

Undergraduate Curricula for the 21st Century at the Pennsylvania State University

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- Overview of undergraduate degree programs at PSU
- Thinking behind the different degree programs
- Description of new Geobiology BS program



Undergraduate Programs at Penn State

Geosciences BS — 68 majors

Geosciences BA — 5 majors

Earth Sciences BS — 23 majors

Geobiology BS — 15 majors

Geosciences BS/MS — 0

New as of last year

111 total majors

Undergraduate Programs at Penn State

Why do we offer so many degree programs?

- Recruitment purposes
- Diverse student clientele with diverse goals
- Our science is evolving, becoming more interdisciplinary

Who pursues these different degrees? Where are the students headed?

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Geoscience BS

Oil & Gas	Environmental consulting
Other	Higher education

Geoscience BA

Environmental law	
Other	Secondary education

Earth Science BS

Secondary education	Environmental consulting
Higher education	Other

Geobiology BS

Higher education	Environmental consulting
Other	Medical School

Principal Components of Degree Programs

Geoscience BS

6 core classes

2 sem. Physics,
Calc., Chem,
1 sem Bio

Senior Thesis

Field Camp

Geoscience BA

Reduced
core classes

More
humanities &
foreign lang.

5 sem. total
Phys., Chem, Bio, Math

Large number
of electives in
each program
enables
students to
pursue special
interests

Earth Science BS

Intro and advanced
course in Geosc,
Geog., Meteo.

Minor in related
field

Internship

2 sem. Physics,
Calc., Chem,
1 sem Bio

Geobiology BS

6 core
classes

2 sem. Physics,
Calc., Chem,
2 sem Bio

Senior Thesis

Field Camp

What is our core composed of?

Earth Materials (Mineralogy & Petrology)

Geochemistry (local fieldwork integrated into labs)

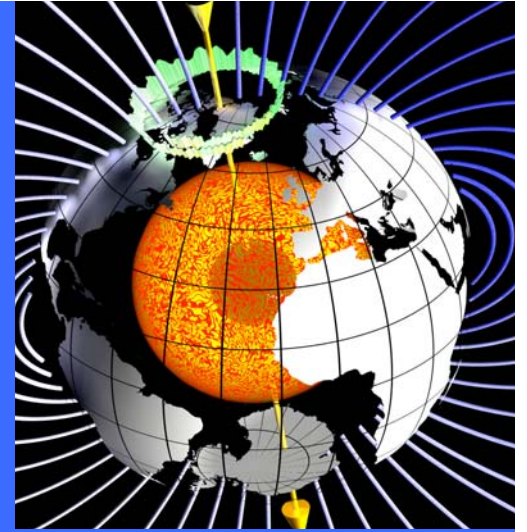
Physical Processes/Geophysics (weekly writing assignment)

Geobiology (5-day field trip + long paper)

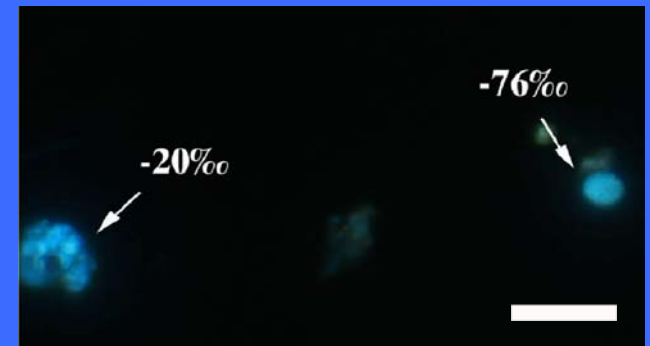
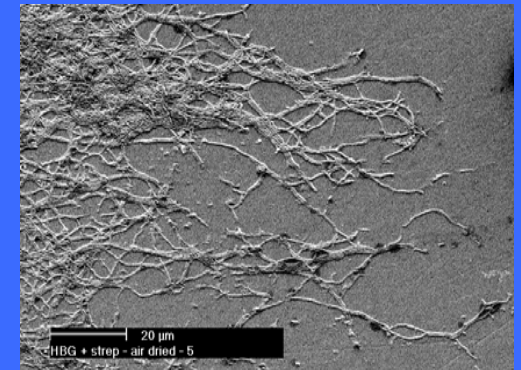
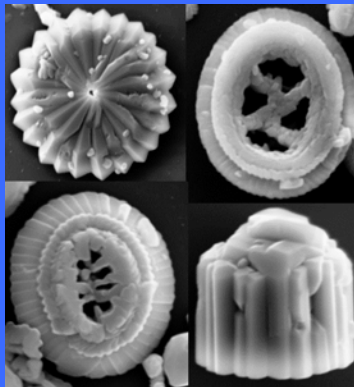
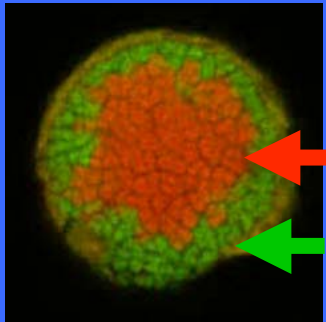
Earth History (an upper level, integrative, everything class)

Structural Geology (2 weekend field trips, local mapping labs)

Field Camp (includes extensive writing & quantitative computing)



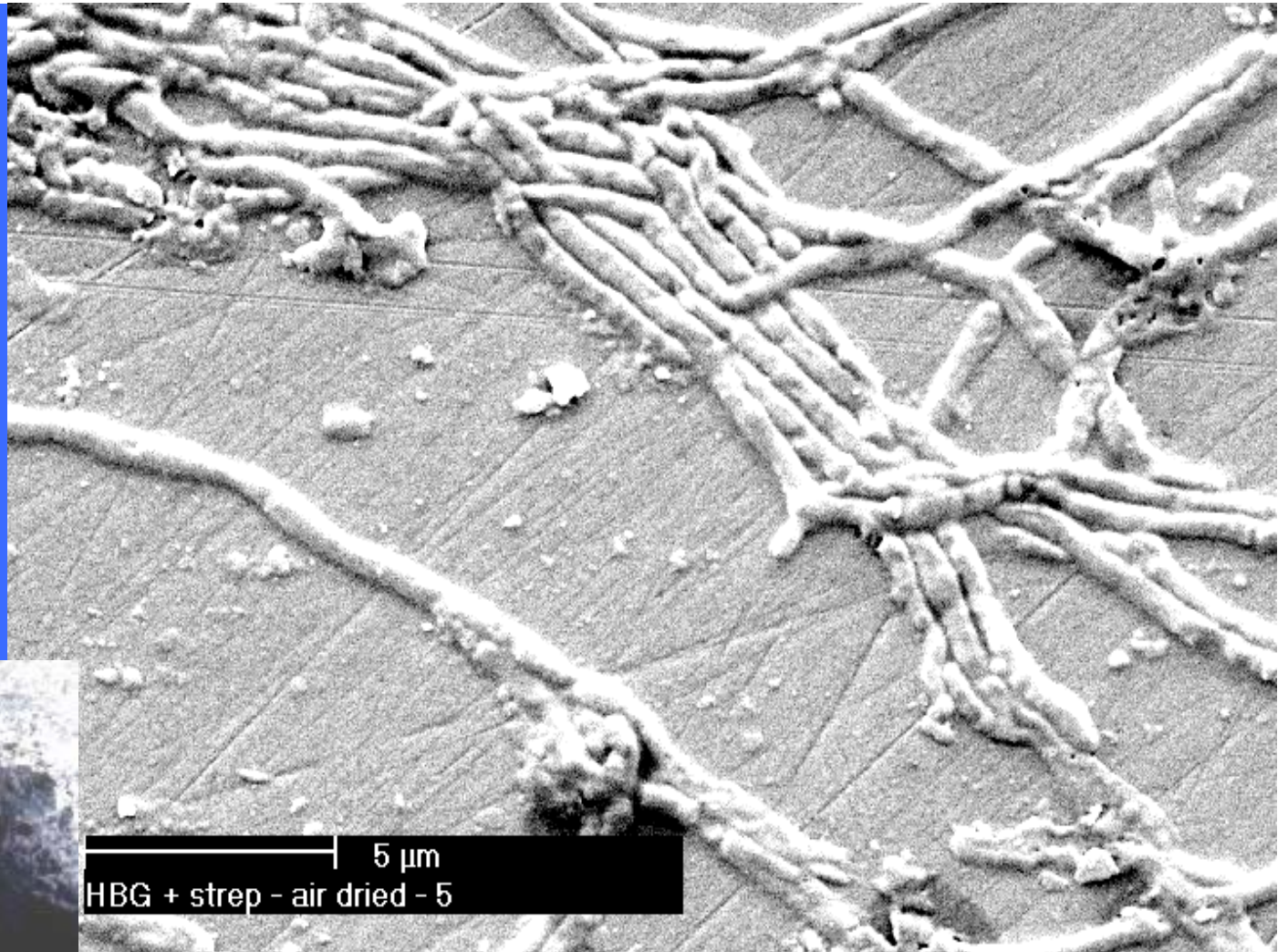
Overview of Geobiology BS Program



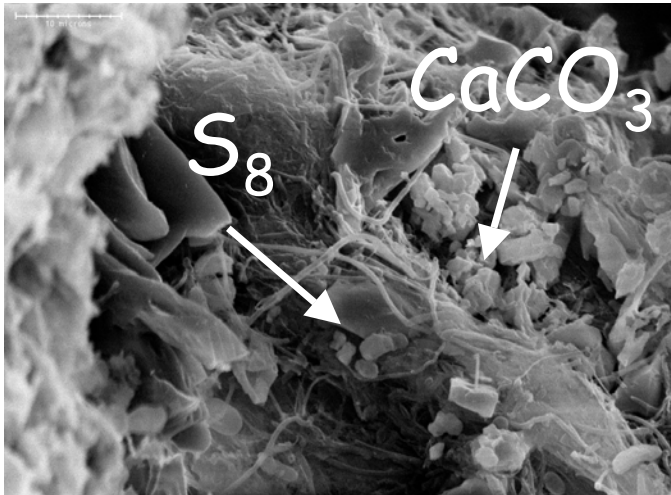
Key Motivations

- Large number of faculty in biogeochemistry, geomicrobiology and paleobiology
- College and department that foster innovation in curriculum design
- Students looking for different path into environmental, museum, law, policy and medical fields
- Huge cadre of biology majors on campus

Role of microbes in weathering



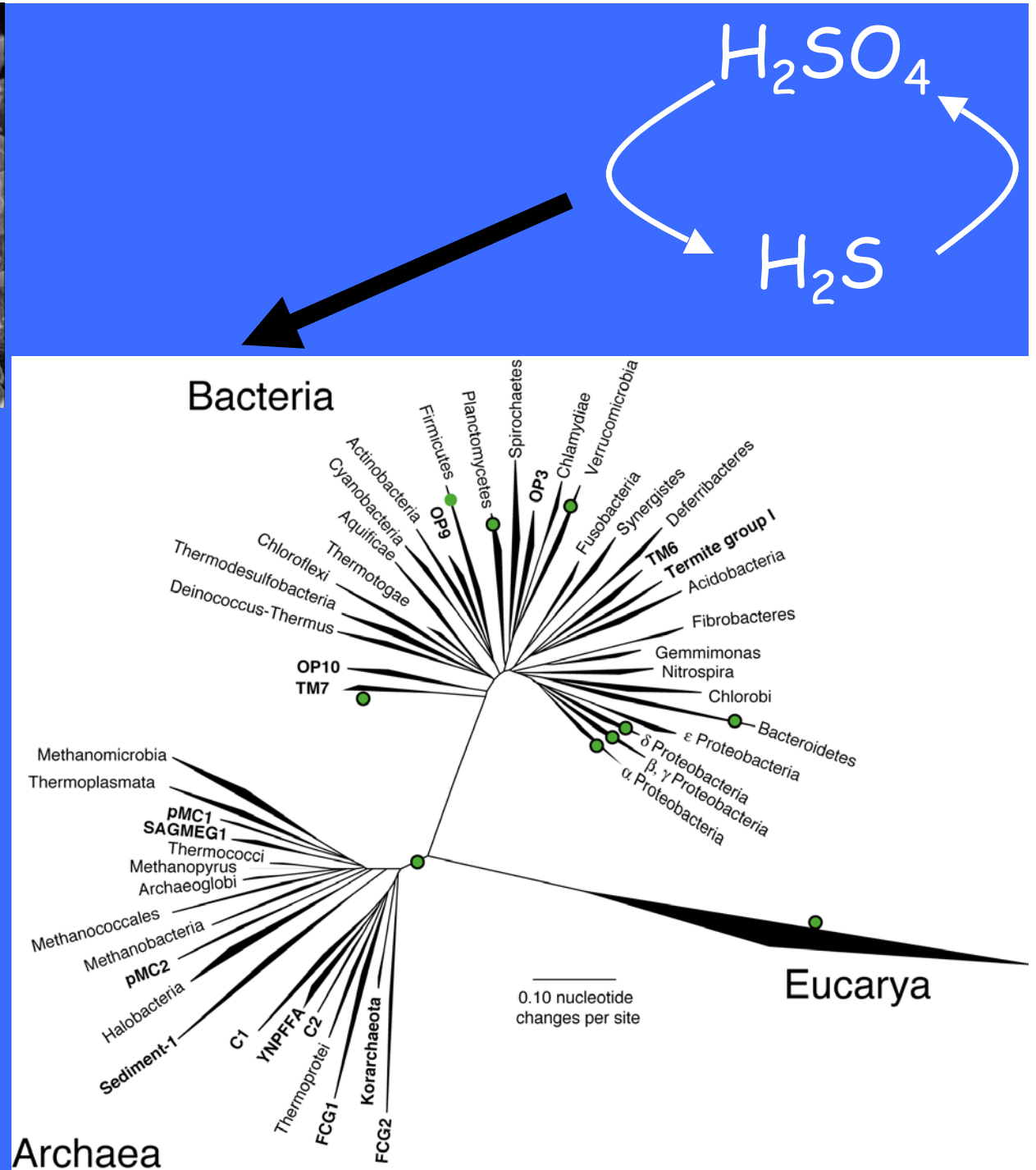
Susan Brantley



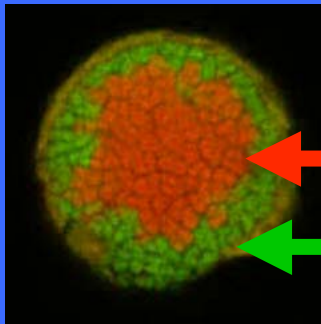
Microbes,
genomics,
geochemistry, cave
formation



Jenn Macalady



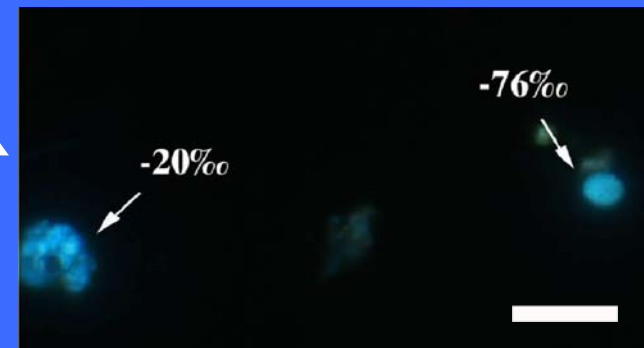
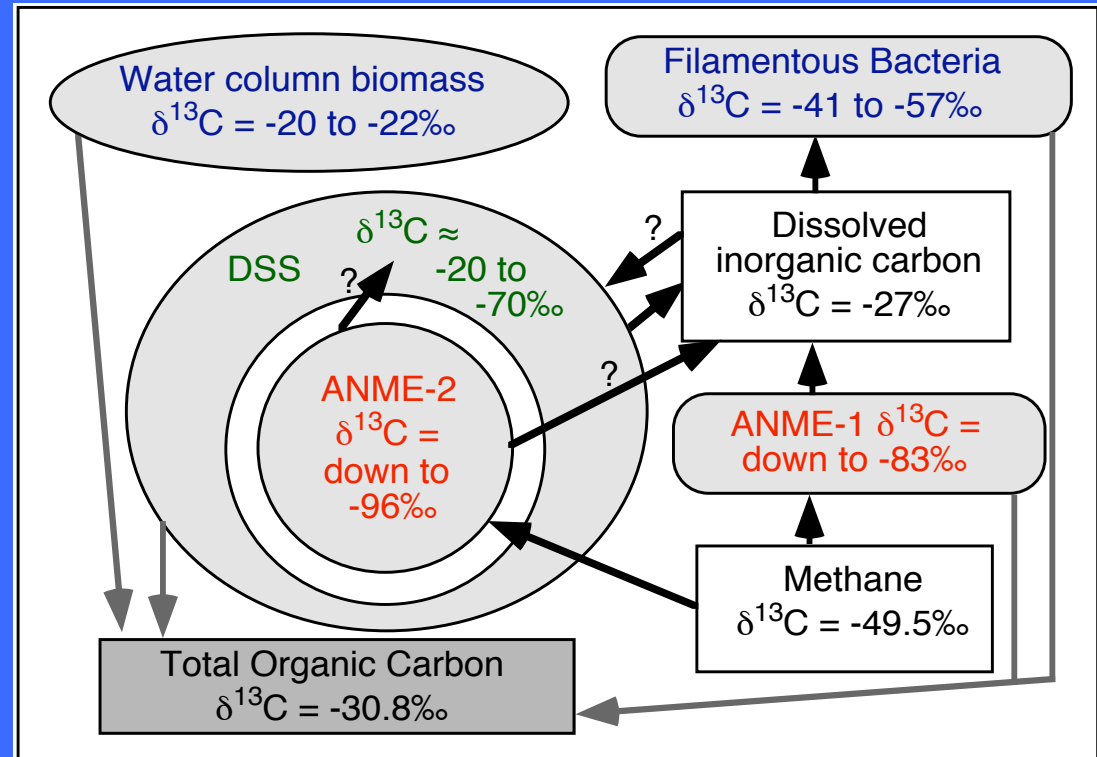
Eel River Methane Seep Biogeochemistry



← Archaea
← SRB



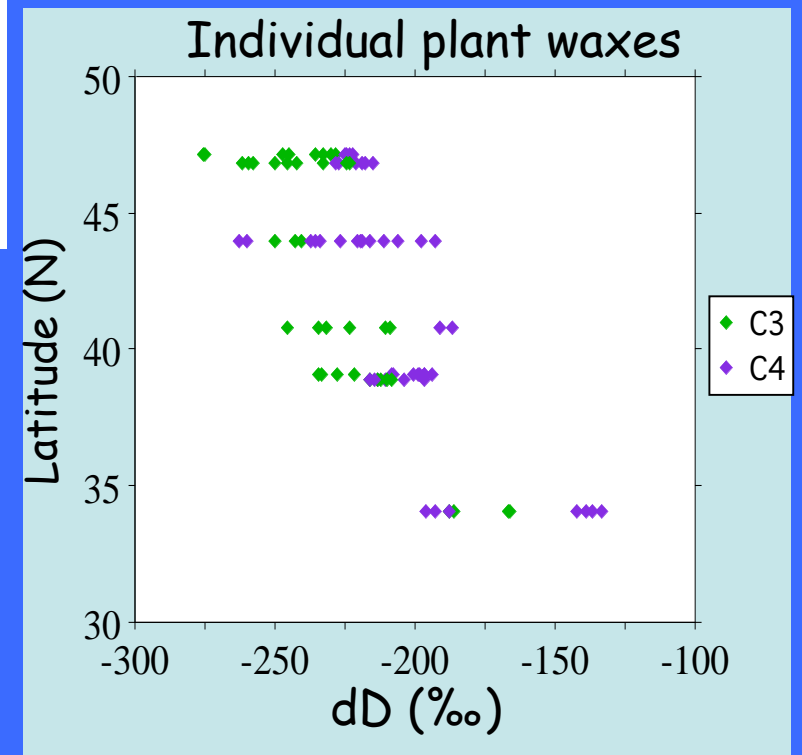
Chris House





A man with dark hair, wearing a blue t-shirt and light blue jeans, is bending over to feed a kangaroo. The kangaroo is standing on its hind legs, facing the man. They are in a grassy field with trees in the background.

D/H signals in plant waxes
Reflect surface water values,
climate signals and plant types



Geobiology Curriculum

Required Biology Courses

- BIOL 110 Basic concepts and biodiversity
- BIOL 220W Populations and communities

Required Geosciences Courses

- GEOSC 001 Physical Geology
- GEOSC 201 Earth Materials
- GEOSC 204 Geobiology
- GEOSC 310 Earth History

Curriculum, continued

Additional Core Courses (one geo and one bio)

- GEOSC 202 Chemical processes
- GEOSC 203 Physical processes
- BIOL 230W Molecules and cells
- BIOL 240W Function and development of organisms
- MICRB 201 Introductory Microbiology

Curriculum, continued

Field Experience (3 credits)

- GEOSC 472a Summer Field Camp (1st 3 weeks)
- BIOL 444 Field ecology of the Central Appalachian Highlands

Senior Thesis

- GEOSC 494W Senior Thesis Writing & Presentation
- GEOSC 496 Thesis research

Curriculum

Advanced Geobiology Electives (15 credits)

Evolution, Paleobiology and Geology Track

- GEOSC 465 Structural Geology
- GEOSC 424 Paleontology
- GEOSC 439 Stratigraphy
- GEOSC 420 Paleobotany
- GEOSC 425 Micropaleontology
- GEOSC 474 Astrobiology
- ANTH 401 Human Evolution: the material record
- BIOL 428 Population Genetics
- BIOL 405 Molecular evolution

Curriculum

Advanced Geobiology Electives (15 credits)

Biogeochemistry Track

- GEOSC 452 Hydrogeology
- GEOSC 419 Organic Geochemistry of Natural Waters and Sediments
- GEOSC 412 Water resources
- GEOSC 413W Techniques in geochemistry
- GEOSC 410 Marine biogeochemistry
- GEOSC 475W Global Biogeochemical Cycles
- BIOL 435 Ecology of Lakes and Streams
- BIOL 406 Symbiosis
- SOILS 412W Soil Ecology
- BIOL 419 Ecological and environmental problem solving

Summary:

A curriculum is more than just a list of classes that are content-delivery devices.

A curriculum is the means to an end.

What is that end?

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A curriculum is more than just a list of classes that are content-delivery devices.

A curriculum is the means to an end.

What is that end?

It is the development of students who can pose questions, solve problems, and communicate results, utilizing geologic knowledge and concepts.

And there's more...

A curriculum is also a kind of map that lays out the intellectual terrain that will be explored in a course of study, and in that mode, it serves as a recruitment tool — it communicates to students something about where they are headed.

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So our curricula must change, without losing sight of the fundamental goals we are trying to accomplish — the training of capable, flexible, creative scientists.

Proposed Earth Science Policy BS Degree

- Global Change Focus (Geoscience, Geography, Meteorology)
- Calculus, Statistics, Computer Science, Modeling
- Policy or Law Internship
- Collaborations with Liberal Arts Departments and Law School
- Slated to begin in Fall 2009

3+2 Dual Degree Program with Fort Valley State University (FVSU)

- HBCU in Fort Valley, GA with a national recruiting pipeline beginning in the 9th grade
- Students receive Chemistry or Math BS at FVSU in 3 years, then a Geosciences BS at PSU in 2 years
- Possibly receive MS in Geoscience after 1 year by converting senior thesis to MS project
- Funded by Industry
- Program at Penn State and UT-Austin
- Each school has 5 current students
- New PSU 3+2 program in Petroleum Engineering