

# Biochemistry Major Talk 2018-19

August 10, 2018

Dr KM Yao

Division of Biochem, Sch of Biomed Sc

The University of Hong Kong

**Welcome!!!!!!!!!!!!!!!**

# Education Div of Biochem, Sch of Biomed Sc



- ❖ Professors: 15 (+7 from other Div/Dept;  
<http://www.sbms.hku.hk/staff/academic-staff> )  
(+Research assistant professors: 1)
- ❖ Lecturers: 3 (1 Principle Lecturer)
- ❖ Postdoctoral Fellows and Research Associates: ~35
- ❖ Research Assistants: ~20
- ❖ Research postgraduates: ~90
- ❖ Administrative staff: 5
- ❖ Technical staff: 10 technicians & 5 supportive staff

# Introduction to Biochemistry

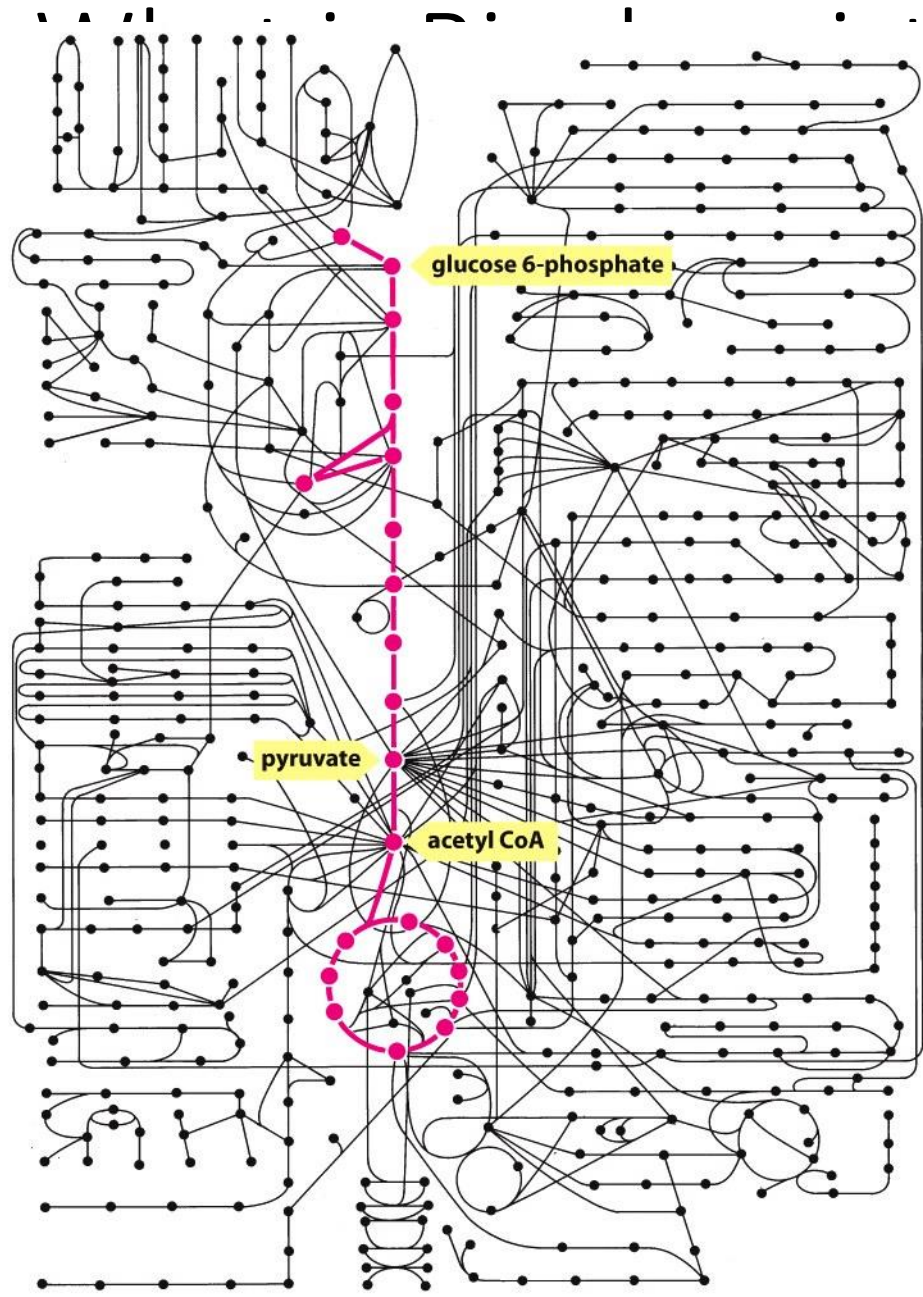
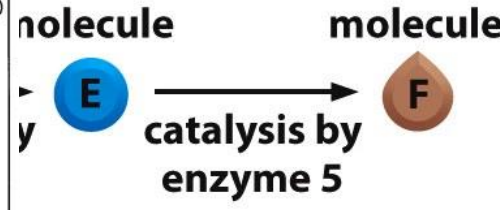
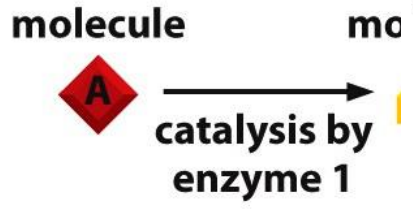
[A four-minute video:](#)

[http://www.youtube.com/watch?v=tpBAmzQ\\_pUE&list](http://www.youtube.com/watch?v=tpBAmzQ_pUE&list)

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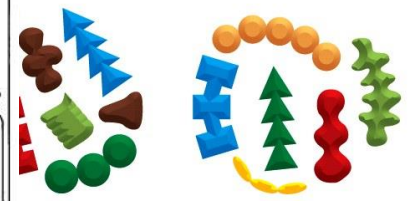
cesses!

• Stu



# Metabolism

the many molecules that form the cell



useful forms of energy

+  
lost heat

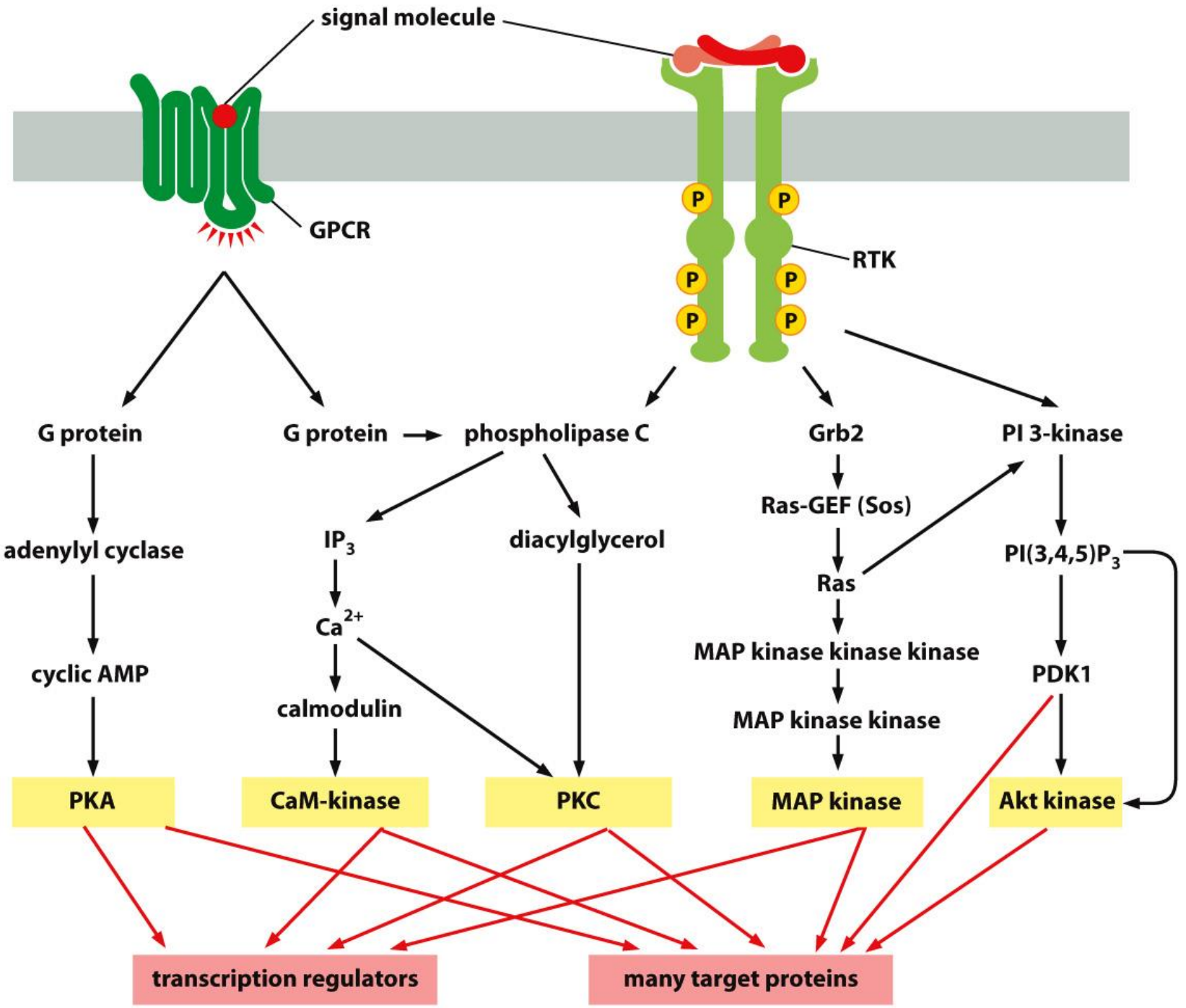
**ANABOLIC PATHWAYS**



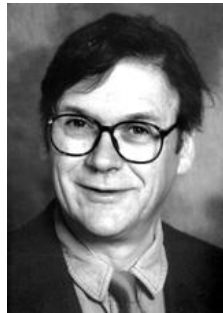
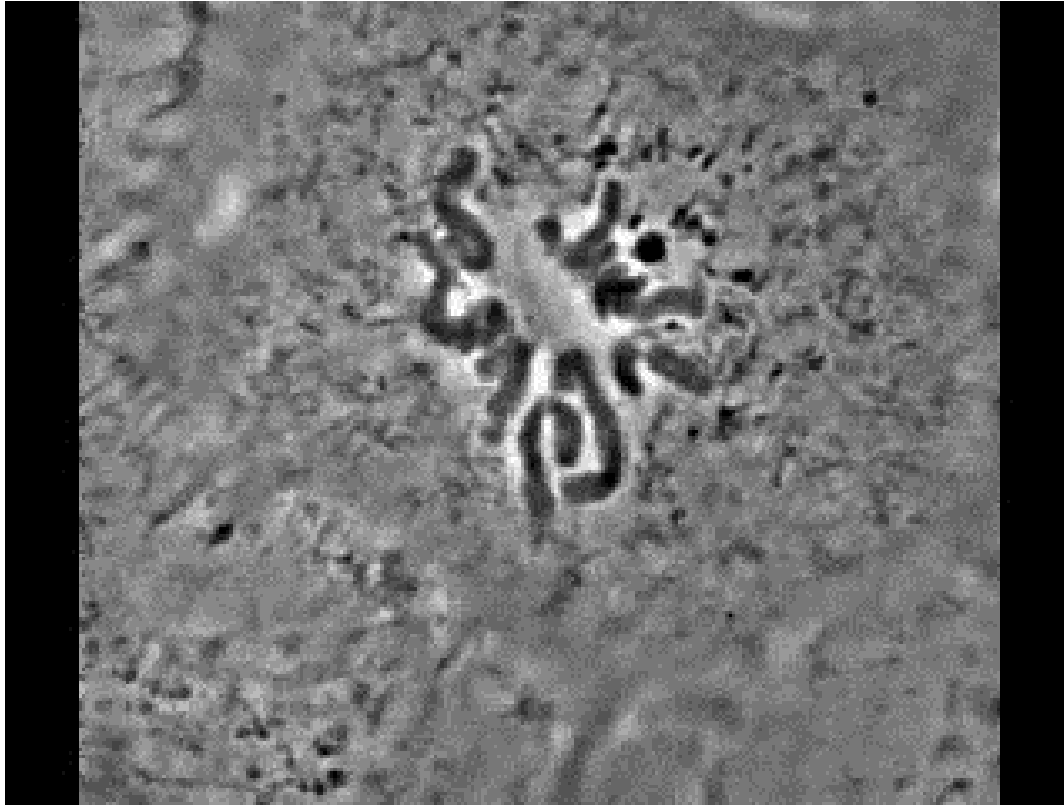
... many building blocks for biosynthesis

Figure 13-19 Essential Cell Biology 3/e (© Garland Science 2010)

Ce



# Biochemistry at Cellular Level

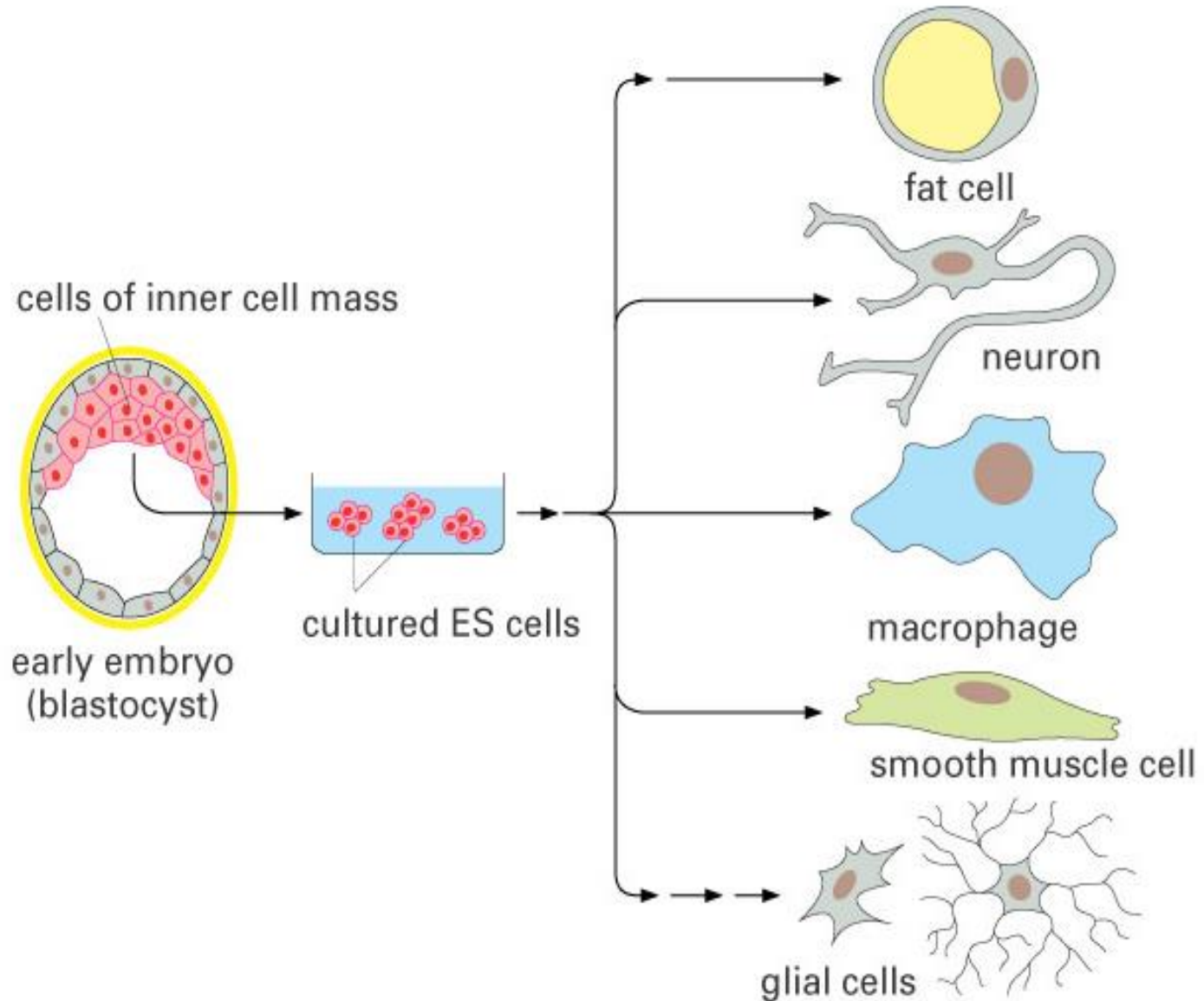


(Hartwell, Hunt and Nurse – Nobel laureates in 2001)

Regulated by Cyclin-dependent Kinases first discovered in yeasts

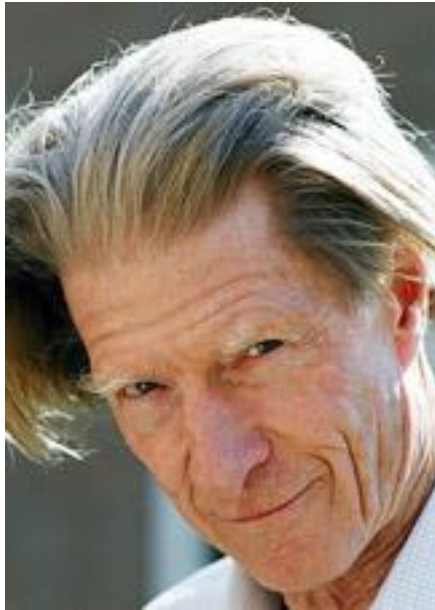
# Pluripotent stem cells can differentiate into any fetal or adult cell type

(Taken from Alberts et al., Essential Cell Biology, 3<sup>rd</sup> Ed.)

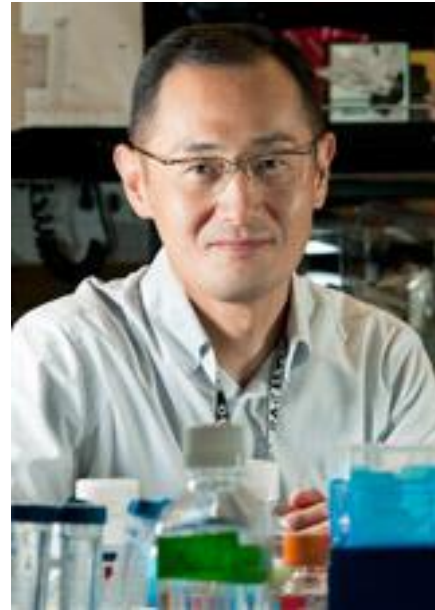


# Induced Pluripotent Stem Cells

(Nobel Prize in Physiology or Medicine Winner 2012)



Sir John B. Gurdon



Shinya Yamanaka

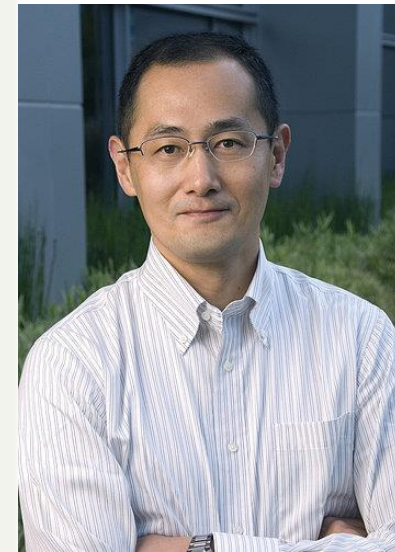
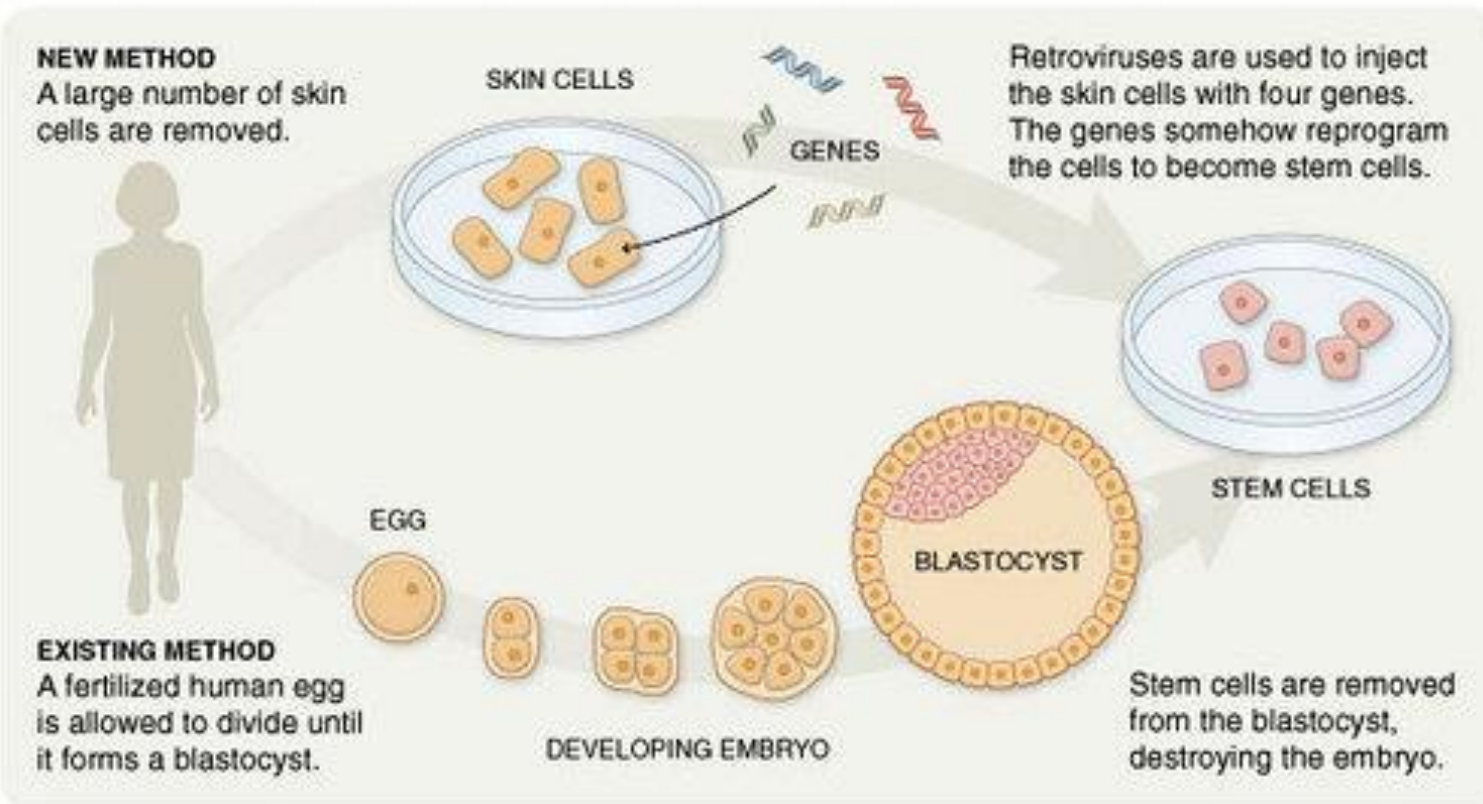
*"for the discovery that mature cells can be reprogrammed to become **pluripotent**"*



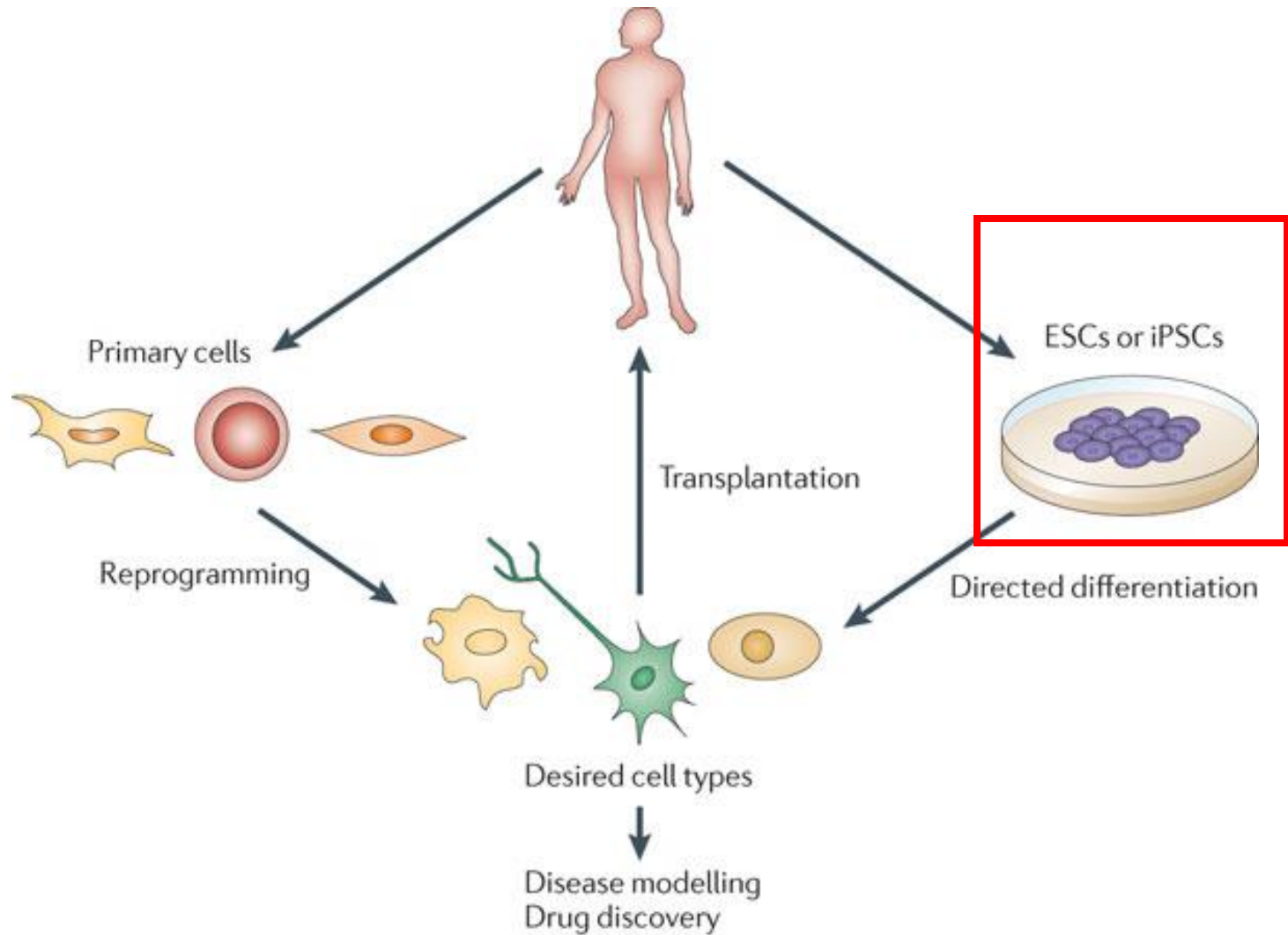
# “Reprogramming” Cells: Achieving pluripotency using the Yamanaka factors

## Reprogramming Human Skin Cells (iPS cells)

Researchers have developed a technique for creating stem cells without the controversial use of human eggs or embryos. If the method can be perfected, it could quell the ethical debate troubling the field.



# The Central Strategies of Regenerative Medicine



# Study of tissue regeneration using Planarian (*S. mediterranea*)



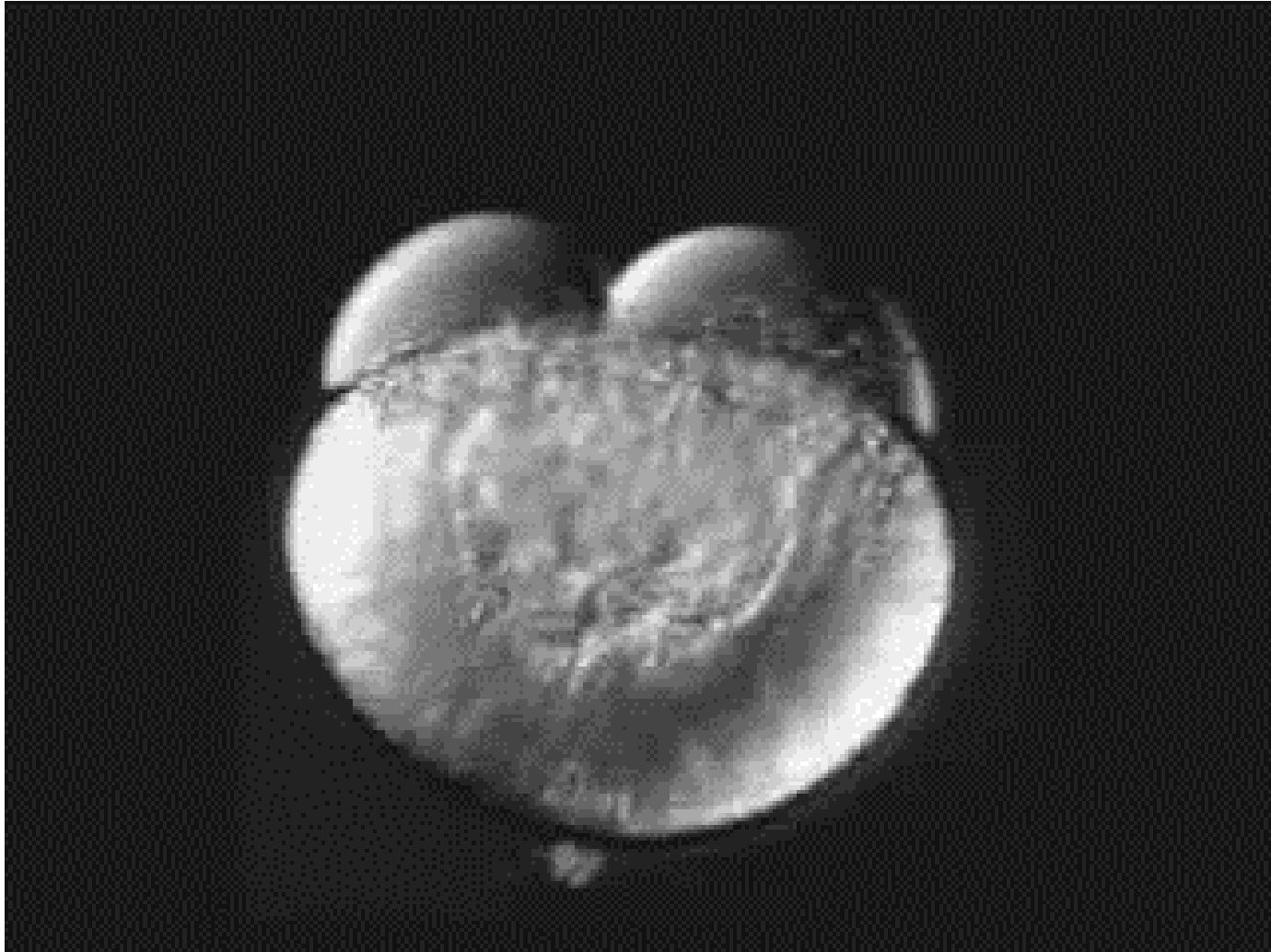
**Stem Cells**

Planarian stem cells are highly enriched for  
**37 FOX** factors!!!

FOXM1/FOXO1 orthologs?

Required for tissue regeneration?

# Biochemistry during development



# The Nobel Prize in Physiology or Medicine 2007



"for their discoveries of principles for introducing specific gene modifications in **mice** by the use of **embryonic stem cells**"



**Mario R. Capecchi**



**Sir Martin J. Evans**

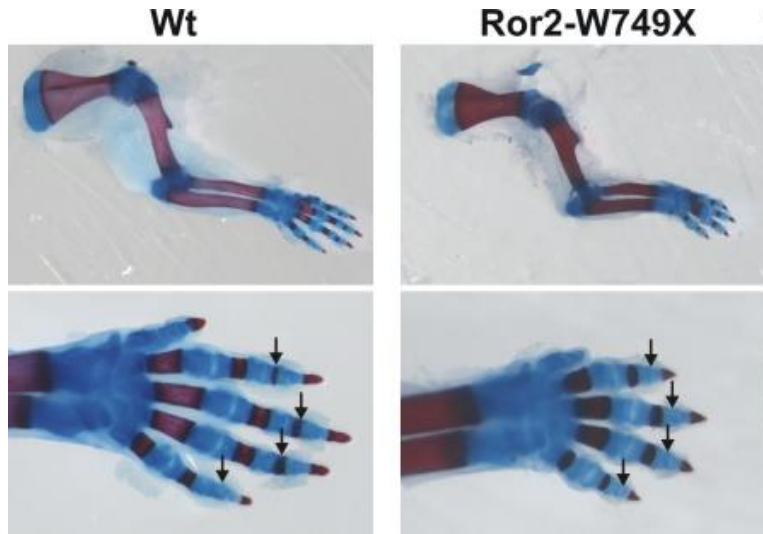


**Oliver Smithies**

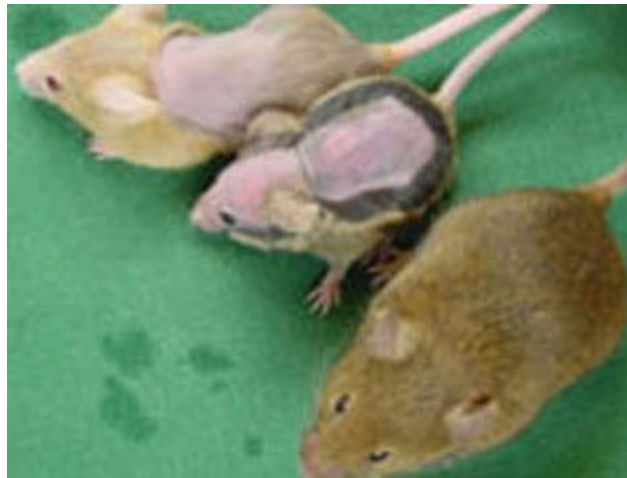
**Gene targeting** technology now widely used to understand the functions of genes in health and diseases

Taken from <http://nobelprize.org>

# Mouse Models of Disorders



Skeletal



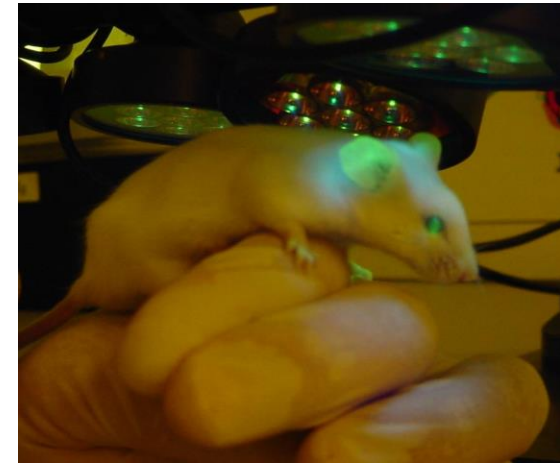
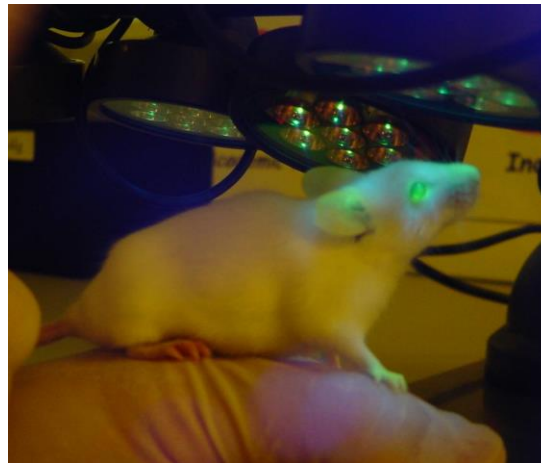
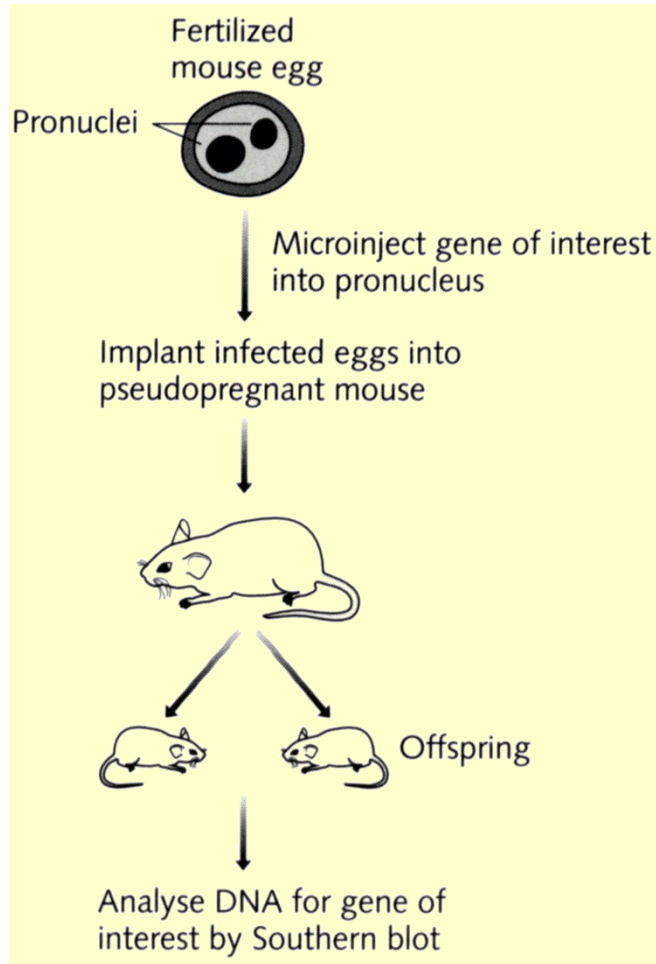
Aging



Deaf and balance

# Mouse as Model System

(Transgenic core facility)



Mouse expressing a **fluorescent** protein

# Study of Biochemistry:

- Evolving discipline - take on new meanings with time!

E.g. Proteins (enzymes) in 60s-70s

→ Genes in 80s

→ Whole genomes in ~2000

→ System biology in ~2010 (transcriptome, proteome, metabolome)

→ Noncoding RNAs and epitranscriptome most

recently

- Broad

→ studied at different levels of complexity using various model systems

(3D modeling, cancer cells, chick neural tube, Planaria, mutant mice, etc.)

- Relevance to **health and diseases**



# 6901 Bachelor of Science

- **One entry in application for a choice of 14 Science majors**

## **Biochemistry**

**Biological Sciences**

**Chemistry**

**Decision Analytics**

**Earth System Science**

**Ecology & Biodiversity**

**Environmental Science**

**Food & Nutritional Science**

**Geology**

**Mathematics**

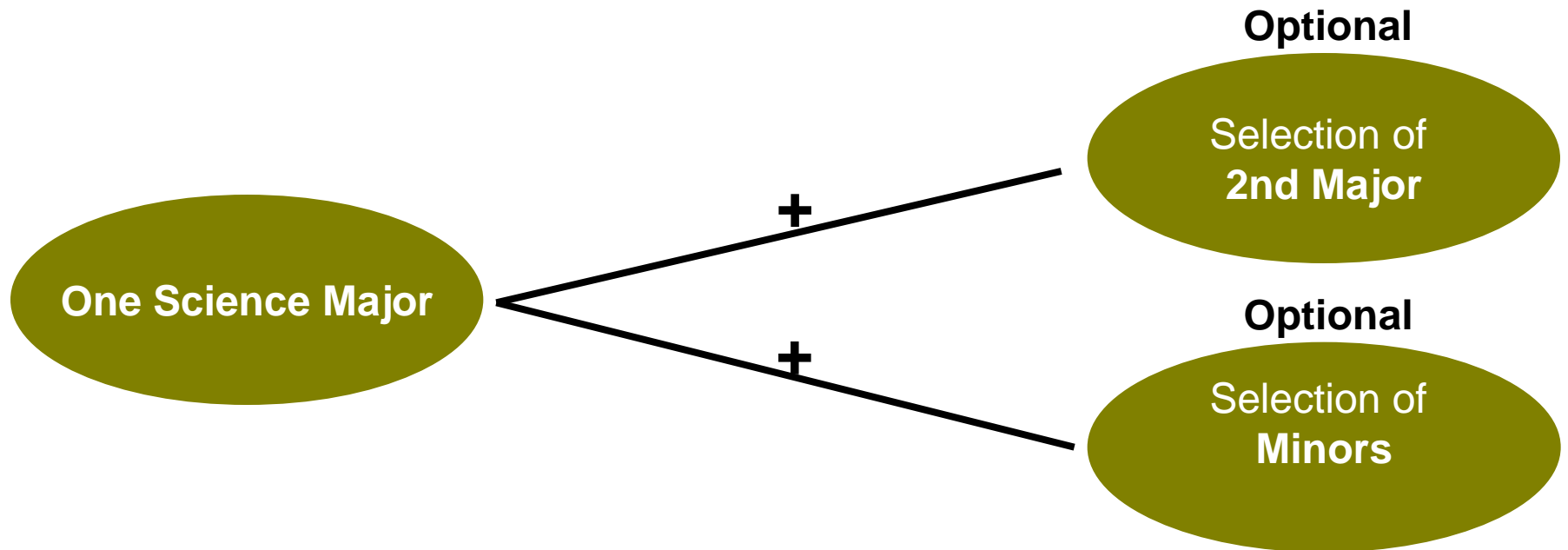
**Molecular Biology & Biotechnology**

**Physics**

**Risk Management**

**Statistics**

# *Major-Minor and Double-Major Options*



90 choices of minors and second majors in Science, Arts, Social Sciences, Business & Economics, Education, Computer Science, and Sports Science

**(quota & timetabling restrictions may also apply)**

# BSc Curriculum Requirements

## Curriculum requirements (240 credits)

### Option A

Students taking one Science major

### Option B

Students taking one Science major and one minor

### Option C

Students taking double majors (one Science major and a 2<sup>nd</sup> major)

**Primary Science Major: 96 credits**  
2 Science Foundation courses (SCNC1111 & SCNC1112, taken in Year 1),  
13 Disciplinary courses  
and 1 Capstone course

**Common Core Courses: 36 credits #**  
6 courses in 4 Areas of Inquiry  
(at least 1 and not more than 2 courses from each AoI)

**Language Courses: 18 credits**  
English: 12 credits [6 credits in Core University English (CAES1000<sup>△</sup>, taken in Year 1) and  
6 credits in English in the Discipline (CAES9820, taken in Year 2)]  
Chinese: 6 credits (CSCI9001<sup>≡</sup>, taken in Year 3)

**Electives: 90 credits**  
To make up the 240 total credits

**Minor<sup>△</sup>: 36 – 48 credits**

**Electives: 42 – 54 credits**  
To make up the 240 total credits

**2<sup>nd</sup> Major <sup>△\*</sup>: 72 – 96 credits**

# Example of BSc Programme Structure by Year of Study

Year	CC	Major	Major	Major	Major	Major				
1	CC	CC	Chi	Major	Major	Major				
2	CC	CC	Eng 2	Major	Major	Major				
3	CC	CC	Eng 1	SF1	SF2	Major	Major			

CC – Common Core Courses

SF – Science Foundation Courses

Chi – Chinese

Eng 1 – Core University English

Eng 2 – English in the Discipline

Note: Different distributions of courses over the years are possible. Blank boxes can be used for elective courses, or courses leading to a minor or a 2<sup>nd</sup> major (Major 2).

**Students are NOT allowed to take more than 72 credits in their first year. Application will not be entertained.**

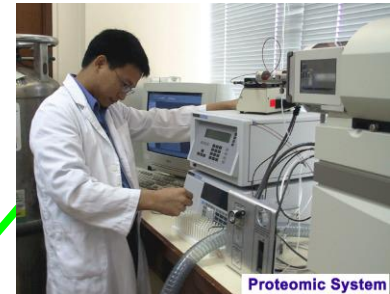
# Education Div of Biochem, Sch of Biomed Sc



- ❖ Professors: 15 (+7 from other Div/Dept;  
<http://www.sbms.hku.hk/staff/academic-staff> )  
(+Research assistant professors: 1)
- ❖ Lecturers: 3 (1 Principle Lecturer)
- ❖ Postdoctoral Fellows and Research Associates: ~35
- ❖ Research Assistants: ~20
- ❖ Research postgraduates: ~90
- ❖ Administrative staff: 5
- ❖ Technical staff: 10 technicians & 5 supportive staff

# Division of Biochem, Sch of Biomed Sc

3/F Lab Block, New Medical Complex, 21 Sassoon Rd



Lab Tour on 24/8 (Fri, 4:00 to 5:30pm) organized by Biochemistry Society, SS, HKUSU!

# BIOCHEMISTRY MAJOR (2012 onwards)

## Objectives:

The Major in Biochemistry aims to provide students with both basic and advanced knowledge in contemporary **biochemistry and molecular biology**. Core courses in the curriculum emphasize equipping students with a general understanding of the fundamental ideas, principles and theories of biochemistry with particular focus on the relevance of biochemistry, molecular biology and genomics to **biology, human health and disease**. Elective courses extend this core knowledge to provide students with specialized insight into both basic and applied scientific endeavour in biochemistry, bioinformatics, molecular biology and molecular genetics. Throughout the curriculum there is an emphasis on experiential learning through laboratory practicals, problem-solving exercises, group-based learning, industrial experience, overseas exchange and research-based projects. These experiences are designed to develop students' ability **to read and interpret scientific data, to integrate knowledge with wider scientific theory, and to improve logical thinking and communication skills**. The ultimate goal is to provide a comprehensive degree-level biochemistry education that equips students with the critical thinking, communication and analytical skills essential for them to play a leading role in society in the future.

## Learning Outcomes:

By the end of this programme, students should be able to:

- (1) **describe the principles** of biomolecular structure, metabolism, molecular interactions, molecular processes and their regulation, genetics and systems biology critical to contemporary biochemistry and molecular biology  
(by means of coursework and experiential learning)
- (2) **apply** biochemical, bioinformatics and molecular genetics technologies for new observations, measurements and analyses; **and to design experiments that bring discovery and insight into the unknown**  
(by means of laboratory-based and research project-based learning)
- (3) **interpret and communicate scientific data and literature using appropriate scientific language**  
(by means of literature-based coursework and debate)
- (4) **work effectively as a team** and synergize with their colleagues in a supportive manner  
(by means of group-based learning and by group-based problem solving)
- (5) **recognize the interconnections of biochemistry with other disciplines** in science, medicine and engineering, humanities and ethics, which are relevant for diverse working environment in the society  
(by means of multidisciplinary-based research projects, internship and debate)

# Required courses (96 credits) (16 courses)

## 1. Introductory level courses (42 credits) (7 courses)

### Disciplinary Core Courses: Science Foundation Courses (12 credits) (semester)

SCNC1111	Scientific method and reasoning (6)	(1,2)
SCNC1112	Fundamentals of modern science (6)	(1,2)

### Disciplinary Core Courses (30 credits)

CHEM1042	General chemistry I (6)	(1,2)
CHEM1043	General chemistry II (6)	(2)
BIOC2600	Basic biochemistry (6)	(1)
CHEM2441	Organic chemistry I (6)	(1,2)

### Disciplinary Electives (6 credits)

BIOC1600	Perspectives in biochemistry (6)	Take either BIOC1600 or BIOL1110, but not both. (1)
BIOL1110	From molecules to cells (6)	Take either BIOC1600 or BIOL1110, but not both. (1,2)



**2. Advanced level courses (48 credits) (8 courses)****Disciplinary Core Courses (30 credits) (semester)**

BIOC3601	Basic Metabolism (6)	(1)
BIOC3604	Essential techniques in biochemistry and molecular biology (6)	(2)
BIOL3401	Molecular biology (6)	(1)
BIOC4610	Advanced biochemistry (6)	(1)
BIOC4613	Advanced techniques in biochemistry & molecular biology (6)	(1)

**Disciplinary Electives (18 credits)**

Plus at least 18 credits selected from the following courses:

BIOC3605	Sequence bioinformatics (6)	(2)
BIOC3606	Molecular medicine (6)	(2)
BIOL3202	Nutritional biochemistry (6)	(1)
BIOL3402	Cell biology and cell technology (6)	(1)
BIOL3403	Immunology (6)	(2)
BIOL3404	Protein structure and function (6)	(2)
BIOL3408	Genetics (6)	(1)
CHEM3441	Organic chemistry II (6)	(1,2)
BIOC4612	Molecular biology of the gene (6)	(2)
BIOL4417	'Omics' and systems biology (6)	(2)
CHEM4145	Medicinal chemistry (6)	(2)
CHEM4444	Chemical biology (6)	(2)

**3. Capstone requirement (6 credits) (1 course)**

At least 6 credits selected from the following courses:

BIOC3999	Directed studies in biochemistry (6)	(1,2,summer)
BIOC4966	Biochemistry internship (6)	(1,2,summer)
BIOC4999	Biochemistry project (12)	(1+2)

<p>Black: Core (11 courses)  Purple: Elective (4 courses)  Green: Capstone requirement (1 course)</p>	<p>Science Foundation and Chemistry</p>	<p>Fundamental Biochemistry/ Molecular Biology</p>	<p>Advanced and Integrative Biochemistry/ Molecular Biology</p>	<p>Techniques/ Undergrad Research (Capstone)</p>
<p>Year 1</p>	<p>SCNC 1111 Scientific method and reasoning (6)  SCNC1112 Fundamentals of modern science (6)  CHEM1042 General Chemistry I  CHEM1043 General Chemistry II</p>	<p>BIOC1600 Perspectives in biochemistry (6) or  BIOL1110 From molecules to cells (6)</p>		
<p>Year 2</p>	<p>CHEM2441 Organic Chemistry I (6)</p>	<p>BIOC2600 Basic Biochemistry (6)</p>	<p>BIOC3605 Sequence bioinformatics (6)  BIOC3606 Molecular medicine (6)  BIOL3404 Protein structure and function (6)</p>	<p>BIOC3604 Essential techniques in biochemistry and molecular biology (6)</p>
<p>Year 3</p>	<p>CHEM3441 Organic Chemistry II (6)</p>	<p>BIOC3601 Basic Metabolism (6)  BIOL3401 Molecular Biology (6)</p>	<p>BIOL3202 Nutritional biochem (6)  BIOL3402 Cell biol &amp; cell tech (6)  BIOL3403 Immunology (6)  BIOL3408 Genetics (6)</p>	<p>BIOC4613 Advanced Techniques in biochemistry and molecular biology (6)</p>
<p>Year 4</p>	<p>CHEM4145 Medicinal chem (6)</p>		<p>BIOC4610 Advanced Biochemistry (6)  BIOC4612 Molecular biology of the gene (6)  BIOL4417 "Omics" and systems biol (6)  CHEM4444 Chemical biology (6)</p>	<p>BIOC3999 Directed studies in biochemistry (6)  BIOC4966 Biochemistry internship (6)  BIOC4999 Biochemistry project (12)</p>

# Suggested Electives at the Advanced Level

	<b>Advanced and Integrative Biochemistry/ Molecular Biology</b>
Premed/Graduate school track	<p>BIOC3605 Sequence bioinformatics (6) BIOC3606 Molecular medicine (6) BIOL3403 Immunology (6) BIOL3404 Protein structure and function (6) BIOL3408 Genetics (6) BIOC4612 Molecular Biology of the gene (6)</p>
Biotech/Pre-business track	<p>BIOC3606 Molecular medicine (6) BIOL3402 Cell biol &amp; cell tech (6) CHEM3441 Organic Chemistry II (6) BIOL4417 "Omics" and systems biol (6) CHEM4145 Medicinal chem (6) CHEM4444 Chemical biology (6)</p>
Teaching track	<p>BIOC3606 Molecular medicine BIOL3402 Cell biol &amp; cell tech BIOL3404 Protein structure and function BIOL3408 Genetics CHEM3441 Organic Chemistry II BIOC4612 Molecular Biology of the gene</p>

**Talk to your Academic Advisor!!!!!!!**

Sch of Biomed Sc website:

<http://www.sbms.hku.hk/undergrad/courses.html>

Three common core courses offered!

<b>Course Code</b>	<b>Course Title</b>
CCST9001	<a href="#">Redesigning Life</a>
CCST9006	<b>Chasing Biomedical Miracles: Promises and Perils</b>
CCST9009	<a href="#">Living with Stem Cells</a>

CCST9006 course video at CCC website:

[https://youtu.be/ZjWQa-or\\_k0](https://youtu.be/ZjWQa-or_k0)

# Student Peer Advisers in 2018-19

- General roles
  - to **offer advice** in relation to academic studies to freshmen; and
  - to **facilitate** freshmen's **smooth transition** from secondary to university education
- You are highly encouraged to contact the following **Student Peer Advisers (SPAs)** if you have any questions about your study (their contacts can be found at the Faculty's website)
  - Mr CHAN Timothy (BSc Year 2)
  - Mr SZETO Dei Men (BSc Year 2)
  - Miss TANG Tsz So Acacia (BSc Year 3)
  - Miss ZHANG Xiaotian (BSc Year 2)



# Student Peer Advisers (SPAs)

## *Specific roles:*

- *to offer assistance during the add/drop period for freshmen: by performing shift duty in the 'Student Peer Advising Corner' counter in the Faculty to assist in checking **course selection** documents submitted by freshmen and answering their enquiries; and*
- *to serve as a **contact point** for freshmen regarding **academic enquiries**: contact details of Student Peer Advisers will be available at the **Faculty website** to facilitate freshmen to enquire on academic related matters.*

# Welcome Party for BSc freshmen

Date: **September 10, 2018 (Monday)**

Time: 6:00 pm - 8:00 pm

Venue: Convocation Room, 2/F., Main Building

**Come to meet School staff members, fellow students and recently graduated alumni!!!!**

**Jot this down in your diary!!!**