# BARRIERS & OPPORTUNITIES

# CURRICULUM

# PROFESSIONAL DEVELOPMENT

What are the <u>barriers and opportunities</u> to the development and implementation of pathways between K12 and college?

# Barriers to the development and implementation of pathways between K-12 and college

- The information-focused nature of thinking about what defines a discipline

- The ability of students to understand:
    - What's possible in and after college
    - What's reasonable in and after college

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- The inability of many colleges and universities to articulate the ways in which students can craft a valuable and, ultimately, useful college experience

# Opportunities for the development and implementation of pathways between K-12 and college

- Through new accountability initiatives, teachers are now incentivized to take advantage of professional development opportunities and college/university partnerships

- Colleges, universities and departments are highly motivated to attract students in a world that is increasingly fragmented when it comes to higher education

- Social media and technologies have enormous potential in their ability to reach and connect with students
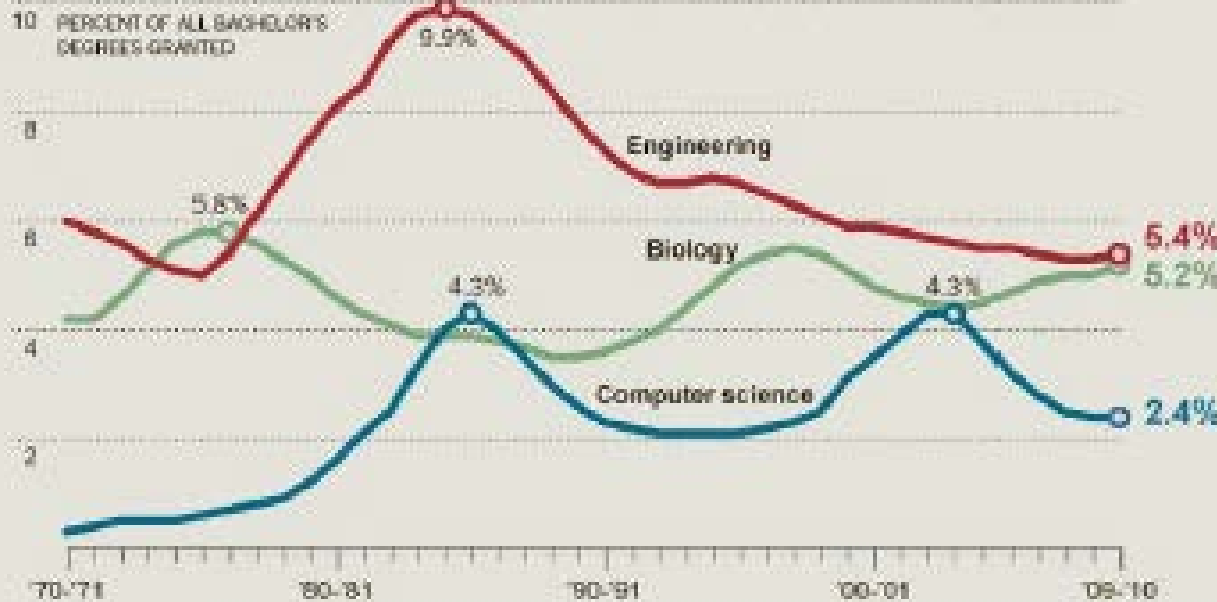
# Pathways: K-12 to College

**Why Science Majors Change Their Minds (It's Just So Darn Hard) (NY Times, Nov 2011)**

- **Goal to increase the number of students in the STEM pipeline**
- **Increased interest in STEM majors at K-12**
- **But 40% of STEM students switch majors**
- **Lower grades in STEM subjects**
- **Theory over application**

# Pathways: K-12 to College



**(Less) Popular Science**
The three largest fields in science have lost ground in recent decades.

10 PERCENT OF ALL BACHELOR'S DEGREES GRANTED
9.9%
Engineering
5.8%
Biology
4.3%
4.3%
5.4%
5.2%
Computer science
2.4%

'70-'71    '80-'81    '90-'91    '00-'01    '09-'10

**GENDER GAP** While women lag in engineering and computer science, they dominate in biology, where pay is lower. Salaries start at $40,000 to $50,000, compared with $55,000 to $65,000 for the other fields.

Number of women for every 10 graduates, 2009-10

1.7 engineers
5.8 biologists
1.8 computer scientists
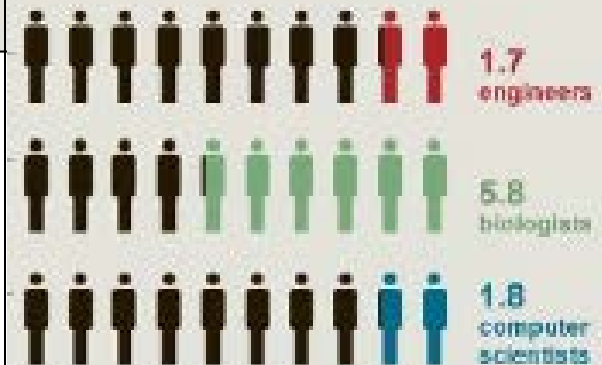
# Development of pathways between K12 and college

- Barriers
  - Few opportunities for K12 and college teachers to interact
  - Lack of time
  - Lines of communication are lacking
  - Many districts, few colleges
- Opportunities
  - State/NSTA/NABT science teaching conferences
  - Citizen science projects

**What are the barriers and opportunities to the development and implementation of pathways between K12 and college?**

# What <u>curriculum</u> already works and what changes are needed?

# Curriculum



Do they know I don't want to be a biologist??

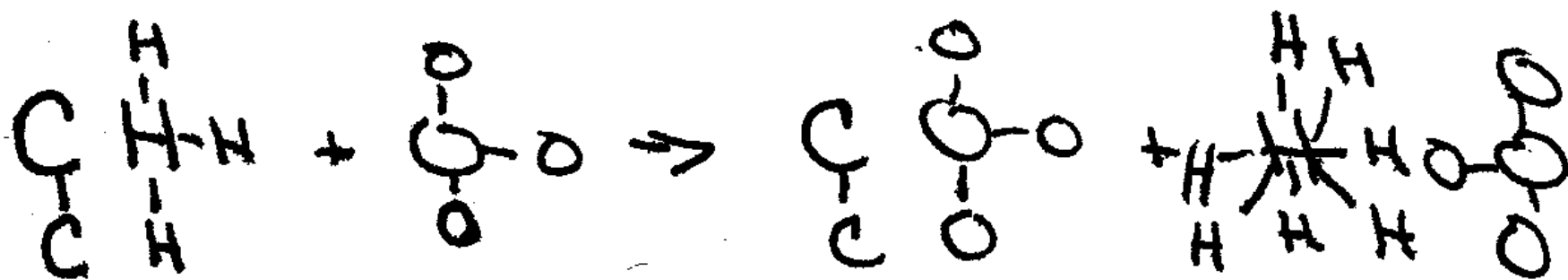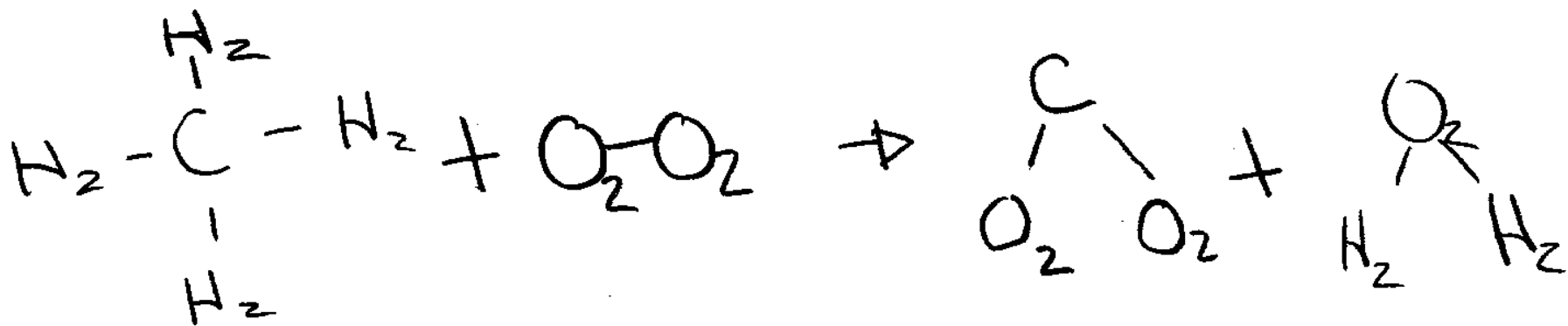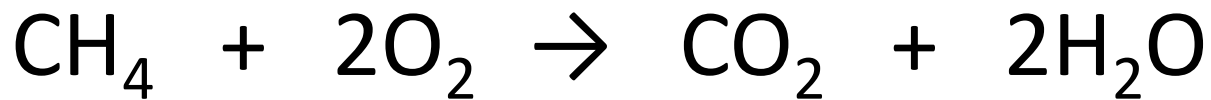There is SO much to memorize!

The teacher just talks and talks….

# Curriculum



Maybe if we learned one thing properly?

Maybe if you taught us something important?

# Curriculum

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

# What works?

Advanced Technological Education

Summer Academic Enrichment Programs

Authentic Science Curriculum

# Advanced Technological Education

- Creates clear links from HS to college to the workforce
- Focused on problem and project-based learning
- Real world problems addressed through the creative use of technology





ADVANCED MANUFACTURING TECHNOLOGIES

AGRICULTURAL, ENERGY, AND ENVIRONMENTAL TECHNOLOGIES

BIOTECHNOLOGY AND CHEMICAL PROCESSES

ELECTRONICS, MICRO- AND NANOTECHNOLOGIES

ENGINEERING TECHNOLOGIES

INFORMATION, GEOSPATIAL, AND SECURITY TECHNOLOGIES

LEARNING, EVALUATION, AND RESEARCH

# Summer Academic Enrichment Programs

- Provides students with a college-level academic experience
- Learn from more than 15 faculty and 5 college student staff
- Come to understand what it means to ask questions about the environment from a myriad of perspectives
- Attracts students who already are interested and gives them a deep and meaningful experience

# Authentic Science Curriculum
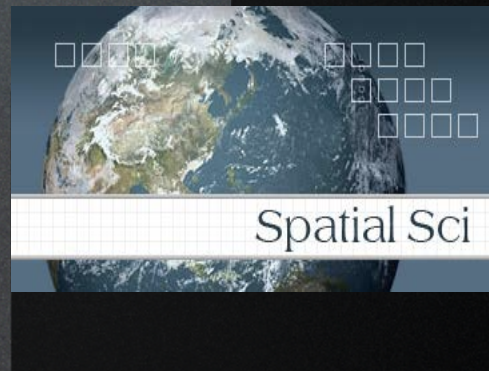
# What **curriculum** already works and what changes are needed?

**What types of teacher and faculty professional development are needed?**

# Professional Development needed

- Taught by college faculty or mixed with classroom teachers
- Authentic scientific opportunities for teachers
  - relevant to HS classrooms
  - Inquiry based

# Teacher Professional Development

- Focus on authentic science problems

- Model scientific and environmental inquiry

- Make explicit links among high school, college and careers

- Involve college students as role models for both teachers and students

# Faculty Professional Development

- Support the disciplinary and subject-specific adaptation of resources, technology and opportunities

- Help faculty better understand today's HS students, teachers

- Involve teachers as co-participants, presenters or partners

- Develop, articulate and employ models of student recruitment and preparation

# Professional Development

What research says about quality PD

- Coherence
- Focus on content knowledge
- Active learning
- Sufficient duration
- Collective participation

# What types of teacher and faculty professional development are needed?

# Barriers & Opportunities

# Curriculum

# Professional Development