



Diascopic-science Approach to Teaching General-education Science

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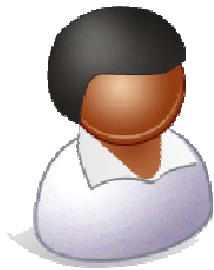
General Education Foundation (GEF) Programme
Office of University General Education



Diascopic

- *dia-*
 - From Greek, means “through” (e.g. diameter)
- *scopic*
 - From Greek, means “look at”
- Diascopic science: by looking through science ...

Diascopic-science (透觀科學) Approach



Science

Enduring
questions
(To be explained)



This talk

1. General Education (GE) at CUHK
2. GEF: Dialogue and Enduring Questions
3. Diascopic-science Approach in “In Dialogue with Nature”
4. Common misunderstanding of GE science

A holistic GE at CUHK

Intellectual development

GEF Programme

broad view on different aspects of human existence, skills in discussion and writing.

UGEA, UGEB, UGEC, UGED

more in-depth knowledge of different areas

graduates with a holistic training in general education

College general education

Students' involvement in college life and college tradition





The University GE

- GEF Programme
 - In Dialogue with Humanity (UGFH1000)
 - In Dialogue with Nature (UGFN1000)
- Four areas
 - Area A - Chinese Cultural Heritage
 - Area B - Nature, Science and Technology
 - Area C - Society and Culture
 - Area D - Self and Humanity



Where is natural science?

- GEF Programme
 - In Dialogue with Humanity (UGFH1000)
 - **In Dialogue with Nature (UGFN1000)**
- Four areas
 - Area A - Chinese Cultural Heritage
 - **Area B - Nature, Science and Technology**
 - Area C - Society and Culture
 - Area D - Self and Humanity



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Dialogue and Enduring Questions

GEF Programme



CUHK in 2012

- 3-year \Rightarrow 4-year curriculum.
- 6 more credits in general education.
- Easiest way: require each student to take 2 more courses from the existing UGEA/B/C/D.



We chose a difficult way ...

- developed a 6-credit GEF Programme:
 - In Dialogue with Humanity
 - In Dialogue with Nature
- Students have to read classics, discuss and write.

Human existence

- In the past thousands of years, nearly all things changed.
- What has never changed?
 - The question about ourselves:

Who am I?



A statue at Columbia University

My identity carries a set of values.

Who am I?

- Values*
- Honesty*
 - Loyalty*
 - Piety*
 - ...
 - ...

Reflection on the values reshapes my identity.



Questions of values

- We frequently ask these questions.
 - What is a good life?
 - What is a good society?
 - Should I love my enemy?
 - Should I be honest?
 -



Dialogue: Q & A & Q & A ...

- Questions of values wait for answers.
- The answers are questioned.
- New questions give rise to new answers.
- ...
- These are dialogues
 - between individuals
 - between texts
 - between individuals and texts

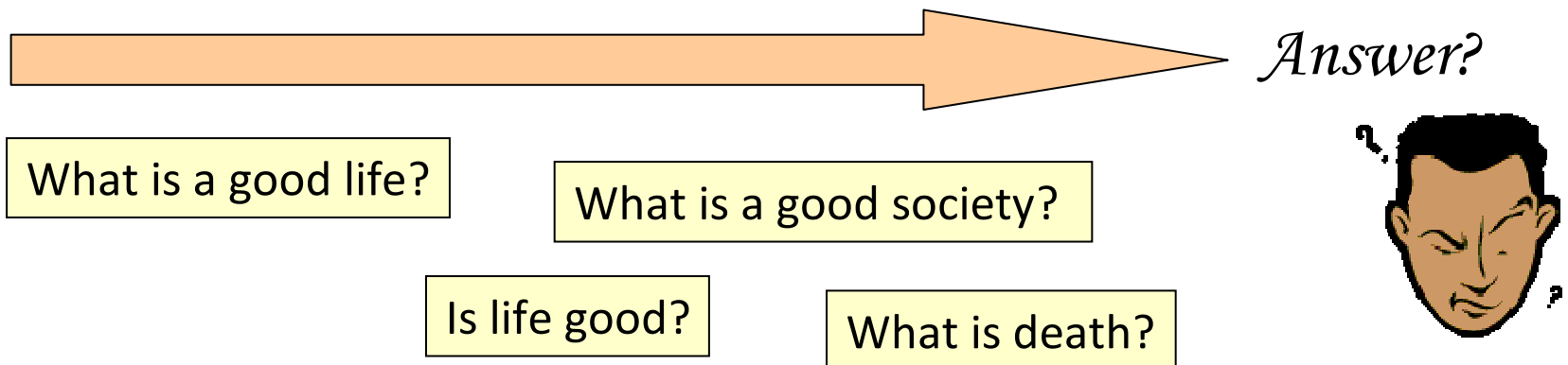


Dialogue: Q & A & Q & A ...

- No perfect answer \Rightarrow Dialogues keep going on.
- Dialogues initiate the pursuit of knowledge.
- Dialogues \Rightarrow Answers to enduring questions

From dialogue to classics

- How can a university student enter the tradition of dialogue?
- Classics: records of the thoughts of great minds on the human existence.





Seminar-based GEF Programme

- in small groups of 25 students for all 3600 Y1/T2 or Y2/T1 students.
- reading classics, discussions, writing.
- Each teacher teaches 6 groups.



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UGFN1000

In **D**ialogue with **N**ature

DIANA: An intellectual expedition



I. Exploration of the Physical Universe

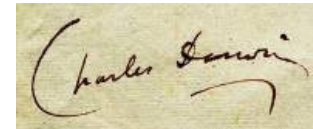
Readings

Plato, *Republic* Book VII: The allegory of the cave and
David C. Lindberg, *The Beginnings of Western Science* (Chapter 2)

David C. Lindberg, *The Beginnings of Western Science* (Chapters 3, 12)

I. Bernard Cohen, *The Birth of a New Physics* (Chapter 7) and
Isaac Newton, *Principia* (Definitions and Axioms).

II. Exploration of the World of Life

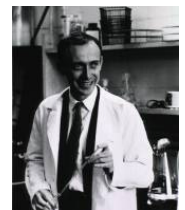


Readings

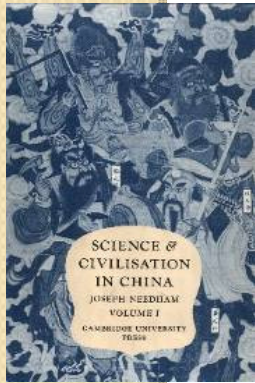
Charles Darwin, *On the Origin of Species* (Chapter 4)

James D. Watson, *DNA: The Secret of Life* (Chapters 1 and 2)

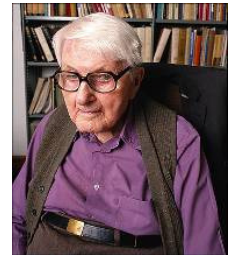
Rachel Carson, *Silent Spring* (Chapter 6)



III. Understanding of Human Understanding



Readings
Henri Poincaré, <i>Science and Method</i> (Chapters 1, 3)
Eric R. Kandel, <i>In Search of Memory: The Emergence of a New Science of Mind</i> (Chapters 4 and 28)
Joseph Needham, <i>The Shorter Science and Civilisation in China</i> (Chapter 10)
Nathan Sivin, 'Why the Scientific Revolution Did Not Take Place in China – or Didn't it?' <u>and</u> Shen Kua, <i>Brush Talks from Dream Brook</i> (沈括：《夢溪筆談》)
William Dunham, <i>The Mathematical Universe</i> (Chapter G) <u>and</u> Euclid, <i>Elements</i> (selected propositions)





Newton's *Principia*

(The last paragraph before Axioms)

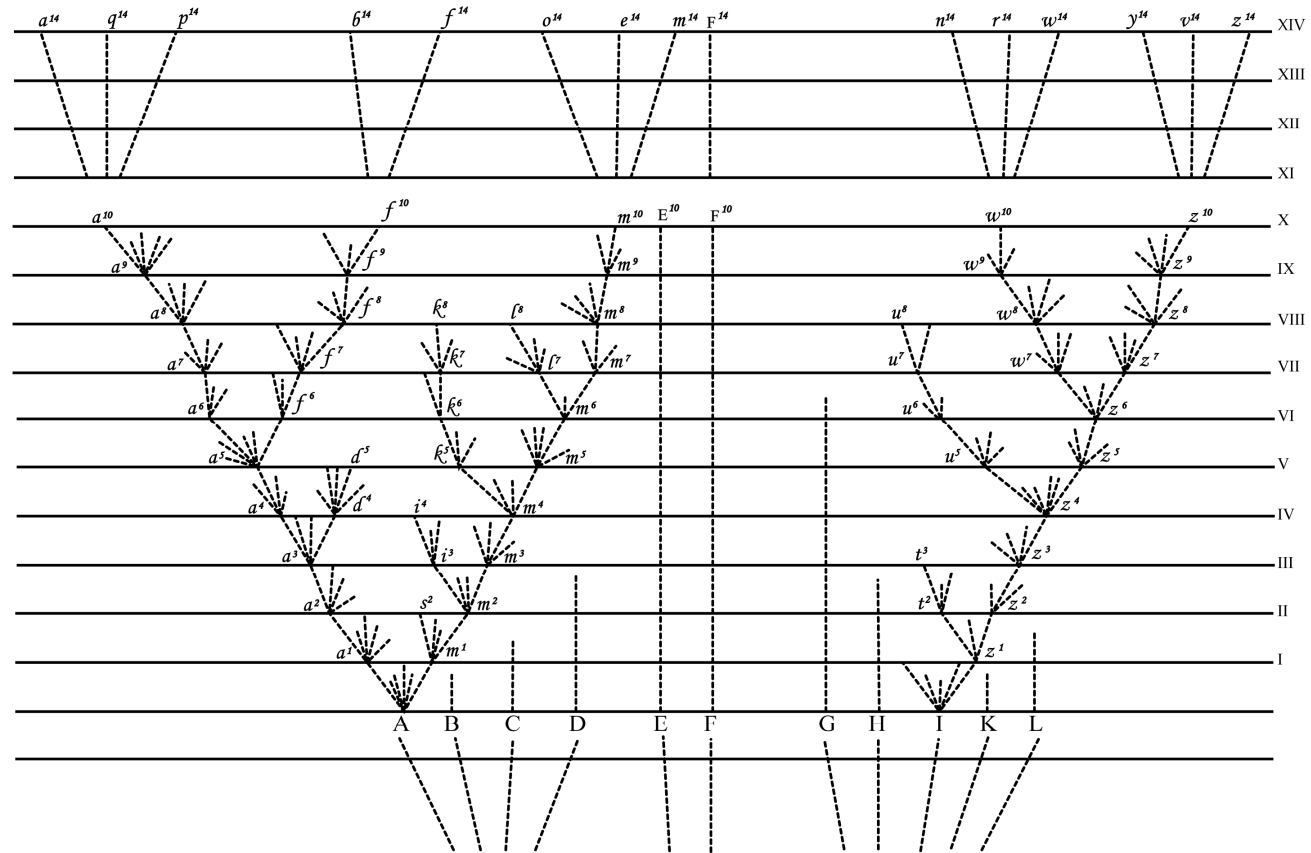
The quantity of centripetal force is of three kinds: absolute, accelerative, and motive.

[. . .]

Further, it is in this same sense that I call attractions and impulses accelerative and motive. Moreover, I use interchangeably and indiscriminately words signifying attraction, impulse, or any sort of propensity toward a center, considering these forces not from a physical but only from a mathematical point of view. Therefore, let the reader beware of thinking that by words of this kind I am anywhere defining a species or mode of action or a physical cause or reason, or that I am attributing forces in a true and physical sense to centers (which are mathematical points) if I happen to say that centers attract or that centers have forces.

- What did Newton understand?
- Mathematical understanding.

Darwin's dream



- What do scientists assume? Universality.



Enduring questions

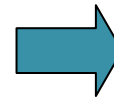
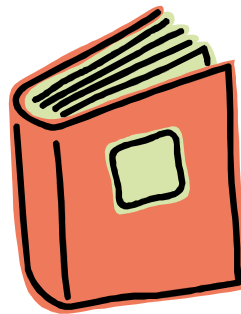
- Is science going towards the truth?
- What do I mean when I say “I understand”?
- What is the beauty of nature?
- Is life just a matter of physics and chemistry?
- Do I have a soul?
- ...

Learning Outcomes

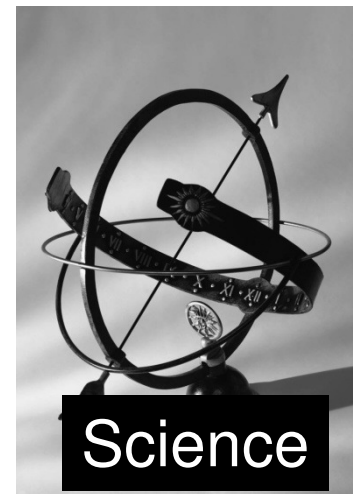
1. Ability



read and discuss
science texts with
confidence



2. 3. 4. 5. Intellectual



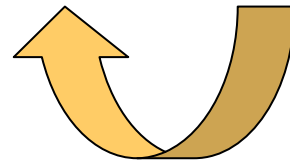
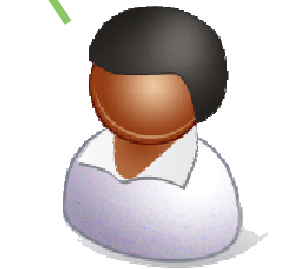


identify the essential characteristics of various methods of scientific inquiry that have significant impacts on how human beings view life and universe.

world (世界)

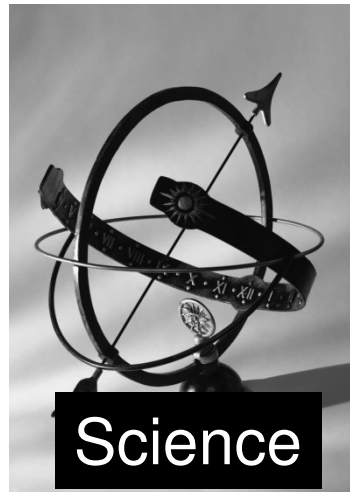
formulate informed personal views on the societal implications of scientific explorations.

society (社會)



relate the development in natural sciences highlighted in the course to contemporary human conditions.

individuals (個體)



evaluate
highlighted
scientific
methods using
multiple
perspectives

science (科學)



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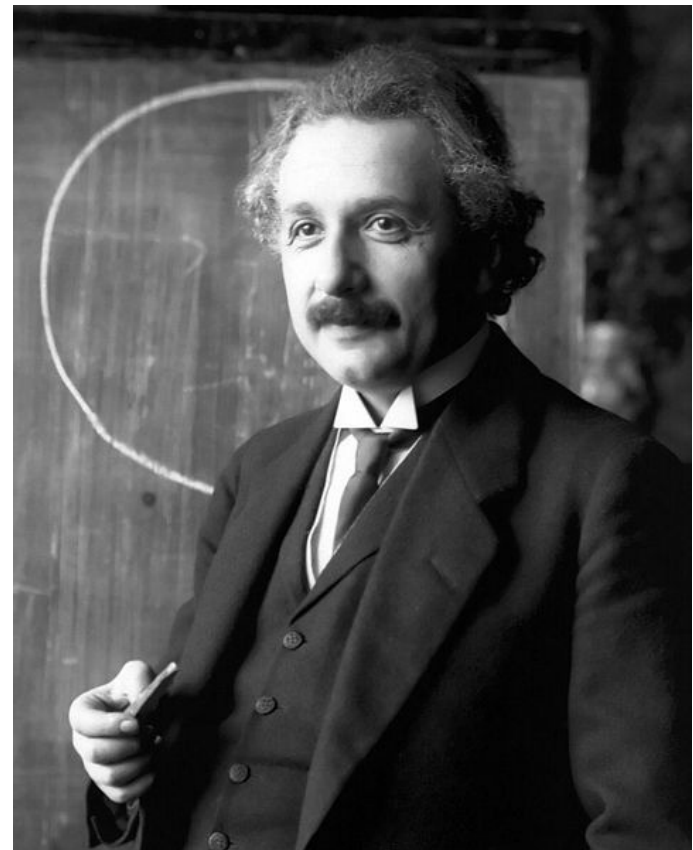


Common misunderstanding ...

- GE science = popular science
- GE science = science with no mathematics
- GE science = 1000-level major science

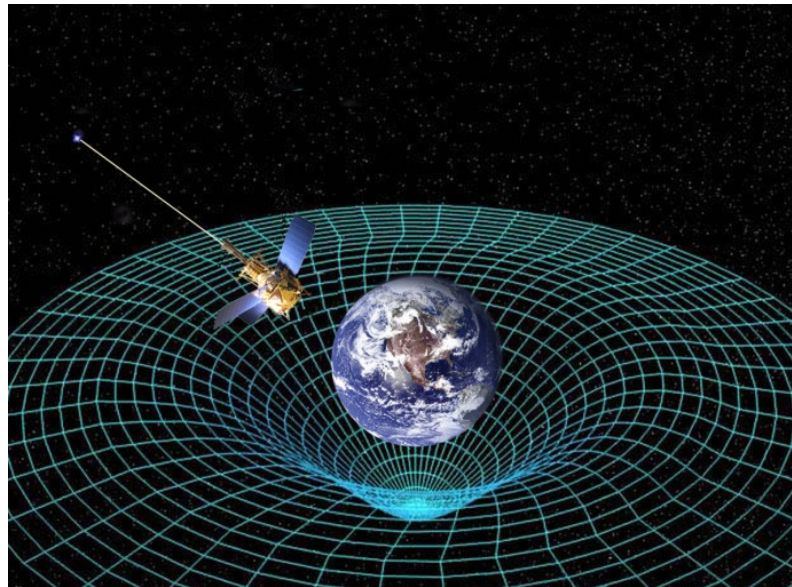
Example: General Relativity (GR)

- A theory describing our universe.
- Only professionals can understand GR.
- “Translation” is needed for non-scientists.



Translation ...

- No equations. Pictorial illustration of the idea of curved space-time.
- Talk about applications:
 - Global positioning system (GPS).



Up to this point, same as popular science.



Diascopic science asks ...

- GPS was originally for military uses, what does this imply?
- People believed in a flat space-time, but GR reveals a curved space-time, what does it mean to our understanding of the universe?
- Does the universe (which follows GR) have a purpose?

Diascopic science and others

	Popular science	Diascopic science	Technical science
Scientific concepts	Explained	Explained	Explained
Technical details	Avoided	Avoided	Important
Methodology	Described	Described and reflected on	Assumed
Discussion of relations between science and other fields	To arouse the reader's interest in science	To acquire an understanding of what science implies	Rare
Target	Common readers	All people	Researchers/ major students

Diascopic science: welcomed by **both** science majors and non-majors.



Enduring
questions

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