Learning science without boundaries: pedagogical innovations that shape the Integrated Science (iSci) program at McMaster

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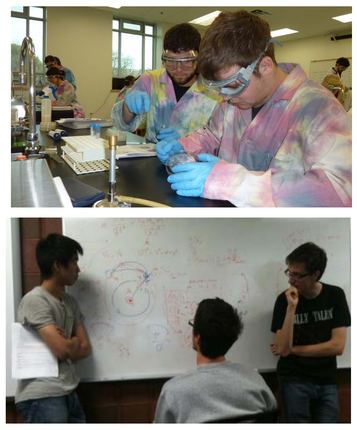
What is iSci?

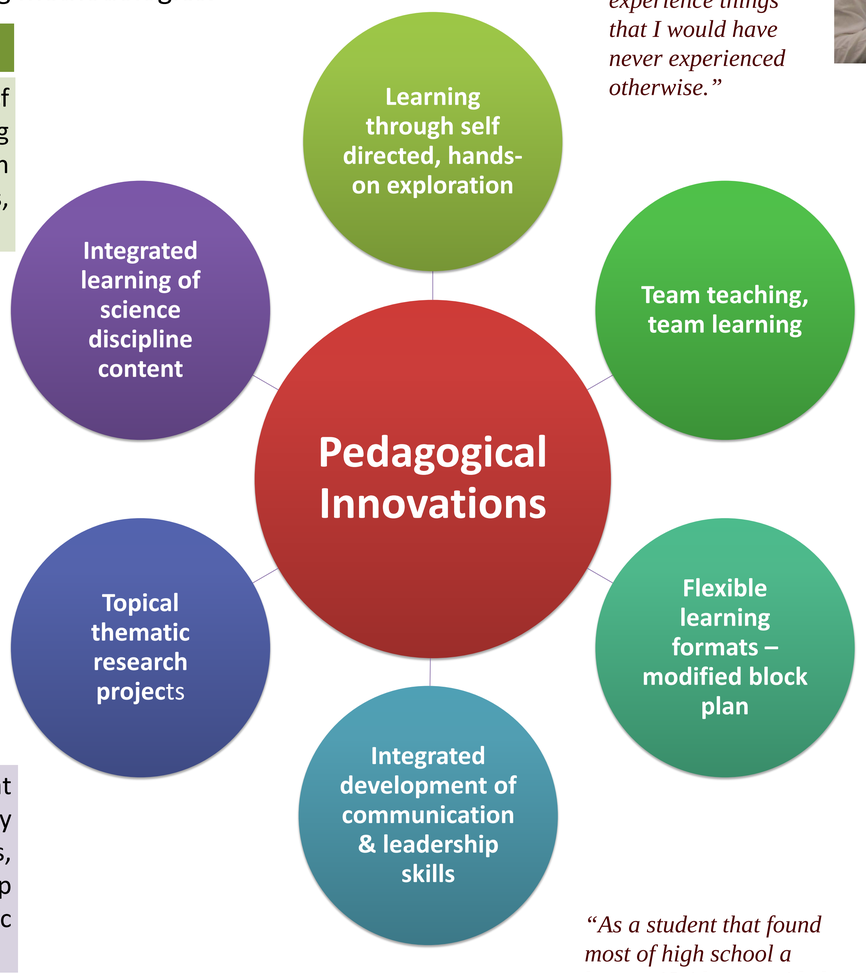
The Honours Integrated Science (iSci) program is an interdisciplinary, research-based science program that focusses on the development of self-directed learning skills in a supportive and collaborative environment. The iSci program is designed to allow students to learn science without the constraints of traditional discipline boundaries, course structures, or teaching methodologies.

"Being in iSci has given me the opportunity to learn and experience things that I would have never experienced otherwise."

Learning through self directed, hands-on exploration

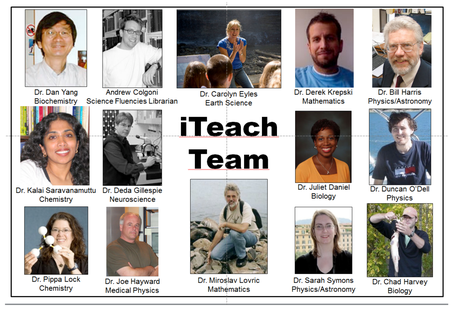
Students in the iSci program learn through their own exploration of scientific issues in classroom, laboratory and field settings. Beginning in first year and continuing throughout the program, students gain expertise in research question design, experiment design and analysis, and communication of research findings.





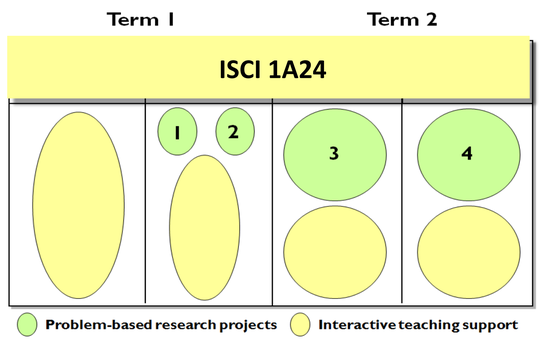
Team teaching, team learning

The iSci learning environment is team-based with team-teaching and team project work functioning as the norm. The iSci teaching team includes faculty, teaching assistants, the science fluencies librarian, iSci Administrator, lab co-ordinator and instructional assistant. Instructors are exposed to a variety of teaching and learning techniques that they can take back to other courses and programs.



Integrated learning of science discipline content

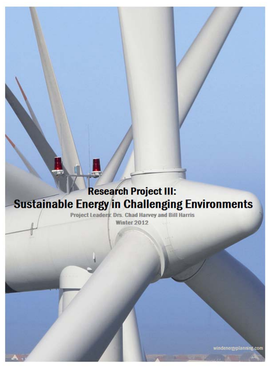
First year students take a single 24 unit course (ISCI 1A24) that integrates learning of the knowledge, concepts, and skills covered by traditional discipline courses in chemistry, physics, math, life sciences, earth science and psychology. In subsequent years students develop their understanding of the connections between key scientific concepts through directed project-based interdisciplinary research.



Research Project 1: **Mission to Mars**
Research Project 2: **Drugs, Doses & Biodistribution**
Research Project 3 : **Sustainable Energy in Challenging Environments**
Research Project 4 : **Cancer: A 21st Century Plague**

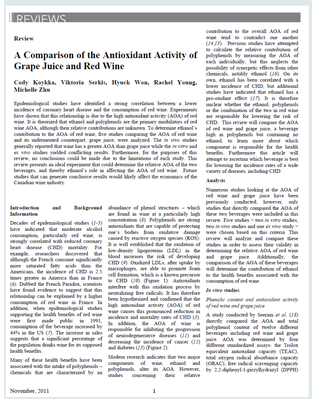
"iSci is, put quite simply, EPIC. There really is no other program that allows you to meet an astronaut, look at the core of a nuclear reactor, and take part in a lab in a hospital...all in your first year !"

"As a student that found most of high school a breeze, iSci has provided me with challenges at many different fronts that have helped me grow."



Integrated development of communication & leadership skills

Essential communication skills are developed through the integrated science literacy program. Students learn how to communicate the results of their research in a variety of formats including scientific papers, podcasts, and web materials intended for different types of audience. iSci is a learning community and also fosters the development of personal and leadership skills.

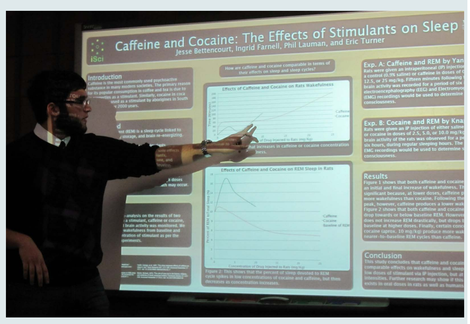

REVIEWS

Review

A Comparison of the Antioxidant Activity of Grape Juice and Red Wine

Cody Koykka, Viktoria Serkis, Hyuck Won, Rachel Young, Michelle Zhu

Epidemiological studies have identified a strong correlation between a lower incidence of coronary heart disease and the consumption of red wine. Experiments have shown that this relationship is due to the high antioxidant activity (AOA) of red wine. Although many studies have investigated the relative contributions to the AOA of red wine, few studies comparing the AOA of red wine and its undecocanted counterpart, grape juice, were analyzed. The *in vitro* studies generally reported that wine has a greater AOA than grape juice while the *in vivo* and *ex vivo* studies yielded conflicting results. Furthermore, for the purposes of this review, no conclusions could be made due to the limitations of each study. This review recommends experiments that could determine the relative AOA of the two beverages, and thereby evaluate's role in affecting the AOA of red wine. Future studies that can generate conclusive results would likely affect the economics of the Canadian wine industry.



Flexible learning formats – modified block plan

In the second year of the iSci program research projects are scheduled in a modified 'block plan' format and run for periods of between 6 and 10 weeks. Topics include thermodynamics, ecology, biochemistry, neuroscience, and earth history. Second year students also select an 'enrichment' project based upon one of these five topics to further enhance their understanding of that topic, or a quantum mechanics project.

Level II Structure

	Term 1		Term 2	
ISCI 2A18	Plant-Animal Interactions	History of the Earth	Thermodynamics	Enrichment Research Project
	Drug Discovery		Neuroscience	
	Math		Math	
	Scientific Literacy		Scientific Literacy	
Electives	Elective		Elective	
	Elective		Elective	

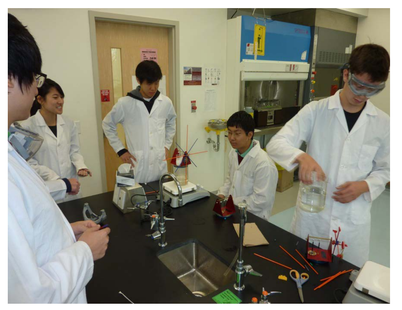
Topical, thematic research projects

The majority of student learning takes place through interdisciplinary research projects that focus on topical and relevant scientific issues. In first year students complete four team research projects. In second and third year students complete several team research projects and an enrichment/individual research project on a topic of their choice.

Level III Structure

	Term 1	Term 2
ISCI 3A12	Wine Science	Climate Change
	Light, the Universe and Everything	Independent Project
	SCIENTIFIC LITERACY	SCIENTIFIC LITERACY
Electives	Elective	Elective
	Elective	Elective
	Elective	Elective

iConS: Integrated Concept Seminars *are at the heart of the iSci week. iConS are where key scientific concepts and links are introduced, where research project material is shared, and faculty members interact with the iSci group.*



Level IV Structure

	Term 1	Term 2
ISCI 4A12	Thesis Project	Thesis Project
	Interdisciplinary Seminar	Interdisciplinary Seminar
Electives	Elective	Elective
	Elective	Elective
	Elective	Elective

In their fourth and final year students complete a senior independent research project and an interdisciplinary seminar.

"*iSci opens students' eyes to the beauty of science, providing students with the tools, resources, and exposure to explore everything from the smallest particles to the entire universe" – 2nd year iSci student*

Words and phrases to describe iSci: "challenging, stressful, sleep-depriving, demanding, overwhelming, headache-inducing; rewarding, thought-provoking, exhilarating, entertaining, unique, ***awesome.****"*