

Growing a Backbone: Developing an ‘Ethics Spine’ for ASU’s Biomedical Engineering Curriculum

Emma Frow^{1,2}, James Abbas¹, Jerry Coursen¹ & Stephen Helms Tillery¹

¹ School of Biological & Health Systems Engineering, ² School for the Future of Innovation in Society, Arizona State University

Motivation

Over the past 5 years, ASU’s biomedical engineering (BME) faculty have implemented a ‘Design Spine’ that runs through the BME curriculum, providing students with structured and systematic exposure to principles & practices of biomedical engineering design.

We are now working towards an ‘Ethics Spine,’ intended to promote professional responsibility and capacity for ethical deliberation. In 2015, 15/143 of our Seniors self-identified as ‘not meeting’ ABET Criterion 3f (ethical & professional responsibility), and 35/143 as ‘not meeting’ Criterion 3j (contemporary issues). These are the two ABET outcomes for which they reported the least confidence, and ones that our Ethics Spine aspires to address.

Objectives

- To integrate ethics across ASU’s BME curriculum through the creation of an ‘ethics spine’
- To develop student capacity and confidence to grapple with a range of ethics-related issues

Design constraints

- **Curricular constraints:** limited credit hours for explicit ethics content; primary focus is on technical content
- **Large class sizes:** 100+ students per class
- **Faculty discretion:** no obligation to incorporate ethics into individual syllabi

Findings (Stages 1 & 2)

Our BME students currently receive **exposure** to ethics-related topics including:

- Academic integrity
- Codes of engineering ethics
- Basic principles of biomedical ethics
- CITI training² in research ethics (human & animal)
- Safety and quality control in biomedical devices
- FDA regulation of drugs & devices

In contrast, our students receive **little exposure** to:

- Design as an ethical & value-laden process
- Macro-ethical issues concerning engineering &/in society
- Structured frameworks and tools to assist with ethical deliberation and decision-making (in real-world contexts)

Ethical capacities identified by faculty as **desirable to foster**:

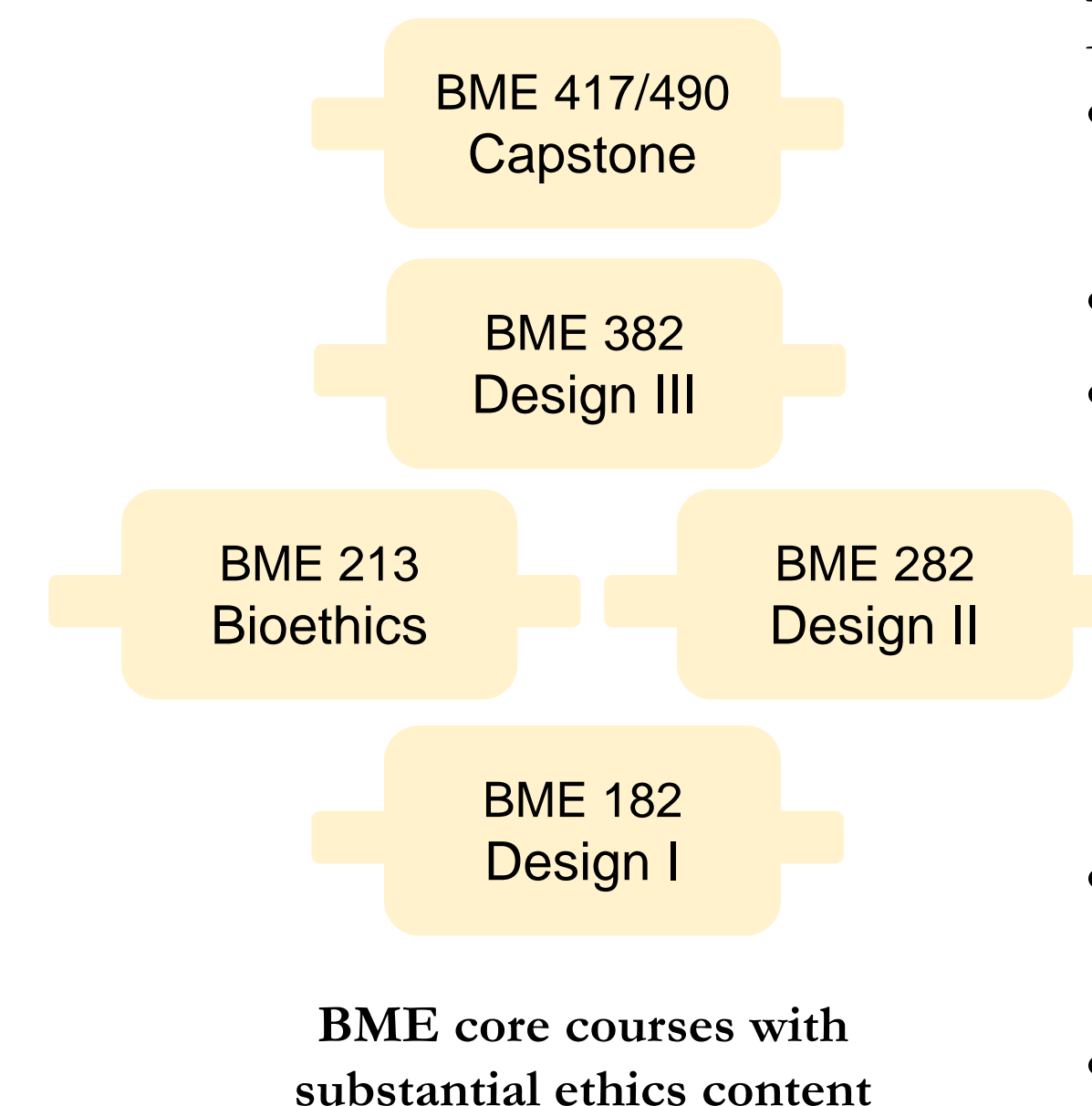
- Ownership – of behavior, of coursework, of designs (and their consequences)
- Increased awareness of the ethical dimensions of design
- Increased agency and capacity for ethical decision-making on-the-job (post-graduation)

Looking ahead (Stages 3+)

- Identifying frameworks & tools to facilitate student identification of ethical questions, and to assist with decision-making
- Coordination of ethics content across the curriculum
- Capacity-building among BME teaching faculty
- Identifying robust tools for measuring and documenting ethical capacities

Stages	Timeline
1. Participation at National Academy of Engineering workshop on ‘Overcoming Challenges to Infusing Ethics into the Development of Engineers’ ¹	Winter 2017
2. Information-gathering meetings with 13 BME faculty	Spring 2017
3. Developing toolkits and structuring ethical ‘pathways’ through the BME curriculum*	Summer 2017
4. Curating BME-relevant examples of activities & best practices*	Summer / Fall 2017
5. Integrating ethics content into existing Design Spine courses	2017-2018 year
6. Integrating ethics content into additional BME courses	2018-

* These stages will draw on expertise from across ASU, including partnerships with the Lincoln Center for Applied Ethics and the School for the Future of Innovation in Society



Works cited

1. National Academy of Engineering, Center for Engineering Ethics & Society project on ‘Infusing Ethics into the Development of Engineers’; see <https://www.nae.edu/Projects/CEES/57196/InfusingEthics.aspx>
2. CITI Program, see <https://about.citiprogram.org/en/homepage/>