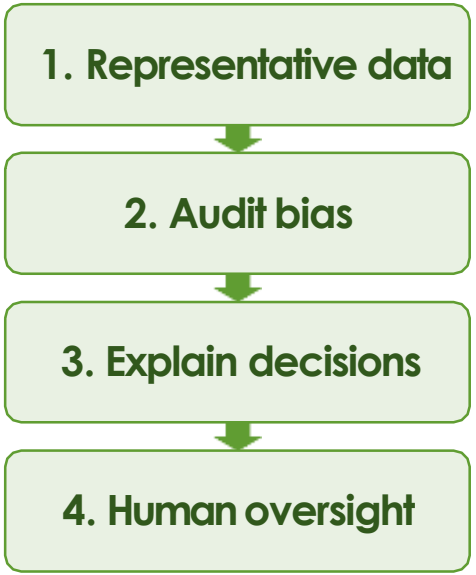
Ethics Of Artificial Intelligence In Research

AI systems may produce biased results due to unrepresentative training data or algorithm design.

Key Ethical Principles:

- Representative and reliable data.
- Regular bias assessment.
- Transparent AI decision-making.
- Human oversight and accountability.

Researchers must ensure that AI-generated results are accurate, fair, and scientifically reliable.



Generative AI & Text Generation Rules

Permitted uses of AI	Prohibited uses
• Grammar and language correction. • Text editing and proofreading. • Literature organization. • Data analysis assistance. • Reference formatting.	• Presenting AI-generated text as original work. • Fabricating data or references. • Using AI to manipulate research results. • Submitting AI-generated content without required disclosure.

Environmental And Societal Impact Of Research

Scientific research has social, environmental, and economic impacts.

1. Key Considerations:
2. Social benefits and public health.
3. Environmental protection.
4. Sustainable resource use.
5. Community well-being.



Researchers should minimize negative impacts and promote sustainable development.

Global Ethics & Research In Developing Nations

International research requires equity, respect, and fair collaboration.

Key Ethical Principles:
Local researcher involvement.
Fair authorship and recognition.
Knowledge and technology sharing.
Capacity building.
Equal access to research benefits.



Ethical partnerships promote trust, fairness, and sustainable scientific development.

Workshop: Ethical Dilemmas

Case Study: Research Ethics Violations

An industry-funded drug study faces pressure to remove statistical outliers, include unrelated work in the references, and omit funding disclosure.

Discussion Tasks:

1. Identify three ethical violations in the scenario.
2. Explain why removing outliers without methodological justification violates data integrity.
3. Distinguish between fabrication and falsification.
4. Explain the authorship criteria (ICMJE) and conflict of interest (COI) disclosure requirements.

Task: Discuss the appropriate ethical actions the research team should take.



References & Ethics Handbooks

The following documents provide essential guidance for ethical scientific research, responsible conduct, and research integrity:

1. Declaration of Helsinki (2013)
2. Belmont Report (1979)
3. Fostering Integrity in Research (2017)
4. European Code of Conduct for Research Integrity (2023)



These guidelines support ethical decision-making, transparency, accountability, and responsible research practices.