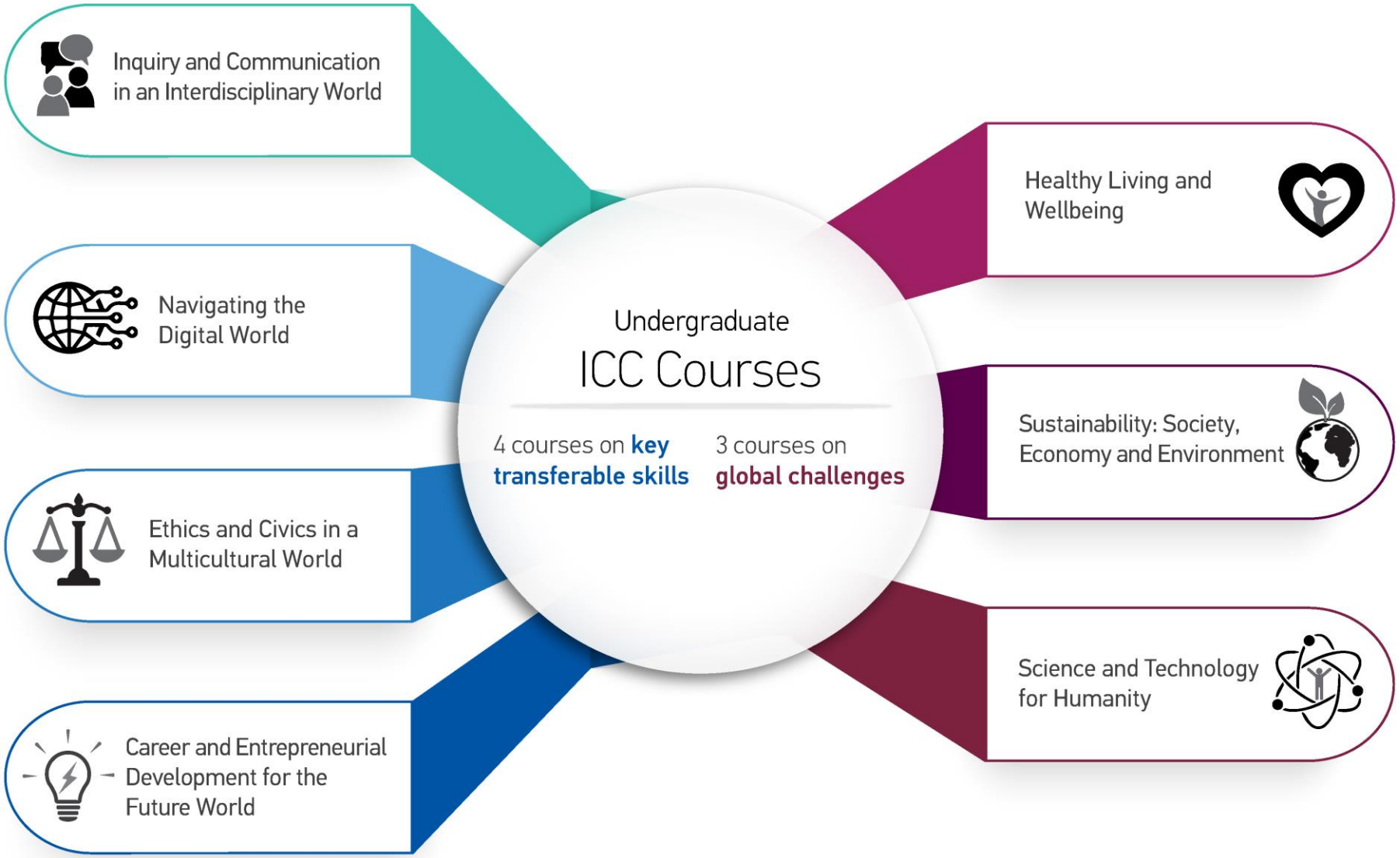
NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

CC0007 Science and Technology for Humanity

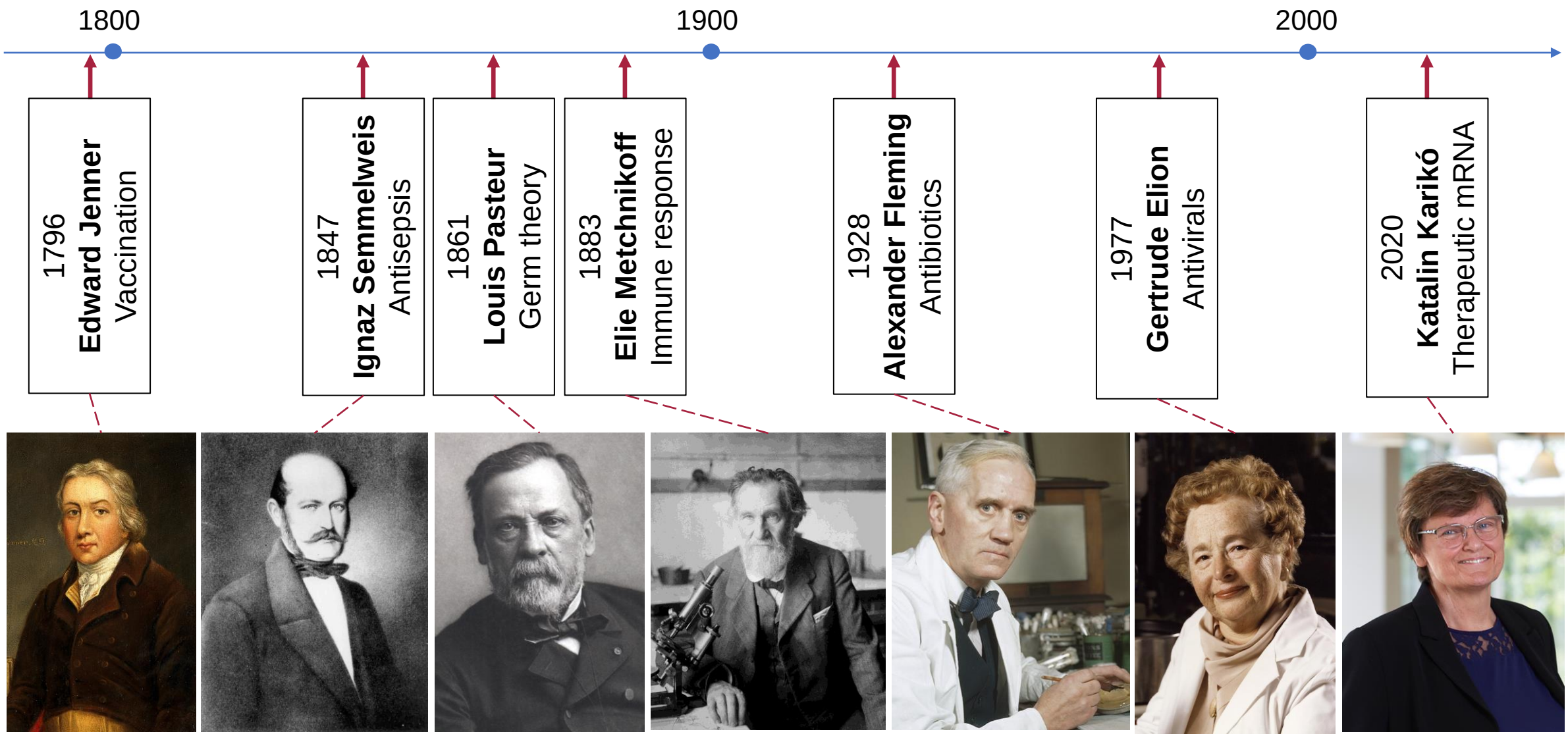
Introductory Lecture to CC0007



Science and Technology for Humanity: Motivational Examples from the Past

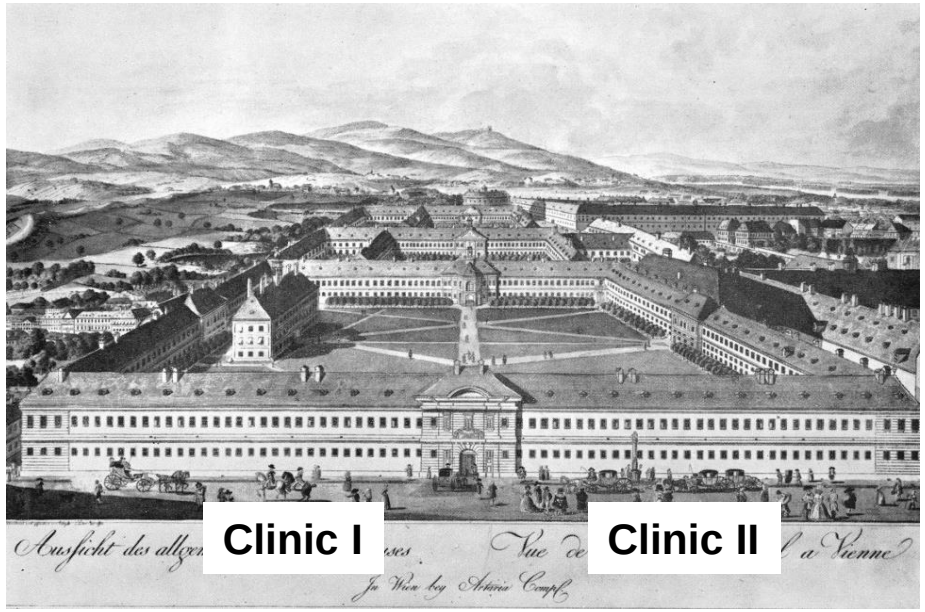
- Fighting infectious diseases
- Electricity
- Computing

Fighting Infectious Diseases



Fighting Infectious Diseases

Ignaz Semmelweis (1818–1865): The Saviour of Mothers – The Father of Hand-Hygiene (1847)



Clinic	I	II
Mothers' mortality	10%	4%
Students	Medical	Midwifery
Pathology class before obstetrics class	YES	NO

Electricity

1800

1900

1747 **Benjamin Franklin** Electrical charge, lightning rod

1800 **Alessandro Volta** Electrical battery

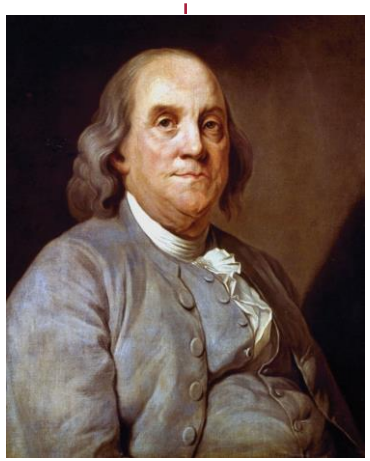
1821 **Michael Faraday** Electromagnetism, electrochemistry

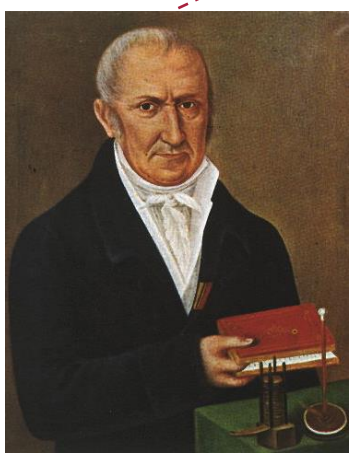
1827 **Ányos Jedlik** Electric motor, dynamo

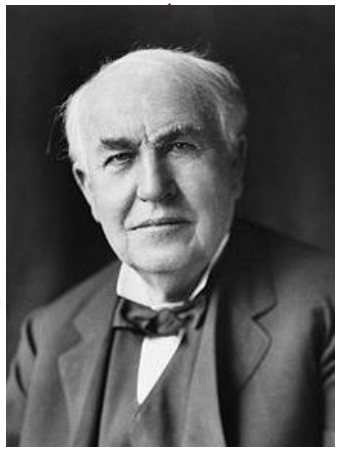
1865 **James Maxwell** Equations for electromagnetism

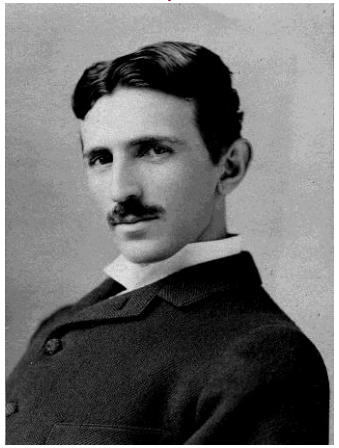
1883 **Thomas Edison** Electric light

1888 **Nikola Tesla** Induction motor



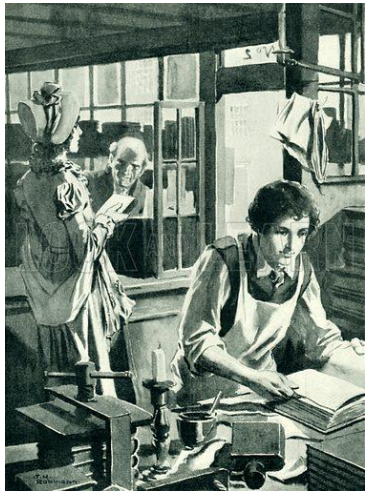






Electricity

Michael Faraday (1791–1867) – The Bookbinder Apprentice Who Became the Father of Electricity

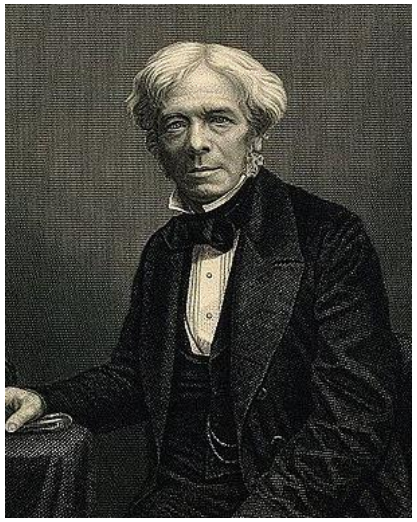


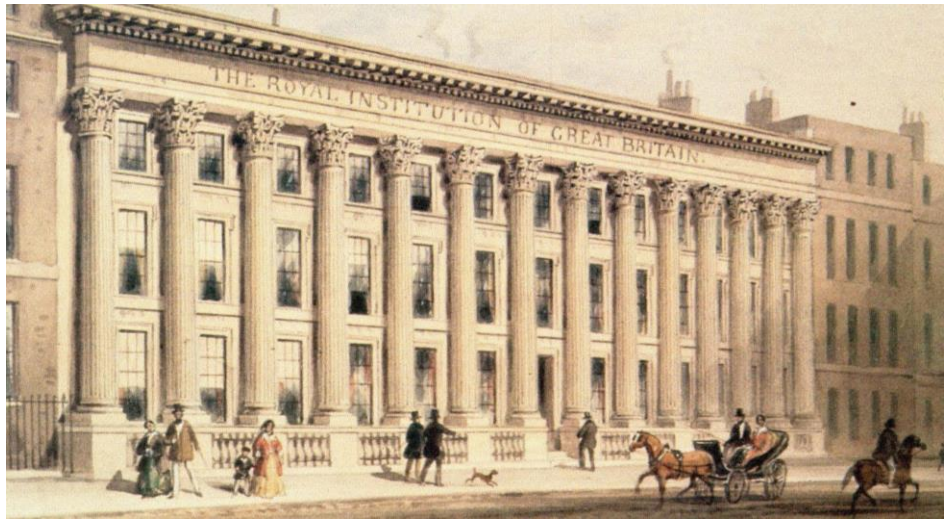
Age 14–21: Bookbinder apprentice

"...you kindly interested yourself in the progress I made in the knowledge of facts relating to the different theories in existence, readily permitting me to examine those books in your possession that were in any way related to the subjects occupying my attention."

Age 21: Assistant to Humphry Davy
at the Royal Institution
Age 33: Fellow, Royal Society

… and the rest is history…





Computing

1900

1823 **Charles Babbage** Difference engine

1844 **George Boole** Boolean algebra

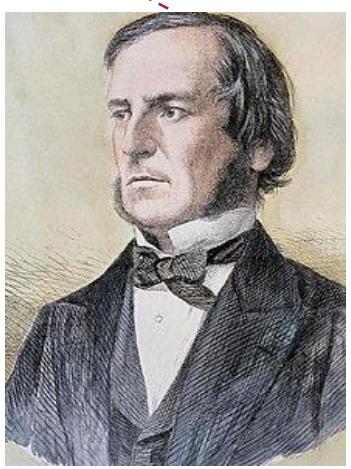
1936 **Alan Turing** Computability

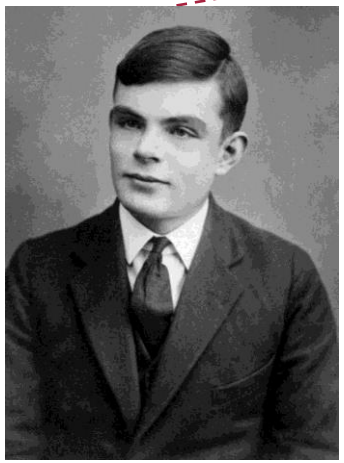
1948 **Claude Shannon** Information theory

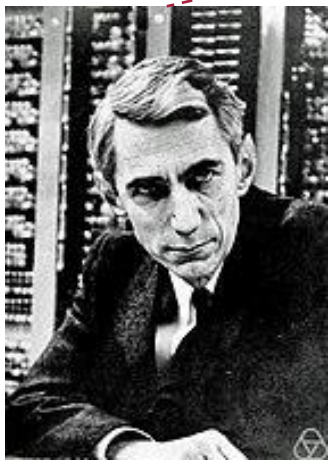
1948 **Norbert Wiener** Cybernetics

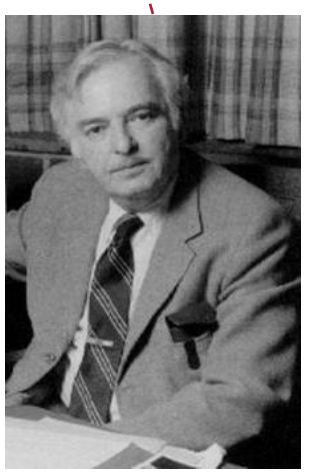
1958 **John von Neumann** Computer science

1964 **John Kemeny** Computer language



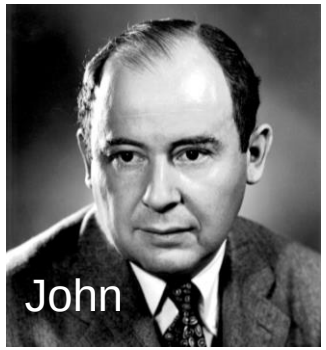


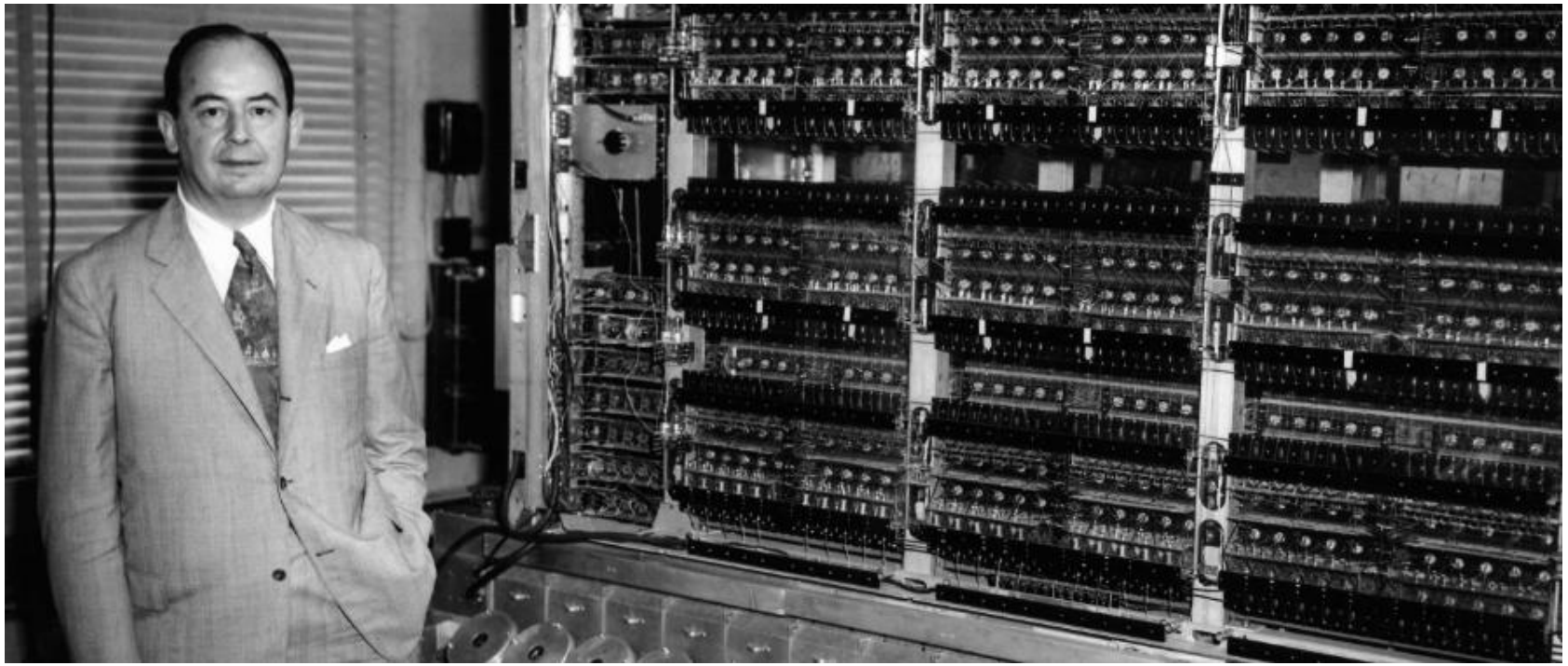




Computing

John von Neumann (1903–1957) – The Father of Computer Science



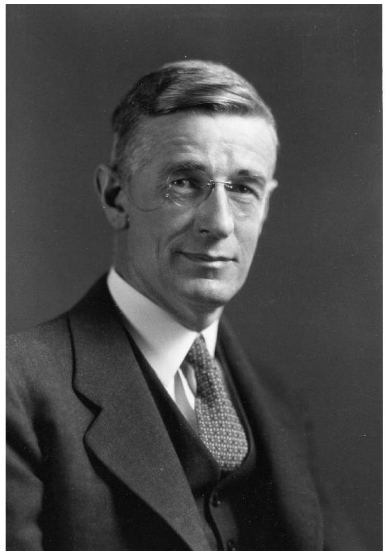


The challenge:
The brain consists of neurons and neurons have a stochastic behaviour.
Despite all this, the brain functions quite reliably.
How to create a reliable system from stochastic elements?

Science and Technology for Humanity: Lessons From the Past (1):

Research is an intricate interplay between

“blue sky research”, serendipity, curiosity driven search, “pure science”, …
and
goal-oriented approaches, society-based challenges, economic drive, etc.



In the past decades, two major research policy approaches have been crystallised in the world:

(1) Basic research versus applied research

advocated by Vannevar Bush, the founder of the US science policy

and

(2) “Solutions for Society”-oriented research

advocated by the “Tiger Countries” like Singapore, Israel, South Korea.

“Research should not be based on the ‘basic research versus applied research’ division. It should focus on important scientific questions crucial for society. It should enlarge humankind’s knowledge base and offer vital solutions for Society at the same time.”

Sir George Radda, Former Chairman, Medical Research Council UK and Biomedical Research Council Singapore

Science and Technology for Humanity: Lessons From the Past (2):

Can you "engineer" research?

Yes and no!

What you can do:

You can build a very good basis for having as wide a knowledge base as possible;

and

you should train a "sharp eye" for challenges and discovery.

"Discovery consists of seeing what everybody has seen and thinking what nobody has thought."

(Albert Szent-Györgyi, Nobel Prize Winner, 1937, Discoverer of Vitamin C)

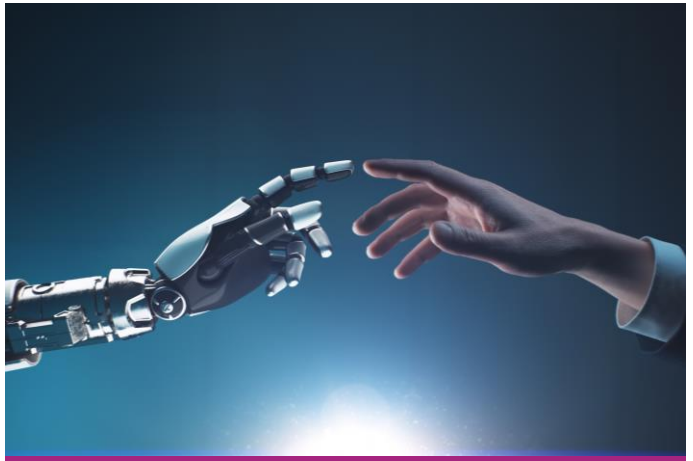
Science and Technology for Humanity: Lessons From the Past (3):

- From your everyday life experience, you can identify the challenges and the opportunities.
- During your university studies, you can get the concepts and ideas to spark your imagination.
- You can develop your ideas into deliverables useful for and used by society.
- Remember how humanistic values and social aspirations inspired the great scientific/technological developments and breakthroughs in the past. Always consider these values and aspirations in your science and technology-related endeavours.
- This course is helping you to learn how to use science and technology for humanity.

Three Themes for CC0007

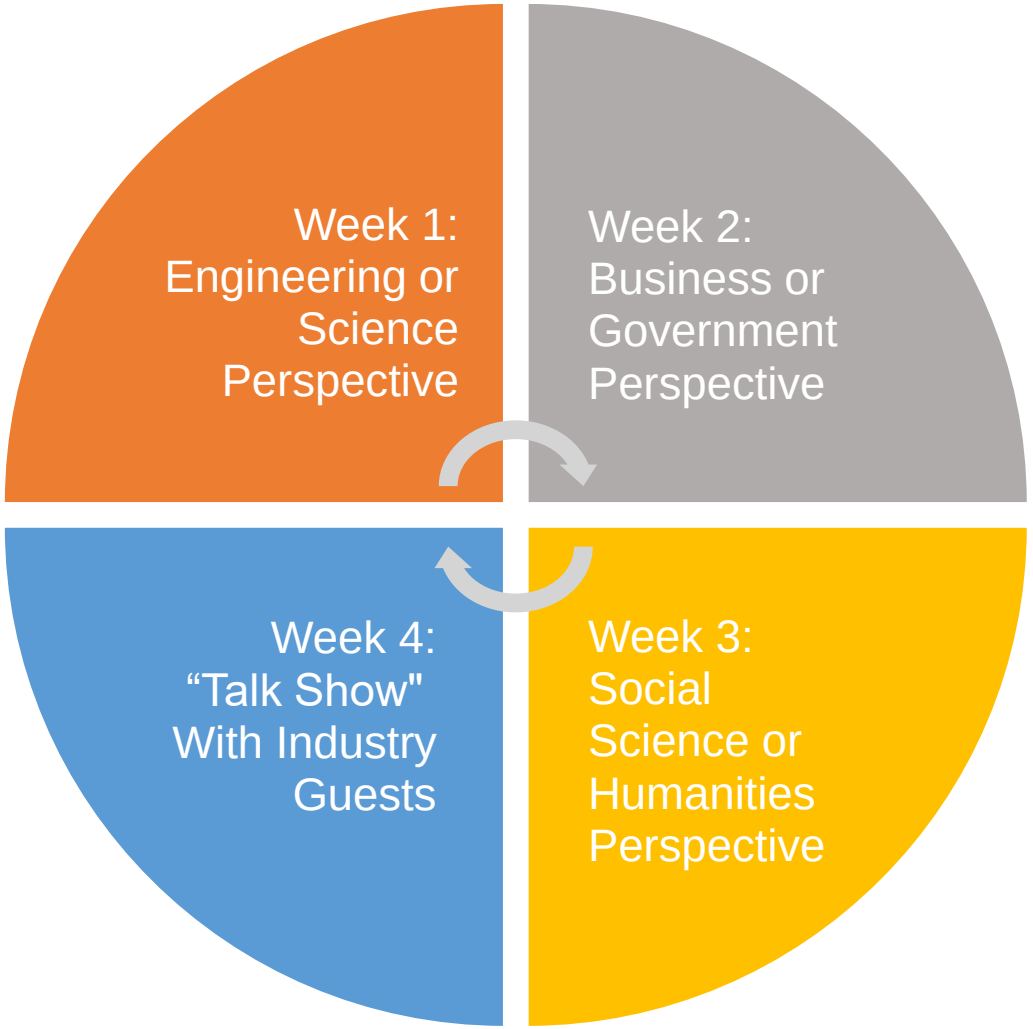
Life Science: Ageing

Blockchain & Trust



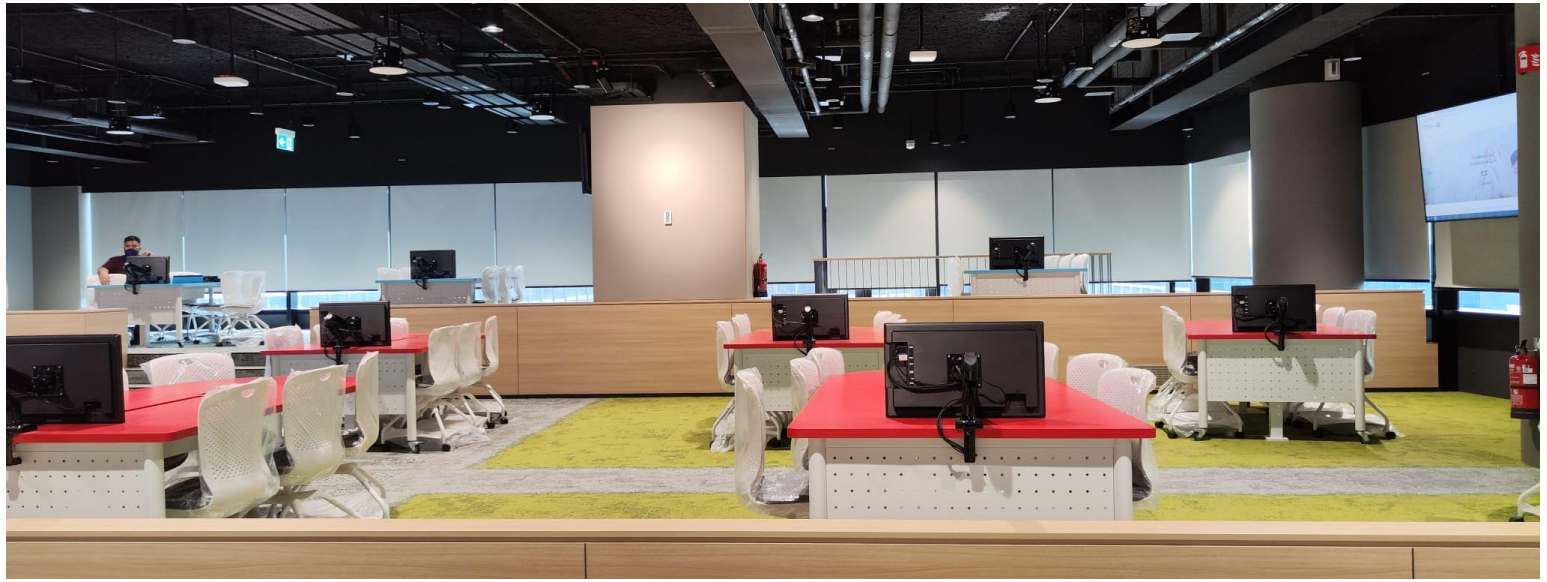
Artificial Intelligence (Algorithms for Prediction/ Recommendation)

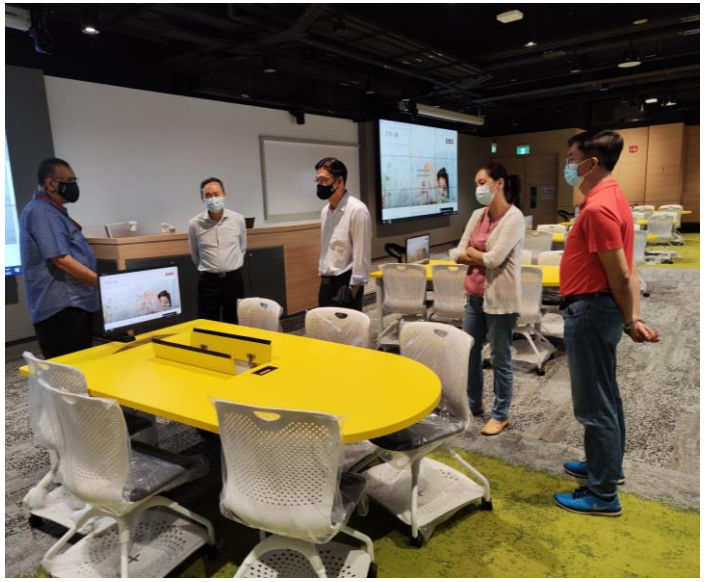
Pedagogical Approach

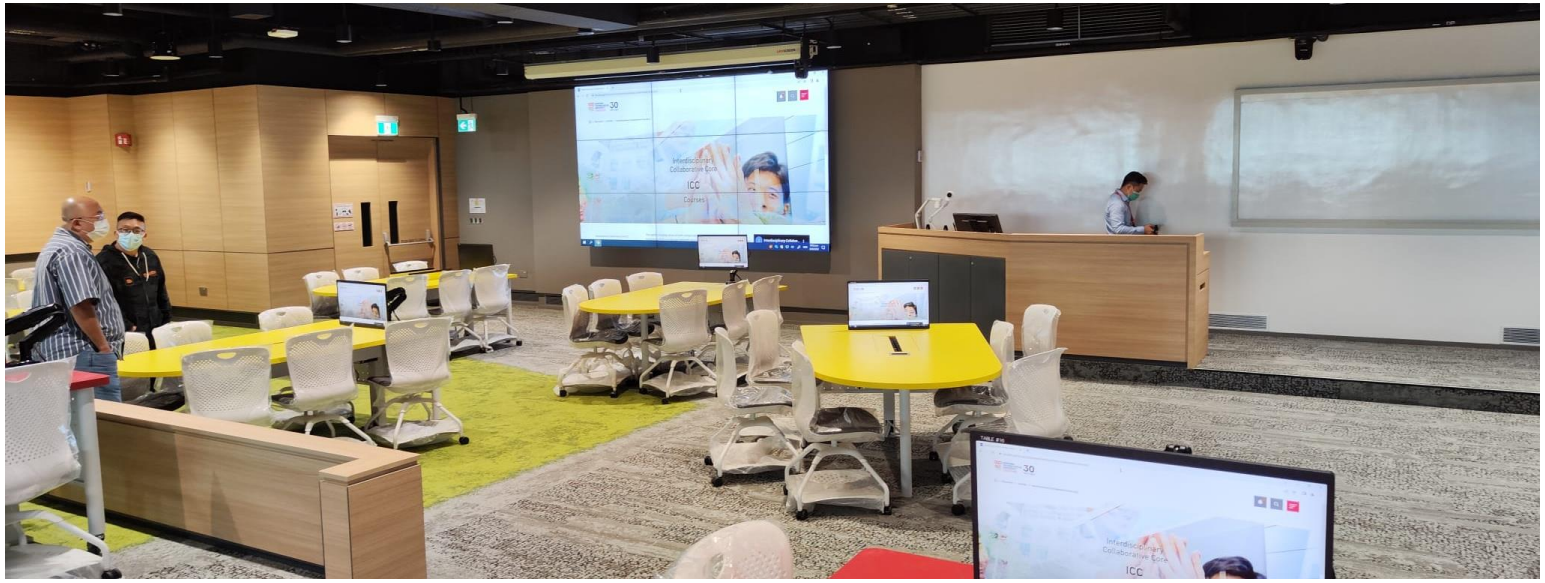


Faculty Members and Speakers

Themes	Engineering or Science	BUSINESS or Government	Social Science or Humanities
Ageing	Zoltán Sarnyai, *JCU* *Oliver Dreesen, A*STAR* Balázs Zoltan Gulyas, *LKC*	Goh Kim Huat, *NBS* Pang Weng Sun, *LKC*	Hedwig Alfred, *WKWSCI* Tan Chin Hong, *SSS* *Andy Ho, SSS*
Blockchain & Trust	Yi Li, *SCSE*	*Cindy Deng Xin, NBS*	*Younbo Jung, WKWSCI*
Algorithms for Prediction and Recommendation	Andy Khong, *EEE*	Vijay Sethi, *NBS*	Mark Cenite, *WKWSCI*

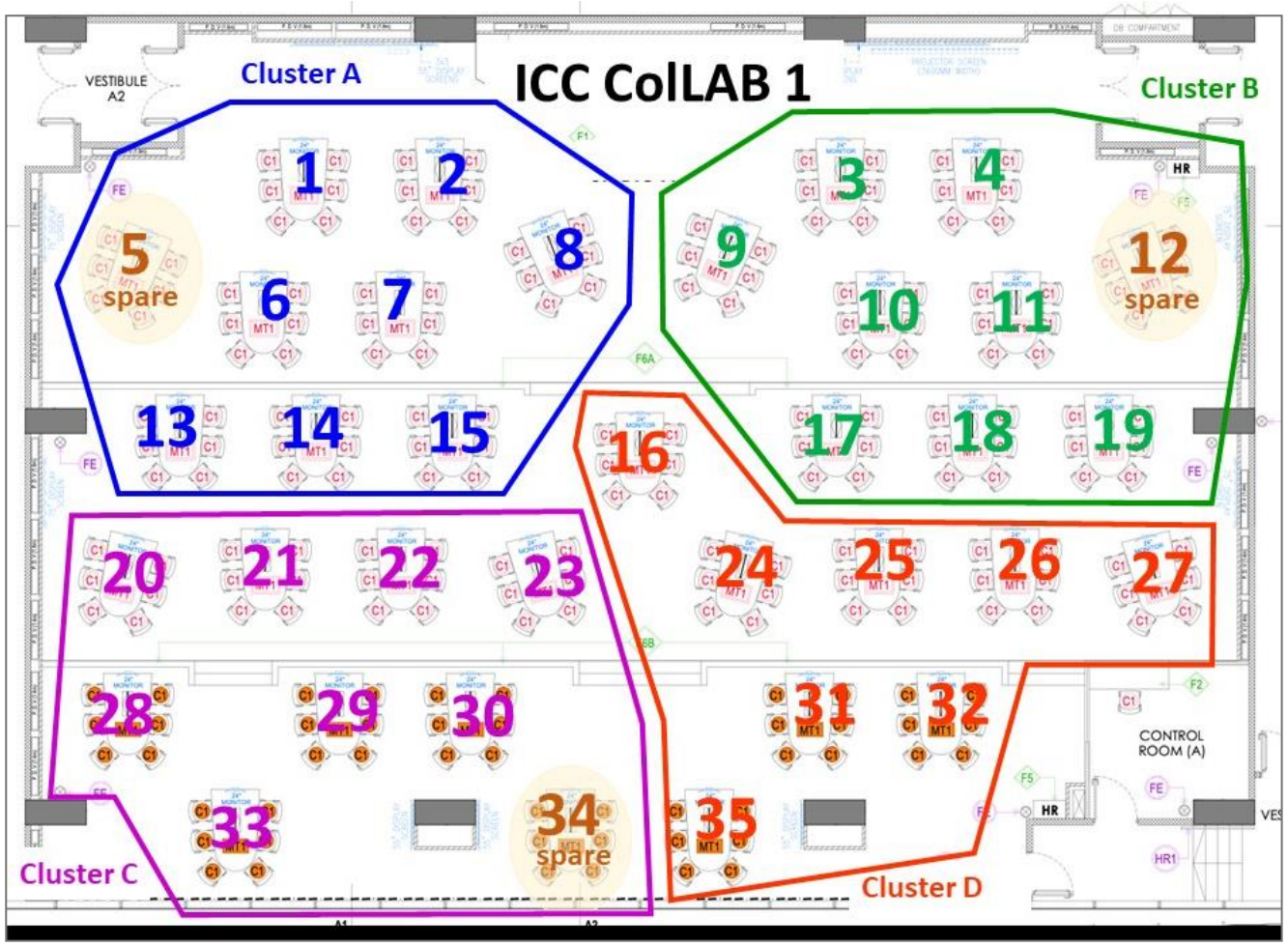






Cluster Arrangements

- Experimental Medicine Building, #05-19 (NTU maps)
- Assigned seating—please check seating allocations on NTULearn before class
- One instructor per cluster



Course Components and Grading

Component	Weighting	Type
Pre-lesson quizzes	25% (20% IRA + 5% TRA)	Individual
In-class team activities	10%	Team
Project proposals × 3 (intergroup peer assessment)	30% (10% each)	Team
Final project (intragroup peer evaluation)	25%	Team/Individual
Individual reflection paper	10%	Individual

Lesson Structure

15 minutes	Quiz attempt 1 (IRA) Group discussion of quiz questions Quiz attempt 2 (TRA)
15 minutes	Recap/summary of lecture content
25 minutes	Group activity
35 minutes	Discussion and presentation at cluster/class level
10 minutes	Wrap-up and conclusion

Team Roles

- Chief Executive Officer (Project Coordinator)
- Chief Administration Officer (Secretary)
- Chief Communication Officer (Liaison)
- Chief Innovation Officer (Technology Advisor)
- Chief Marketing Officer (Strategy Planner)

What Makes a Good Team?

Criteria (Weighs)	Score from 1 to 9 (1: Never; 3: Rarely; 5: Occasionally; 7: Frequently; 9: Always)				
a. Fulfilling one's responsibilities duly (15%)					
Behaved responsibly, such as attend meetings punctually and regularly; participate in discussion; complete assigned tasks/roles punctually.	Score from 1 to 9				
	Qualitative comments/reasons				
b. Fulfilling one's responsibilities effectively (25%)					
Behaved and contributed effectively, such as quality of work produced; creativity of ideas; extensiveness of research and thinking.	Score from 1 to 9				
	Qualitative comments/reasons				
c. Managing interpersonal relationships (30%)					
Listened attentively to and sought inputs from others; helped team resolve conflicts and achieved common understanding to function effectively; promoted respect for others and differences; fostered camaraderie.	Score from 1 to 9				
	Qualitative comments/reasons				
d. Providing support to others to achieve goals (30%)					
Behaved fairly and ethically, such as sharing responsibilities and giving credits. Exhibited group citizenship behaviour, such as helping others to learn and complete their work through guidance and encouragement; standing up for others when needed.	Score from 1 to 9				
	Qualitative comments/reasons				