Standardization in Action: A Translational Curriculum

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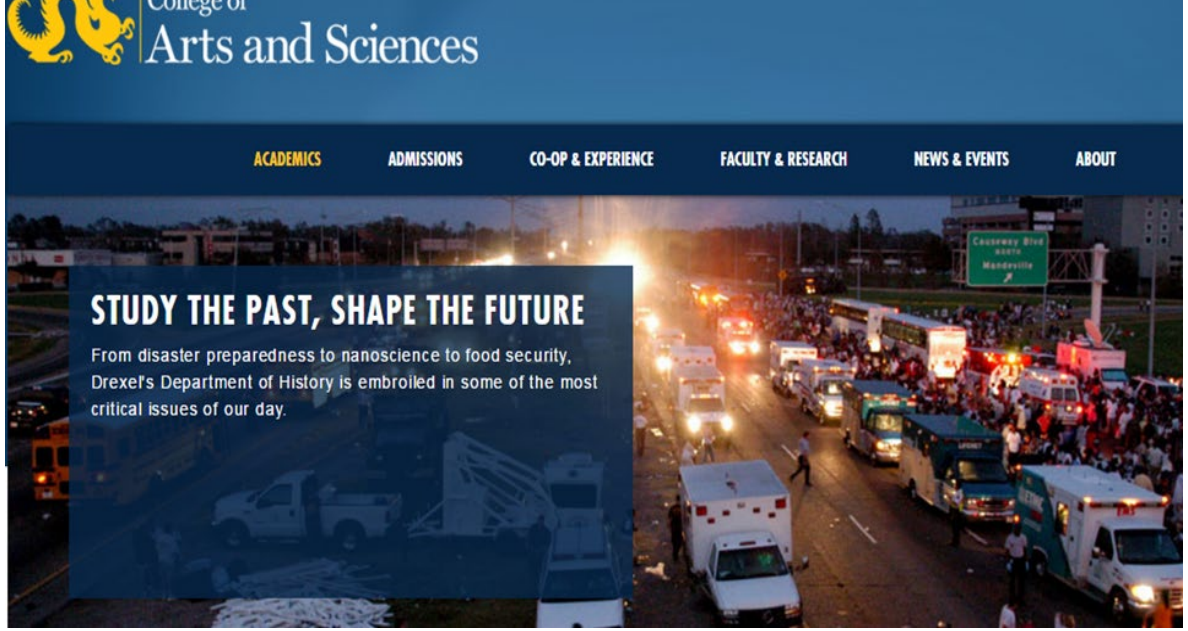


- Research faculty at the Department of History
- Physicist/Sociologist/Anthropologist of Science & Technology
- ISO TC229, ASTM E56 Nanotechnology Committee member
- US-EU nanoEHS/Nanoinformatics Planning Committee

Justin Carone

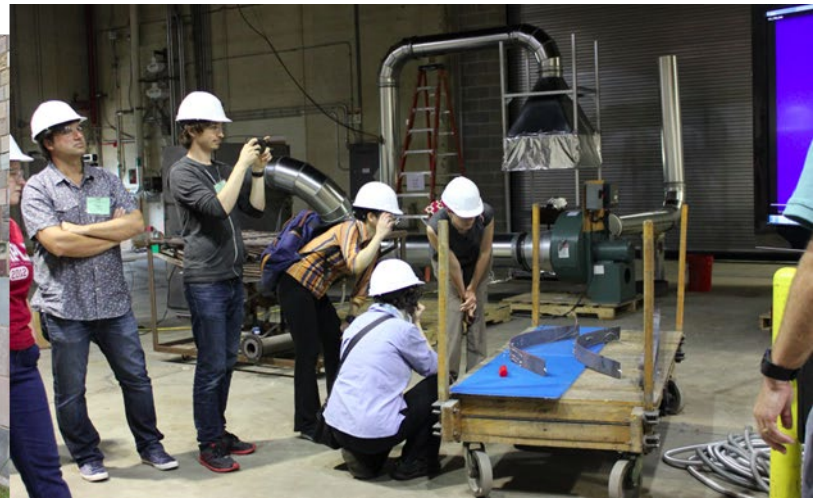
BS/MS STUDENT JUSTIN CARONE AWARDED SECOND PLACE IN ANSI STUDENT PAPER COMPETITION

September 2, 2014

ASTM Headquarters
July 21, 2015

- Ten students and five faculty participated in a one-day event
- Part of a two-week "Summer Standards Institute" hosted by Drexel University and made possible by a NIST grant
- Included historical presentations, outside speakers, and meeting simulation
- Continued follow-up between ASTM and Drexel to pursue future activities

2014 Drexel Standard Summer Institute



Wallace H. Coulter Foundation

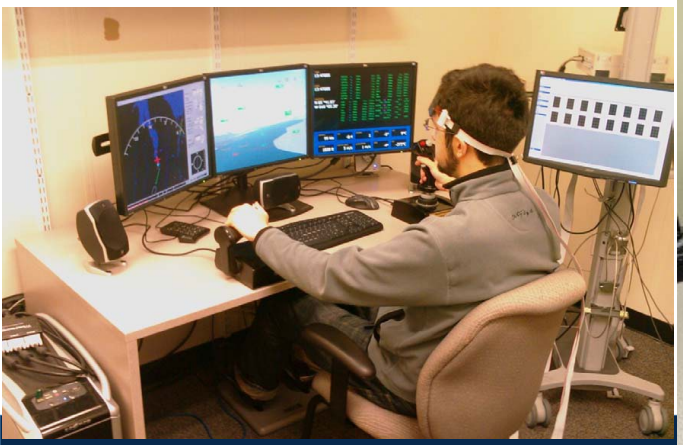
National Translational Research Partnership

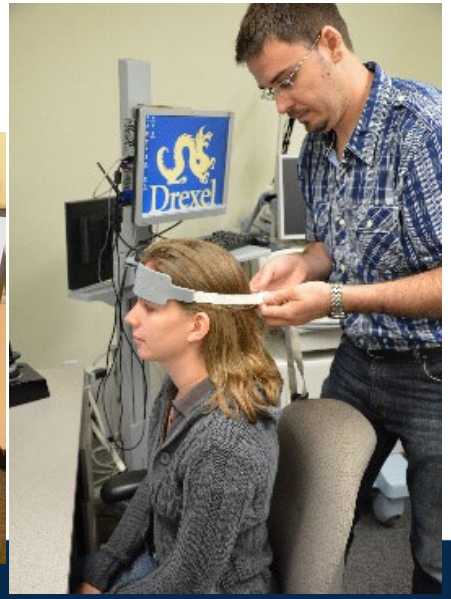
CONQUER CollabOrative

Cognitive Neuroengineering & Quantitative Experimental Research

A Collaborative = A place where all collaborators studying **brain function and health** from diverse perspectives and different purposes join arOund the circle

- The circle or zero also refers to 'zero degree of separation'
- Technology Platform: **Functional Near Infrared Spectroscopy**





DREXEL UNIVERSITY
School of
Biomedical Engineering
Science and Health Systems

Formerly 'Neuroengineering Resource Center'
Sponsored by DCED – Commonwealth of PA

However, the road of translation is rocky, unpaved labyrinth, despite all the innovative technologies we've developed!

Challenges in current STEM education

- Integration between STEM, social science and humanities
- Holistic views of knowledge ecosystem
- Global views and contemporary techno-political issues
- Lack of collaboration/mutual understanding between faculty from humanities and engineering
- Disconnection between classroom and co-op
- The cultural of disengagement

"STEM practitioners who understand the role of their profession in society are better at solving real-world problems…Engineering students left their degrees less interested in public welfare than when they began…This culture of disengagement is a concern because most STEM problems have cultural and political issues built into them."

Cech, E (2014) *Nature* 505: 477

Drexel solution

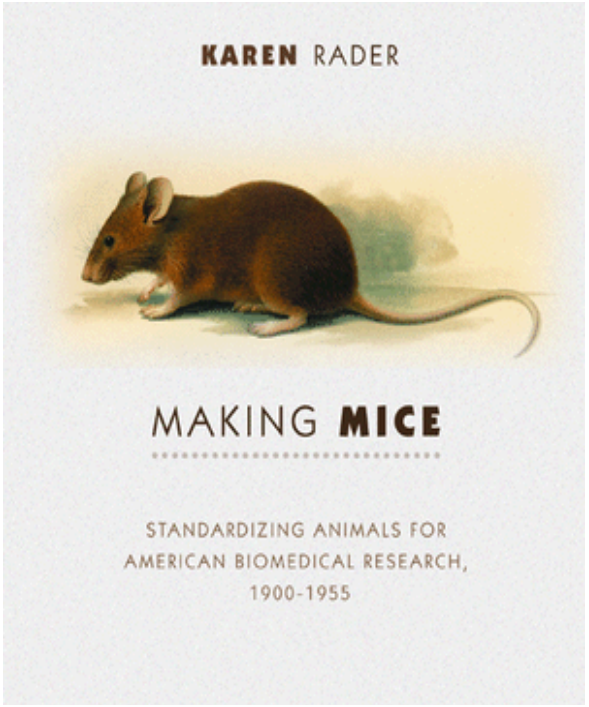
Standardization in Action: A translational curriculum

Following the Threads of an Innovation: The History of Standardized Patients in Medical Education

Peggy Wallace

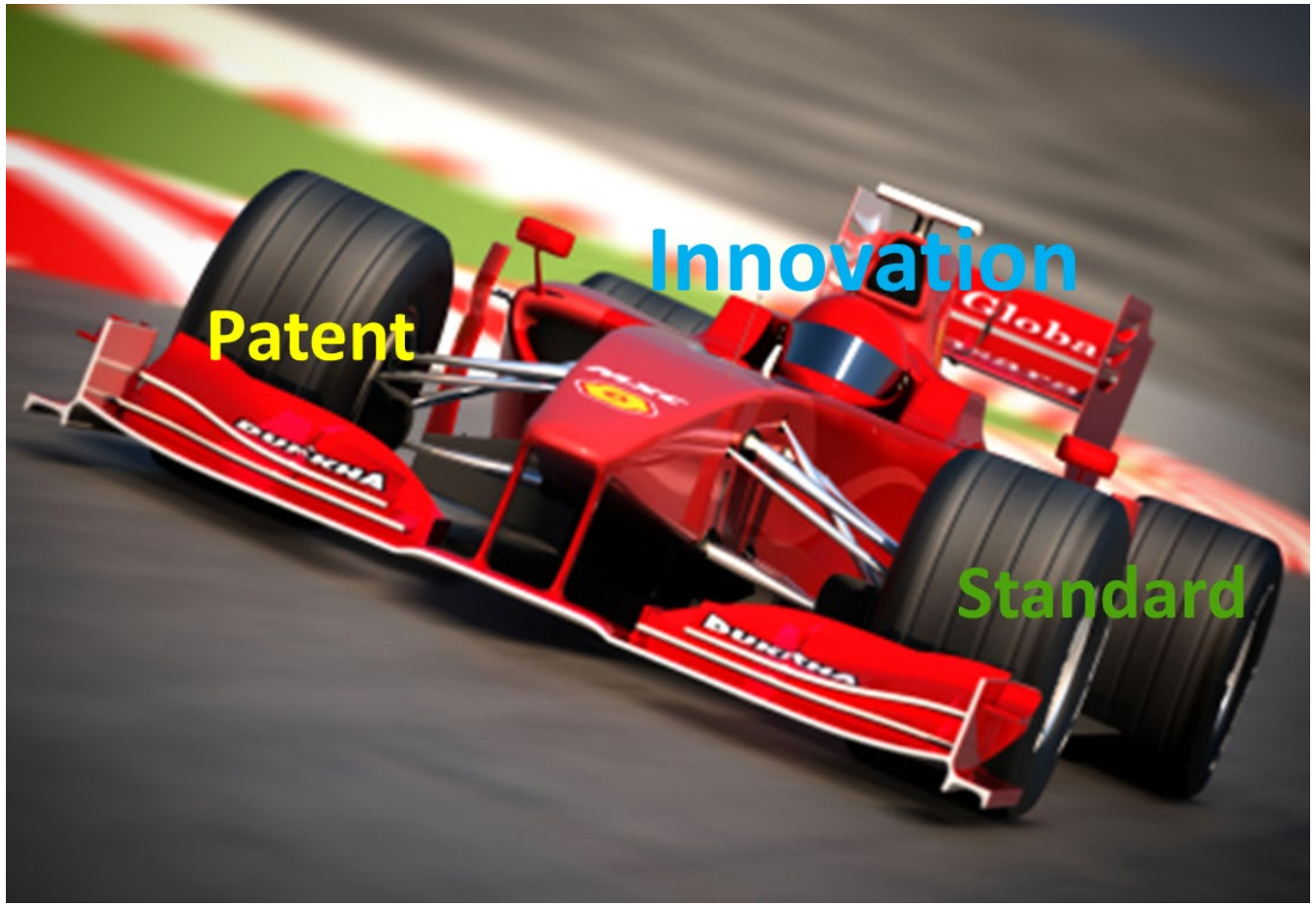
In 1963, Dr. Howard S. Barrows, MD, created the first standardized patient (SP) for his third-year neurology clerkship.

A Standardized Patient (SP) is a person carefully recruited and trained to take on the characteristics of a real patient thereby affording the student an opportunity to learn and to be evaluated on learned skills in a simulated clinical environment.



Historical lesson: Standard is the concrete meeting point of science, technology, society, economy, laws, human/animal right, ethics and local/global politics!

How to build the car, and make it run smoothly on the road of translation?



Thinking critically and creatively about standardization in action:

- Innovation-driven standardization
- Standard-driven innovation
- What does the road of translation look like? What does the endpoint (commercialization) look like? How to get there?
- What are the technical, social, legal and ethical cost to get on the road?

Standardization in Life Science: An translational Curriculum

	Fall 2016	Winter 2017	Spring 2017
HIST 280: Standardization in Action -- A Global Perspective		X	
BMES 488: Medical Device Development			X
BMES534/535: Design Thinking for Biomedical Engineers		X	
BMES 338: Biomedical Ethics and Laws	X		X
Students senior design thesis	X	X	X

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Real-world case driven themes: Translating practitioners' know-how and experience into teaching

Point-of-Care Hematoma Detector

INFRASCAN
HANDHELD BRAIN DIAGNOSTICS

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Food and Drug Administration

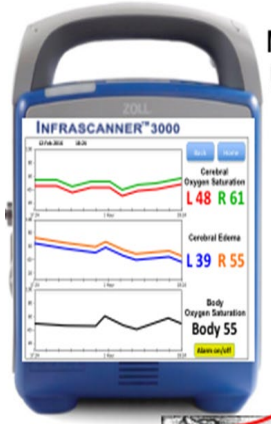
21 CFR Part 882

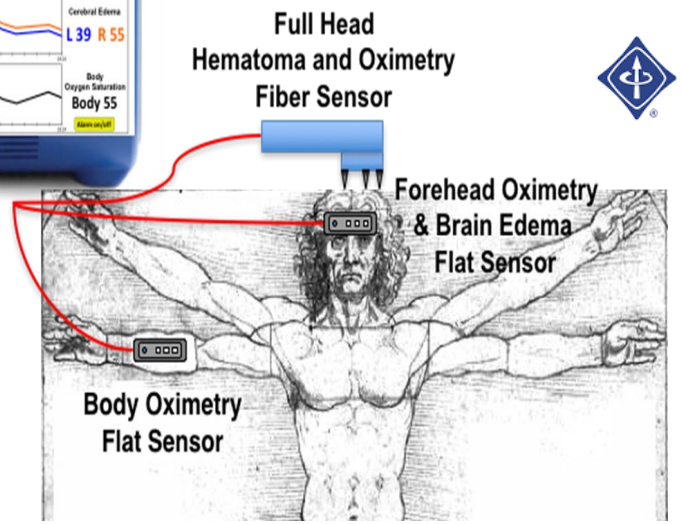
[Docket No. FDA–2012–M–0206]

Medical Devices; Neurological Devices; Classification of the Near Infrared Brain Hematoma Detector

AGENCY: Food and Drug Administration HHS.

ACTION: Final rule.





IEEE EMB

IEEE STANDARDS ASSOCIATION IEEE

2010 — **Painful self-education process to make the device translatable** — 2017

It would be great if we have known:

What:

- Language & Metadata Standards
- Standardizing Body
- Standardizing Risk
- Standards & Regulation
- Standardization and Innovation
- Standardization & Globalization
- Socio-technical Infrastructures of Standards
- Ethics & Justice of Standardization
- Users/Public Participation in Standardization

How:

- Identify shared core themes among four courses: A multi-disciplinary understanding of “body”, “data”, “risk”, “regulation”, etc.
- Faculty’s mutual class visits/teaching support (History, Biomed, Design school)
- Meet-the-experts from CONQUER CollabOrative Staff/researchers, ISO, FDA and IEEE
- Field trip ASTM for mock standard review meetings
- Combining class with students’ design projects and clinical co-op learning

Student's Design Project:
Standardize human-machine interaction-- virtual reality surgical training simulator

Reality — **Augmented Reality** — **Virtual Reality**

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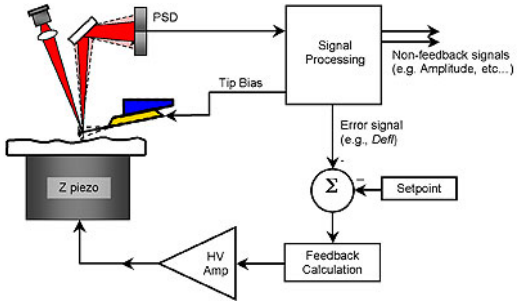

Experiment-verified prototype

DREXEL UNIVERSITY
College of
Arts and Sciences
Department of Global Studies and Modern Languages

DREXEL UNIVERSITY
Westphal
College of Media Arts & Design
Department of Design

User friendly VR design

Leveraging standards to make a socio-technically robust design

- Who are the users?
- Why, when and how to incorporate standards in the innovation process?
- Which standards to be cited?
- What are the technical, social, economic, legal, and ethical consequence of citing certain standards

ABET requirement	Standardization-in-Action Curriculum
Apply knowledge of mathematics, science, and engineering	Life cycle of engineering design, allowing students to develop an integrative understanding and application of STEM.
Design and conduct experiments, as well as to analyze and interpret data	Performance and data/metadata standardization to help students learn the foundation of engineering language, grammar and practice
Design a system, component, or process to meet desired needs within realistic constraints such as economic, political, environmental, social, ethical, health and safety, manufacturability and sustainability	Comprehension of "realistic constraints", providing a systematic approach and concrete intellectual space to embed societal concerns and normative ethical claim into engineering process.
Function on multidisciplinary teams	Collaboration, communication, negotiation and consensus among stakeholders.
Identify, formulate, solve problems	Immerses students in a practical problem-solving environment for realistic solutions.
Understanding of professional and ethical responsibility	Standardization can serve as an effective entry point to materialize abstract ethical concerns through which reflexivity and responsibility can be better understood.
Communicate effectively	The mechanism of communication and negotiation is the core of standardization.
Broad education to impact of engineering solutions in a global, economic, environmental, and societal context	Knowledge ecosystem to understand the inherent socio-political-technical infrastructures in knowledge translation and commercialization at the global scale
Recognition of the need for, and an ability to engage in life-long learning	Aligning engineering knowledge and engineers' ability with evolving socio-economic dynamic and timely societal needs.
Knowledge of contemporary issues	Standards speak for contemporary issues of innovation trend, policy direction, national/international interests, market demands and public trust/concerns in S&T.
Techniques, skills, and modern engineering tools necessary for engineering practice	Standardization requires a thorough understanding of principles, assumptions, operations, and limitations of modern engineering tools