

Designing to achieve rich learning outcomes in a research- based undergraduate program

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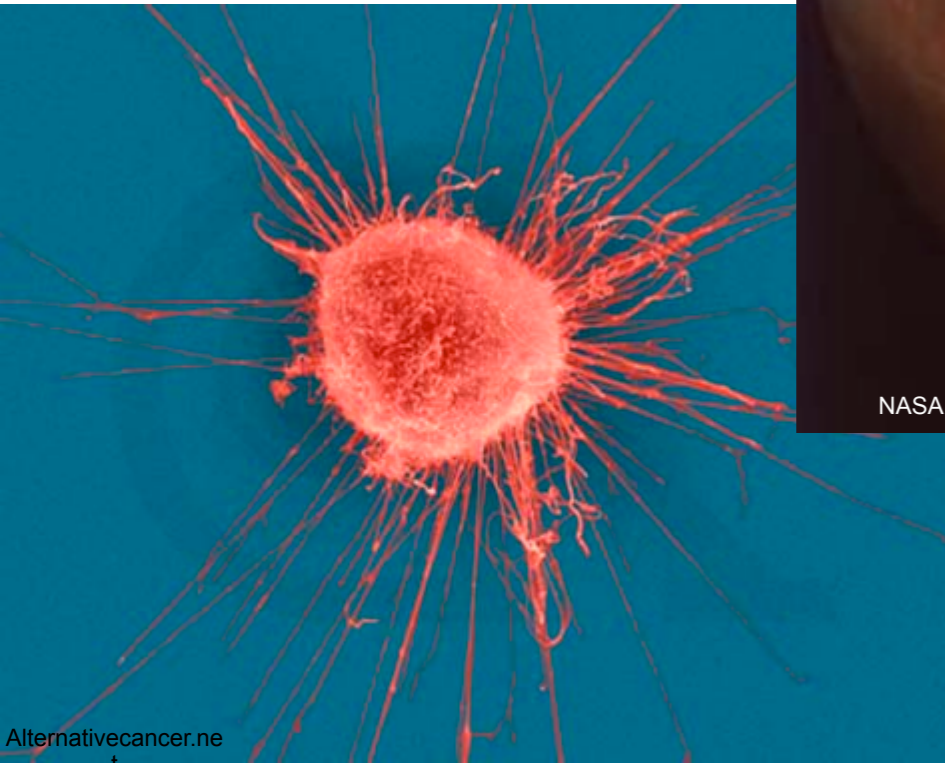
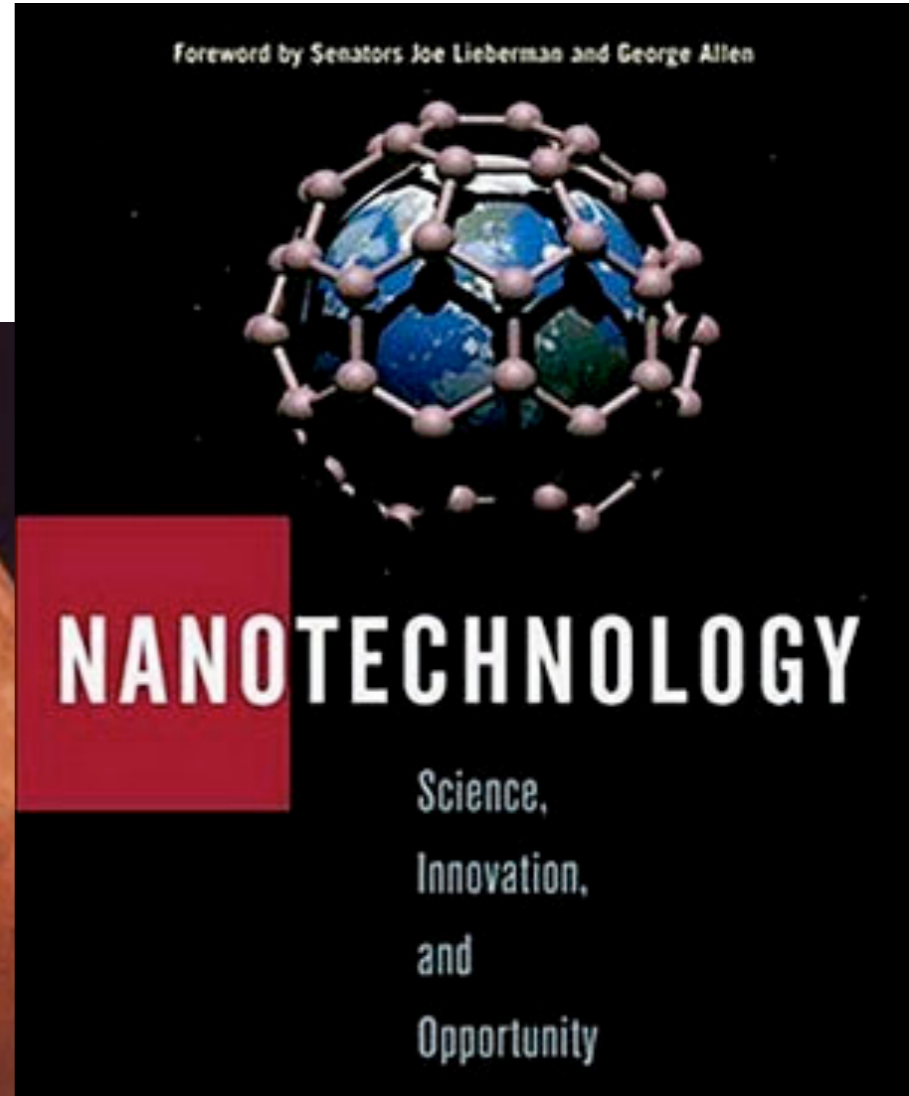


Outline

- What is iSci?
- Founding principles
- Design principles
 - alignment, integration, equivalency
- Design processes
 - LOs, assessment, evaluation
- Extension and discussion

WHAT IS ISCI?

Modern science and society...



Science education...



What is iSci?

- Introduced September 2009
- Interdisciplinary, research-based undergraduate science program
- Enrolment: 60 max per year
- Small class sizes, big custom courses
- Collaborative, self-directed learning

Program Features

- **Staged transfer to research-based learning**
- Team teaching approach
- Delivery style matched to content
- Assessment & evaluation matched to content
- Collaborative & individual research projects
- Science literacy spine

Level I: ISCI 1A24

- One big, iSci only, full-year course
- 24 out of 30 Level I units (+ two 3 unit electives)
- Integrates mathematics, physics, chemistry, life science, & Earth science
- Prerequisite for most Level II science courses
- 24 hrs contact time per week
- 4 interdisciplinary research projects (3 or 6 weeks)

Levels II to IV

ISCI 2A18: 6 interdisciplinary research projects

ISCI 3A12: 4 interdisciplinary research projects

ISCI 4A12: Honours thesis research

Students can focus electives in a discipline
to gain a ‘Concentration’ or Minor

FOUNDING PRINCIPLES

Founding Learning Objectives

- Disciplinary knowledge
- Disciplinary skills and competencies
- Professionalism
- Awareness of science and scientists in society
- Scientific leadership
- Research process

Founding Student Outcomes

- Scientifically literate students
- Researchers, communicators, teachers, leaders, colleagues

Founding Vision

- Integration
- Pedagogical innovation
- Creativity
- Community

DESIGN PRINCIPLES

Balancing wants and needs

- Integration
- Alignment
- Equivalency



DESIGN PROCESSES

Alignment Grid

LOs	Pedagogy	Assessment	Evaluation
Discipline Content	Lecture	Exam	Course Evaluation
Discipline Skills	Lab	Lab Report	?

Alignment Network

LOs

Pedagogy

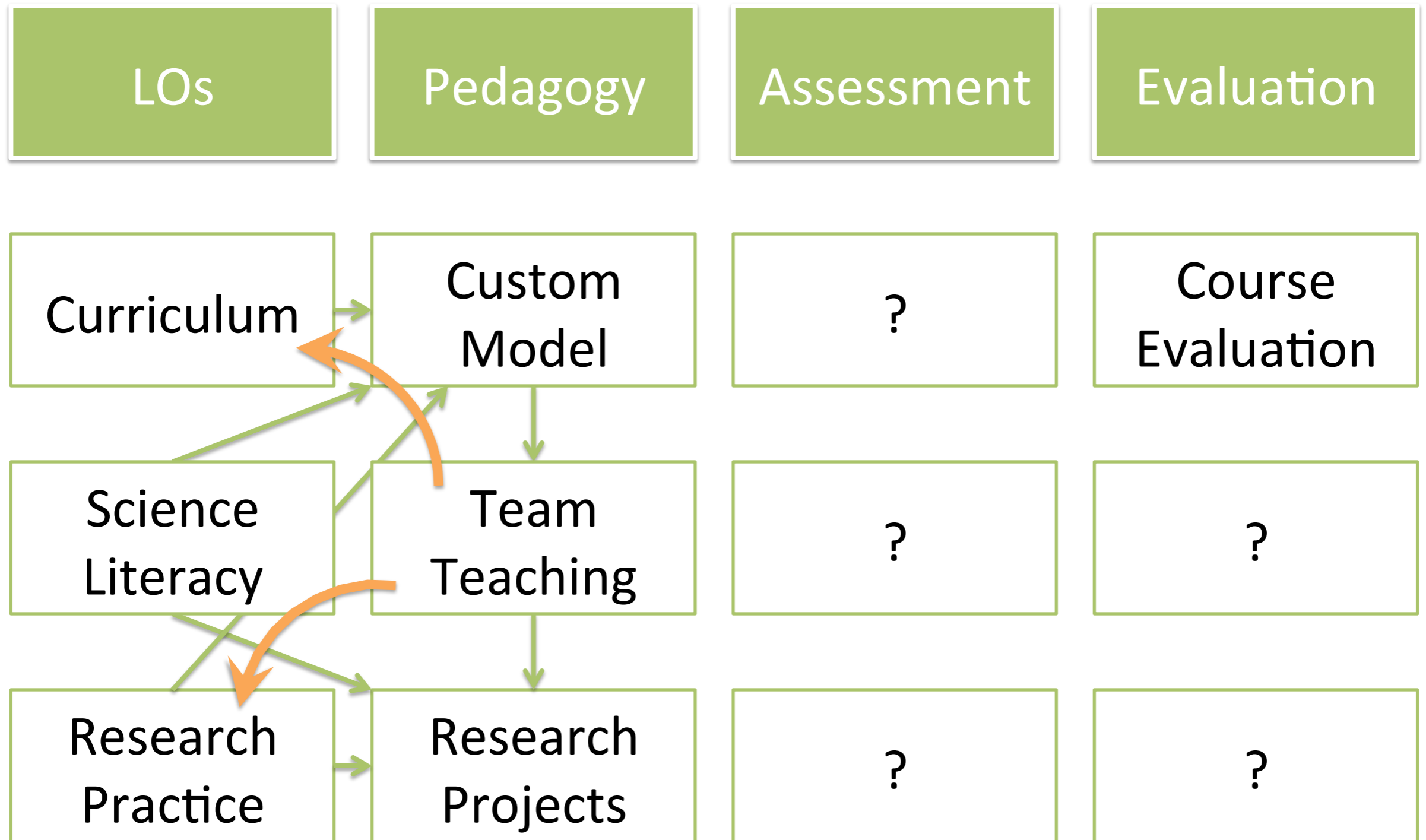
Assessment

Evaluation

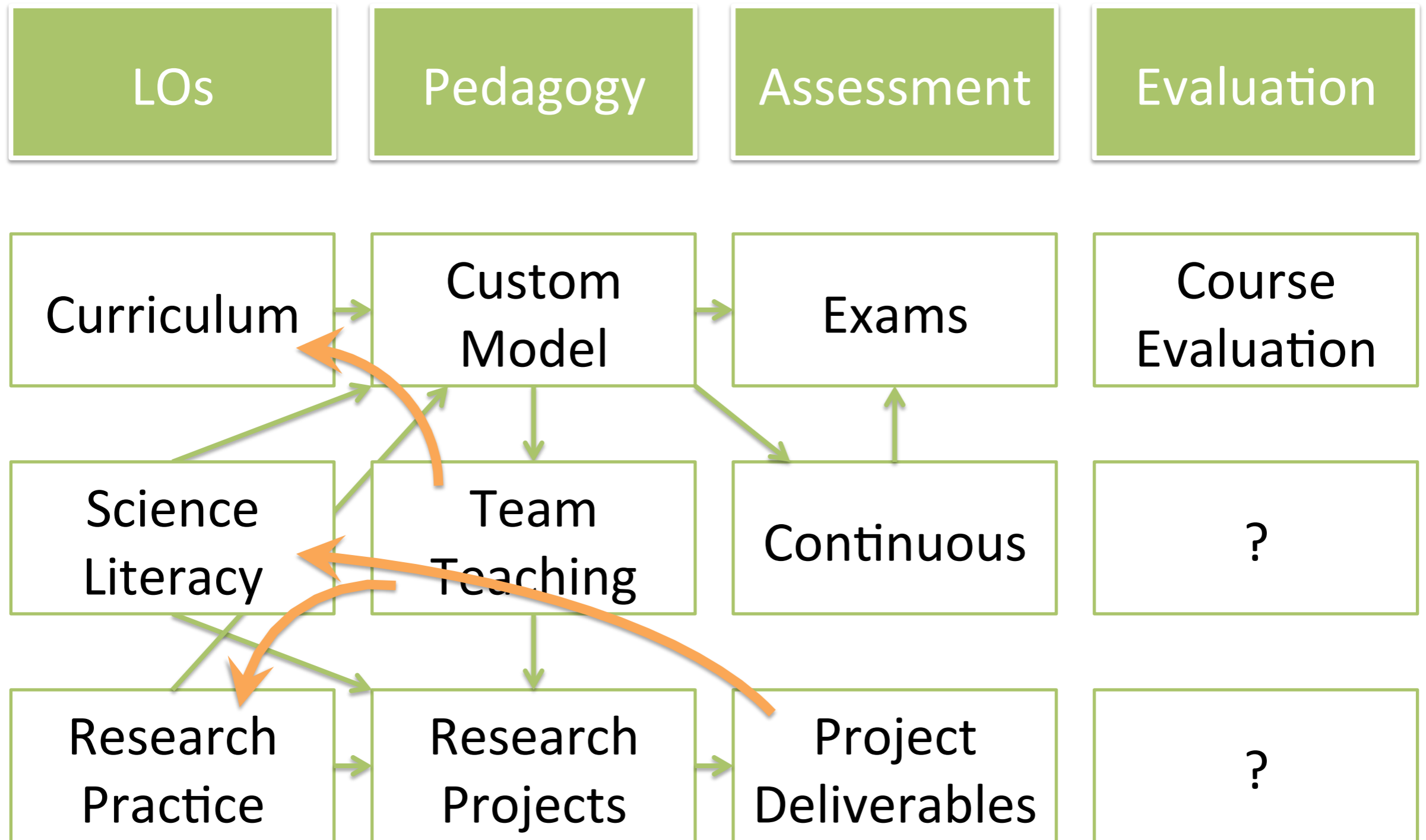
Design methods

LOs	Pedagogy	Assessment	Evaluation
Curriculum	Custom Model	?	Course Evaluation
Science Literacy	Team Teaching	?	?
Research Practice	Research Projects	?	?

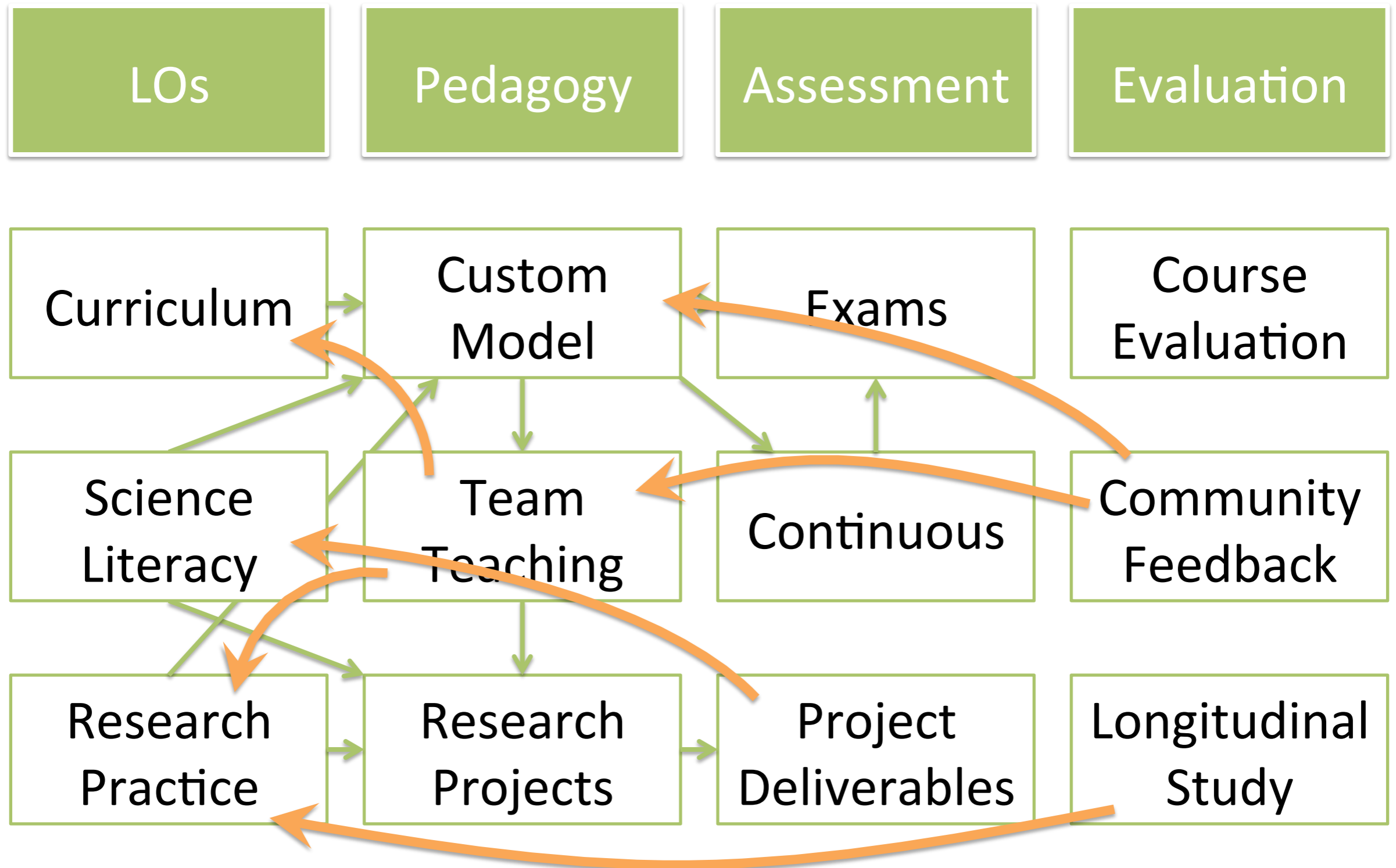
Design methods



Design methods



Design methods



ISCI 1A24 Student Assessment

Assessment style matched to content
 assignments, quizzes, written
 reports, essays, oral and poster
 presentations, peer evaluation
 exams and tests
 discipline ‘equivalencies’

Approx.

40% projects

35% exams

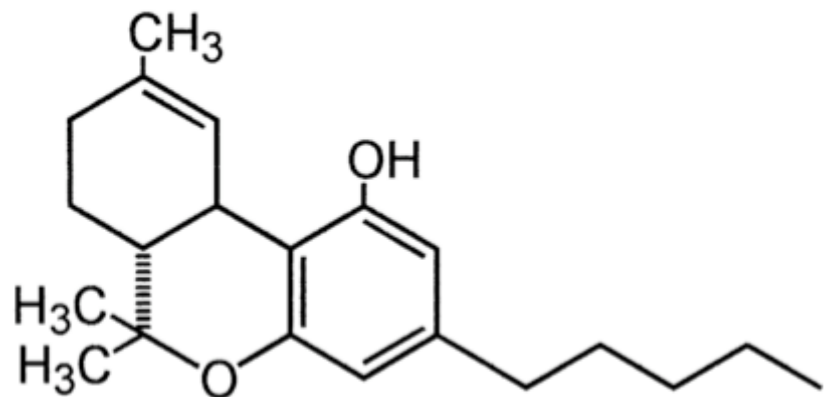
25% course work

		ACTIVITY							
		Exams	Continuous	Project components (example weightings)				Projects	TOTAL
				Mars	Drugs	Renewable Energy	Cancer		
DISCIPLINE	Math	32	20	3	3	10	12	28	80
	Physics	32	20	3	2	11	12	28	80
	Chemistry	32	20	2	3	11	12	28	80
	Life Sciences	32	20	2	3	11	12	28	80
	Earth Sciences	12	0	3	2	9	4	18	30
	Scientific Literacy	0	20	3	3	12	12	30	50
	TOTAL	140	100					160	400

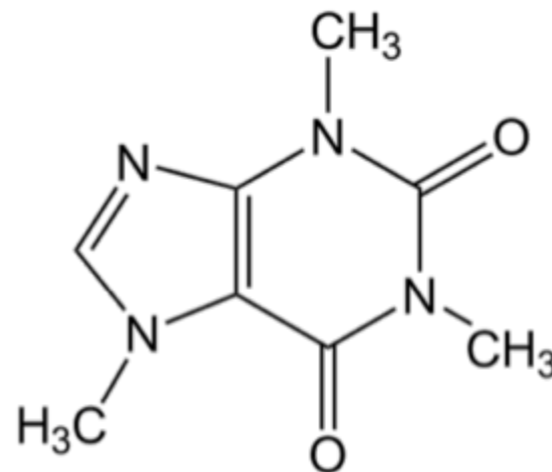
EXAMPLE: ISCI 1A24

RP2: Drugs, Doses & Biodistribution

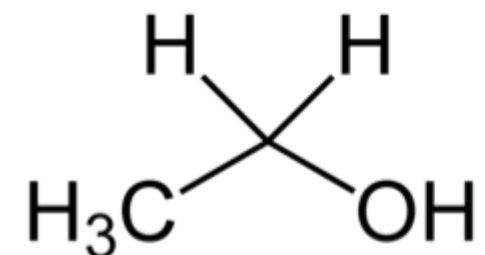
- 2nd half of Term 1
- 3 week research project
- Links 1st year content with topics relevant to undergraduate life – *Target audience*
- Experience scientific poster symposium



Δ-9-tetrahydrocannabinol (THC)



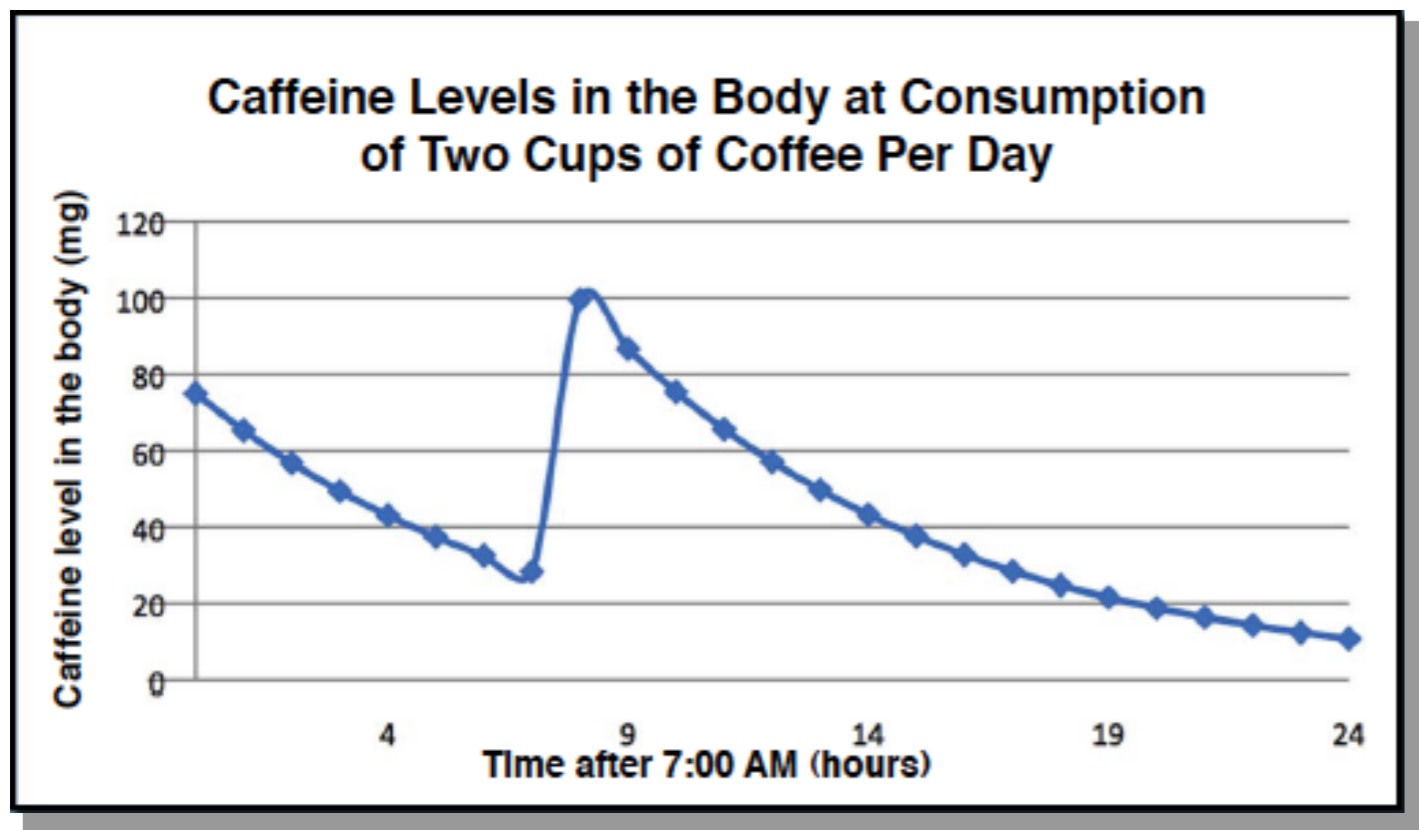
Caffeine



Ethanol (Alcohol)

Drugs, Doses & Biodistribution

- Question-driven, group research
- Caffeine, alcohol & a drug of their choice
- Freedom to research any aspect of these drugs affecting the human body or environment



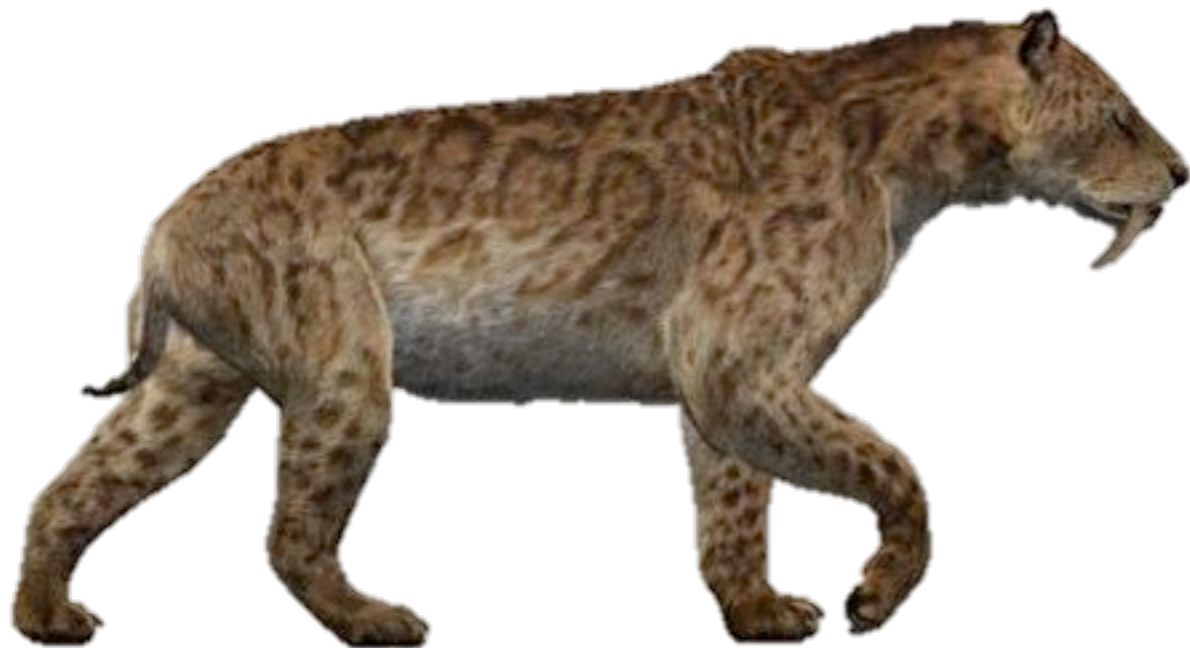
Model of caffeine absorption and metabolism over time

Drugs, Doses & Biodistribution

- **Biology:** Homeostasis, drug metabolism and ecotoxicology
- **Chemistry:** Chemical structure organic chemistry, acid-base chemistry and intermolecular forces
- **Mathematics:** Discrete time dynamical systems
- **Physics:** Fluid mechanics and diffusion
- **Earth Science:** Ground water movement and environmental toxicity
- **Psychology:** Drug addiction and treatment

EXAMPLE: ISCI 2A18

A history of scientific exploration



EXAMPLE: LONGITUDINAL STUDY

Study Motivation

Is iSci successful?

- How is the program for the students?
- What components are valuable to their experience?
- How can we improve program curriculum and instruction?
- What are we contributing to the greater SOTL community?

Longitudinal Study Design

Phase I – trial instruments

Phase II – end of year survey of all in-Program students; expectation data for incoming students and exit data from graduands

Phase III – comparative data from non-iSci student and instructors

Phase IV – institutional data including iSci instructor questionnaire

Phase V – alumni reflections

In-program survey

Online questionnaire targeting student perceptions:

1. efficacy of pedagogical methods and instructional spaces
2. preparedness for their next academic step
3. confidence in skill development
4. their expectations for next year

Summary

- iSci is progressing in the *right direction*
- Students across years perceive the Program positively and are confident it is preparing them well for the future
- Some variation in skill development and between perceptions between years

