# Bioethics
## A Coursebook

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# 1. Bioethics: A Global Approach

## Introduction

This is a coursebook about bioethics. Bioethics is the branch of applied ethics that studies the philosophical, social, and legal issues arising in medicine and the life sciences. It is a discipline that is nowadays often conflated with biomedical ethics, as opposed to environmental ethics. In this book, however, we consider bioethics in the spirit of Van Rensselaer Potter, who thought bioethics should be a global endeavour (Potter, 1988). By that, he meant that it should truly be an ethics of life, spanning both the human and the other-than-human world: both biomedical ethics and environmental ethics. Also, for us—the writers of this textbook—it does not make much sense to consider duties towards human health and the environment separately. Recent developments in molecular biology, such as epigenetics and exposomics, demonstrate that such separation is unhelpful. Recent initiatives such as *OneHealth* link human, other-than-human, and ecosystem health and advocate for a transdisciplinary approach to health. Such a transdisciplinary approach not only involves biological and biomedical scientists but also includes sociological, legal, ethical, and political perspectives. This book aims to give a broad overview of the method of bioethics and some of the central debates in the field. It is aimed at students of philosophy, biology, biomedical sciences, bioengineering, and all those interested in researching and working with life in the widest sense.

As a student in the sciences, finding yourself with this coursebook, you might wonder, 'Why would scientists have to learn about ethics?' Is something scientifically accurate not immediately equivalent to what is morally good, and is doing good science in the technical sense not the same as doing morally good science? Acting ethically correct is 'doing good', and do we not all know intuitively what that is? Maybe conceptions about what is good are different for everybody or based on the culture in which we are situated. Maybe finding a universal answer to the question 'what is good' makes no sense. In this book, we will ask ourselves questions such as: what is good ethical practice in general and for the life sciences in particular? Which ethical dilemmas do life scientists face? It will become clear from the start that we do not aim to provide straightforward answers to ethical dilemmas. Instead, we want to offer you the tools to reflect on ethical issues and arrive at a balanced conclusion.


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We shall start with a small exercise: Imagine that you are a biologist working on chemical herbicides to inhibit undesirable plants in agriculture, forestry, or non-crop areas such as industrial sites, roadsides, and lawns. What kind of ethical questions do you think may arise?

Arthur Galston was a biologist and plant physiologist at Yale University, who turned into a bioethicist later in his career. His dissertation on the flowering process of soybean plants led others to develop Agent Orange: the most widely employed herbicide during the Vietnam War, used to defoliate forests and eliminate enemy cover and food sources. Galston, as a bioethicist, said, "The only recourse for a scientist concerned about the social consequences of his work is to remain involved with it to the end" (Galston, 1972). While well-intended, we would like to offer two points of reflection. Firstly, we can expect a scientist's work's social and ethical consequences to continue long after the scientist has passed away. Secondly, proper critical thinking requires reflection before and during scientific development, too, not just after. In the following paragraphs, we discuss three aspects of basic critical reflection.

## Know what you don't know

Our knowledge production and our methods to test hypotheses are, by definition, limited by our senses and the instruments we have to extend what we can observe with those senses. The human naked eye cannot capture ultraviolet or infrared light, but technology allows us to measure and characterize these frequencies. Our ears do not capture radio signals without the help of a radio. There are plenty of phenomena like these that we can only observe through technology. However, there are many more phenomena which we do not have the tools required to capture. Sometimes, we can infer from the feedback we receive. For instance, there are many toxins we cannot smell or taste. But if we consistently drop dead after inhaling or ingesting them, we can assume that they are deadly. Perhaps we can also find other ways to detect them. However, we will likely not detect phenomena outside of our field of perception, whether through senses, technology, or feedback. As a result, we will not even know whether these phenomena exist (and yet this does not mean they don't exist!). These boundaries of our empirical knowledge represent the first way in which our view of reality may be limited.

## Perspectives and bias

Aside from reducing what humans *can* know, the limitations in our sense-making also strongly *distort* all that we *do* know. Not just *what* we can experience but *how* we can experience it is informed by our senses, technology, and feedback, but also our intuition and cognition. Mental processes have their own limitations, and they are greatly affected by cognitive, cultural, and contextual factors. Heuristics and cognitive biases give shape to the information by influencing the interpretation of that information.

Changing one's point of view often seems to change everything. Even if the situation hasn't changed at all, a different perspective may change not only the most relevant factors, but also the ways one can or wishes to respond to the situation. On the one hand, this explains why we can observe a global trend of questioning and reforming old concepts. On the other hand, it creates extreme, often polarized, viewpoints where people question even the most fundamental assumptions (e.g. fake news, flat earthers).

### Outdated and incomplete knowledge

Finally, even if we do have some concrete, 'objective' information, the world changes fast. Scientific knowledge travels slowly, although this, too, is changing. And yet, even though the spread of information is accelerating, schoolbooks can be outdated by the time they come into print. This is especially the case for basic, general knowledge about geography and recent history, for instance (e.g. world population statistics). Moreover, knowledge can still be correct in and of itself, but when new insights are gained on a wider scale, these change the meaning of the smaller parts (e.g. the tip of the iceberg).

Critical reflection requires our awareness of all these limitations, as well as the openness and curiosity to find satisfying answers in spite of non-ideal conditions.

## Our approach to bioethics: an ethico-onto-epistemology

When scientists from fields of study such as biology, biochemistry, or biomedicine hear the word 'ethics,' they often think about procedural requirements—such as GDPR, ethics committees, and consent forms—or restrictions on the use of laboratory animals, and safety regulations. Indeed, part of the role of bioethicists is to sit on committees that evaluate the ethics of research proposals and (clinical) interventions. Specifically, these evaluations take the form of assessing whether consent forms are clear enough about the risks that research participation entails, or whether animals are unnecessarily harmed in experiments. But it is also the task of ethicists, in their capacity as philosophers, to think about what it *means* that animals are not unnecessarily harmed. How do we define what 'harm' entails? And when is harm 'acceptable'? How do we weigh the interests of other-than-human animals vs humans? And this is where it gets interesting.

Our approach to bioethics is reminiscent of what Oxford philosopher Onora O'Neill once said. O'Neill (born 1941), who received an honorary doctorate from the University of Antwerp on 3 April 2021, has called bioethics "a meeting ground for a number of disciplines, discourses and organisations concerning ethical, legal and social questions raised by advances in medicine, science and biotechnology." (O'Neill, 2002, p. 1). Indeed, one cannot think about the practical dilemmas in the life sciences without engaging with these sciences. Bioethicists are often philosophers, but also sometimes people with a background in the life sciences. Galston, encountered earlier,

is but one example of a biologist turned bioethicist. However, this 'interdisciplinarity' is not only applicable to dialogues between ethicists and scientists. Ethics and bioethics necessarily also engage with other branches of philosophy.

Traditionally, philosophy has been divided into practical and theoretical disciplines, each with subdisciplines with their own journals and conferences. Subdisciplines of theoretical philosophy include metaphysics, philosophical anthropology, and epistemology. In the former two disciplines, people ask themselves what human beings are, what the world is, and what the universe is. In epistemology, people ask what knowledge is and how we know things. Practical philosophy includes disciplines such as ethics, political philosophy, and social philosophy. In political philosophy, people consider questions of politics and power: structures and ideologies such as capitalism, democracy, colonization, communism, and the patriarchy are analyzed. In social philosophy, people consider the origins and essence of a society and the relation between the individual and social structures.

At the same time, we may question this carving up of philosophy (and science in general) into different subdisciplines. As we will see, bioethicists need to coordinate with philosophers of science, metaethicists, and scientists. Questions about how the world is (ontology) and how we know things (epistemology) are intimately entangled with ethical questions. The way bioethics is approached in this coursebook is hence inspired by the concept of *ethico-onto-epistemology*, first coined by feminist philosopher of science Karen Barad (Barad, 2007). In this neologism, you may recognize several of the main subdisciplines in philosophy: ontology, epistemology, and ethics. Let us discuss these in order.

## Ontology

Ontology refers to our conceptualization of reality and of the phenomena that are part of reality. Specific concepts we take for granted in everyday life are not straightforward upon closer consideration. Think, for example, about 'curing a disease'. What do we actually mean when we call something a *disease*? Do we mean that there is a specific biological *cause*, such as in the case of influenza? Do we mean that a particular person significantly deviates from the statistical mean, such as with high blood pressure? Does this relate to the way people typically function?

This type of question is also relevant for researchers. For example, much research is spent searching for genes that explain the cause of autism. At the same time, we can ask ourselves why people are doing this kind of research. Do we eventually want to 'cure', 'solve', or 'prevent' autism? That idea itself is problematic, as the neurodiversity movement has argued. Should we consider autism a disease or a disorder, or is it just a variant of typical human behaviour? Thinking about how concepts are used in scientific disciplines is also essential for communicating science. If scientists find a statistical association between a specific gene and a specific behaviour or characteristic,

such as intelligence, can we say 'the gene for…' has been found? What's more, different cultures may have different views on reality and may even be said to 'live in different worlds'. For example, Indigenous peoples in North and South America view humans as deeply interconnected with the land, animals, and spirits, whereas other cultures view the land and its creatures as resources to be used. This already shows how views on the world are always connected with what we consider morally good.

## Epistemology and philosophy of science

Epistemology is the branch of philosophy that is concerned with how we know things. The philosophy of science, which is considered by some a subbranch of epistemology, critically reflects on many questions in science and tries to clarify these. Think, for example, about the question of *scientific knowledge*. When is knowledge scientific? Is a statement scientific if we have sufficient empirical proof? If we are thinking about the question 'what is reality made of?', for example, we often stumble upon concepts that we may never be able to prove empirically. Think about string theory in physics. We may use strings to explain certain observable phenomena in reality, but we will probably never be able to observe the strings themselves empirically. Is string theory science, or is this the place where the distinction between philosophy and exact science blurs? Philosophers of science and physicists can think together about scientific practice and what counts as scientific fact in light of these new theories.

Another common assumption pertains to science and scientific knowledge as progressing linearly and cumulatively. Philosophers of science have investigated this idea and have tried to consider whether and how scientific progress is possible. Thomas Kuhn, a philosopher of science, challenged this widely held view. Kuhn argued that scientific development is not a smooth, continuous process but rather occurs through revolutions or paradigm shifts (Kuhn, 2012). According to Kuhn, scientists operate within shared frameworks or *paradigms*, and a crisis arises when anomalies—results that do not fit the current framework—challenge the prevailing paradigm. This leads to a scientific revolution where a new paradigm emerges, fundamentally changing the way scientists understand, approach their field, and even see the world. Different paradigms, Kuhn suggests, are *incommensurable*. Since scientists in different frameworks understand the world differently, we can establish no shared measures to compare different paradigms (e.g. the Ptolemaic vs Copernican worldview). In this view, it becomes difficult to see scientific progress as purely cumulative.

In addition to the question of the possibility of scientific progress, feminist philosophers of science have also explored how scientists are also (subconsciously) led by other influences. They have suggested that social and political influences play a decisive role in research, separately from the principles and norms of scientific practice itself (i.e. the 'scientific method'). Societal, political, and economic interests, for one, inform what questions scientists ask and the types of research we pursue. We have

historically been, for example, more interested in male health than in women's health. The hype surrounding the Human Genome Project also led to a 'geneticization' of research: framing research questions in primarily genetic terms.

While these factors primarily inform science from the 'outside', values also inform scientific decision-making in the lab. A famous example of the 'internal' influence of values on science is the *argument from inductive risk*, which suggests that in conditions of uncertainty—endemic to all science—the acceptance or rejection of a particular hypothesis always involves the risk of getting it wrong. Whether we accept or reject a hypothesis thus not only depends on the data but also on our weighing of the *consequences of error*. A factory making lightbulbs can, for example, tolerate a 5% error rate; whereas, in cancer diagnostics, we might want to be more conservative. Therefore, while scientists generally agree upon a specific threshold for statistical significance (often $p<0.05$)—i.e. for the acceptance or rejection of a hypothesis—the judgement should depend on how we value the consequences of getting it wrong.

If values play a significant role in deciding what we find interesting and how scientists come to scientific knowledge, this raises the question of whose values we take into account: who is at the helm of scientific decision-making? Who gets to decide what types of research we pursue and how we pursue them? Feminist philosophers of science have noted that there exists no neutral, value-free standpoint from which we (and also scientists) approach phenomena. Instead, we are all deeply *situated*. This means that what we can know, which evidence we have access to, and how we weigh those data are all (variously) dependent on our social identity. Arguing against the common-sense view, feminist epistemologists suggest that identity does matter in science, and diversity in the scientific community can itself lead to better knowledge acquisition. They suggest that those who are often excluded from the research community or those affected by the topic of interest often hold valuable and novel insights into the issue at hand. The efforts of feminist activists in tandem with the inclusion of women in biomedical research, for example, led to significant improvements in women's health, a topic which had been considered relatively unimportant. The inclusion of diverse standpoints, these authors suggest, is not only morally favourable but can also lead to better, more objective science. In sum, what is considered scientific depends on current scientific paradigms and what we find acceptable as a society, and who is contained within this 'we'.

## Ethics

### *What is ethics?*

Ethics is a branch of philosophy that deals with morality on different levels. There are two non-normative branches. In *descriptive ethics* or *moral sciences,* morality is approached from social sciences, psychology, and cultural anthropology. For example,

when discussing care ethics, we will talk about psychologists Lawrence Kohlberg (1927–1987) and Carol Gilligan (born 1936), who have studied the different stages of moral development in children. *Metaethics* is a branch of ethics that investigates why human beings are moral and how they are moral. Philosophers look at history, the social sciences, or biology to understand why human beings have moral sensitivity. For example, we can ask ourselves if it is sufficient to feel guilty to be moral or whether you must have a rational conviction that you have done something wrong. Is morality a matter of emotions or reason? Metaethics also studies concepts such as good and evil and justice.

Ethics also has two normative branches. In *general normative ethics*, philosophers think about which kind of behaviour is good or bad. Ethicists try to lay down the basic principles of morality in rational terms and look for an encompassing moral theory. In applied ethics, these questions are asked in specific contexts. Specific moral dilemmas from specific subdomains of human action are analyzed and specified. For example, in business ethics, we can determine the extent of a company's responsibility concerning the well-being of its employees and their families. In media ethics, we investigate journalists' duties towards those interviewed. Bioethics, the topic of this coursebook, is also a form of applied ethics.

### *Metaethics: why are we sensitive to morality?*

As a scientist, you are maybe specifically interested in one question from metaethics: why are people sensitive to morality, and is this specific to human beings? One explanation stresses the struggle to survive and states that ethics primarily applies to humans in a community. Seventeenth-century philosopher Thomas Hobbes (1588–1679) situates the origins of morality in *egoistic prudence* (1996). He asks us to imagine that at a certain moment there were only a few people and lots of food and other resources, at the beginning of human history. However, as the population grew, people had to compete for those resources. Individuals were entangled in a bitter struggle to survive. Only the strongest made it. In this harsh climate, the social contract emerged: people realized that it was to everyone's advantage to keep to a set of moral rules and norms. These rules and norms were institutionalized in laws and enforced by the state.

More recently, Western scientists have acknowledged that other-than-human animals also show altruistic behaviour. Biologists Sarah Brosnan and Frans de Waal demonstrated that sensitivity to fairness and altruism, considered prerequisites for morality, is also present in other-than-human animals (2003). Of course, many people consider human morality to be different from morality in other-than-human animals. There is a place for religion in human morality, for taboo, which might not be the case with other-than-human animals. Still, de Waal and others have argued that morality has its roots in our animal nature, contrary to what Hobbes has suggested.

### *Metaethics: how do moral facts and scientific facts relate to one another?*

When trying to solve ethical dilemmas about new technologies, people often feel that it is sufficient to list these technologies' benefits and disadvantages or risks. What is morally good can, so to say, be discovered by looking at scientific data and be logically deduced from the facts. The underlying idea is that moral facts can be reduced to non-moral facts. Moral facts thus have no separate ontological status in reality. This is called *ethical* (or *moral*) *naturalism*. An example of an ethical naturalist is Peter Railton (born 1950). According to Railton, an act is morally good only if the act is done by a fully rational and informed subject (a subject that has 'looked at the data') but also takes the social point of view into account and includes all interests of all involved. Hence, it is necessary to look at empirical data to understand the concept of moral goodness (Railton, 1986). *Ethical* (or *moral*) *non-naturalists* believe that the good cannot be reduced to other, non-moral facts. The most important name associated with ethical non-naturalism is G. E. Moore (1873–1958). He states that if moral goodness coincides with a natural characteristic—for example, what is good is pleasurable—then whether a specific act that increases pleasure is good becomes a senseless question because the answer would be, per definition, positive—just as the question of whether bachelors are unmarried would make little sense. For Moore, however, the question about the goodness of acts does make sense. It is essential to ask the question. Hence, goodness is a fundamental, separate characteristic that cannot be directly deduced from natural facts. It follows that the properties of goodness cannot be defined but can only be shown and grasped. Goodness is that which our moral intuitions point to, not what we can imply from empirical data (Moore, 1903).

For this coursebook, we shall not go into further detail concerning discussions between ethical naturalists and non-naturalists, nor will we take a stance about who is right. When confronted with bioethical questions, we must consider scientific facts as part of ethical deliberation. For example, people may intuitively feel that we should not genetically modify plants (the 'yuck feeling'), but—especially in a field like bioethics—it is vital to look at and thoroughly understand the scientific facts and advantages that such technologies may yield. However, this does not mean we can deduce good and bad from a mere risk-benefit analysis. Evaluative judgements unavoidably creep into such risk-benefit analysis itself (recall the argument from inductive risk), and judging whether or not a specific use of technology is morally good requires something more.

## Philosophical method

People often think that philosophy is a reflection of one's personal values. However, philosophy is a discipline in which one tries to think clearly and thoroughly about certain things. In this way, philosophy differs from other forms of critical thought in several ways:

## The method of cases (thought experiments)

Rather than generating scientific data through experiments, philosophers develop philosophical theories based on data from their areas of interest. They often use *thought experiments*. Thought experiments are fictional cases with which one tries to test or bring to the fore certain philosophical intuitions. Some of these thought experiments are even funny. For example, philosopher Derek Parfit (1942–2017), who wrote extensively about the concept of personal identity, uses the example of a 'teletransporter' in his book *Reasons and Persons* (*1984*) (Parfit, 1984). This teletransporter is similar to the one in *Star Trek*. If you get into the teletransporter, you fall asleep, get destroyed, and break down into atoms. This information is then copied to Mars, where you are reassembled. Is this newly reassembled person the same as you were on Earth? What if the original person has not been destroyed, but copies of you are made throughout the entire universe? What does it mean to be and to remain the same person?

Such thought experiments may seem far-fetched, but they can help us solve dilemmas closer to home. They help us reflect on what it means to have an identity, and how stable such an identity is. For example, the question of how much you have to be altered neurologically before you become a different person is relevant to several bioethical issues. Is it ethical to perform euthanasia on a person with dementia if this person has, at a time when they did not yet have dementia, expressed the wish to be euthanized if they ever develop dementia? What about drugs like *Ritalin*, which can make life easier but may also influence one's personality? Is keeping your 'personal identity' an essential value, or is our identity held together by the story we tell ourselves and others? The use of thought experiments is not only reserved for philosophers, by the way. Modern physics has also often started from thought experiments, such as the double-split experiment by Thomas Young (1804).

During the last twenty years, there has been some critique within philosophy on using thought experiments 'from the armchair'. Thought experiments often draw certain conclusions or state philosophical (and universal) truths. However, is this possible from 'the armchair'? How do we know that our intuitions are the correct intuitions? Are they not relative to the culture we have grown up in? For example, think about the thought experiments inspired by Edmund Gettier (1927–2021), the so-called Gettier cases (1963). They deal with the circumstances under which you can know something. In epistemology, it is often stated that you really know something if (1) it is true, (2) you believe yourself that it is true, and (3) you are justified in your belief that it is true. This is the *justified true belief* thesis of knowledge and was long considered the standard account. Edmund Gettier used a thought experiment to prove that this conception of knowledge is actually not complete: something more than justified true belief is necessary to constitute knowledge.

### Gettier's thought experiment ('Smith and Jones')

Smith and Jones have both applied for a job. Smith has good reasons to think that Jones (1) will get the job and (2) has ten coins in his pocket. Jones has shown him the coins, and Smith has counted them. Moreover, the assistant of the HR director came out after the job interviews and told Smith that Jones would get the job. Hence, Smith has good reasons to believe the following statement: Jones will get the job, and Jones has ten coins in his pocket. From this, it follows that he is also convinced of the following statement: the person who will get the job has ten coins in his pocket. But the company's people have changed their mind at the last moment and will offer the job to Smith.

Moreover, Smith also has ten coins in his pocket, although he is unaware. Hence, the first statement that Jones will get the job and has ten coins in his pocket is not true. But this is the statement from which Smith has deduced that the person who will get the job has ten coins in his pocket. Intuitively, we feel that Smith does not really *know* that the person who gets the job has ten coins in his pocket, although it is a true and justified belief. Hence, the intuitions called forth by this thought experiment suggest that it is not enough to have a truly justified belief in order to be able to speak about really *knowing* something.

## Experimental philosophy

However, is it really true that everyone feels intuitively that we cannot talk about really knowing something in the case of Smith? Or are philosophers from their armchairs the only ones who think like this? Since the beginning of this century, some philosophers have started to deploy methods from psychology and sociology to test longstanding philosophical intuitions. This *experimental philosophy* often questions the function of thought experiments and the philosophical intuitions they are thought to invoke. Experimental philosophers demonstrate, for example, that philosophical intuitions can differ between cultures. A study by Weinberg, Nichols, and Stich (2001) has suggested that people from East Asia have a different intuition regarding such Gettier cases compared to Americans: in some scenarios, they would consider that Smith 'really knows' this. Other studies found no difference. Some people have criticized experimental philosophy. They say it is not real philosophy but rather psychology. The research would use a flawed methodology (poor sample size, data analysis, etc.). Nevertheless, it is also interesting for philosophers to relate to empirical data, either by doing the research themselves or by being informed by empirical studies. Moreover, experimental philosophy demonstrates that the values and thoughts that have formed the gist of Western philosophy may be less universal than previously thought. In this course, we mainly talk about Western philosophers. This does not

mean Western philosophers have a more direct line to the truth: we must remain aware that philosophy and ethics are also partially culturally sensitive endeavours—or, as we put it earlier, philosophical and ethical reasoning are *situated*. Later in this chapter, we will introduce concepts such as *Buen Vivir* and *decolonizing ethics*.

## Empirical and embedded bioethics

A similar concern pertains to theories and frameworks operationalized by bioethics. As we will see in the chapter on health care ethics, a ubiquitous tool in bioethical reflection are the principles of autonomy, beneficence, non-maleficence, and justice. It is often assumed that these principles are indicative of a 'common morality' and shared across culture and time. Given what we have seen in the section on feminist philosophy of science, it is important to also critically approach those intuitions. One way to achieve that is through empirical methods.

Empirical bioethics is a field that uses empirical methods, such as surveys, interviews, or observations, to inform normative questions about relevant bioethical topics. Bioethicists use empirical methodologies to question and explore the implications of bioethical decisions, to describe and assess attitudes towards specific intuitions, or to assess normative assumptions with regard to specific technologies or medical practices. A typical empirical bioethics paper will consist of survey or interview results of a relevant stakeholder group—physicians, researchers, patients, citizens—on a particular matter of concern. A common (and familiar) concern with the field is that the samples in empirical bioethics research are often quite homogeneous. In line with what we read on the feminist philosophy of science, we should note that if the preferences and intuitions of stakeholders are meant to inspire additional moral considerations, it is important to sample a sufficiently diverse group of individuals.

Embedded ethics is another somewhat novel methodological approach to applied ethics. Embedded ethics responds to concerns over ethics' increasing distance from scientific practice. This distance is reflected in scientists' concerns that bioethics hampers scientific progress, is often irrelevant to the actual science, and tends to focus on sensationalized cases such as designer babies and human cloning. Ethicists, too, increasingly recognize the limitations of a top-down approach to ethics that decontextualizes and abstracts away the specificities of the actual cases and responsibilities that (individual) scientists may have in their work. This leads—among other concerns—to issues of translating ethical principles to the practice and personal experiences of scientists. In turn, ethicists have been increasingly calling for an *embedded* approach to bioethics. Embedded ethics refers to the ongoing practice of integrating ethics in the entire (scientific) process. Several levels of embedding have been suggested in the literature, ranging from better ethics education in the sciences, the implementation of ethics throughout scientific research (from research design and planning to implementation), or the integration of an ethicist in the lab. Taking

inspiration from fieldwork in field philosophy and anthropology, and the idea that good science is ethical science and vice versa, embedded ethics aims to bridge the gap between science and ethics (and scientists and ethicists) by inspiring dialogue, collaboration, and deliberation on ethical issues as they arise within scientific practice. Other ethicists are critical of the so-called 'embedded turn', arguing that it reduces ethical inquiry to a mere servant of scientific progress. Embedded ethics may stand too close to science and not have sufficient distance to engage critically with disruptive technologies and scientific developments.

## Conclusion

In this chapter, we have drawn on Van Rensselaer Potter's vision to present bioethics as a unified and transdisciplinary approach. Through the example of Arthur Galston's involvement in the development of Agent Orange, we demonstrated how ethical reflection must be embedded in scientific practice from the start. We adopt an ethico-onto-epistemological approach, emphasizing that ethics, knowledge, and our understanding of reality are deeply intertwined. Drawing on philosophy of science (e.g. Kuhn's paradigms) and feminist epistemology, this approach challenges the idea of science as value-free and highlights the importance of diversity in knowledge production. This chapter has also explored major branches of ethics, including metaethics and applied ethics, contrasting ethical naturalism with non-naturalism. We have introduced thought experiments as a method of philosophical reasoning, while also discussing experimental philosophy's efforts to test intuitions empirically. Finally, we have presented empirical and embedded bioethics as practical approaches for integrating ethics into real scientific contexts, showing how bioethics can—and should—be grounded in both philosophical reasoning and everyday research practice.

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