Course number	U-LAS70 10002 SE50				
Course title (and course title in English)	ILAS Seminar-E2 :Introduction to Engineering in Biology and Medicine（医工学の基礎） ILAS Seminar-E2 :Introduction to Engineering in Biology and Medicine	**Instructor's name, job title, and department of affiliation**	Institute for Life and Medical Sciences Senior Lecturer,OKEYO, Kennedy Omondi		
Group	Seminars in Liberal Arts and Sciences	**Number of credits**	2	**Number of weekly time blocks**	1
Class style	seminar (Face-to-face course)	**Year/semesters**	2024・First semester	**Quota (Freshman)**	10 (10)
Target year	Mainly 1st year students	**Eligible students**	For all majors	**Days and periods**	Mon.5
Classroom	21, Yoshida-South Campus Bldg. No. 1			**Language of instruction**	English
Keyword	Biomedical engineering / Medicine / Biological systems / Biomanipulation				

[Overview and purpose of the course]

With increasing integration of science and engineering, more and more focus is being placed on multidisciplinary research. Against this background, this seminar will aim at introducing students, in particular first year students, to on-going engineering approaches aimed at understanding and/or solving biological and clinical problems. Discussions will be centered on (biological/clinical) problem identification, hypothesis setting around the problem, discussions on potential engineering solutions and, as may be necessary, experimental verification of the discussed solution(s).

[Course objectives]

This seminar is intended to help students develop interest in knowledge integration across different scientific disciplines, and to be able to formulate and apply concepts learnt to problem-solving in biology, medicine and health sciences.

[Course schedule and contents)]

This seminar will tackle selected topics related to application of engineering principles and knowledge to solving clinical problems, and/or elucidating known and unknown biological phenomena. Although the topics listed below are wide and varied, discussions will center on problem setting and solving with focus on understanding current multidisciplinary research areas expected to revolutionize the future of medicine.

1) Engineering in biology at the micro and nano scale and their clinical applications (3 weeks)
We will discuss the convergence of biology with micro/nano technology that have enabled the manipulation, analysis and detailed study of living systems including single cells, DNA molecules and other biological materials. Engineering principles behind micro/nano technology will be highlighted and potential clinical applications discussed.

2) Introduction to point-of-care diagnostics (3 weeks)
Provision of medical care at the bedside of a patient or at home (at the comfort of a patient) is increasingly becoming important in the face of a rapidly aging society. Here we will identify and discuss emerging technologies such as microfluidics/wearable clinical devices that are enabling the realization of point-of-care or personalized medicine.

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3) Introduction to emerging trends in engineering artificial organs/tissues (3 weeks)
Fusion of engineering and biology has made it possible to realize constructs of organs or tissues which mimic the functions of native organs/tissues. One such technology is "organ-on-a-chip" which borrows from the semiconductor technology to fabricate organ or tissues models on a chip for disease modeling and drug development. Here, we will discuss emerging trends in fabricating on-chip body organs/tissues, and highlight the potential applications of this technology in disease modeling, drug development and basic biology.

4) Advances in biomedical engineering and applications (2 weeks)
Rapid progress in micro/nano engineering have yielded small devices which are increasingly finding application in cell, DNA and protein analyses for disease diagnosis and drug screening. In this seminar, we will look at specific examples of new trends in biomedical engineering and specific application in areas such as cancer immunotherapy, detection of circulating tumor cells, DNA analysis, among others.

5) Discussions on the future role of engineering in biology and medicine (3 weeks)
We will discuss the importance of multidisciplinary research and highlight emerging technologies such as brainchips, wearable diagnostic devices that are promising to revolutionize traditional medicine, drug discovery, cancer research and personal disease management. On a rotational basis, students will each pick a topic of interest for discussion and presentation. Grading will be based on how well a topic is researched, presented and discussed.

6) Lecture review and student presentations (2 week)

[Course requirements]

None in particular. The seminar will be discussion-based, so prior preparation by way of reading about the above topics will be helpful in making the discussions lively.

[Evaluation methods and policy]

Attendance and active calss participation 60%, Duscussions and Presentations: 40%

[Textbooks]

Handouts

[References, etc.]

（References, etc.）
Yoshihiro Ito 『Biochip Technologies-Principles and Applications』（CMC Books）ISBN:9784781310794
（Biodesign: The Process of Innovating Medical Technologies 2nd Edition by Paul G. Yock and others, ISBN-13: 978-1107087354）

[Study outside of class (preparation and review)]

Prior reading of scientific papers on topics to be discussed is recommended to enhance understanding.

[Other information (office hours, etc.)]

To be announced during class. However, questions, suggestions and comments can be posted by email anytime.