Design, Network, Achieve,
Student Success is in Our DNA
Three Stories of Outreach and Student Success

> iGEM and Human Practices
> iGEM and K-12 Outreach
> Miner Challenge and Community Engagement
iGEM and Human Practices

**Treat disease**

[Diagram: Engineered bacteria for treatment of cancer]

1. Invasion production
2. Bacterial invasion of a cancer cell
3. Release of shRNA
4. Colon cancer inhibition by gene silencing

http://www.nature.com/scitable/blog/bio2.0/synthetic_biology_is_on_its

**Sense a toxic compound**

[Image: Bacteria detecting a toxic compound]

www.laboratoryequipment.com

**Produce valuable products**

[Diagram: Microorganisms producing various products]

www.spacedaily.com
What is iGEM?

International Genetically Engineered Machines

Purpose

Build biological systems from standard, interchangeable parts and operated in living cells. (http://parts2.mit.edu/wiki/index.php/About_iGEM)

The Team

Students from Biology, Chemistry, Chemical Engineering and others.

More Information

http://web.mst.edu/~igem/
Students develop project ideas to solve real world problems

– Combat emerald ash borer
– Protect bats from white nose syndrome
– Combined nitrogen cycle for power plant exhaust
– Biological glucose sensor
– Fighting tuberculosis
– Biological fuel cells
> "Human Practices is the study of how your work affects the world, and how the world affects your work."

Peter Carr, Director of Judging
- Informational session on synthetic biology for students and general public.
- “Speak Up Speak Out” - Public discussion of ethics.
- Survey of public attitudes toward synthetic biology.
- Bat symposium.
- Public forums.
- Engineers week events.
Key lesson learned

- Value of dialogue
- Importance of listening to diverse perspectives
- Greater acceptance of controversial topics through hands-on learning
Importance of K-12 Outreach

  – Encourage schools to integrate 21st century skills.
  – Develop mentoring relationships with K–12 schools.
  – Work collaboratively with educators to modernize content and assessments.
  – Study the best ways to educate, train and evaluate teachers in 21st century skills.
> “They start to adopt a perception — accurate or inaccurate — of their personal strengths and weaknesses in certain subjects. **Middle school is often the tipping point when such perceptions and misconceptions lead children to lose interest in math and science for good.** Yet kids can get excited about math and science if they are exposed to real world applications of these subjects.”

4, 2011
Keep Science and Math Alive in Middle School
Paula Golden
“Middle school also is a time when kids look to adults other than their parents for inspiration. The impression made by an adult teacher, mentor, friend or acquaintance can be indelible and also drive academic choices going forward. A recent survey by Microsoft found that 57 percent of STEM college students were inspired to study STEM subjects because of a teacher or class. That was particularly true for female students.”
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However, for intentional learning of science to occur in school, out of school, and after school, there needs to be a motivation to learn science. Prior research had shown that students' motivation to learn science tends to decrease during adolescence.

The decline in adolescents' motivation for science learning in school and out of school is not an inevitable developmental trend.

Adolescents' Declining Motivation to Learn Science: Inevitable or Not? Vedder-Weiss and Fortus, JRST, 2010
iGEM engaged in K-12 Outreach

> Expanding your Horizons
> Classes at Kaleidoscope Discovery Center
> Hand-on science activities
  – Campus
  – The Centre
  – Libraries
  – Street festivals
iGEM engaged in K-12 Outreach
Key lesson learned

> Value of dialogue
> Joy of teaching
> Communicating without jargon
Miner Challenge and Community Engagement
Missouri S&T's Alternative Break Program. Every year, students engage in immersive volunteer experiences across the U.S. over Spring Break. Participants bond with a small team while they develop leadership skills, gain awareness of social issues, and work to improve communities.

> WORK HARD | DREAM BIG | CHANGE LIVES
2018-2019 Trips

> Indigenous Nations: Fostering reservation wellbeing & supporting native identity- Tuba City, AZ
> Military Veterans: Supporting the men & women who served us- Colorado Springs, CO
> Wildlife Conservation: Implementing solutions to protect the diversity of our planet- New Orleans, LA
> Education & the Arts: Investigating the effects of education cutbacks in rural America- Charleston, WV
> Hunger & Homelessness: Combatting food insecurity to improve quality of life- Conway, AR
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Team Wildlife Conservation
Audubon Institute

> Audubon Nature Center
> Audubon Zoo
> Audubon Aquarium
> Audubon Park
> Audubon Wilderness Park
> Audubon Species Survival Center
Audubon Institute

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Team Wildlife Conservation
Key lesson learned

> Value of dialogue
> Importance of wildlife to a community
> Even the smallest gestures can have a large impact.
Team Wildlife Conservation

~2019~ MINER WILDLIFE CONSERVATION CHALLENGE ~Rolla, MO~
Thank you!