BMEG4450
BIONANOTECHNOLOGY

Course Information

(2014 – 2015)

Instructor and TAs

Instructor	Prof. Aaron Ho (1st half of course)	Prof. Jonathan Choi (2nd half of course)
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Lectures and Locations

- Lectures:
  - Wednesdays 11:30am – 12:15pm (William M W Mong Eng Bldg 703)
  - Friday 9:30am – 11:15am (William M W Mong Eng Bldg 703)
- Tutorials:
  - Wednesdays 12:30pm – 1:15pm
    (T1: Lady Shaw Bldg C3; T2: Y.C. Liang Hall, LHC G03)
- Shared teaching arrangement:
  - Aaron Ho for 1st part, Jonathan Choi for 2nd part (see calendar in later slides)
- TA office hours:
  - To be announced
- Poster presentation project:
  - Venue: To be announced
  - Details in later slide

Topics

Chapter 1	Historical Background & Basic Concepts in Bionanotechnology
Chapter 2	Bionanotechnology Overview
Chapter 3	Nanostructured Interfaces/Materials: Synthesis & Characterisation
Chapter 4	*Ex Vivo* Applications of Bionanotechnology
Chapter 5	*In Vitro* Applications of Bionanotechnology
Chapter 6	*In Vivo* Applications of Bionanotechnology

- Notes will be posted on the course website periodically during the semester

Textbook/References

- Major Text:
  - *Nanobiotechnology: Concepts, Applications and Perspectives*
    - Ed. C.M. Niemeyer, C.A. Mirkin, Publisher: Wiley-VCH (TP248.25.N35 N36 2004)

- Reference:
  - *Bionanotechnology*
    - E. Papazoglou, A. Parthasarathy, Publisher: Morgan & Claypool (TP 248.25.N35 P36 2007)

- Collection of published papers

Assessment

- Assignment sheets #1 and #2: 10%
  - Total of two, 5% each
  - Due date: February 13 and April 10 (Friday) 5:00pm
- Random Quizzes (class participation): 5%
  - Total of five, 1% each
- Mid-term: 30%
  - March 18 (Wednesday), closed-book
- Poster Presentation Project: 15%
  - April 10 (Friday)
- Final Exam: 40%
  - Closed-book

Teaching Calendar (January 2014)

Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7 HPH – Course Introduction – Ch 1: Historical Background & Basic Concepts in Bionanotechnology	8	9 HPH – Course Introduction – Ch 1: Historical Background & Basic Concepts in Bionanotechnology	10
11	12	13	14 HPH – Ch 2: Bionanotechnology Overview	15	16 HPH – Ch 2 – Ch 3A: Nanostructured Interfaces/Materials: Synthesis & Characterisation (Deposition of nanometer thickness thin films, Application example: semiconductor devices, Thin film characterisation techniques)	17
18	19	20	21 HPH – Ch 3A	22	23 HPH – Ch 3A	24
25	26	27	28 HPH (DOUBLE LECTURE, i.e. normal + make-up, 11:30 – 13:15, due to conference leave on following Wednesday) – Ch 3A	29	30 HPH – Ch 3B: Nanostructured Interfaces/Materials: Synthesis & Characterisation (Nano-scale material patterning/ lithography)	31

Teaching Calendar (February 2014)

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4 N.A. NO LECTURE (DUE TO CONFERENCE TRIP)	5	6 HPH – Ch 3B	7
8	9	10	11 JC - Ch 4: *Ex vivo* applications	12	13 JC - Ch 4: *Ex vivo* applications - **Due date of Assignment sheets #1**	14
15	16	17	18 Chinese New Year break	19	20 Chinese New Year break	21
22	23	24	25 JC - Ch 5: *In vitro* applications	26	27 JC - Ch 5: *In vitro* applications	28

Teaching Calendar (March 2014)

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4 JC - Ch 5: *In vitro* applications	5	6 JC - Ch 5: *In vitro* applications	7
8	9	10	11 HPH – Ch 3B	12	13 HPH – Ch 3B (end of Part 1)	14
15	16	17	18 HPH Mid-term examination	19	20 JC - Ch 5: *In vitro* applications	21
22	23	24	25 JC - Ch 6: *In vivo* applications	26	27 JC - Ch 6: *In vivo* applications	28
29	30	31				

Teaching Calendar (April 2014)

Su	Mo	Tu	We	Th	Fr	Sa
			1 JC - Ch 6: *In vivo* applications	2	3 Easter Break	4
5	6	7	8 JC - Ch 6: *In vivo* applications	9	10 HPH and JC **POSTER PRESENTATION** – **Due date of Assignment sheets #2**	11
12	13	14	15 JC - Ch 6: *In vivo* applications	16	17 JC - Ch 6: *In vivo* applications	18 End of semester
19	20	21	22	23	24	25
26	27	28	29	30		

Poster Presentation

- *Objectives:* (i) To provide training on analyzing the literature of a given topic; (ii) To encourage active participation in discussion between classmates
- *Form TWO-member groups between yourselves*
- *Choose one topic from the list shown in next two slides*
- *Prepare a A1-size poster on the topic (template will be released later)*
- *Pin-up the poster during lecture time on April 10 (venue to be confirmed); upload the poster file to Blackboard for record*
- *Course lecturers (Ho and Choi) will conduct 3-minute Q&A with each team*
- *Class students will do the same in parallel at the same time*
- *Marking criteria:* (i) Ability to provide a precise summary of the topic, (ii) Comprehensiveness of materials, (iii) Presentation layout, (iv) Standard of English, (v) Application of your own analysis on the topic, (vi) Signs of applying BMEG4450 contents, (vii) citation of references, (x) Q&A performance
- *Marks:* Maximum score 15%, with each lecturer responsible for 5%; students will be given a form to vote for the top 10 posters (i.e. score from 10 to 1 in decreasing order) and the remaining 5% will be awarded to each poster according to its ranking scores accordingly through a normalization process

Topical Presentation (1)

- *Choose one from the following list of titles:*

1. Super hydrophobic surfaces - physics, fabrication and applications
2. Nano-imprinting
3. Scanning near-field optical microscopy
4. Nano-electronics fabrication techniques – present status and future prospects
5. High speed DNA sequencing techniques
6. Nano-positioning instrumentation
7. Nanoparticles as anti-infection agents
8. Colloidal synthesis of semiconductor quantum dots
9. Titanium oxide-based nano-materials
10. Nanoparticles and water quality
11. Carbon nanotubes
12. Graphene – properties and applications
13. Membrane technology for biological and chemical applications
14. Nanoparticles as photo-catalysts
15. Molecular Beam Epitaxy (MBE)

Topical Presentation (2)

- *Choose one from the following list of titles (continued):*

16. Metal Organic Vapour Phase Epitaxy (MOVPE)
17. Application of nanotechnology in cosmetics
18. Building novel nanostructures by DNA origami
19. Developing eye drops that contain nanoparticles
20. Treating/imaging brain diseases with nanoparticles
21. Nanoparticles as contraceptives
22. Treating/imaging cardiovascular diseases with nanoparticles
23. Nanoparticles and air quality
24. Nanoparticles in food
25. Biomedical applications of DNA origami nanostructures
26. Nanoparticles as biocatalysts
27. New solid-state memory devices with novel nano-sized materials
28. Deep UV lithography - present status and future development
29. E-beam lithography - present status and future development
30. Focus ion beam lithography - resent status and future development

Course Logistics and Lecture Style

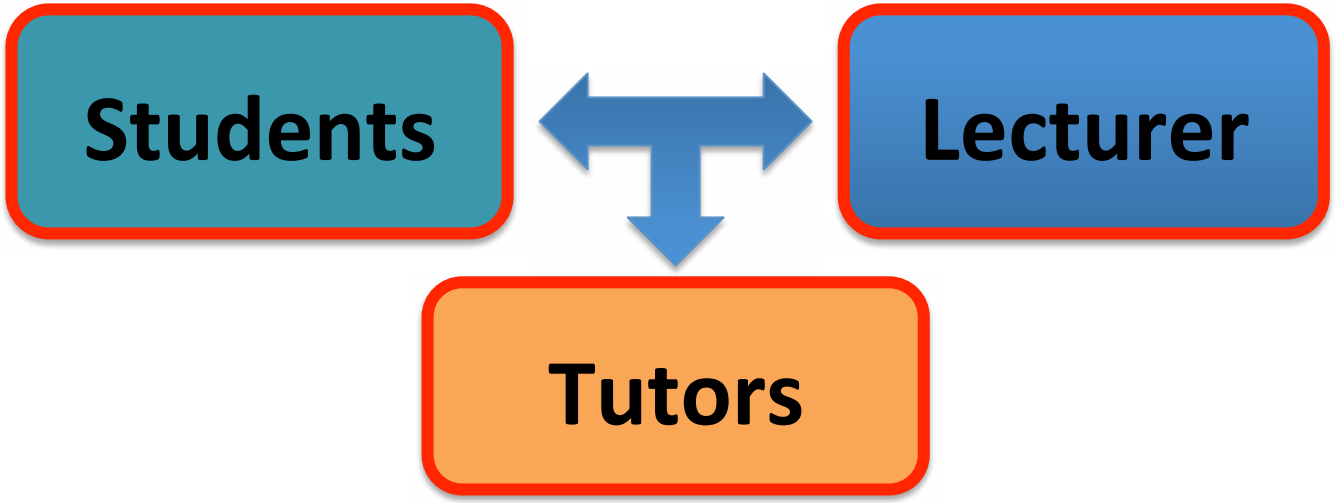
- Prime objectives: help you understand course contents with equal emphasis on theory and applications
- PowerPoint slides will be uploaded approximately one week ahead of schedule
- Promote an interactive atmosphere
- Introduce examples and demonstrations wherever possible
- Be prepared for in-class questions/quizzes from me

- Avoid use of cell phones
- Avoid frequent talking/noise generation

Learning Outcomes

- By the end of this course, you are expected to:
  - "Understand the fundamentals of bionanotechnology in the context that it is the fusion between biotechnology and nanotechnology"
  - "Appreciate the impact of bionanotechnology in the field of biomedical engineering"
  - "Understand the key processing technologies involved in the fabrication of practical devices based on bionanotechnology"

Building a Learning Community



- Interaction + discussion
- Everyone takes part
- Learning through exploration

"Tell me, I will forget;
show me, I may remember;
involve me, I will understand"

The End