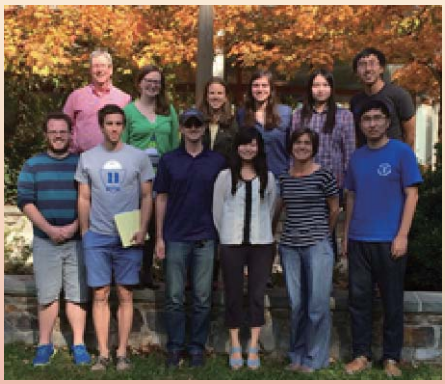
京都大学大学院
博士課程教育リーディングプログラム

充実した健康長寿社会を築く
総合医療開発リーダー育成プログラム

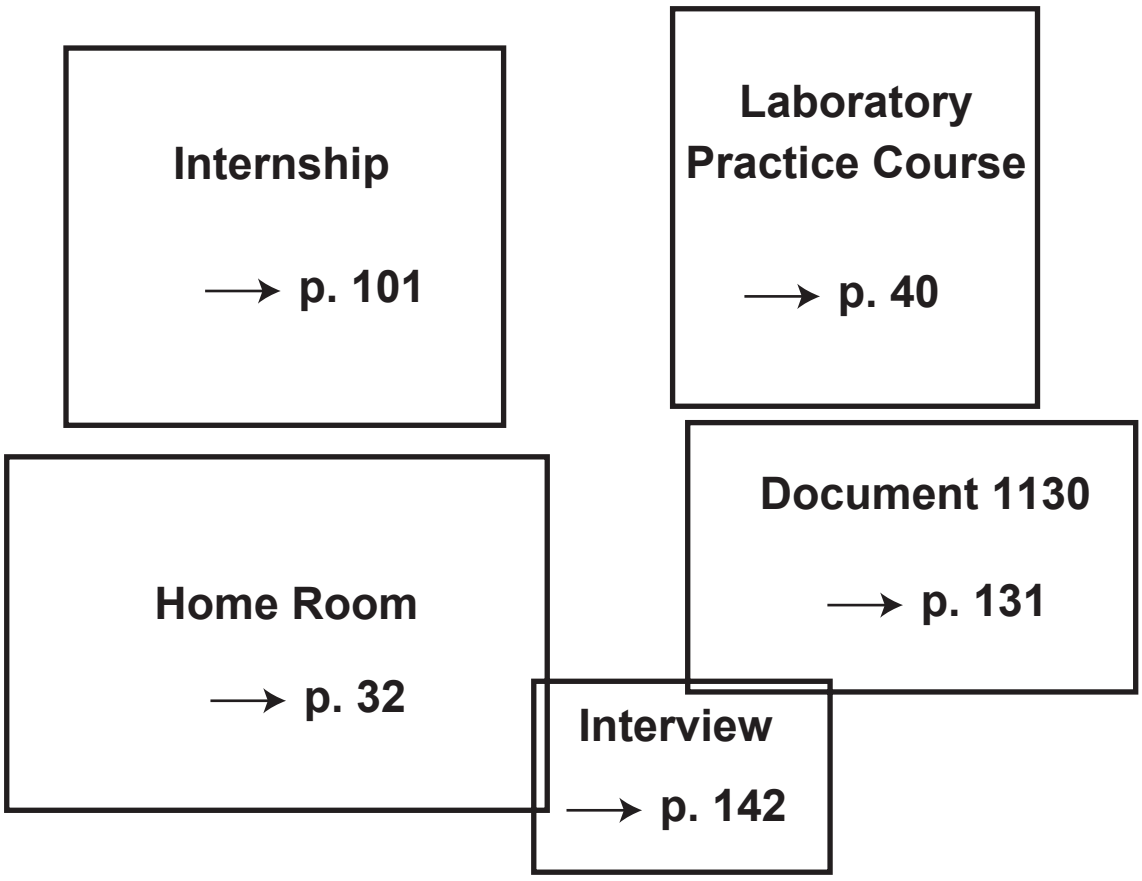
Training Program of Leaders for Integrated Medical System for Fruitful Healthy-Longevity Society

平成 28 年度　年次報告書

Annual Report 2016



Cover Photos



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中間評価「それから」

2017 年 1 月

LIMS プログラムコーディネーター
福山秀直

誰か慌たゞしく門前を馳けて行く足音がした時、代助の頭の中には、大きな俎（まないた）下駄が空から、ぶら下がつてゐた。けれども、その俎下駄は、足音の遠退くに従つて、すうと頭から抜け出だして消えて仕舞つた。さうして眼が覚めた。

夏目漱石の「それから」の書き出しであるが、「三四郎」のあとを記したものである。旧制高等学校、帝国大学の後の話で、リーディング大学院とは、少し、話や時代背景が異なるが、多くの部分でよく似たところがある。

多くの人の協力もあり、LIMS の評価も上がりつつある。これからが大変であるが、次のステップには、どうしても超えて行く必要がある。授業そのものはあまり変化はないが、少なくなったメンターの先生達の努力もあり、これまでのレベルを維持できている。さらに、これから入ってくる若い院生、現在、LIMS に所属している院生の勉学に少しでも役立つ授業ができれば、そして、これまでにない新しい考えを持った大学院生が多く育ってくれている。最初のころの、どのようになっていくか、不安な状況から、だいぶ、先まで見通せるような状態になったので、これからが、重要な時期で、どのような社会人になっていくか、これまでの院生と異なった人が社会に羽ばたいていくことを夢見ていると、多くの協力していただいた人々に感謝するとともに、院生の努力にも、感謝したい。

次世代は、LIMS のうたい文句にもある、高齢社会で、かつ、少子化が進む大変な時代に遭遇する。その諸問題を解決できるきっかけが、LIMS の授業で培われた、知識、考え方、友人、先生方によってもたらせられるようになることを、心から願ってやまない。私達、団塊の時代の人間がなくなる時代の日本や世界を背負う人たちを少しでも後ろから押して、前に進めたいと考えて、さまざまな授業を用意したつもりで、その中から得られたものを生かして、新しい世界を目指してもらいたいと期待しているこのごろである。

Another story

January 2017

LIMS Program coordinator
H. Fukuyama, M.D., Ph.D.

The program in 2016 had a difficult problem. But many staffs including teachers, mentors, as well as students made great efforts to overcome this. I would like to appreciate all of them at this instance.

I think it is a good time to give the message from the “New world” to “ Old world”.

The leading program has a unique role for education. Similar systems of Graduate School of Medicine, Pharmacology and Engineering should leave behind the conventional education, and different points of views on graduate students will make them unique thinking and provision on the similar objects and the creative thinking. The revolutional process of teaching will create the original students different from the conventional students. This will lead the students to the world-wide level graduate school of bioengineering or other fields. This is the original concepts on LIMS proposal, which will make some contributions to the aged society problem solutions.
We should not forget this concept in spite of any criticism from other concept oriented persons. I think we can contribute to the future graduate school and aged society through this program. The revolution will not be accepted from the old world, but the thinking on the new concept will overcome the old one.

We will have a short duration for this program but I wish all of the attending personnel do a good contribution to LIMS another two years.

1.

プログラムの概要

Outline of the Program

1. 京都大学博士課程教育リーディングプログラム事業に係る人材養成の目的と学位授与の方針

京都大学の基本理念（2001）抜粋

- 京都大学は、研究の自由と自主を基礎に、高い倫理性を備えた研究活動により、世界的に卓越した知の創造を行う。
- 京都大学は、総合大学として、基礎研究と応用研究、文化系と理科系の研究の多様な発展と統合をはかる。
- 京都大学は、多様かつ調和のとれた教育体系のもと、対話を根幹として自学自習を促し、卓越した知の継承と創造的精神の涵養につとめる。
- 京都大学は、教養が豊かで人間性が高く責任を重んじ、地球社会の調和ある共存に寄与する、優れた研究者と高度の専門能力を持つ人材を育成する。
- 京都大学は、開かれた大学として、日本および地域の社会との連携を強めるとともに、自由と調和に基づく知を社会に伝える。
- 京都大学は、世界に開かれた大学として、国際交流を深め、地球社会の調和ある共存に貢献する。

（以下、略）

博士課程教育リーディングプログラム公募要領（2012、文部科学省）から

「博士課程教育リーディングプログラム」は、優秀な学生を俯瞰力と独創力を備え広く産学官にわたりグローバルに活躍するリーダーへと導くため、国内外の第一級の教員・学生を結集し、産・学・官の参画を得つつ、専門分野の枠を超えて博士前期課程・後期一貫した世界に通用する質の保証された学位プログラムを構築・展開する大学院教育の抜本的改革を支援し、最高学府に相応しい大学院の形成を推進する事業である。

（１） 博士課程教育リーディングプログラムに係る人材養成の目的

学内外の卓越した教員・指導者との対話や産官学の協働による教育など、博士課程前期・後期一貫の質の保証された学位プログラムのもと、多様な専門分野を俯瞰し、創造的に課題解決にあたる人材、および、コミュニケーション力と国際性を備えてグローバルに活躍する人材を養成することを目的とする。

（２） 博士課程教育リーディングプログラムに係るアドミッション・ポリシー

京都大学が実施する博士課程教育リーディングプログラムの目的に共感し、これを遂行するための基本的能力と教養、倫理性を兼ね備え、強い意欲をもって参加しようという人を求める。アドミッション・ポリシーの詳細は当該プログラムにおいて定める。

（３）　博士課程教育リーディングプログラムに係るカリキュラム・ポリシー

国内外の複数の教員・指導者との対話を通じた発展的自学自習や産官学の参画による人材養成を介して、研究企画の推進力と社会への説明力、研究チームを組織し新しい研究分野を国際的に先導する能力をもって多様な専門分野を俯瞰し、創造的に課題解決にあたるために必要な能力を育む世界に通用するカリキュラムを編成・実施する。

博士論文研究基礎力審査までの学修期間においては、質の保証された多様な専門教育によって当該プログラムに関する幅広い知識を修得させるとともに、複数の教員による研究指導を通じて専門分野を総合的に理解させるカリキュラムを編成・実施する。また、産官学の協働による実践的教育などを介して、コミュニケーション力、研究・開発の計画力と推進力、自ら課題を発見する能力などを身につけさせる。

カリキュラム・ポリシーの詳細は当該プログラムにおいて定める。

（４）　博士課程教育リーディングプログラムに係るディプロマ・ポリシー

後期課程においては、当該研究科の定める期間在学して、研究科等が実施する博士課程教育リーディングプログラムのカリキュラム・ポリシーに沿った研究指導を受け、当該プログラムを修了するとともに、所定年限内に提出した博士論文について研究科が行う審査と試験に合格し、後期課程を修了することが博士の学位授与の要件である。研究科によっては、所定の授業科目を履修して、基準となる単位数以上を修得することを要件に含む場合がある。

多様な専門分野を俯瞰し、創造的に課題解決にあたるために必要な能力とその基盤となる学識を身につけているかどうか、および、グローバルに活躍するために必要なコミュニケーション力と国際性を蓄えているかどうかが、当該プログラム修了の基準である。

前期課程において修士の学位を授与する研究科にあっては、研究科等が実施する博士課程教育リーディングプログラムのカリキュラム・ポリシーに沿って設計された授業科目を履修して、基準となる単位数以上を修得し、当該プログラムが定める博士論文研究基礎力審査に合格するとともに、所定年限内に提出した修士論文について、研究科が行う審査と試験に合格し、前期課程を修了することが修士の学位授与の要件である。

博士論文研究基礎力審査に合格するには、当該プログラムの目的に沿って設定した授業科目を履修して、基準となる単位数以上を修得するとともに、プログラムの定めるその他の要件を満たす必要がある。

博士論文作成に必要な研究基礎力である専門基礎知識、幅広く深い知識、研究計画力、語学力を基礎とするコミュニケーション力などを備えているかどうかが、博士論文研究基礎力審査合格の基準である。

研究科が行う博士論文及び修士論文の審査基準については当該研究科のディプロマ・ポリシーを参照すること。

２　充実した健康長寿社会を築く総合医療開発リーダー育成プログラム

世界的に人口の高齢化が広がる中、世界最長の健康寿命と先端的研究開発能力という条件を合わせ持つ日本では、高齢化社会の問題を俯瞰し、メディカルイノベーションを通じて充実した健康長寿社会を達成する人材を、世界に輩出することが急務となっている。そこで本プログラムでは、高齢化社会が抱える問題を俯瞰し、Ⅰ.工学技術を医療・支援システムへ適用し、Ⅱ.医学の中に蓄えられた知識を工学に活用するという２方向から、具体的な解決法を創案し、充実した健康長寿社会の構築に向け推進することの出来る「総合医療開発リーダー」を、異分野の研究者を組み合わせた産学横断的な教育プログラムにおいて組織的に育成する。

Ⅰ．真に医学・医療が分かる医工学人材

本プログラムでは、工学系のプログラム履修者に人体解剖学、生理学、病理学などの基礎医学教育と病院内実習を課し、複数分野の教員による綿密な討論・指導を行い、医学部卒業生と同等の医学・医療知識を有する医工学人材を育成する。医療・支援現場の実習や医療倫理学を通じ、利用者にとり負担の少ない「高齢者に優しい」機器・システムを開発するセンスを涵養する。医療現場のニーズや医療経済学・許認可制度の知識に基づき、機器・システムの産業化・市場の予測能力を養う。国際標準化の知識や卓越したコミュニケーション能力を備え、国際標準化機構などで活躍できる人材を育成する。

Ⅱ．医学の中に蓄えられた知識を多分野に発展させるリーダー

世界の他地域に先駆けて高齢化社会を迎える日本で、健康寿命が世界最長であるという背景を活かし、高齢者が自立して社会参加するのに適した社会システムや新産業を創出できる人材を育成する。更に、この“日本モデル”を先達として世界の健康長寿向上を牽引できる人材を育成する。

これらⅠ．及びⅡ.のリーダー人材を輩出し、新たな学際的研究開発の推進を可能とすることによって、豊かな健康長寿社会の構築に貢献することを目的とする。

本プログラムの学問分野は、「医工学」であり、プログラム履修者は、医学研究科、工学研究科、薬学研究科の何れかに属することから、工学部出身者、または生物関係学部出身者の何れかが想定される。ただし、出身学部を限定することはない。工学部出身者は、工学者としての実力を有しかつ医学部学生と同等な人体・生物学の知識を有すること、また生物関係学部の出身者では工学研究が行える工学の専門性の高い知識を取得することを目指す。プログラムは講義、演習・実習と特別研究により構成される。

３　充実した健康長寿社会を築く総合医療開発リーダー育成プログラムのアドミッション・ポリシー

医工連携ということが重要であると言われて久しい。しかし、言葉そのものの意味するところは、医学研究者と工学研究者が協力し合い、あたらしい医療機器なり、医療方法を開発するというところにあり、すでにある研究成果や問題点を協力して解決していくということであった。

歴史をたどると、脳動脈瘤手術で根治療法となるネッククリップができない場合、手が着けようのないものを動脈瘤の上から接着剤で出血しないようにするという発想を脳外科から持ち、工学と共同してビオボンドという、湿気のある組織でも接着能力のある特殊な接着剤を考案して、脳動脈瘤の手術の幅を広げることに成功している。以前は、工学研究に人体の標本などを持ち込むことは無謀に近い話しであったようであるが、現在では、当然と思われているこのような研究成果も先人の多くの努力によるもので、しかも、研究組織をまたいでの研究という点で重要なものである。

本プログラムでは、このような研究領域を超えた研究を行うだけではなく、互いに専門とする研究領域を持ち、それをもとに新しい発想をするのではなく、「医学研究環境の中で工学を学ぶ」というさらに一歩踏み込んだ発想で、工学系の大学院生の研究の場を医学研究科の中におき、医学研究そのものを行うのではなく、工学的見地から見て新しく医学へ貢献するところがないかを研究する目的意識を持ち、工学の基礎研究のトレーニングを受けつつ、医学の基礎から臨床、介護までを学び、医学・工学の垣根を越えた新しい研究領域を開拓していくことを目的としている。

特に、高齢化が顕著に進んでいる日本で、高齢者医療・介護は長い健康長寿を達成するには必須の条件の一つであるが、単に、病院で行う医療だけではなく、一般家庭にもっとも近い掛かり付け医への支援、長期療養施設のあり方など、医療設備の刷新とともに、工学的手法をもとにして高齢化した社会を支えるためのさまざまな工夫を社会に向かって積極的に発信できる人材を育成して、新しい医工連携の姿が社会に有効に機能できることを示すことを、もう一つの大きな目的としている。

このような新しい考え方をもとに、今回のプロジェクトがスタートし、医学研究科が中心となって、工学研究科や再生医科学研究所のスタッフが協力した体制を作り、上記の目的を達成すべくカリキュラムを工夫している。これまでの大学院と異なりリーディング大学院では社会との接点を重視した人材育成を目的としているので、広く英語による討論・ディベートによる自分の意思の発信能力の養成と、社会を医療の観点から俯瞰する医療経済学など、医工連携だけにとどまらない広い世界的視野に立った人材育成を目指している点で、これからの高齢社会へ資する人材の育成に役立つと信ずるものである。

４　充実した健康長寿社会を築く総合医療開発リーダー育成プログラムのカリキュラム

（１）５年一貫教育

本プログラムは５年一貫の大学院教育を行う。本プログラムの履修者の受入過程として、先ず所属研究科となる本学医学研究科（医科学専攻・人間健康科学系専攻）・工学研究科・薬学研究科の修士課程の入学試験を受験し、合格することを前提とする。ただし、これらの学部や京都大学の出身者である必要はない。留学生も積極的に受け入れる。

社会人経験者の履修も許可するが、本プログラムではかなりハードな教育プログラムを課すので、学業に専念できる環境作りを所属企業・組織との間で協議のうえ選抜する。

（2）ＬＩＭＳプログラムにおける履修方法及び修了審査の概要

【修士・博士後期課程５年用】

〇履修要件

修士課程では、指定された必修科目（人体解剖学、生理学、学際応用科目；医療生活支援システム学、英語 debate Ⅰ・Ⅱ）13 単位を修得し、プレリサーチを完了すること。
必修科目以外の科目については、研究科指導教授、プログラム指導教授及びメンターと相談し、プレリサーチと関連する科目をできるだけ履修することを推奨する。
博士後期課程では、プログラム修了までに英語 debateⅢ～Ⅴを習得し、インターンシップ（修士２年次から履修可能）及び特別研究を完了すること。
ホームルーム（コロキウム）：原則毎月最終週の水曜日の５限目に行うので、必ず出席すること。

〇ＬＩＭＳでの研究テーマの設定、ポートフォリオ

前後期、年２回指導教授及びメンターと相談のうえ、ＬＩＭＳで実施する研究テーマ及び研究内容を決める。
また、履修・成績・達成度の自己点検、教員による評価を目的として、ポートフォリオを作成し、指導教員が閲覧できるようにする。

〇プログラム修了審査

・研究指導

各履修者に対して、プログラムの指導教授及びメンターが指導に当たる。
指導教授は、毎学年の終わりにプログラム履修にかかる研究指導記録書を作成する。

・博士論文研究基礎力審査（QE）

修士課程２年次修了前に QE を行う。QE 審査に合格することにより、本プログラムの L3 として履修することができる。
◎審査の基準
本プログラムにおいて、以下の審査基準により博士論文研究の主体的な遂行に必要な基礎的知識及び能力が修得されていることを審査し、ともに基準に達しているとされた履修生については QE に合格したことを認める。

(1) 所属研究科の履修において、それぞれの研究科の定める修士学位取得に必要な単位数等の基準に達していること。
(2) 所属研究科の定める修士論文が当該研究科に提出されていること。
(3) 所属研究科において博士後期課程進学試験に合格していること。
(4) 本プログラムのカリキュラム（英語力審査を含む）の履修において、本プログラムが別に定める単位数等の基準に達していること。

(5) 博士後期課程における LIMS の研究計画を作成し、その内容が本プログラムが求める博士論文研究着手のための要件を満たしていること。

◎審査手続き、提出物

履修生は、２月上旬までに以下のものを提出すること

(1) 所属研究科及びプログラムの修士課程で実施したプレリサーチについて英語によるレポート

(2) 博士後期課程進学後のプログラムで実施する特別研究の研究計画書（日本語または英語）

(1)及び(2)について、口頭試問を行う。（３月上旬）

・プログラム修了審査

５年次には、

履修生は、LIMS へ特別研究論文(thesis)を添えてプログラム修了審査願の提出を行う。

プログラム修了審査委員会は、修了調査委員を選定し、プログラム修了調査を行う。

修了審査委員会は、調査結果を審査し、その結果をユニット教授会に報告する。

ユニット教授会は、プログラムの修了判定を行い、その結果を全学のリーディングプログラム運営委員会へ報告する。

全学のリーディングプログラム運営委員会は、プログラムの修了審査を行い、研究科へ修了審査結果について、報告を行う。

研究科における博士学位論文の審査に合格すれば、リーディングプログラム修了の付記がなされる。

・学位については、研究科の学位にプログラム名を付記

博士（医科学、または医学、または人間健康科学、または薬科学、または薬学、または工学）「充実した健康長寿社会を築く総合医療開発リーダー育成プログラム」の修了

【博士課程 4 年用】

○履修要件

指定された必修科目（人体解剖学、生理学、医療経済論、知的財産＆国際標準化、学際応用科目；医療生活支援システム学、英語 debateⅡ～Ⅴ及び機械工学基礎または材料化学基礎から１科目）１５単位以上を修得すること。

プログラム修了までにインターンシップ及び特別研究を完了すること。

ホームルーム（コロキウム）：原則毎月最終週の水曜日の５限目に行うので、必ず出席すること。

○ＬＩＭＳでの研究テーマの設定、ポートフォリオ

前後期、年２回指導教授及びメンターと相談のうえ、ＬＩＭＳで実施する研究テーマ及び研究内容を決めること。

また、履修・成績・達成度の自己点検、教員による評価を目的として、ポートフォリオを作成し、指導教員が閲覧できるようにすること。

〇プログラム修了審査

・研究指導

各履修者に対して、プログラムの指導教授及びメンターが指導に当たる。
指導教授は、毎学年の終わりにプログラム履修にかかる研究指導記録書を作成する。

・プログラム修了審査

４年次には、
履修生は、LIMS へ特別研究論文(thesis)を添えてプログラム修了審査願の提出を行う。
プログラム修了審査委員会は、修了調査委員を選定し、プログラム修了調査を行う。
修了審査委員会は、調査結果を審査し、その結果をユニット教授会に報告する。
ユニット教授会は、プログラムの修了判定を行い、その結果を全学のリーディングプログラム運営委員会へ報告する。
全学のリーディングプログラム運営委員会は、プログラムの修了審査を行い、研究科へ修了審査結果について、報告を行う。
研究科における博士学位論文の審査に合格すれば、リーディングプログラム修了の付記がされる。
・学位については、研究科の学位にプログラム名を付記
博士（医科学、または医学、または人間健康科学、または薬科学、または、薬学または工学)「充実した健康長寿社会を築く総合医療開発リーダー育成プログラム」の修了

（３）ディプロマポリシー

医学的知識を十分に学習し会得した、医科学・工学・薬学などの実験・研究ができる研究者で、海外の研究施設・企業・公共組織などで活躍できるよう十分な英語力・ディベート力をもち、全世界的に進行する高齢社会の現状と将来を自分で俯瞰的に考察し、多様な人や組織と協力して問題点を解決するために、さまざまな自分の知識と手法を用いることができ、高齢者が安心して生活できる環境を作り上げられる人物になり、かかる分野における日本、アジア、世界のリーダーとなること。

５．履修カテゴリーについて

本プログラムで開設する科目は別表の通りであり、その概要は以下の通りである。

基盤科目

・工学、薬学、医学・生物学

医工学領域の研究に必要となる工学、医学、薬学に関する基礎知識を習得する。工学部出身者か生物関係学部出身向けの標準履修メニューを提示。それを参考に科目を選択する。

・医療倫理

医療倫理について学習する。

数理科学科目

シミュレーションを中心としたもので、本プログラムでは、医療経済学とともに高齢化社会の将来予測等に必要な重要な科目として推奨科目とする。

医療経済学

高齢化社会における医療経済学的課題、知的財産、国際標準化の理解力を身に付けさせる。

医療工学特別講義

協力企業から派遣された講師により、医療・健康・ケアなどに関し、最先端の技術や現場の課題等について講義を受け、議論する。

学際応用科目

特別研究で行う研究領域に応じて用意された専門科目

英語 debate

国際的リーダーに不可欠な能力として英語でのコミュニケーション力を養う。

インターンシップ

企業において、研究開発などについて、実践しながら理解し、特別研究に活かす。行政機関、国際機関に短期研修を行い、許認可や国際標準化の仕組み、課題について理解を深める。

プレリサーチ

研究室ローテーションなどを通じ、専門以外の分野に関する理解を広げる。研究者としての基礎能力を養い特別研究の研究計画を作成する。

特別研究

プレリサーチで作成した研究計画に基づいて博士の研究を遂行し、学位取得とリーディングプログラムの修了を目指す。

６　プログラム履修者への支援

プログラム履修者には、リーディング博士課程における履修及び学位研究に専念するための以下のような経済支援を行う。

なお、本プログラムは、文部科学省「博士課程教育リーディングプログラム」の採択を受けて実施しているため、「博士課程教育リーディングプログラム」による奨励金等の経済的支援期間については、平成３１年３月末までの予定となっている。

◎特待生奨励金

以下の受給資格をすべて満たす優秀な履修者に対して特待生奨励金を支給する。支給額及び支給継続については、選抜時及び各学年末に決定され、年度ごとに見直される。また、奨励金受給者の氏名は受給開始前に学内掲示及びＬＩＭＳホームページにて公表する。

【受給資格】

(1) プログラム履修者選抜試験に合格した本プログラムの履修者

(2) 各種奨学金等の就学支援経費（本学の定める授業料等免除は除く）を受けていない者
ただし、国費留学生等で本奨励金を辞退した者は、他の奨学金を受けながら本プログラムを履修することができる。

(3) 奨励金以外の収入（アルバイトの給与等）を得ていない者
ただし、研究成果の公表に伴う謝金、著作料および TA・RA の給与（本プログラムにおいて本プログラムの実施に不可欠と判断される場合に限り、週５時間を上限とする。）等に限り、これを除外する。

(4) 本学大学院の在籍期間（休学期間を除く）が標準修業年限に１年を加えた期間を超えない者

(5) 本プログラムにおける成績等評価において特に優秀と認められる者

(6) 本プログラムが５年一貫の教育研究課程であることを了解する者

【受給資格の喪失条件】 受給者が次の各号の一に該当する場合は、その資格を失う。

(1) 上記に定める受給資格を失ったとき。

(2) 受給者からの辞退届が受理されたとき。

(3) 奨励金について提出された書類に虚偽の記載があるとき。

(4) 休学又は退学したとき、および除籍されたとき。

(5) 京都大学通則の規定により懲戒処分を受けたとき。

【所得税・住民税・社会保険等について】

i　奨励金は「雑所得」として取り扱われるため、源泉徴収は行わない。

ii　奨励金は「雑所得」として課税対象となるため、受給者は家族の税法上の扶養親族から外れなければならない。

iii　受給者は自身で必ず確定申告の手続き（毎年 3 月 15 日までに）を行った上で、所得税・住民税納付に係る証拠書類を LIMS 事務室へ提出しなければならない。

iv　受給者は個人で国民健康保険・国民年金保険へ加入すること。

v　国民年金保険の学生納付特例制度は適用除外となるので注意すること。（前納や口座振替による割引制度はある。）

vi　留学生の場合は、租税条約の締結の有無により取扱が変わるため、注意すること。

vii　各種手続きについては、居住する市区町村へ問い合わせること。

◎研究活動経費

プログラム履修者の研究活動を支援するため、研究活動経費を支給する。

研究費の年間を通しての有効な使い方、研究目的に合った物品の購入などを、研究者として適切に執行できるようになるために、研究費を申請内容によって、一定限度額まで配分する。詳細については、博士課程教育リーディングプログラム履修生研究活動経費取扱要領、およびLIMSプログラム教授会で決める。必ず、e-learningで、研究費の使用の注意点を学ぶこと。

申請資格は、修士課程２年次以上で、選考委員会で申請内容、申請額を審査して、配分額を決定する。

募集要項は、別途案内する。

プログラム担当者一覧（平成28年度）

	氏　名	所　属	専攻等	職　名	備　考
1	上本　伸二	医学研究科	医学	教授	プログラム責任者・医学研究科長
2	福山　秀直	学際融合教育研究推進センター	健康長寿社会の総合医療開発ユニット	特任教授	プログラムコーディネーター
3	渡邉　大	医学研究科	医学	教授	LIMSユニット長
4	萩原　正敏	医学研究科	医学	教授	
5	斎藤　通紀	医学研究科	医学	教授	
6	武田　俊一	医学研究科	医学	教授	
7	松田　道行	医学研究科	医学	教授	
8	羽賀　博典	医学研究科	医学	教授	
9	岩田　想	医学研究科	医学	教授	
10	野田　亮	医学研究科	医学	教授	
11	伊佐　正	医学研究科	医学	教授	
12	河野　憲二	学際融合教育研究推進センター	健康長寿社会の総合医療開発ユニット	特任教授	
13	大森　治紀	学際融合教育研究推進センター	健康長寿社会の総合医療開発ユニット	特任教授	
14	木村　剛	医学研究科	医学	教授	
15	伊達　洋至	医学研究科	医学	教授	
16	富樫　かおり	医学研究科	医学	教授	
17	一山　智	医学研究科	医学	教授	
18	坂井　義治	医学研究科	医学	教授	
19	戸井　雅和	医学研究科	医学	教授	
20	小川　修	医学研究科	医学	教授	
21	鈴木　茂彦	医学研究科	医学	教授	
22	松田　秀一	医学研究科	医学	教授	
23	高橋　良輔	医学研究科	医学	教授	
24	宮本　享	医学研究科	医学	教授	
25	小杉　眞司	医学研究科	社会健康医学系	教授	
26	前川　平	医学部附属病院	輸血細胞治療部	教授	
27	桂　敏樹	医学研究科	人間健康科学系	教授	
28	木下　彩栄	医学研究科	人間健康科学系	教授	
29	足立　壯一	医学研究科	人間健康科学系	教授	人間健康科学系専攻長
30	椎名　毅	医学研究科	人間健康科学系	教授	
31	杉本　直三	医学研究科	人間健康科学系	教授	
32	黒木　裕士	医学研究科	人間健康科学系	教授	
33	市橋　則明	医学研究科	人間健康科学系	教授	
34	二木　淑子	医学研究科	人間健康科学系	教授	
35	小寺　秀俊	工学研究科	マイクロエンジニアリング	教授	
36	木村　俊作	工学研究科	材料化学	教授	
37	白川　昌宏	工学研究科	分子工学	教授	

38	秋吉　一成	工学研究科	高分子化学	教授	
39	森　泰生	工学研究科	合成・生物化学	教授	
40	濱地　格	工学研究科	合成・生物化学	教授	
41	中部　主敬	工学研究科	機械理工学	教授	
42	大嶋　正裕	工学研究科	化学工学	教授	
43	神野　郁夫	工学研究科	原子核工学	教授	
44	大江　浩一	工学研究科	物質エネルギー化学	教授	
45	近藤　輝幸	工学研究科	物質エネルギー化学	教授	
46	佐治　英郎	薬学研究科	薬学	教授	
47	橋田　充	薬学研究科	薬学	教授	
48	掛谷　秀昭	薬学研究科	医薬創成情報科学	教授	
49	中山　和久	薬学研究科	薬科学	教授	薬学研究科長
50	加藤　博章	薬学研究科	薬科学	教授	
51	後藤　励	慶應義塾大学	経営管理研究科	准教授	
52	田畑　泰彦	ウイルス・再生医科学研究所		教授	
53	戸口田　淳也	ウイルス・再生医科学研究所		教授	
54	安達　泰治	ウイルス・再生医科学研究所		教授	
55	開　祐司	ウイルス・再生医科学研究所		教授	再生医科学研究所長
56	瀬原　淳子	ウイルス・再生医科学研究所		教授	
57	河本　宏	ウイルス・再生医科学研究所		教授	
58	岡本　久	数理解析研究所		教授	
59	山田　道夫	数理解析研究所		教授	
60	寺西　豊	医学研究科	「医学領域」 産学連携推進機構	特任教授	
61	石井　加代子	学際融合教育研究推進センター	健康長寿社会の 総合医療開発ユニット	特定教授	
62	木村　祐	学際融合教育研究推進センター	健康長寿社会の 総合医療開発ユニット	特定准教授	
63	髙折　恭一	学際融合教育研究推進センター	健康長寿社会の 総合医療開発ユニット	特定准教授	
64	西　美幸	学際融合教育研究推進センター	健康長寿社会の 総合医療開発ユニット	特定准教授	
65	松橋　眞生	学際融合教育研究推進センター	健康長寿社会の 総合医療開発ユニット	特定准教授	
66	木下　武彦	学際融合教育研究推進センター	健康長寿社会の 総合医療開発ユニット	特定講師	
67	高橋　めい子	学際融合教育研究推進センター	健康長寿社会の 総合医療開発ユニット	特定講師	
68	東森　信就	学際融合教育研究推進センター	健康長寿社会の 総合医療開発ユニット	特定講師	
69	樋口　ゆり子	学際融合教育研究推進センター	健康長寿社会の 総合医療開発ユニット	特定講師	
70	松田　和郎	学際融合教育研究推進センター	健康長寿社会の 総合医療開発ユニット	特定講師	

特定教員一覧

	氏　名	職　名
1	イシイ　カヨコ 石井　加代子	特定教授
2	キムラ　ユウ 木村　祐	特定准教授
3	タカ オリ　キョウイチ 髙折　恭一	
4	ニシ　ミユキ 西　美幸	
5	マツハシ　マサオ 松橋　眞生	
6	キノシタ　タケヒコ 木下　武彦	特定講師
7	タカハシ　メイコ 高橋　めい子	
8	ヒガシモリ　ノブユキ 東森　信就	
9	ヒグチ　ユリコ 樋口　ゆり子	特定講師（平成28年4月まで）
10	マツダ　ワコト 松田　和郎	特定講師（平成28年8月まで）
11	イマイ　ヒロヒコ 今井　宏彦	特定助教
12	サトウ　フミノリ 佐藤　文規	
13	タキモト　アキ 滝本　晶	
14	ディン　ハ　ユィ　ティ Dinh Ha Duy Thuy	
15	ヒライ　ヤスハル 平井　康治	
16	ヤ ワ タ　サトシ 矢和多　智	
	クリスチャン　アルトマン Christian Altmann	医学研究科特定准教授

事務職員一覧

	氏　名	職　名
1	ノギ　ヨシマサ 野木　淑全	特定職員
2	テラカワ　ヒデヨ 寺川　秀世	特定職員
4	サキモト　マリコ 崎本　真梨子	事務補佐員
5	キダ　ヤスコ 木田　靖子	派遣職員

平成２８年度（Ｌ１）　LIMS履修者・指導教授・メンター　一覧

※メンターについて
上段：名前　　下段：勤務場所

	研究科	専攻	所属分野	氏名	ＬＩＭＳ研究テーマ	研究科指導教授	LIMS指導教授	メンター
1	医学	医科学	化学研究所 ケミカルバイオロジー	稗谷（ハガヤ）　隼世（ハヤセ）	化学修飾ゼラチンナノファイバーによる生理活性人工細胞外マトリックスの応用研究 (Application Study of Physiologically Functional Artificial Extracellular Matrix made by chemically modified Gelatin Nanofibrous Scaffolds.)	上杉（ウエスギ）　志成（モトナリ）　教授 化学研究所　生体機能化学研究系 ケミカルバイオロジー	濱地（ハマチ）　格（イタル）　教授 工学研究科　合成・生物化学専攻 生物化学講座 生物有機化学分野	Dinh（ディン） Ha（ハ） Duy（ユイ） Thuy（ティ）　特定助教 医学研究科 脳機能総合研究センター
2	医学	人間健康科学系	検査応用開発学分野	鈴木（スズキ）　健壁（ケンジロウ）	制御性T細胞制御機構の解明およびその遺伝子スイッチ法の開発 (Developpng gene-switch system of regulatory T cell and Elucidating underlying mechanisms of regulatory T cell differentiation.)	足立（アダチ）　壮一（ソウイチ）　教授 医学研究科　人間健康科学系専攻 検査技術科学コース　医療検査展開学講座 検査応用開発学	河本（カワモト）　宏（ヒロシ）　教授 再生医科学研究所 再生統御学研究部門 再生免疫学	佐藤（サトウ）　文規（フミノリ）　特定助教 再生医科学研究所 再生増殖制御学 (瀬原研究室)
3	医学	人間健康科学系	情報理工医療学講座	髙山（タカヤマ）　裕成（ヤスナリ）	慢性肝炎早期診断のためのshear wave による粘弾性推定に基づく肝線維化ステージの評価法の開発 (Development of methos for liver fibrosis staging for early diagnosis of chronic hepatitis based on tissue viscoelasticity estimated by shear wave speed)	椎名（シイナ）　毅（ツヨシ）　教授 医学研究科　人間健康科学系専攻 検査技術科学コース　情報理工医療学講座 医療画像情報システム学	安達（アダチ）　泰治（タイジ）　教授 再生医科学研究所 ナノ再生医工学研究センター バイオメカニクス研究領域	東森（ヒガシモリ）　信就（ノブユキ）　特定講師 情報学研究科 応用解析学講座 （磯研究室）
4	医学	人間健康科学系	先進医療機器開発学分野	寺田（テラダ）　伊織（イオリ）	長時間３D超音波の臨床応用に向けた検討 (Examination of long time 3D ultrasound for clinical apply)	杉本（スギモト）　直三（ナオゾウ）　教授 医学研究科　人間健康科学系専攻 検査技術科学コース　情報理工医療学講座 先進医療機器開発学	椎名（シイナ）　毅（ツヨシ）　教授 医学研究科　人間健康科学系専攻 検査技術科学コース　情報理工医療学講座 医療画像情報システム学	木下（キノシタ）　武彦（タケヒコ）　特定講師 医学部先端棟4階410号室 LIMS教員室
5	医学	人間健康科学系	情報理工医療学講座	西山（ニシヤマ）　美咲（ミサキ）	光超音波イメージングによるリウマチ診断応用に関する研究 (Study of the application of photoacoustic imaging to diagnosis of rheumatoid arthritis)	椎名（シイナ）　毅（ツヨシ）　教授 医学研究科　人間健康科学系専攻 検査技術科学コース　情報理工医療学講座 医療画像情報システム学	山田（ヤマダ）　道夫（ミチオ）　教授 数理解析研究所 数学・数理解析専攻 数理解析系	今井（イマイ）　宏彦（ヒロヒコ）　特定助教 医学研究科 人間健康科学系専攻 医療画像情報システム学 （椎名研究室）
6	医学	人間健康科学系	検査応用開発学分野	前田（マエダ）　信太郎（シンタロウ）	ゼラチンハイドロゲルを用いた低分子化合物の革新的DDS法の開発 (Development of innovative DDS by using Biodegradable gelatin hydrogel including small molecules)	上久保（カミクボ）　靖彦（ヤスヒコ）　准教授 医学研究科　人間健康科学系専攻 検査技術科学コース　医療検査展開学講座 検査応用開発学	田畑（タバタ）　泰彦（ヤスヒコ）　教授 再生医科学研究所 生体組織工学研究部門 生体材料学分野	佐藤（サトウ）　文規（フミノリ）　特定助教 再生医科学研究所 再生増殖制御学 (瀬原研究室)
7	薬学	医薬創科学情報	システムバイオロジー分野	小島（コジマ）　莉果（リカ）	RNA制御による生体リズム発振機構の解明 (RNA regulation of circadian oscillation in mammals)	岡村（オカムラ）　均（ヒトシ）　教授 薬学研究科　医薬創成情報科学専攻 医薬創成情報科学講座 システムバイオロジー分野	松田（マツダ）　道行（ミチユキ）　教授 医学研究科　基礎病態学講座 病態生物医学	矢和多（ヤワタ）　智（サトシ）　特定助教 医学研究科 生体情報科学 （渡邉研究室）
8	工学	高分子化学	重合化学分野	成清（ナリキヨ）　颯斗（ハヤト）	有機ー無機ハイブリッドの機能性生体関連材料への応用 (Application of organic-inorganic hybrids to functional biomaterials)	中條（チュウジョウ）　善樹（ヨシキ）　教授 工学研究科　高分子化学専攻 高分子合成講座　重合化学分野	森（モリ）　泰生（ヤスオ）　教授 工学研究科　合成・生物化学専攻 生物化学講座　分子生物化学分野	今井（イマイ）　宏彦（ヒロヒコ）　特定助教 医学研究科 人間健康科学系専攻 医療画像情報システム学 （椎名研究室）
9	医学	医学	遺伝医学講座 放射線遺伝学	赤川（アカガワ）　礼美（レミ）	がん細胞における相同組換え因子の発現レベルを基にした、患者毎のがん治療効果予測法の開発 (The development of in silico approach based on the expression level of homologous recombination factors to predict cancer therapy effect)	武田（タケダ）　俊一（シュンイチ）　教授 医学研究科　遺伝医学講座 放射線遺伝学	掛谷（カケヤ）　秀昭（ヒデアキ）　教授 薬学研究科 医薬創成情報科学専攻　医薬創成情報科学講座 ｼｽﾃﾑｹﾐｾﾗﾋﾞｰ(制御分子学)	髙橋（タカハシ）　めい子（メイコ）　特定講師 医学研究科　附属ゲノム医学センター 疾患ゲノム疫学解析分野 (松田研究室)
10	医学	医学	遺伝医学講座 放射線遺伝学	Akter（アクター） Salma（サルマ）	Development of the method of predicting the oncogenic potential of mutations found in the BRCA1 gene in healthy females	武田（タケダ）　俊一（シュンイチ）　教授 医学研究科　遺伝医学講座 放射線遺伝学	佐治（サジ）　英郎（ヒデオ）　教授 薬学研究科　薬学専攻 病態機能解析学講座　病態機能分析学分野	今井　宏彦　特定助教 医学研究科 人間健康科学系専攻 医療画像情報システム学 （椎名研究室）
11	医学	医学	再生統御学研究部門 再生増殖制御学	王（オウ）　梓（シ）	ゼブラフィッシュを用いた加齢に伴う筋萎縮の分子メカニズムの解明 (Elucidation of the molecular mechanisms underlying aging-associated muscle atrophy using zebrafish)	瀬原（セハラ）　淳子（アツコ）　教授 再生医科学研究所 再生統御学研究部門 再生増殖制御学	斎藤（サイトウ）　通紀（ミチノリ）　教授 医学研究科　生体構造医学講座 機能微細形態学	平井（ヒライ）　康治（ヤスハル）　特定助教 医学部先端棟4階410号室 LIMS教員室
12	薬学	薬学	病体機能解析学講座 生体機能解析学	長島（ナガシマ）　卓也（タクヤ）	1.データベース解析を駆使した最適な薬物治療法の提案 2.医薬品有害事象データベースFAERSを用いた副作用発現リスク因子の探索及び予測 (1.Research on the optimal pharmacotherapy using database analysis　2.Exploration and prediction of the risk factors for drug's side effects using adverse drug event database FAERS)	金子（カネコ）　周司（シュウジ）　教授 薬学研究科　薬学専攻 病態機能解析学講座　生体機能解析学分野	松田（マツダ）　秀一（シュウイチ）　教授 医学研究科　感覚運動系外科学講座 整形外科学	木下（キノシタ）　武彦（タケヒコ）　特定講師 医学部先端棟4階410号室 LIMS教員室

2016.09.01

平成２８年度（Ｌ２）　ＬＩＭＳ履修者・指導教授・メンター一覧

※メンターについて
上段：名前　　下段：勤務場所

	研究科	専攻	分野等	氏名	LIMS研究テーマ	研究科指導教授	LIMS指導教授	メンター
1	医学	医科学	放射線遺伝学	ラーマン　ムハンマド　モミヌール Rahman Md Maminur	ミスマッチ修復因子MLH3及びPMS2のホリデイ構造の解離における役割 (The role of mismatch repair (MMR) factors, the MLH3 and PMS2 nucleases in resolution of Holliday Junction)	タケダ　シュンイチ 武田　俊一　教授 医学研究科　遺伝医学講座 放射線遺伝学	モリ　ヤスオ 森　泰生　教授 工学研究科　合成・生物化学専攻 生物化学講座　分子生物化学分野	タキモト　アキ 滝本　晶　特定助教 再生医科学研究所 生体分子設計学 （開研究室）
2	医学	医科学	臨床神経学	シャミマ　スルタナ SHAMIMA SULTANA	デジタル脳波ネットワークを用いた国内および国外（特にアジア地域）における脳波遠隔判読システムの運用の確立 (Establishment of network-based, remote reading system of digital-electroencephalogram in nationwide- or global area)	タカハシ　リョウスケ 髙橋　良輔　教授 医学研究科　脳病態生理学講座 臨床神経学	カケヤ　ヒデアキ 掛谷　秀昭　教授 薬学研究科 医薬創成情報科学専攻 医薬創成情報科学講座 ｼｽﾃﾑｹﾐｾﾗﾋﾟｰ(制御分子学)	ディン　ハ　ユイ　ティ Dinh Ha Duy Thuy　特定助教 医学研究科 脳機能総合研究センター
3	薬学	薬科学	生体機能解析学	オヤマ　ショウヘイ 尾山　翔平	慢性膀胱炎モデルにおける食事の役割 (A role of diet in a mouse model of chronic cystitis)	カネコ　シュウジ 金子　周司　教授 薬学研究科　薬学専攻 病態機能解析学講座　生体機能解析学分野	オガワ　オサム 小川　修　教授 医学研究科　器官外科学講座 泌尿器科学	ヒガシモリ　ノブユキ 東森　信就　特定講師 情報学研究科 応用解析学講座 （磯研究室）
4	薬学	薬科学	病態情報薬学	マツモト　アキヒロ 松本　明宏	エキソソームを利用した高齢者疾患の治療法の開発 (Development of Exosome-based treatment for elderly people)	タカクラ　ヨシノブ 髙倉　喜信　教授 薬学研究科　薬学専攻 病態機能解析学講座　病態情報薬学分野	サカイ　ヨシハル 坂井　義治　教授 医学研究科　外科学講座 消化管外科学	タカハシ　メイコ 高橋　めい子　特定講師 医学研究科 附属ゲノム医学センター 疾患ゲノム疫学解析分野 (松田研究室)
5	薬学	医薬創成情報科学	システムケモセラピー	リ　セツ ヒョウ 李　雪氷	がん分子標的化学療法における低酸素応答シグナル：UCHL1-HIF経路 (A research in molecular target chemotherapy of cancer in hypoxia response signals: UCHL1-HIF Pathway)	カケヤ　ヒデアキ 掛谷　秀昭　教授 薬学研究科 医薬創成情報科学専攻 医薬創成情報科学講座 ｼｽﾃﾑｹﾐｾﾗﾋﾟｰ(制御分子学)	スズキ　シゲヒコ 鈴木　茂彦　教授 医学研究科　感覚運動系外科学講座 形成外科学	サトウ　フミノリ 佐藤　文規　特定助教 再生医科学研究所 再生増殖制御学 (瀬原研究室)
6	工学	エンジニアリング マイクロ	バイオメカニクス	マツムラ　ヤスユキ 松村　保之	高齢者における骨代謝異常と運動器障害の現状と課題 (Current issues of metabolic bone diseases and movement disorders in old person)	アダチ　タイジ 安達　泰治　教授 再生医科学研究所 ナノ再生医工学研究センター バイオメカニクス研究領域	マツダ　シュウイチ 松田　秀一　教授 医学研究科　感覚運動系外科学講座 整形外科学	タキモト　アキ 滝本　晶　特定助教 再生医科学研究所 生体分子設計学 （開研究室）
7	工学	高分子化学	生体機能高分子	ミウラ 三浦　理紗子	免疫系を制御しえる新規ナノ微粒子の開発 (Development of new functional nanoparticles for immunotherapy.)	アキヨシ　カズナリ 秋吉　一成　教授 工学研究科　高分子化学専攻 高分子物性講座 生体機能高分子分野	キムラ　シュンサク 木村　俊作　教授 工学研究科　材料化学専攻 高分子材料化学講座 生体材料化学分野	タカハシ　メイコ 高橋　めい子　特定講師 医学研究科 附属ゲノム医学センター 疾患ゲノム疫学解析分野 (松田研究室)

平成２８年度（Ｌ３）　ＬＩＭＳ履修者・指導教授・メンター一覧

※メンターについて
上段：名前　　下段：勤務場所

	研究科	専攻	分野等	氏名	LIMS研究テーマ	研究科指導教授	LIMS指導教授	メンター
1	医学	医科学	iPS細胞研究所 臨床応用研究部門 疾患再現研究分野	松原（マツバラ）　弘幸（ヒロユキ）	iPS細胞由来NK細胞を用いた疾患治療に関する研究 （NK cells derived from iPS cells for a clinical application）	中畑（ナカハタ）　龍俊（タツシ）　教授 iPS細胞研究所　臨床応用研究部門 疾患再現研究分野	安達（アダチ）　泰治（タイジ）　教授 再生医科学研究所 ナノ再生医工学研究センター バイオメカニクス研究領域	佐藤（サトウ）　文規（フミノリ）　特定助教 再生医科学研究所 再生増殖制御学 (瀬原研究室)
2	医学	医科学	遺伝医学講座 放射線遺伝学	SAHA（サハ）　Liton（リトン）　Kumar（クマール）	Assessment of the proteolytic activity role of SPRTN in DNA-Protein crosslink repair in human	武田（タケダ）　俊一（シュンイチ）　教授 医学研究科　遺伝医学講座 放射線遺伝学	前川（マエカワ）　平（タイラ）　教授 医学研究科　輸血医学	矢和多（ヤワタ）　智（サトシ）　特定助教 医学研究科 生体情報科学 （渡邉研究室）
3	医学	医科学	脳機能総合研究センター	Aila（アイラ）　Johanna（ヨハンナ）	The potential of linguistic methods for evaluation of age-related cognitive decline	村井（ムライ）　俊哉（トシヤ）　教授 医学研究科　脳病態生理学講座 精神医学	平家（ヘイケ）　俊男（トシオ）　教授 医学研究科　発生発達医学講座 発達小児科学	Dinh（ディン）　Ha（ハ）　Duy（ユイ）　Thuy（ティ）　特定助教 医学研究科 脳機能総合研究センター
4	薬学	薬科学	化学研究所 生体機能化学研究系 生体機能設計化学	篠田（シノダ）　昂樹（コウキ）	時間生物学からみた加齢に伴うバイオリズムの変化と疾患発症・治療に関する研究 （Association between age-related changes in biorhythm and disease onset; chronobiological study and its application to clinical treatment）	二木（フタキ）　史朗（シロウ）　教授 化学研究所　生体機能化学研究系 生体機能設計化学	松田（マツダ）　道行（ミチユキ）　教授 医学研究科　基礎病態学講座 病態生物医学	滝本（タキモト）　晶（アキ）　特定助教 再生医科学研究所 生体分子設計学 （開研究室）
5	薬学	医薬創成情報科学	医薬創成情報科学講座 システムバイオロジー分野	堂上（ドウジョウ）　久美子（クミコ）	シフトワーカーがかかりやすい病気の研究 （The Health Risks of Shift Work）	岡村（オカムラ）　均（ヒトシ）　教授 薬学研究科　医薬創成情報科学専攻 医薬創成情報科学講座 システムバイオロジー分野	渡邉（ワタナベ）　大（ダイ）　教授 医学研究科　生体情報科学講座 生体情報科学	木下（キノシタ）　武彦（タケヒコ）　特定講師 医学部先端棟4階410号室 LIMS教員室
6	工学	分子工学	生体分子機能化学講座	宇野（ウノ）　雅俊（マサトシ）	抗炎症シグナルタンパク質TIARPの機能解析 （Functional analysis of TIARP as anti-inflammatory signal protein）	白川（シラカワ）　昌宏（マサヒロ）　教授 工学研究科　分子工学専攻 生体分子機能化学講座	岩田（イワタ）　想（ソウ）　教授 医学研究科　分子生体統御学講座 分子細胞情報学	高橋（タカハシ）　めい子（メイコ）　特定講師 医学研究科 附属ゲノム医学センター 疾患ゲノム疫学解析分野 （松田研究室）
7	工学	高分子化学	高分子合成講座 重合化学分野	末永（スエナガ）　和真（カズマサ）	生体分子定量のための有機－無機ハイブリッド材料を基盤とした機能性光学材料の開発 （Development of Functional Optical Materials for Quantifying Biomolecules Based on Organic-Inorganic Hybrids）	中條（チュウジョウ）　善樹（ヨシキ）　教授 工学研究科　高分子化学専攻 高分子合成講座　重合化学分野	足立（アダチ）　壮一（ソウイチ）　教授 医学研究科　人間健康科学系専攻 検査技術科学コース医療検査展開学講座 検査応用開発学	東森（ヒガシモリ）　信就（ノブユキ）　特定講師 情報学研究科 応用解析学講座 （磯研究室）
8	工学	合成・生物化学	合成化学講座 物理有機化学分野	西谷（ニシタニ）　暢彦（ノブヒコ）	生体超分子の構築を目指した協同的組織化プロセスの制御 （Control of Cooperative Self-Assembly for Bio-Inspired Supramolecular Materials）	松田（マツダ）　建児（ケンジ）　教授 工学研究科　合成・生物化学専攻 合成化学講座　物理有機化学分野	野田（ノダ）　亮（マコト）　教授 医学研究科　分子生体統御学講座 分子腫瘍学	平井（ヒライ）　康治（ヤスハル）　特定助教 医学部先端棟4階410号室 LIMS教員室

平成２８年度（Ｌ４）　LIMS履修者・指導教授・メンター一覧

※メンターについて
上段：名前　　下段：勤務場所

	研究科	専攻	分野等	氏名	LIMS研究テーマ	研究科指導教授	LIMS指導教授	メンター
1	医学	人間健康科学系	検査技術科学コース 医療画像情報システム学	五明（ゴミョウ）　美香子（ミカコ）	超音波弾性イメージング法の組織発熱解析による安全性評価 （Safety assessment of ultrasound elastography by analyzing thermal effect of soft tissue）	椎名（シイナ）　毅（ツヨシ）　教授 医学研究科　人間健康科学系専攻 検査技術科学コース　情報理工医療学講座 医療画像情報システム学	戸井（トイ）　雅和（マサカズ）　教授 医学研究科　外科学講座 乳腺外科学	木下（キノシタ）　武彦（タケヒコ）　特定講師 医学部先端棟4階410号室 LIMS教員室
2	薬学	薬科学	病態機能解析学講座 生体機能解析学	宮之原（ミヤノハラ）　遵（ジュン）	海馬萎縮を伴う血管性認知症におけるTRPM2の病態生理学的役割 (Pathophysiological role of TRPM2 in a mouse model of vascular dementia with hippocampal atrophy)	金子（カネコ）　周司（シュウジ）　教授 薬学研究科　薬学専攻 病態機能解析学講座　生体機能解析学分野	木下（キノシタ）　彩栄（アヤエ）　教授 医学研究科　地域看護学 在宅医療看護学	平井（ヒライ）　康治（ヤスハル）　特定助教 医学部先端棟4階410号室 LIMS教員室
3	工学	高分子化学	高分子物性講座 生体機能高分子分野	粟原（クワバラ）　令（レイ）	細胞移植による糖尿病治療と高齢化社会 （Meaning of treatment of diabetics by cell transplantation in aged society.）	秋吉（アキヨシ）　一成（カズナリ）　教授 工学研究科　高分子化学専攻 高分子物性講座　生体機能高分子分野	木村（キムラ）　剛（タケシ）　教授 医学研究科　内科学講座 循環器内科学	滝本（タキモト）　晶（アキ）　特定助教 再生医科学研究所 生体分子設計学 （開研究室）
4	工学	合成・生物化学	生物化学講座 生体認識化学分野	水藤（スイトウ）　拓人（タクト）	加齢に伴う健康障害と腸内細菌との関わりについて （Study on age-related disease and gut microbiome）	梅田（ウメダ）　真郷（マサト）　教授 工学研究科　合成・生物化学専攻 生物化学講座　生体認識化学分野	渡邉（ワタナベ）　大（ダイ）　教授 医学研究科　生体情報科学講座 生体情報科学	東森（ヒガシモリ）　信就（ノブユキ）　特定講師 情報学研究科 応用解析学講座 （磯研究室）
5	工学	合成・生物化学	生物化学講座 分子生物化学分野	山口（ヤマグチ）　一真（カズマ）	・脊髄小脳失調症6型におけるCACNA1A遺伝子のmRNA splicing機構の解明 ・脊髄小脳変性症の分子病理学的知見 (・ Elucidate the mRNA splicing mechanisms of CACNA1A gene in Spinocerebellar Ataxia type 6. ・ Molecular pathological study of spinocerebellar degeneration.)	森（モリ）　泰生（ヤスオ）　教授 工学研究科　合成・生物化学専攻 生物化学講座　分子生物化学分野	髙橋（タカハシ）　良輔（リョウスケ）　教授 医学研究科　脳病態生理学講座 臨床神経学	矢和多（ヤワタ）　智（サトシ）　特定助教 医学研究科 生体情報科学 （渡邉研究室）

2.

教育カリキュラム及び指導体制

Curriculum and Staff

平成28年度 履修科目表（修士・博士後期課程）

No	科目群		科　目	担当者	修士				博士後期						備考
					1年次		2年次		3年次		4年次		5年次		
					前	後	前	後	前	後	前	後	前	後	
1	基盤科目	工学	機械工学基礎	中部・安達	2										8月集中
2			医用電子工学	椎名・杉本		2									
3			材料化学基礎	近藤・木村祐		2									
4			医薬用高分子設計学	田畑				2							
5			連続体力学	安達		2									
6			生物分子解析学	森・西		2									
7			＊画像処理の基礎	杉本・椎名			2								
8		薬学	＊薬物動態学	中山・高倉・橋田・樋口				2							
9		医学・生物学	人体解剖学	萩原・山田・青山・松田	5										必修
10			生理学	大森・河野		2									必修 9月～
11			＊医化学	渡邉・YOUSSEFIAN	2										
12			＊加齢医学	荒井			2								
13			再生医学	開・瀬原・田畑・安達				2							
14			ゲノムコホート研究	松田文・高橋			2								
15		医療倫理	＊医療倫理	小杉・福山			1								
16	数理科学		＊基礎数学	東森	2										
17			＊シミュレーション概論	木下		2									
18			＊応用数学	木下・東森		2									
19	医療経済学		＊医療経済論	後藤			2								
20			＊知的財産＆国際標準化	寺西			2								
21	医療工学特別講義		＊医療工学特別講義Ⅰ	福山		2									9月～
22			＊医療工学特別講義Ⅱ	福山			2								
	学際応用科目	講義	＊　1. 画像診断学												
23			1-1 病理画像診断学	羽賀		1									
24			1-2 放射線画像診断学	福山		1									
25			1-3 MRI画像診断学	福山											
26			＊　2. 低侵襲治療学	木村剛・高折		1									
27			＊　3. 生体材料学・人工臓器学	田畑・松田秀				1							
28			＊　4. 医療情報学	黒田				1							
29			＊　5. 検査機器学・研究機器学	一山				1							
30			＊　6. 医療・生活支援システム学	椎名	1										必修 9月～

No	科目群		科　目	担当者	修士				博士後期						備考
					1年次		2年次		3年次		4年次		5年次		
					前	後	前	後	前	後	前	後	前	後	
	学際応用科目	実習及び病院内研修	＊ 1. 画像診断学												
23			1-1 病理画像診断学	羽賀		1									
24			1-2 放射線画像診断学	福山		1									
25			1-3 MRI画像診断学	福山											
26			＊ 2. 低侵襲治療学	木村剛・高折		1									
27			＊ 3. 生体材料学・人工臓器学	田畑・松田秀				1							
28			＊ 4. 医療情報学	黒田				1							
29			＊ 5. 検査機器学・研究機器学	一山				1							
30			＊ 6. 医療・生活支援システム学	椎名	1										必修 9月～
31	英語 debate Ⅰ			Altmann	2										必修
32	英語 debate Ⅱ			Altmann			2								必修
33	英語 debate Ⅲ			Altmann											必修
34	英語 debate Ⅳ			Altmann											必修
35	英語 debate Ⅴ			Altmann											必修
36	インターンシップ		短期海外インターンシップ	武田・福山											*1 選択必修
37			企業・公的機関インターンシップ	福山											
38	プレリサーチ			担当教員											必修
39	特別研究			担当教員											必修

網掛けは履修学年・学期、数字は単位数

学際応用科目は、講義及び実習の両方を受講しないと単位は認められない。

*1 短期海外インターンシップまたは企業・公的機関インターンシップのどちらかを選択し、必ず修得すること

修士課程での必修単位数　13単位

*印の科目は、推奨科目

平成28年度　履修科目表（医学専攻 博士課程）

No	科目群		科　　目	担当者	Medical	Non medical	博士課程								備考
							1年次		2年次		3年次		4年次		
							前	後	前	後	前	後	前	後	
1	基盤科目	工学	機械工学基礎	中部・安達	*1選択必修		2								8月集中
2			医用電子工学	椎名・杉本				2							
3			材料化学基礎	近藤・木村祐	*1選択必修			2							
4			医薬用高分子設計学	田畑						2					
5			連続体力学	安達				2							
6			生物分子解析学	森・西				2							
7			画像処理の基礎	杉本・椎名					2						
8		薬学	薬物動態学	中山・高倉・橋田・樋口						2					
9		医学・生物学	人体解剖学	萩原・山田・青山・松田和	免除	必修	5								
10			生理学	大森・河野	免除	必修		2							9月～
11			医化学	渡邉・YOUSSEFIAN			2								
12			加齢医学	荒井					2						
13			再生医学	開・瀬原・田畑・安達						2					
14			ゲノムコホート研究	松田文・高橋					2						
15		医療倫理	医療倫理	小杉・福山					1						
16	数理科学		基礎数学	東森	必修		2								
17			シミュレーション概論	木下	*2選択必修			2							
18			応用数学	木下・東森				2							
19	医療経済学		医療経済論	後藤	必修				2						
20			知的財産＆国際標準化	寺西	必修				2						
21	医療工学特別講義		医療工学特別講義Ⅰ	福山				2							9月～
22			医療工学特別講義Ⅱ	福山					2						
	学際応用科目	講義	1.画像診断学												
23			1-1　病理画像診断学	羽賀				1							
24			1-2　放射線画像診断学	福山				1							
25			1-3　MRI画像診断学	福山											
26			2.低侵襲治療学	木村剛・高折				1							
27			3.生体材料学・人工臓器学	田畑・松田秀						1					
28			4.医療情報学	黒田						1					
29			5.検査機器学・研究機器学	一山						1					
30			6.医療・生活支援システム学	椎名	必修		1								9月～

	科目群	科　　目		担当者	Medical	Non medical	博士課程								備考
							1年次		2年次		3年次		4年次		
							前	後	前	後	前	後	前	後	
	学際応用科目	実習及び病院内研修	1.画像診断学												
23			1-1　病理画像診断学	羽賀				1							
24			1-2　放射線画像診断学	福山				1							
25			1-3　MRI画像診断学	福山											
26			2.低侵襲治療学	木村剛・高折				1							
27			3.生体材料学・人工臓器学	田畑・松田秀						1					
28			4.医療情報学：実習	黒田						1					
29			5.検査機器学・研究機器学	一山						1					
30			6.医療・生活支援システム学	椎名	必修		1								9月～
32	英語 debateⅡ			Altmann	必修										
33	英語 debateⅢ			Altmann	必修										
34	英語 debateⅣ			Altmann	必修										
35	英語 debate Ⅴ			Altmann	必修										
36	インターンシップ	短期海外インターンシップ		武田・福山	*3 選択必修										
37		企業・公的機関インターンシップ		福山											
39	特別研究			担当教員	必修										

網掛けは、履修学年・学期。数字は単位数

*1 機械工学基礎及び材料化学基礎から必ず1科目を選択し履修すること。

*2 シミュレーション概論及び応用数学から必ず1科目を選択し履修すること。

*3 短期海外インターンシップ及び企業・公的機関インターンシップから必ず1科目を選択し、履修すること

学際応用科目は、講義及び実習の両方を受講しないと単位は認められない。

平成28年度　履修科目表（薬学専攻 博士課程）

No.	科目群		科　　目	担当者	区分	博士課程								備考
						1年次		2年次		3年次		4年次		
						前	後	前	後	前	後	前	後	
1	基盤科目	工学	機械工学基礎	中部・安達	*1選択必修	2								8月集中
2			医用電子工学	椎名・杉本			2							
3			材料化学基礎	近藤・木村祐	*1選択必修		2							
4			医薬用高分子設計学	田畑					2					
5			連続体力学	安達			2							
6			生物分子解析学	森・西			2							
7			画像処理の基礎	杉本・椎名				2						
8		薬学	薬物動態学	中山・高倉・橋田・樋口					2					
9		医学・生物学	人体解剖学	萩原・山田・青山・松田和	必修	5								
10			生理学	大森・河野	必修		2							9月～
11			医化学	渡邉・YOUSSEFIAN		2								
12			加齢医学	荒井				2						
13			再生医学	開・瀬原・田畑・安達					2					
14			ゲノムコホート研究	松田文・高橋				2						
15		医療倫理	医療倫理	小杉・福山				1						
16	数理科学		基礎数学	東森		2								
17			シミュレーション概論	木下			2							
18			応用数学	木下・東森			2							
19	医療経済学		医療経済論	後藤	必修			2						
20			知的財産＆国際標準化	寺西	必修			2						
21	医療工学特別講義		医療工学特別講義Ⅰ	福山			2							9月～
22			医療工学特別講義Ⅱ	福山				2						
	学際応用科目	講義	1.画像診断学											
23			1-1　病理画像診断学	羽賀			1							
24			1-2　放射線画像診断学	福山			1							
25			1-3　MRI画像診断学	福山										
26			2.低侵襲治療学	木村剛・高折			1							
27			3.生体材料学・人工臓器学	田畑・松田秀					1					
28			4.医療情報学	黒田					1					
29			5.検査機器学・研究機器学	一山					1					
30			6.医療・生活支援システム学	椎名	必修	1								9月～

	科目群		科　　目	担当者	区分	博士課程								備考
						1年次		2年次		3年次		4年次		
						前	後	前	後	前	後	前	後	
	学際応用科目	実習及び病院内研修	1.画像診断学											
23			1-1　病理画像診断学	羽賀			1							
24			1-2　放射線画像診断学	福山			1							
25			1-3　MRI画像診断学	福山										
26			2.低侵襲治療学	木村剛・高折			1							
27			3.生体材料学・人工臓器学	田畑・松田秀					1					
28			4.医療情報学：実習	黒田					1					
29			5.検査機器学・研究機器学	一山					1					
30			6.医療・生活支援システム学	椎名	必修	1								9月～
32	英語 debateⅡ			Altmann	必修									
33	英語 debateⅢ			Altmann	必修									
34	英語 debateⅣ			Altmann	必修									
35	英語 debateⅤ			Altmann	必修									
36	インターンシップ		短期海外インターンシップ	武田・福山	*2 選択必修									
37			企業・公的機関インターンシップ	福山										
39	特別研究			担当教員	必修									

網掛けは、履修学年・学期。数字は単位数

*1 機械工学基礎及び材料化学基礎から必ず1科目を選択し履修すること。

*2 短期海外インターンシップ及び企業・公的機関インターンシップから必ず1科目を選択し、履修すること

学際応用科目は、講義及び実習の両方を受講しないと単位は認められない。

Curriculum (FY 2016)

(5-year doctoral course)

No	Subjects	Lecturer	1st Grade		2nd Grade		3rd Grade		4th Grade		5th Grade		Remarks
			1st Sem	2nd Sem	1st Sem	2nd Sem	1st Sem	2nd Sem	1st Sem	2nd Sem	1st Sem	2nd Sem	
1	Mechanics and Dynamics, Fundamental	Nakabe, Adachi	2										
2	Medical Electronics	Shiina, Sugimoto		2									
3	Basic Materials Chemistry	Kondo, Kimura		2									
4	Design of Biomaterials for Medical and Pharmaceutical Applications	Tabata				2							
5	Continuum Mechanics	Adachi		2									
6	Molecular Analysis of Life	Mori、Nishi		2									
7	＊ Image Processing Basics	Sugimoto, Shiina			2								
8	＊ Biopharmaceutics	Nakayama, Takakura, Hashida, Higuchi				2							
9	Human Anatomy	Hagiwara,Yamada,Aoyama,Matsu	5										Compulsory
10	Physiology	Ohmori, Kawano		2									Compulsory (Sep.～)
11	＊ Medical Chemistry	Watanabe,YOUSSEFIAN	2										
12	＊ Gerontology, Geriatrics, and Aging Science	Arai			2								
13	Regenerative Medicine	Hiraki, Sehara, Tabata, Adachi				2							
14	Genome Cohort Study	Matsuda, Takahashi			2								
15	＊ Medical Ethics	Kosugi, Fukuyama			1								
16	＊ Basic Mathematics	Higashimori	2										
17	＊ Introduction to Numerical Simulation	Kinoshita		2									
18	:＊ Applied Mathematics	Kinoshita, Higashimori		2									
19	＊ Health Economics	Goto			2								
20	＊ Intellectual Property & Global Standardization	Teranishi			2								
21	＊ Medical Engineering for Society Ⅰ	Fukuyama		2									Sep.～
22	＊ Medical Engineering for Society Ⅱ	Fukuyama			2								
	◆ Interdisciplinary application（1～6）												
	＊ 1. Medical imaging: Lecture												
23	1-1 Diagnostic Pathology	Haga		1									
24	1-2 Radiology	Fukuyama		1									
25	1-3 MRI introduction	Fukuyama											
26	＊ 2. Minimally invasive therapeutics : Lecture	Kimura,Takaori		1									
27	＊ 3. Biomaterials and Artificial Organs : Lecture	Tabata, Matsuda				1							
28	＊ 4. Medical informatics : Lecture	Kuroda				1							
29	＊ 5. Inspection equipment studies Science research equipment :Lecture	Ichiyama				1							
30	＊ 6. Medical and life support systems : Lecture	Shiina	1										Compulsory (Sep.～)

No	Subjects	Lecturer	1st Grade		2nd Grade		3rd Grade		4th Grade		5th Grade		Remarks
			1st Sem	2nd Sem	1st Sem	2nd Sem	1st Sem	2nd Sem	1st Sem	2nd Sem	1st Sem	2nd Sem	
	＊ 1. Medical imaging : Practice												
23	1-1 Diagnostic Pathology	Haga		1									
24	1-2 Radiology	Fukuyama		1									
25	1-3 MRI introduction	Fukuyama											
26	＊ 2. Minimally invasive therapeutics : Practice	Kimura,Takaori		1									
27	＊ 3. Biomaterials and Artificial Organs : Practice	Tabata, Matsuda				1							
28	＊ 4. Medical informatics: Practice	Kuroda				1							
29	＊ 5. Inspection equipment studies Science research equipment : Practice	Ichiyama				1							
30	＊ 6. Medical and life support systems : Practice	Shiina	1										Compulsory (Sep.～)
31	Debate Ⅰ	Altmann	2										Compulsory
32	Debate Ⅱ	Altmann			2								Compulsory
33	Debate Ⅲ	Altmann											Compulsory
34	Debate Ⅳ	Altmann											Compulsory
35	Debate Ⅴ	Altmann											Compulsory
36	Internship (Abroad)	Takeda, Fukuyama											＊1 Compulsory elective
37	Internship (Industrial and public parties)	Fukuyama											
38	Pre-research												Compulsory
39	Thesis Research												Compulsory

Number: The number of credits

Note: Students must take both the lecture and practice for "the Interdisciplinary application".

＊ for recommended courses

＊ 1 Students must take either "Internship (Abroad)" or "Internship (Industrial)".

Curriculum (FY 2016)

(4-year doctoral course)

No	Subjects	Lecturer	Medical	Non medical	1st Grade		2nd Grade		3rd Grade		4th Grade		Remarks
					1st Sem	2nd Sem	1st Sem	2nd Sem	1st Sem	2nd Sem	1st Sem	2nd Sem	
1	Mechanics and Dynamics, Fundamental	Nakabe, Adachi	＊1 Compulsory elective		2								
2	Medical Electronics	Shiina, Sugimoto				2							
3	Basic Materials Chemistry	Kondo, Kimura	＊1 Compulsory elective			2							
4	Design of Biomaterials for Medical and Pharmaceutical Applications	Tabata						2					
5	Continuum Mechanics	Adachi				2							
6	Molecular Analysis of Life	Mor, Nishi				2							
7	Image Processing Basics	Sugimoto, Shiina					2						
8	Biopharmaceutics	Nakayama, Takakura, Hashida, Higuchi						2					
9	Human Anatomy	Hagiwara,Yamada,Aoyama,Matsuda	Exemption	Compulsory	5								
10	Physiology	Ohmori, Kawano	Exemption	Compulsory		2							Sep.～
11	Medical Chemistry	Watanabe, YOUSSEFIAN			2								
12	Gerontology, Geriatrics, and Aging Science	Arai					2						
13	Regenerative Medicine	Hiraki, Sehara, Tabata, Adachi						2					
14	Genome Cohort Study	Matsuda, Takahashi					2						
15	Medical Ethics	Kosugi, Fukuyama					1						
16	Basic Mathematics	Higashimori	Compulsory		2								
17	Introduction to Numerical Simulation	Kinoshita	＊2 Compulsory elective			2							
18	Applied Mathematics	Kinoshita, Higashimori				2							
19	Health Economics	Goto	Compulsory				2						
20	Intellectual Property & Global Standardization	Teranishi	Compulsory				2						
21	Medical Engineering for Society Ⅰ	Fukuyama				2							Sep.～
22	Medical Engineering for Society Ⅱ	Fukuyama					2						
	◆ Interdisciplinary application（1～6）												
	1. Medical imaging: Lecture												
23	1-1 Diagnostic Pathology	Haga				1							
24	1-2 Radiology	Fukuyama				1							
25	1-3 MRI introduction	Fukuyama											
26	2. Minimally invasive therapeutics : Lecture	Kimura,Takaori				1							
27	3. Biomaterials and Artificial Organs : Lecture	Tabata, Matsuda						1					
28	4. Medical informatics : Lecture	Kuroda						1					
29	5. Inspection equipment studies Science research equipment :Lecture	Ichiyama						1					
30	6. Medical and life support systems : Lecture	Shiina	Compulsory		1								Sep.～

No	Subjects	Lecturer			1st Grade		2nd Grade		3rd Grade		4th Grade		Remarks
					1st Sem	2nd Sem	1st Sem	2nd Sem	1st Sem	2nd Sem	1st Sem	2nd Sem	
	1. Medical imaging : Practice												
23	1−1 Diagnostic Pathology	Haga				1							
24	1−2 Radiology	Fukuyama				1							
25	1−3 MRI introduction	Fukuyama											
26	2. Minimally invasive therapeutics : Practice	Kimura,Takaori				1							
27	3. Biomaterials and Artificial Organs : Practice	Tabata, Matsuda						1					
28	4. Medical informatics: Practice	Kuroda						1					
29	5. Inspection equipment studies Science research equipment : Practice	Ichiyama						1					
30	6. Medical and life support systems : Practice	Shiina	Compulsory		1								Sep.～
31	Debate Ⅱ	Altmann	Compulsory										
32	Debate Ⅲ	Altmann	Compulsory										
33	Debate Ⅳ	Altmann	Compulsory										
34	Debate Ⅴ	Altmann	Compulsory										
36	Internship （Abroad）	Takeda, Fukuyama	＊3 Compulsory elective										
37	Internship （Industrial and public parties）	Fukuyama											
39	Thesis Research		Compulsory										

Number: The number of credits

Note: Students must take both the lecture and practice for "the Interdisciplinary application".

＊1 Students must take either "Mechanics and Dynamics, Fundamental"or "Basic Materials Chemistry".

＊2 Students must take either "Introduction to Numerical Simulation" or " Applied Mathematics".

＊3 Students must take either "Internship （Abroad)" or "Internship （Industrial)".

1. Human Anatomy

Instructors: Masatoshi Hagiwara (Professor, Dept. Anatomy and Developmental Biology)
Takeshi Kaneko (Professor, Dept. of Morphological Brain Science)
Shigeto Yamada (Professor, Graduate School of Human Health Sciences)
Tomoki Aoyama (Associate Professor, Graduate School of Human Health Sciences)
Wakoto Matsuda (Program-specific Lecturer, LIMS)

The human anatomy course is a basic subject for the second grade students of LIMS. We have considered important to teach the musculoskeletal system and kinesiology in detail, which will become essential knowledge in coping with the unprecedented aging society. The students will apply what they have learned in human anatomy to structure-movement coordination, which will help their themes in medico-engineering collaboration. This year, we have distributed handouts and asked the students to hand in reports about the fundamentals of human anatomy. During anatomical practice, the students have learned the three-dimensional arrangement of the human body by observing and touching the cadaver, studying virtual pictures and plastic models. For further learning, the students have also learned histology and microscopic anatomy including how to use a light, electron fluorescence, and confocal laser scan microscope (CLSM). An important feature of this program is to have the LIMS students experience human anatomy in a similar way as medical students do.

2. Physiology

Instructors: Harunori Ohmori (Specially Appointed Professor, LIMS)
Kenji Kawano (Specially Appointed Professor, LIMS)
Dai Watanabe (Professor, Graduate School of Medicine)
Yasuharu Hirai (Program-Specific Assistant Professor, LIMS)

The lecture course Physiology was provided as the compulsory course to the first year LIMS students from September to December. The course is organized to give the minimum essential knowledge to those who do not have medical background. Knowledge in human physiology is fundamental for understanding of the mechanisms how human can live, and should be the background to learn further the other field of medical sciences in the LIMS program. Accordingly, the Physiology lecture course is organized in the following topics:

1. summary of methodology for physiology,
2. homeostasis; its concept and examples,
3. fundamentals of neural activities; ion channels, membrane excitability, action potential, and synapse,

4. structure and function of the brain, sensory reception, and motor coordination,
5. cardiovascular system and pulmonary system.

To check and promote the students' understanding, a writing assignment was given after each topic.

At the end of lecture course, a practice of physiology was given to teach students how to conduct experiments and analyze data of physiology. Students have had a firsthand experience of human visuomotor learning through prism adaptation. They threw a ball with/without prism glasses repeatedly and measured the distance between the hit position and the target. Students realized the rapid increase of the accuracy when the prism was applied and residual "cerebellar correction" after they took off the prism.

3. Medical and daily life support systems

Instructors: Hidenori Arai (Professor, Graduate School of Medicine and Faculty of Medicine)
Mie Torii (Assistant Professor, Graduate School of Medicine and Faculty of Medicine)
Hirohiko Imai (Program-specific Assistant Professor, LIMS)

In Japan, one in four people are over 65, and we are under pressure to take increased measures to deal with welfare, nursing and medical care needs. The Ministry of Health, Labor and Welfare recommends regional comprehensive support in which older adults can spend the terminal stage of their lives in their own homes and neighborhoods rather than staying in long-term care facilities. To enhance this support, we need strengthening of coordination with welfare and medical care, full care services, promotion of preventive care, and elderly access features in the home. This course provides the lectures on basic characteristics of elderly patient life and welfare law and policy, and also provides field trips to welfare facilities. We will focus on the present condition of older adults and aim to promote dialogue and consideration how to advance medical support systems and equipment

September. 30th, 2016 Lecture (1)

A. Background of an aging society: The trend in Japan and other countries

B. The characteristics of older adults:

Progression of physical/ physiological and mental/ social function

C. Diseases associated with older adults

D. Elderly welfare law and policy:

Outline, background and service content of Long-Term Care Insurance Act

September. 23th, 2016 Field trip (1)

A. Welfare facilities

These composite facilities consist of 1) intensive-care nursing homes; 2) short-term admission for daily lifelong term-care facilities; 3) day-care centers. Local families can use facilities within the day-care centers, designed to foster intergenerational social communication with elderly patients and local families. In order to understand varied care levels, types of healthcare cooperation, life support services and regional exchange, our students observed older adults who lived in various types of facilities.

September. 27th, 2016 Field trip (2)

B. Rehabilitation day care center

This center is a novel day care center which specializes in living rehabilitation, using purpose-built machinery introduced from countries with developed welfare service infrastructures.

This center provides older adults with physical assessment and muscular workout programs supervised by physiotherapists. In order to understand the importance of prevention and rehabilitation, our students acted as subjects in the program.

4. English Debate Course and Practice

Instructor: Christian F. Altmann, Associate Professor (Graduate School of Medicine)

The English Debate course and practice was held in 2016 as a weekly course with the aim to a) improve the students' ability to form and express their opinions in English, for an audience with different scientific backgrounds and nationalities, b) improve their ability to respond to questions and to defend their opinion, and c) improve their ability to refute other people's arguments.

First year students were trained in basic argumentation skills, and the presentation of scientific and societal topics and ideas. They led various discussions, for example on the ethical implications of experiments on fish and amphibians and on the treatment of negative data in science. In addition, students presented project ideas such as implementing an improved AED (automated external defibrillator) emergency system and research on the life cycle of some peculiar jellyfish.

The second year students practiced project discussion and debate activities in teams. In one part of the course, teams of two students proposed an idea which was discussed in a simulated meeting, which – depending on the topic – simulated a science grant committee, a company board, or a political TV discussion. Exemplary topics were the fitting of micro-ICs (integrated circuits) on drugs to acquire information and a

discussion on how to decrease waiting time in hospitals.

Third and fourth year students (doctoral level) engaged in discussions with researchers from a diverse range of research fields (engineering, medicine, biochemistry, geography, global environmental studies, etc.) and nationalities (Japanese, US American, German, etc.). The students' self-chosen topic of interest was virtual/augmented reality, but other topics such as the relationship of telomeres with aging and the physics of neurodegeneration were also discussed.

Thus, the English debate course and practice provided students with a wide range of activities and discussion opportunities in English to widen their viewpoints and hone their communication skills.

5. Mechanics and Dynamics, Fundamental

Instructors: Kazuyoshi Nakabe (Professor, Dept. of Mechanical Engineering and Science)
Taiji Adachi (Professor, Institute for Frontier Life and Medical Sciences)

The course is designed to introduce mechanical engineering, mainly four fundamental dynamics such as Mechanical dynamics, Dynamics for material and structure, Fluid dynamics and Thermodynamics, to students who do not have a background of mechanical engineering. The primary aim is to acquire and refine knowledge of mechanical engineering necessary for developing novel devices or measuring systems in the medico-engineering field. In this academic year, ninety-minute classes were given during August 22nd – 24th for L1 students (Two students attended this class). In the first half of this course, those dynamics were explained with the concept of continuum physics, which can help students understand the relation between equations of motion or governing equations and real phenomena. In the lecture, we focused on the physical implications of the equations describing each dynamics and theoretically expounded common physical phenomena, such as movement and deformation of fluids or objects with mass and shape. In the second half, we introduced how those principles of mechanics have been applied to real-world equipment and systems, and also explained about the latest mechanical engineering technologies used in the field of medical or welfare engineering. Practical training of this course for L2 students was held as part of the class: Biomaterials and Artificial Organs.

[Course Content and Schedule in the 2016 academic year]

<Fundamental Mathematics>

1 Dynamics and mathematics

<Fundamental Dynamics>

2-3 Mechanical dynamics (Mass and rigid-body dynamics)

4-5 Continuum dynamics (Mechanics for deformed body)

6-7 Dynamics for material and structure (Material mechanics)

8-9 Fluid dynamics

10-11 Thermodynamics and heat transfer

<Fundamental Mechanical System Engineering>

12 Control system engineering

13 Robot system engineering

14 Micro-nano system engineering

15 Design system engineering

6. Basic Materials Chemistry

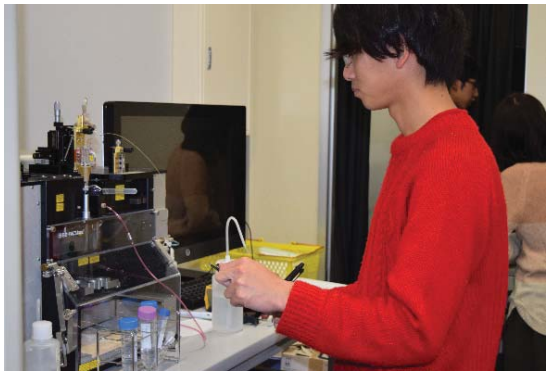
Instructors: Teruyuki Kondo (Professor, Advanced Biomedical Engineering Research Unit, C-PiER)
Yu Kimura (Program-Specific Associate Professor, LIMS)

In academic year 2016, characteristics and synthetic routes of medicines such as sulfa drug and indinavir were lectured from the viewpoint of pharmacophore, structure-property relationship, mechanism of action and their biodistribution. In contrast, biomaterials as a large bulk material for clinical use have many functional moieties and characteristic properties, such as bioavailability, biocompatibility, antithrombogeneity, or other bioactivities, the lecture summarized these properties with the explanation in molecular level. In the lecture, we put emphasis on understanding not only of basic requirements as biomaterial, but also of the reason why the chemical composition was chosen to use as a biomaterial. The knowledge would be helpful to design novel materials based on a demand in fruitful healthy-longevity society. Through the submitting report after the course and the follow-up, we evaluated students on the proficiency and utilizing ability of obtained knowledge. Also a practice in imaging chemical probes on mouse have been executed since academic year 2014. Together with students, pigment molecules as a probe were injected *via* tail vein of mice, and the distribution in body was observed with 3-D photoacoustic CT scanner and fluorescence camera-TV monitor. Moreover, dissection of organs and the photoacousitic and fluorescent imaging was performed together with students. These experiences would be helpful to prepare further anatomy and physiology courses.

7. Molecular Analysis of life

Instructors: Yasuo Mori (Professor, Graduate School of Engineering)
Masayuki Mori (Associate Professor, Graduate School of Engineering,)
Miyuki Nishi (Program-Specific Associate Professor, LIMS)

To understand analytical methods that clarify roles of molecules in controlling biological functions, fundamental techniques and knowledge will be acquired in this course. Specifically, 2nd messengers. The target of this course includes those students who are not familiar to living organisms as their subjects of experiments/studies. The course also provides an opportunity to prepare for the later advanced program curriculum of the leading program.

1. Orientation
2. Analysis of genes and determination of DNA sequences
3. Analysis of cell function by Patch clamp technique
4. Second messenger and thermosensor
5. Cell sorting (BD FACSJazz Cell Sorter)
6. Presentation and Discussion

8. Biopharmaceutics

Instructor: Kazuhisa Nakayama (Professor, Graduate School of Pharmaceutical Sciences)
Yoshinobu Takakura (Professor, Graduate School of Pharmaceutical Sciences)
Mitsuru Hashida (Professor, Graduate School of Pharmaceutical Sciences)
Yuriko Higuchi (Senior Lecturer, Graduate School of Pharmaceutical Sciences)

This lecture toward “Biopharmaceutics” was provided to 2nd-graders. In this lecture, we introduced the anatomical and physiological characteristics of tissues in the body to understand drug disposition processes, including absorption, distribution, metabolism, and excretion. Then, we explained the mechanisms of drug disposition in each process, and provide the basic concept and its application example of drug delivery system (DDS). In this year, this lecture collaborated with Applied Mathematics (Dr. Takehiko Kinoshita). LIMS students studied the basic concept of compartment model and the numerical simulation of the model using

Python in Applied Mathematics. Then, after we introduced the concept of the compartmental model of pharmacokinetics, students calculated pharmacokinetic parameters using Python. This collaboration gave the chance to know how mathematics applied in the field of biopharmaceutics.

9. Medical Chemistry

Instructor: Dai Watanabe (Professor, Dept. of Biological Sciences)
Shohab Youssefian (Professor, Dept. of Molecular Biosciences)
Satoshi Yawata (Program-Specific Assistant Professor, LIMS)

The aim of this course is that LIMS students, especially those with the background in engineering, acquire knowledge in the common diseases in the modern society. With the help of the faculty in Graduate School of Medicine, the biochemical and molecular biological mechanisms for diseases, as well as the current treatment for diseases, are explained and discussed. In this course, the students are expected to acquire the knowledge that the second- or third-grade medical students learn; the lectures cover from the basics in biochemistry, molecular biology and genetics to the mechanism of diseases, especially focused on the disease having social significance, such as cancer. In this academic year, the lectures were held from April to August, aimed at M1 and M2 students.

The LIMS students with the engineering background are expected to utilize the knowledge obtained in this course during the future development of new treatments for diseases or medical instruments. Furthermore, even for the students with the biology background, this course provides the great opportunity to study biochemistry and molecular biology from the perspective of the diseases commonly occurring in the society.

10. Regenerative Medicine

Instructors: Yuji Hiraki (Professor, Institute for Frontier Life and Medical Sciences)
Atsuko Sehara (Professor, Institute for Frontier Life and Medical Sciences)
Yasuhiko Tabata (Professor, Institute for Frontier Life and Medical Sciences)
Taiji Adachi (Professor, Institute for Frontier Life and Medical Sciences)
Hirofumi Suemori (Associate Professor, Institute for Frontier Life and Medical Sciences)
Masaya Yamamoto (Associate Professor, Institute for Frontier Life and Medical Sciences)
Yasuhiro Inoue (Associate Professor, Institute for Frontier Life and Medical Sciences)
Fuminori Sato (Program-Specific Assistant Professor, LIMS)
Aki Takimoto (Program-Specific Assistant Professor, LIMS)

The rapid advances in stem cell biology including iPS cell research and its clinical applications make it more important to comprehensively understand regenerative medicine in the various field of medicine. Institute for Frontier Life and Medical Sciences focuses on the basic and application studies on regenerative medicine

including stem cell biology, developmental biology, and tissue engineering. This course was arranged for the second year LIMS students to provide lectures on the following latest topics:

- History and recent advance of pluripotent stem cell research.
- Use of human PSCs for cell transplantation therapy
- Cellular Differentiation and Stem Cells (I), (II)
- Hard tissue development and regeneration (I) ECM, (II) Growth & differentiation, (III) Connections of building blocks
- Definition of biomaterials and their applications to medical devises and drug delivery system (DDS)
- Regenerative medicine from the viewpoint of biomaterials – Regenerative research and regenerative therapy –
- The importance of material sciences in hard tissue regenerative medicine.
- In vitro fabrication of tissue-like constructs and their applications
- Nanotechnologies for regenerative medicine
- Modeling and simulation of bone regeneration/remodeling and their application to scaffold design
- Modeling and simulation of multicellular dynamics in tissue morphogenesis

Through the lectures concerning stem cells, cellular differentiation, organogenesis, and biomaterials, we made a special effort to encourage students to find a systematic connection between basic and clinical studies on regenerative medicine. This course also provides a lecture on biomechanics to help students understand the mechanical aspects of developmental phenomenon and locomotive organs, which are latest research topics in developmental biology and regenerative medicine.

11. Basic mathematics

Instructor: Nobuyuki Higashimori (Program-Specific Senior Lecturer, LIMS)

This lecture provides basic materials of calculus and linear algebra at first-year undergraduate level, as a review for students who have once learned these materials and as an introduction for those who have not. Main topics are as follows:

- Differential and integral calculus in one and several variables,
- Ordinary differential equations,
- Extremum problems,
- Basic concepts in abstract linear space theory,
- Operations on matrices and solution of simultaneous linear equations,
- Inner product and eigenvalue problems.

These knowledge and concepts will be helpful for LIMS students who take more advanced lectures, such as numerical simulation and basic physics, and in particular for those who want to use mathematical modeling

for understanding various phenomena they are interested in.

12. Applied Mathematics

Instructor: Nobuyuki Higashimori (Program-Specific Senior Lecturer, LIMS)
Takehiko Kinoshita (Program-Specific Senior Lecturer, LIMS)

This course introduced an analysis for application and several concepts of statistics.
The former half was an introduction to topics in statistics. Statistics was provided as a mathematical methods of inference from data obtained by random sampling. This short introduction concentrated on elementary part of inference statistics, and covered topics such as random variables (discrete and continuous), sampling distribution, point and interval estimation, and statistical hypothesis testing mainly for normal population. Some nonparametric methods for testing were also included.
The latter half of this course, we described about machine learning. We explained three problems that become the target by machine learning, namely, clustering, classification, and regression. In this course, we introduced the hierarchical method, k-means clustering, DBSCAN, and mean shift method to solve the clustering problems. Moreover, decision tree, support vector machine (SVM), and random forests were introduced as the method to solve a classification and regression problem. To improve the accuracy of machine learner, we introduced preprocessing data scaling, cross validation, and parameter tuning technique. Python was adopted to actually calculate machine learner. How to use Python was explained by introduction to numerical simulation which is a LIMS lecture. Since Python has the modules not only numerical computation but also machine learning, we used the Python modules to obtain machine learners. Therefore, the students were able to learn well for the machine learning.

13. Introduction to Numerical Simulation

Instructor: Takehiko Kinoshita (Program-Specific Senior Lecturer, LIMS)

This course introduced methods of numerical simulations for various natural, chemical, physiological or social phenomena. The process of simulation is three-fold:
1: Modeling: derive a differential equation which models the phenomenon under consideration.
2: Solving: nondimensionalize the equations and solve them.
3: Visualizing: visualize the solution and analyze its properties.
It is important for modeling to recognize the variables with appropriate dimensions and to derive a relationship between them. It is also important to verify whether the derived equations have appropriate dimensions. Nondimensionalization enables us to reduce the number of parameters without loss of generality as well as to obtain equations for nondimensional quantities. I emphasized these three points in the course, and the students achieved a comprehensive understanding about them.
I taught how to use formula manipulation system in order to solve ordinary differential equations (ODE).

Numerical simulation is necessary for analyzing ODEs which are not solvable by quadrature. I taught some numerical methods, the Euler method, the Runge-Kutta method, and the Dormand-Prince method, to solve ODEs.

Python was adopted as the formula manipulation system and the numerical computation software in this course. I taught how to use Python, matrix operations, conditional expressions, loop, user-defined functions, visualization, and animation. Since we used the Python module to analytically or numerically solve ODEs, the source cords of students are well-made.

This course was collaborated with biopharmaceutics course for the compartment model this year. We analyzed the experimental data performed by biopharmaceutics course and the numerical results were used in biopharmaceutics course. I think the students who attended both lectures could understand a relation between both of simulations and experiments deeply.

In the last part of the course, I taught the qualitative theory of ordinary differential equations. Especially, I introduced the stability and bifurcation theory of equilibria. Moreover, I explained the bifurcation phenomena of equilibria for the SIR model and the FitzHugh-Nagumo equation.

14. Minimally invasive therapy

Instructors: Takeshi Kimura (Professor, Department of Cardiovascular Medicine)
Shinji Uemoto (Professor, Department of Hepato-Biliary-Pancreatic Surgery and Transplantation)
Yoshiharu Sakai (Professor, Department of Gastrointestinal Surgery)
Osamu Ogawa (Professor, Department of Urology)
Kyoichi Takaori (Program-Specific Associate Professor, LIMS)

Lectures and practical seminars about minimally invasive therapies have been given by Doctors Mistuhiro Nakamura, Naritatsu Saito, Shigeru Tsunoda, Takayuki Kikuchi, Yoshiki Arakawa, Takahiro Inoue and Kyoichi Takaori.

Lectures included “Minimally invasive surgery in hepato-biliary-pancreatic surgery and transplantation (orientation inclusive)”, “Minimally invasive surgery for digestive diseases”, “Minimally invasive therapies in neurosurgery”, “High precision radiation therapy for cancer”, “Intravascular catheter treatments in cardiovascular medicine”, “Minimally invasive surgery in urology” and these lectures were given at the Kyoto University Hospital.

First, the attendants of the course received an orientation at the operation theater of Kyoto University Hospital under the supervision of Professor Shinji Uemoto, the course director of LIMS and the dean of Kyoto University Graduate School of Medicine. Subsequently, the attendants experienced laparoscopic surgery by themselves with a simulator at the Kyoto University Hospital during the course of "Minimally invasive surgery for digestive diseases" and observed procedures of gastrointestinal surgery at the operation theater of the Kyoto University Hospital later on. Moreover, Other courses consisted of following contents:

"Minimally invasive therapies in neurosurgery": observation of intravascular therapies for brain vascular diseases.

"High precision radiation therapy for cancer": simulation of radiation therapy planning.

"Intravascular catheter treatments in cardiovascular medicine": observation of intravascular therapies for ischemic heart diseases.

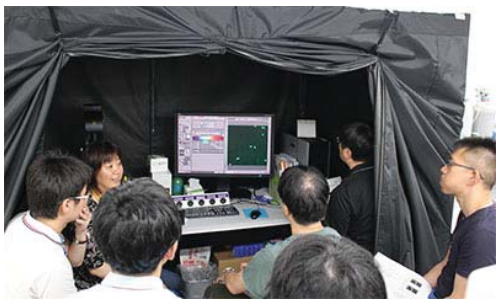
"Minimally invasive surgery in urology": observation of a robotic prostatectomy.

15. Laboratory Practice Course (as part of pre-research)

Starting this year, we launched a new laboratory practice course for advanced research equipment.

- All students (L1 and L2) must attend the course. This is a part of mandatory pre-research.
- You will attend four practices (laboratories) every year, each is three hours.
- We will notify you which practices (laboratories) to attend based on the survey.
- Each practice has specific goals that you have to achieve.

There have been 13 courses held by 12 laboratories:



1. Principle and application of confocal microscope (Anatomy and Developmental Biology, Medical Research Support Center) [July 26, 2016]

2. Chemical Screening (Anatomy and Developmental Biology, Medical Research Support Center) [November 29-30, 2016]

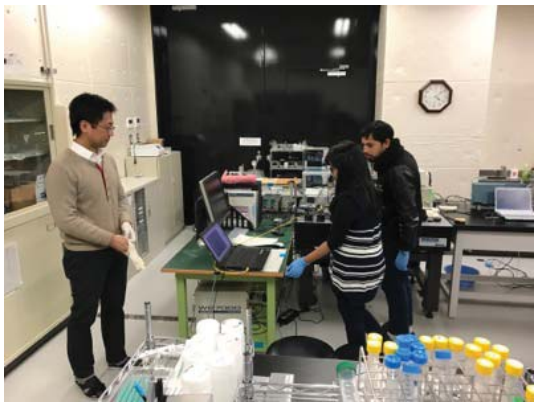
3. Reparative materials(Department of Reparative Materials, Institute for Frontier Medical Sciences) [August 4, 2016]

4. Passive and active muscular force and neural activity in muscular strength exhibiting (Clinical Biomechanics Laboratory, Graduate School of Medicine) [December 21, 2016]

5. Detection and analysis of proteins and RNAs expressed in a cell (Clinical Molecular Biology, Graduate School of Medicine) [September 14, 2016]

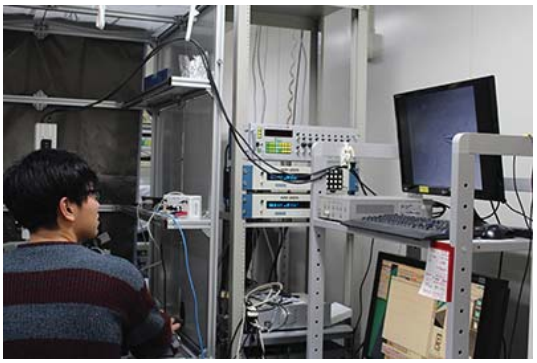
6. Immunology and Cell Biology (Immunology and Cell Biology, Graduate School of Medicine) [October 26, 2016]

7. High field MRI for human brain imaging: the usefulness and the risk (Human Brain Research Center, Graduate School of Medicine) [July 1, 2016]



8. Visualization and Measurement of Small Particle Behaviors in Fluid Flows (Mechanics of Thermal Fluid and Material, Graduate School of Engineering) [December 8, 2016]

9. Measurement of neuronal activity (Biological Sciences, Graduate School of Medicine) [January 23 and 30, 2016]



10. Occupational functioning and adaptation (Occupational functioning and adaptation, Graduate School of Medicine) [October 25, 2016]

11. Analysis of human blood cells by multi-color flowcytometry (Hematological and Infectious Diseases Laboratory, Graduate School of Medicine) [August 30, 2016]

12. 3-D observation of in vio blood vessels and evaluation of body distribution after contrast agent administration by photoacoustic tomography (Adv. Biomed. Eng. Lab./Dept. of Energy and Hydrocarbon Chem., Graduate School of Engineering) [November 18, 2016]

13. Neonatal Cardio-Pulmonary Resuscitation (Nursing Science for Lifestyle-Related Diseases, Graduate School of Medicine) [June 9, 2016]

16. International Student Recruitment

Instructor: Dinh Ha Duy Thuy (Program-Specific Assistant Professor, LIMS)

International student recruitment

Since the basic collaboration between the LISM Program and local universities in the Southeast Asian countries has been established so far, I did not make any local visit to any university in Asia within the 2016 fiscal year. However, through e-mail exchanges, I have been continuing to keep in touch with Professors/staffs over there and ask for their cooperation in disseminating the annual recruitment information or events of the LIMS program to their students.

There are 2 students (1 from Bangladesh, 1 from China) joined in the LIMS program in 2016 year.

International student Support

I am continuing to respond to inquiry of students from abroad, and guide them how to apply to a graduate school as a prerequisite before applying to the LIMS program

3.

国際連携

International Cooperation

平成28年度 履修生の学外活動（外国）

	期間	目的地	氏名	所属	学年	渡航目的
1	2016/6/8～2016/8/1	アメリカ インディアナ州 ブルーミントン	西谷 暢彦	工学研究科 合成・生物化学 合成化学講座 物理有機化学分野	L3	インディアナ大学 Amar H. Flood 教授のもと、リーディングプログラム研究テーマに関するインターンシップを行う。
2	2016/6/14～2016/9/3	アメリカ ニューヨーク州 イサカ	末永 和真	工学研究科 高分子化学専攻 高分子合成講座 重合化学分野	L3	コーネル大学 Christopher K. Ober 教授のもと、リーディングプログラム研究テーマに関するインターンシップを行う。
3	2016/8/31～2016/10/2	カナダ オンタリオ州 トロント	山口 一真	工学研究科 合成・生物化学専攻 生物化学講座 分子生物化学分野	L4	トロント大学 Lu－Yang Wang教授のもと、リーディングプログラム研究テーマに関するインターンシップを行う。
4	2016/10/5～2016/11/6	アメリカ ノースカロライナ州 ダーラム	五明 美香子	医学研究科 人間健康科学系 検査技術科学コース 医療画像情報システム学	L4	デューク大学 Kathryn R Nightingale教授のもと、リーディングプログラム研究テーマに関するインターンシップを行う。
5	2016/11/6～2016/11/10	シンガポール	Rahman Md Maminur	医学研究科 医科学専攻 放射線遺伝学分野	L2	Frontiers in Cancer Science 2016へ参加し、リーディングプログラム研究テーマに関する情報収集を行う。
6	2016/10/14～2016/11/10	アメリカ マサチューセッツ州 ボストン	宮之原 遵	薬学研究科 薬科学専攻 病態機能解析学講座 生体機能解析学分野	L4	Massachusetts General Hospital Neuroprotection Research Laboratory 荒井助教のもと、リーディングプログラム研究テーマに関するインターンシップを行う。
7	2016/11/11～2016/11/17	アメリカ カリフォルニア州 サンディエゴ	宮之原 遵	薬学研究科 薬科学専攻 病態機能解析学講座 生体機能解析学分野	L4	北米神経科学会へ参加し、リーディングプログラム研究テーマに関する情報収集を行う。
8	2016/11/28～2016/12/2	アメリカ ハワイ州	五明 美香子	医学研究科 人間健康科学系 検査技術科学コース 医療画像情報システム学	L4	第5回日米音響学会ジョイントミーティングへ参加し、リーディングプログラム研究テーマに関する情報収集を行う。
9	2016/12/2～2016/12/7	アメリカ カリフォルニア州 サンディエゴ	松原 弘幸	医学研究科 医科学専攻 iPS細胞研究所 臨床応用研究部門 疾患再現研究分野	L3	58th ASH Annual Meetingへ参加し、リーディングプログラム研究課題に関する情報収集、ポスター発表を行う。
10	2016/12/2～2016/12/9	アメリカ カリフォルニア州 サンディエゴ	鈴木 健聖	医学研究科 人間健康科学系専攻 検査応用開発学分野	L1	58th ASH Annual Meetingに参加し、リーディングプログラム研究テーマに関する情報収集を行う。
11	2016/12/2～2016/12/9	アメリカ カリフォルニア州 サンディエゴ	前田 信太郎	医学研究科 人間健康科学系専攻 検査応用開発学分野	L1	58th ASH Annual Meetingに参加し、リーディングプログラム研究テーマに関する情報収集を行う。
12	2017/2/10～2017/2/18	アメリカ フロリダ州 オーランド	寺田 伊織	医学研究科 人間健康科学系専攻 先進医療機器開発学分野	L1	SPIE MEDICAL IMAGINGへ参加し、リーディングプログラム研究テーマに関する情報収集を行う。

4.

学生の活動

Student Activities

平成28年度 履修生の学外活動（国内）

	期間	目的地	氏名	所属	学年	目的
1	2016/5/26	京都府　向日市	(1)松本　明宏 (2)李　雪氷	(1)薬学研究科　薬科学専攻 病態情報薬学分野 (2)薬学研究科　医薬創成情報科学専攻 システムケモセラピー分野	L2	オムロンヘルスケア株式会社を来訪し、LIMS「医療工学特別講義Ⅱ」の見学実習を行う。
2	2016/6/2	奈良県　奈良市	(1)王　梓 (2)松本　明宏 (3)李　雪氷	(1)医学研究科　医学専攻 再生統御学研究部門　再生増殖制御学 (2)薬学研究科　薬科学専攻 病態情報薬学分野 (3)薬学研究科　医薬創成情報科学専攻 システムケモセラピー分野	(1)L1 (2)(3)L2	大和ハウス工業株式会社を来訪し、LIMS「医療工学特別講義Ⅱ」の見学実習を行う。
3	2016/6/29	大阪府　吹田市	堂上　久美子	薬学研究科　医薬創成情報科学専攻 医薬創成情報科学講座 システムバイオロジー分野	L3	IAESTE　Japan全体説明会へ参加し、LIMS海外インターンシップに関する情報収集を行う。
4	2016/7/8～2016/7/10	千葉県　千葉市	(1)Akter Salma (2)松本　明宏	(1)医学研究科　医学専攻 遺伝医学講座放射線遺伝学 (2)薬学研究科　薬科学専攻 病態情報薬学分野	(1)L1 (2)L2	第４回全国博士課程教育リーディングプログラム学生会議へ参加し、LIMS研究テーマに関する情報収集を行う。
5	2016/8/5,8/6	茨城県　つくば市	王　梓	医学研究科　医学専攻 再生統御学研究部門　再生増殖制御学	L1	新領域研究「宇宙に生きる」若手会夏合宿へ参加し、LIMS研究テーマに関する情報収集を行う。
6	2016/9/8	京都府　京都市	(1)秤谷　隼世、(2)高山　裕成 (3)西山　美咲、(4)成清　颯斗	(1)(2)(3)医学研究科 (4)工学研究科	L1	日本ゼオン京都ラボを来訪し、LIMS「医療工学特別講義Ⅰ」の見学実習を行う。
7	2016/9/13	京都府　京都市	(1)鈴木　健聖、(2)高山　裕成 (3)寺田　伊織、(4)西山　美咲 (5)前田　信太郎、(6)小島　莉果 (7)成清　颯斗、(8)赤川　礼美 (9)Akter Salma、(10)王　梓 (11)長島　卓也	(1)(2)(3)(4)(5)(8)(9)(10)医学研究科 (6)(11)薬学研究科 (7)工学研究科	L1	リーディングプログラム学際応用科目「医療・生活支援システム学」における医用画像機器開発現場の見学実習を行う。
8	2016/9/23	京都府　京都市	(1)秤谷　隼世、(2)鈴木　健聖 (3)高山　裕成、(4)寺田　伊織 (5)西山　美咲、(6)前田　信太郎 (7)小島　莉果、(8)成清　颯斗 (9)赤川　礼美、(10)Akter Salma (11)王　梓、(12)長島　卓也	(1)(2)(3)(4)(5)(6)(9)(10)(11)医学研究科 (7)(12)薬学研究科 (8)工学研究科	L1	リーディングプログラム学際応用科目「医療・生活支援システム学」における地域包括支援センターの見学実習を行う。
9	2016/9/27	奈良県　奈良市	(1)秤谷　隼世、(2)鈴木　健聖 (3)高山　裕成、(4)寺田　伊織 (5)西山　美咲、(6)前田　信太郎 (7)小島　莉果、(8)成清　颯斗 (9)赤川　礼美、(10)Akter Salma (11)王　梓、(12)長島　卓也	(1)(2)(3)(4)(5)(6)(9)(10)(11)医学研究科 (7)(12)薬学研究科 (8)工学研究科	L1	リーディングプログラム学際応用科目「医療・生活支援システム学」における運動特化型デイケアの見学実習を行う。
10	2016/10/5～2016/10/8	神奈川県　横浜市	李　雪氷	薬学研究科　医薬創成情報科学専攻 システムケモセラピー分野	L2	第75回日本癌学会学術総会へ参加し、リーディングプログラムに関する情報収集を行う。
11	2016/10/6～2016/10/9	静岡県　静岡市	SHAMIMA SULTANA	医学研究科　医科学専攻 臨床神経学分野	L2	第50回日本てんかん学会学術集会へ参加し、リーディングプログラム研究テーマに関する情報収集および口頭発表を行う。
12	2016/10/19,10/20	大阪府　大阪市	王　梓	医学研究科　医学専攻 再生統御学研究部門　再生増殖制御学	L1	「宇宙に生きる」オミックス解析研究会へ参加し、リーデングプログラム研究テーマに関する情報収集を行う。
13	2016/10/29	大阪府　吹田市	堂上　久美子	薬学研究科　医薬創成情報科学専攻 医薬創成情報科学講座 システムバイオロジー分野	L3	リーディングプログラム海外インターンシップのため、IAESTE　認定試験を受験。
14	2016/10/31～2016/11/30	埼玉県　所沢市	SHAMIMA SULTANA	医学研究科　医科学専攻 臨床神経学分野	L2	日本光電株式会社　医療機器事業本部　馬瀬隆造　部長のもと、リーディングプログラム研究テーマに関するインターンシップを行う。
15	2016/11/11,11/12	東京都　港区	(1)松原　弘幸 (2)西谷　暢彦	(1)医学研究科　医科学専攻　iPS細胞研究所 臨床応用研究部門　疾患再現研究分野 (2)工学研究科　合成・生物化学 合成化学講座 物理有機化学分野	L3	博士課程教育リーディングプログラムフォーラム2016へ参加し、意見交換会にてポスター発表、およびリーディングプログラムに関する情報収集を行う。
16	2016/11/11,11/12	東京都　港区	(1)秤谷　隼世 (2)西山　美咲 (3)小島　莉果 (4)Rahman Md Maminur (5)李　雪氷	(1)医学研究科　医科学専攻 化学研究所　ケミカルバイオロジー (2)医学研究科　人間健康科学系専攻 医療画像システム学分野 (3)薬学研究科　医薬創成情報科学専攻 システムバイオロジー分野 (4)医学研究科　医科学専攻 遺伝医学講座　放射線遺伝学 (5)薬学研究科　医薬創成情報科学専攻 システムケモセラピー分野	(1)(2)(3)L1 (4)(5)L2	博士課程教育リーディングプログラムフォーラム2016へ参加し、リーディングプログラムに関する情報収集を行う。
17	2016/11/12,11,13	愛知県　名古屋市	篠田　昂樹	薬学研究科　薬科学専攻 化学研究所　生体機能化学研究系 生体機能設計化学	L3	第23回　日本時間生物学会学術集会へ参加し、リーディングプログラム研究テーマに関する情報収集を行う。
18	2016/11/13～2016/11/17	島根県　松江市	(1)Akter Salma (2)赤川　礼美 (3)Rahman Md Maminur (4)SAHA Liton Kumar	(1)(2)医学研究科　医学専攻 遺伝医学講座 放射線遺伝学 (3)(4)医学研究科　医科学専攻 遺伝医学講座　放射線遺伝学	(1)(2)L1 (3)L2 (3)L3	3R Symposiumへ参加し、リーディングプログラム研究テーマに関する情報収集を行う。
19	2016/12/8	滋賀県　大津市	(1)秤谷　隼世 (2)高山　裕成 (3)西山　美咲 (4)成清　颯斗	(1)医学研究科　医科学専攻 化学研究所　ケミカルバイオロジー (2)(3)医学研究科　人間健康科学系専攻 医療画像システム学分野 (4)工学研究科 高分子化学専攻 重合化学分野	L1	東レエンジニアリング　滋賀事業場を来訪し、LIMS「医療工学特別講義Ⅰ」の見学実習を行う。
20	2017/2/11,2/12	兵庫県　西宮市	篠田　昂樹	薬学研究科　薬科学専攻 化学研究所　生体機能化学研究系 生体機能設計化学	L3	日本慢性疾患重症化予防学会　第三回年次学術集会へ参加し、リーディングプログラム研究テーマに関する情報収集を行う。
21	2017/3/6～2017/3/9	宮城県　仙台市	松原　弘幸	医学研究科　医科学専攻　iPS細胞研究所 臨床応用研究部門　疾患再現研究分野	L3	第16回日本再生医療学会総会へ参加し、リーディングプログラム研究テーマに関する口頭発表・情報収集を行う。
22	2017/3/8～2017/3/11	東京都　千代田区	王　梓	医学研究科　医学専攻 再生統御学研究部門　再生増殖制御学	L1	新領域研究「宇宙に生きる」国際シンポジウム2017、全体会へ参加し、リーディングプログラム研究課題に関する情報収集を行う。
23	2017/3/24～2017/3/27	宮城県　仙台市	李　雪氷	薬学研究科　医薬創成情報科学専攻 システムケモセラピー分野	L2	日本薬学会 第137年会へ参加し、リーディングプログラム研究テーマに関する口頭発表・情報収集を行う。

Development of Novel Scaffolds for human Pluripotent Stem Cells from Chemically Modified Gelatin Nanofibrous Scaffolds

Graduate School of Medicine
Hayase Hakariya

(1) Overview

Overall, LIMS program gave me a lot throughout the year. This program has been a very good opportunity to once get out the lab and get novel viewpoints that couldn't have been got in my field. Also, what I learned from the LIMS was eventually stimulated my Ph.D. research.

In this annual report, I am going to make it three-part; Pre-research ~Investigation of the theme for LIMS Research~, Course Program, Extracurricular Activity.

(2) Pre-research ~Investigation of the theme for LIMS Research~

Because I'm in the 5-years Ph.D. course, the first thing that I should tackle with is to find the theme for my LIMS research. I will describe things that I have done as a pre-research in this year, 2016.

Firstly, I tried to have time to meet and discuss the progress with my mentor at least once a month throughout the year. Her advice was always to the point and sometimes stimulated me to speed up my LIMS project. Here below, various pre-research activities are going to be mentioned.

-Spring semester

In this semester, too many classes in the graduate school of medicine made me difficult to do my lab work and LIMS activity. However, I made an effort to take classes that seem to have a relationship to the LIMS program, such as preventive medicine, medical statistics, as possible. Also, I took the class for intellectual property and entrepreneurship that are provided by LIMS.

-Autumn semester

Since credits for my department has been got in the previous semester, I took classes for bioinformatics, health informatics, and medical engineering. These classes and the discussion with my mentor lead my interest to the public health or epidemiology. Then, by the great help by Prof. Takaori, I could have an opportunity to meet with Prof. Nakayama, professor of the health informatics. He kindly consulted me and promised to give me advice for my LIMS research. We have already gathered several times for the meeting and my theme for the LIMS research is to be decided soon.

(3) Course Program

I made the best use of the LIMS course to broaden my knowledge and to get the further skill for the future career. First, I took as many classes as I could. Anatomy class and practice, English Debate, Physiology were the essential subjects for the course. Other than them, I took many classes from many fields, such as Intellectual Property, Entrepreneur, Health Informatics, Medical Engineering. Among those, anatomy class was fruitful. I got novel viewpoints to the human body and medicine. Also as I mentioned above, classes for medical informatics or health informatics were useful not only for deepening my knowledge but also for deciding the theme for the LIMS research.

There were practice courses other than classes. In the laboratory practice course, we could learn the way to use the laboratory machine practically as well. Medical and Life Support System course gave me opportunities to visit and see the hospital, nursing home, and the rehabilitation institution. By seeing the very site, I realized how medical practitioners provide the medical service to the patients or users. Some needs in such a place could be seen.

(4) Extracurricular Activity

In addition to the fruitful curricula, there were many other opportunities to learn. For instance, I attended the internship matching networking event in June. LIMS gave me a chance to try the poster presentation in the event. That was a nice experience for me, for I hadn't ever had a chance to do the poster presentation. Also, we had time to talk with those in the chemical company, medical engineering venture, pharmaceutical companies and so on. They told me the importance of thinking the implementation of our technology to the society.

In November, I participated the Leading Forum 2016 held in Tokyo. The forum was hosted by the Keio University, and participants were from the broad range such as industry, academia, government, and international organizations. Program students in the forum were also from various backgrounds. Because 2016 coincide with the year when the first Leading Program Graduate students get prepare into the society, the forum was much focused on the industry. Through the forum, I could gain insight into the way of my thought for my research and was nice opportunity to be inspired.

Expansion of the view of research thanks to the LIMS class

Human Health Science
Graduate School of Medicine
Yasunari Takayama

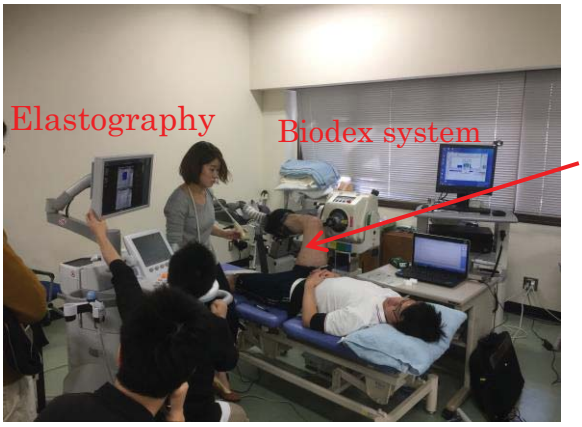
(1) Medical Engineering for Society

Researchers in some companies gave me a lecture and I visited the exhibition room in the company. Opportunities to talk with researchers in other fields were valuable and I got knowledges outside my specialization. I learned many things from their attitude for research and I got motivation to improve the world better with science. I also learned about standardization and intellectual property in other class. It gave me a perspective of profit.

(2) Laboratory practice course

Ultrasonic elastography is the ultrasound diagnostic device that detects cancer or chronic hepatitis by measuring tissue stiffness. I have studied development of evaluating method for liver fibrosis staging based on viscoelasticity estimated by shear wave speed for early diagnosis of chronic hepatitis. And I want to achieve early detection of liver cirrhosis

I learned in Laboratory practice course that elastography applies to muscle in the rehabilitation field. Muscle stiffness is used as an index of rehabilitation effect. I discussed with Prof. Tateuchi about improvement point of elastography in research. Because it is difficult to observe human body in deep area or without artifacts at the boundary between muscles and bones, it is necessary to develop a new method to raise signal noise ratio in the depth direction and to increase the directivity of the beam. These ideas are important in clinical practice, so it is important to keep these ideas in my mind.



Measure the muscular strength of the thigh by elastography and biodex system

Experimental situation

By talking with people in company or other laboratory, I expanded my view on research.

Finding candidate subjects which long time 3D ultrasound is applied to

Department of Human Health Sciences
Graduate School of Medicine
Iori Terada

(1) My research theme in LIMS

In my department, I study about long time 3D ultrasound. It is a new ultrasound system to monitor internal organs for a long time. Long time 3D ultrasound may have the possibility to monitor other organs for diagnosis, estimating health condition and so on. Therefore, I'm researching candidate subjects monitored with long time 3D ultrasound in LIMS program. In 2016 fiscal year, I observed the many fields to apply long time 3D ultrasound to in the future and nominate some applied subjects by literature retrieval.

(2) Observation of the field

Ultrasound in clinical site is used for mainly diagnosis of some diseases. However, I think that Ultrasound is applied to other area such as rehabilitation or nursing care because ultrasound is noninvasive and easy to handle. Then, if the research of long time 3D ultrasound will make progress, it may become more helpful in these areas and come into real use. In 2016 financial year, I observed some fields in LIMS program and considered the capability of long time 3D ultrasound.

Firstly, I observed nursing care site. I visited a day care center and a nursing home. There, I knew that it is desired to detect the timing of the excretion or myocardial infarction. If ultrasound can capture bowels or the abnormality of cardiac, it may become available.

Secondary, I observed rehabilitation site. I visited Kyoto university hospital and a laboratory which studied about muscle. In the laboratory, the muscle function was measured by the ultrasound elastography. Continuous measuring the muscle function may become available by using long time 3D ultrasound.

(3) Researching candidate subjects

From observation of the rehabilitation and the nursing site, I considered the other applied area of long time 3D ultrasound. However, my department is medical technology. Therefore, first of all, I nominate some subjects for diagnosis or estimating physiological function. In 2016 financial year, I researched them by literature retrieval.

However, the utilities of monitoring these candidates for a long time in clinical site are unclear. Therefore, I ask clinicians the utilities now. In the next step, I will narrow candidates from the clinicians' comments and change my LIMS theme to applying long time 3D ultrasound to an organ or function.

Meaningful Experiences in LIMS and Prospects for Research

Department of Human Health Science
Graduate School of Medicine
Misaki Nishiyama

(1) Impressive lectures motivating me

Experience-based lectures taught me the concept of a medical researcher and drove me to work on studies. In debate class, I could notice that as a researcher, I should get more interested in current topics around the world, consider how to solve the problem by myself and discuss other people about it, as well as I could improve my English communication skill. Besides, I could acquire the knowledge of how to give a presentation to adequately make myself understood. In practical lectures, such as Medical and Life Support Systems and Minimally invasive therapeutics, the direct interaction with different medical specialists and patients was very meaningful. Especially in the practice in the Kyoto university hospital, by objectively seeing the relationship between patients and doctors, nurses, and physiotherapist etc., I felt I had to rethink the better way to contact with patients and their family as a researcher.

(2) Leading forum in 2016

The participation in the forum gave me a good opportunity to learn different opinions of other university students and what we should be in the future. It taught me we had to address some problems around us from not negative but more active point of view: to a system or a policy which was not going well, we must think what we needed to do to improve it at first, not complaining about its weakness.

(3) Prospects for LIMS research in the future

I'm researching on the application of photoacoustic imaging utilizing an ultrasound generation by the laser pulse illumination to optical absorbers such as blood to diagnosis of rheumatoid arthritis which is a joint disease that can destruct joints and lead to reduce quality of life by generating new blood vessels in synovium, the membrane covering the bone joint, of the smaller those of especially fingers. Through some simulations of the cross-sectional image of blood vessels of a finger under the ideal condition, I try to design the ring-shaped ultrasound transducer providing the image with higher spatial resolution and contrast for a shorter time. In the future, making good use of the experiments of LIMS program, I hope to develop the great device realizing noninvasive, earlier and appropriate diagnosis of rheumatoid arthritis through building the system using the transducer.

Development of Novel Drug System for cancer therapy

Department of human health sciences
Graduate School of medicine
Shintaro Maeda

(1) Screening candidate reagents for novel transcriptional inhibitor.

In our laboratory, we found that cancer cells require transcriptional factor X. Our novel transcriptional inhibitor targeting X could repress cell growth *in vitro* and *in vivo*. Although this inhibitor has the profound tumor inhibitory effect, it should not be conducted clinical trial because it damages DNA by alkylation. Therefore, we started to find other X inhibitor. To acquire candidates, Mr. Okuno, professor in pharmacoinformatics, and his group simulated which molecule could bind to X and X-cofactor *in silico*. Then about 170 candidates appeared. We conducted screening them by cellular killing assay. We'll investigate these candidate molecules effect and mechanism *in vitro* and *in vivo*.

(2) Presentation about my study and gathering information for my LIMS research theme.

I did a poster presentation in 58th ASH (American society of Hematology) annual meeting. I have never participated in international conference and thus I procured many valuable experiences. Among them, I felt good to have attended when I could see many clinical trials and researches in large hospitals. This experience informed me that there are many obstacles to deliver new treatment or drug to patients.

(3) Attendance in many classes which I never have studied.

I attended the classes energetically. I chose the classes which I never study such as Pharmacology, Continuum mechanics, Basic material chemistry, Design of biomaterials for medical and pharmaceutical applications, Numerical simulation, Biomaterials and Artificial organs. Particularly in Bio materials and Artificial organs, I' could watch surgical operation for coronary bypass surgery and see the biomaterials and artificial organs which used in fact. I'll study more about these fields and apply them to my research theme 'Novel drug delivery system for anticancer drugs.' Concretely, I'll simulate pharmacokinetics in silico and design new career for drug delivery system.

RNA regulation of circadian oscillation in mammals

Department of Pharmaceutical Sciences
Graduate School of Pharmaceutical Sciences
Rika Kojima

(1) Introduction

I am researching about circadian clock in mammals in LIMS program. Especially I'm interested in RNA regulation of circadian clock. The reason why I decided to research this theme is that there is a circadian disease which is popular in aged people. And a particular gene which is thought to regulate circadian clock at RNA level is also thought to be involved in this disease. To investigate the function of the gene of interest, I started to make knockout mice as my pre-research. Knockout mice are made with 100% C57BL/6 derived ES cells in order to get pure-line knockout mice as soon as possible. I obtained founder mice in July. Currently I am making both conventional/conditional knockout mice and I will be able to get enough number of them until I start my research in L3.

(2) LIMS Lectures

This year I took many lectures in LIMS program. Above all, human anatomy and minimally invasive therapeutics were very impressive for me. In human anatomy class, we could observe and touch real dead-bodies to learn anatomy. And in minimally invasive therapeutics class, we could visit operating rooms and observe many kinds of minimally invasive operations such as laparoscopic surgical operations. Through these lectures, I could acquire the real knowledge of anatomy, which cannot learn by just reading textbooks. And also I could learn how minimal invasive operations are actually conducted and what is required to improve the quality of medical treatment.

For me, not a medical student, usually there is no chance to take such kinds of practical lectures. I think I was able to have a very precious experience in LIMS program and it would be definitely meaningful for me to continue my research.

(3) Leading Forum 2016

I attended Leading Forum 2016 at Odaiba, on November 11th to 12th. It is annual forum of leading students around Japan and the main purpose of this year's forum was to connect leading students with industry. I joined a student discussion and a group discussion. In a student discussion, some students who will finish their programs this year discussed about their researches, activities in their programs, job hunting and so on. There were also many guests from industry and students could exchange opinions with them. And in a group discussion, many guest speakers who have a Ph.D. degree and are succeeding in the world talked about their carriers.

As my research in LIMS program has just started this year, I'm not sure what I want to do after graduate LIMS program. But I could learn about the future path of graduate students and also what we are expected from industry. In addition, I could get to know what other leading students around Japan are studying and researching. To do research as a reading student, I think it is important to think about what I want to learn in LIMS program and imagine what I want to be in the future. Therefore, it was a good chance for me to think about my future and my research in LIMS program. Next time I would like to participate in the meeting more initiatively.

(4) Laboratory Practice Course for Advanced Research Equipment

From this year, a laboratory practice course for advanced research equipment is launched. I joined four different courses and practiced how to use advanced research equipment. Especially I got interested in "SimPad" which is a simulation tool for neonate resuscitation. I n the course, we learned the protocol of neonate resuscitating and practiced cardiopulmonary resuscitating a newborn baby using SimPad. It was surprising for me that to improve lifesaving rate, one of the most important things for doctors is to take a good practice. In a situation of resuscitating neonate, doctors have no time and cannot make any mistakes. Of course it is required to develop resuscitation equipment, but good training systems are also required. I learned that a good practice is the key to rescue newborn babies. And I also learned that there are some unexpected demands at a medical scene.

Application of organic-inorganic hybrids to functional biomaterials

Department of Polymer Chemistry
Graduate School of Engineering
Hayato Narikiyo

(1) Development of Emissive Hybrid Materials Composed of Polyhedral Oligomeric Silsesquioxane

Water-soluble network polymers composed of polyhedral oligomeric silsesquioxane (POSS) have hydrophobic spaces in the network because of low polarity of POSS. The water-soluble network polymers connected with POSS and emissive linkers were synthesized, and their functions as a sensor for hydrophobic bio-significant molecules were evaluated. In the previous work, it was found possible to distinguish *trans*-fatty acid from *cis*-one by changing emission intensity and maximum emission wavelength of TPAPOSS which was a POSS network connected with triphenylamine derivatives. However, mechanisms of emission property changes had been still vailed. In the first half of this year, emission properties of TPAPOSS under various conditions were examined to clarify the mechanism.

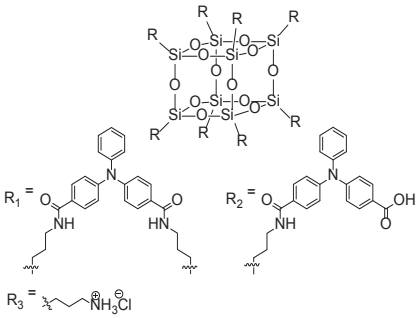


Figure 1. Structure of TPAPOSS.

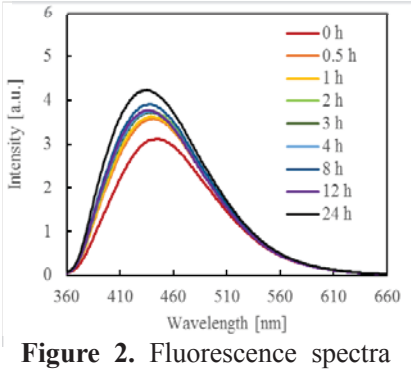


Figure 2. Fluorescence spectra of TPAPOSS with cis-fatty acid.

Initially, time courses of changes in fluorescence spectra were monitored with *trans*- and *cis*-fatty acids (Figures 2 and 3). From both samples, emission enhancement was observed until 4 h without emission wavelength change. It should be noted that the sample containing *trans*-fatty acid showed decrease in emission intensity and the red-shifted spectrum by additional incubation. It is assumed that increase in luminescence intensity observed in both samples could be induced by adsorption of fatty acids in the hydrophobic space of TPAPOSS, followed by suppression of the concentration quenching. In addition, decrease in emission intensity and the bathochromic shift in the sample containing *trans*-fatty acid should be caused by assembly of *trans*-fatty acid molecules and exclusion of the POSS

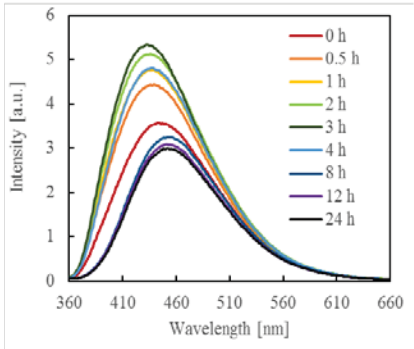


Figure 3. Fluorescence spectra of TPAPOSS with *trans*-fatty acid.

networks. As a result, intermolecular interaction between the dyes should be recovered. From these results, it can be said that TPAPOSS can discriminate the geometric isomers of fatty acids at very low concentration (> 0.1 mM). It is expected that this system could be applicable for quantification of degree of isomerization in fatty acids in the mixture.

(2) Development of Highly-Sensitive Detection System with ^{19}F NMR Probes Based on the Assembly of a Paramagnetic-Metal Complex and a Fluorinated POSS

In the next half of this year, design of molecular probes for highly-sensitive detection for the trace amount of bio-active molecules was performed. The application of the ^{19}F NMR probes has been recently paid great attention for monitoring biological events and reactions at the deep spots inside vital bodies. Because only trace amounts of fluorine are present in the bodies, higher sensitivity can be obtained than those with other multinuclear NMR. However, it is still difficult to monitor a trace amount of a target molecule with ^{19}F NMR due to intrinsic low sensitivity of NMR measurements. To improve the detection sensitivity in the ^{19}F NMR, increase of the number of magnetic-equal fluorine atoms in the probe molecule is a general tactic. We chose a polyhedral oligomeric silsesquioxane (POSS) as a scaffold for constructing a probe to avoid the solubility problem caused by fluorine introduction. POSS has a rigid cubic structure composed of Si-O bonds and eight organic functional groups on each vertex. It is known that POSSs have high dispersibility in liquids because of its unique structure. In this study, we partially modified Amino-POSS which has eight 3-aminopropyl groups with fluorine-containing groups and prepared a ^{19}F NMR probe with the fluorinated POSS (F-POSS, Figure 4).

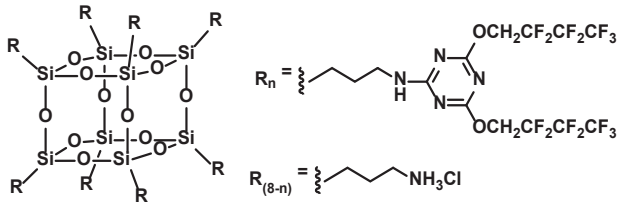


Figure 4. Chemical structure of F-POSS.

F-POSS with one fluorine-containing group was synthesized, and it was found that F-POSS was soluble in water and can capture hydrophobic paramagnetic metal complexes by assembly. However, it was still difficult to purify each POSS derivative having different numbers of the perfluorinated groups in F-POSS due to poor solubility in general organic solvent. To overcome this problem, I aimed to establish the method with the temporary protection for the hydrophobic groups in F-POSS. It was confirmed that amine groups were protected and solubility was improved in general organic solvent. Based on this method, the POSS derivative having a single perfluorinated group was isolated, and accurate control of molecular assembly with paramagnetic metal complexes was accomplished. In the next semester, development of highly-sensitive detection system in ^{19}F NMR utilizing this probe will be carried out.

The development of *in silico* approach based on the expression level of homologous recombination factors to predict cancer therapy effect

Department of Radiation Genetics
Graduate School of Medicine
Remi Akagawa

(1) Summary of research finding

Background

Homologous recombination (HR) is one of the essential DNA repair pathways, and is involved in DNA double strand breaks (DSBs) repair. Some chemotherapeutic agents, such as camptothecin (a topoisomerase1 poison), cisplatin (a chemical crosslinker) and olaparib (a inhibitor against poly [ADP ribose] polymerase), create DSBs in the patients' genome. Unrepaired DSBs cause genome instability and eventually trigger apoptosis.

HR-dependent DSB repair is carried out by step-wise reactions, and a number of proteins are involved in each step. RAD54 plays an important role in HR-dependent DSB repair, indicating that RAD54 promotes homology search by broken sister chromatids by promoting chromatin remodeling of intact sister chromatids. RAD51AP1 stimulates the RAD51 recombinase-mediated strand exchange by biochemical studies. However, the details of the relationship between RAD54 and RAD51AP1 remain elusive.

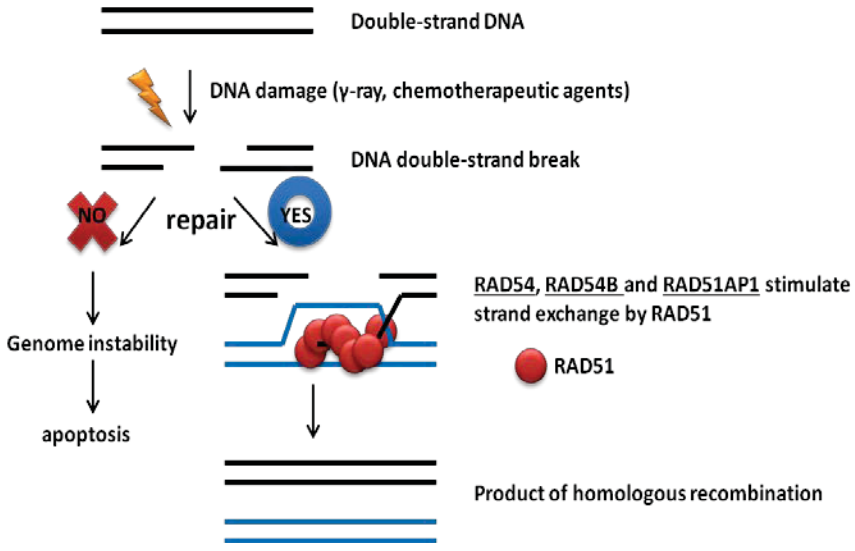


Figure.1 DNA double strand breaks repair pathway by homologous recombination

Results

To analyze the relationship between RAD54 and RAD51AP1, I generated *RAD54*$^{-/-}$ cells, *RAD51AP1*$^{-/-}$cells and *RAD54*$^{-/-}$/*RAD51AP1*$^{-/-}$ cells from human TK6 cell line. The sensitivity of each cell type to DNA damaging agents (camptothecin and olaparib) was examined, and I found that *RAD54*$^{-/-}$/*RAD51AP1*$^{-/-}$ cells exhibited hypersensitivity to these drugs.

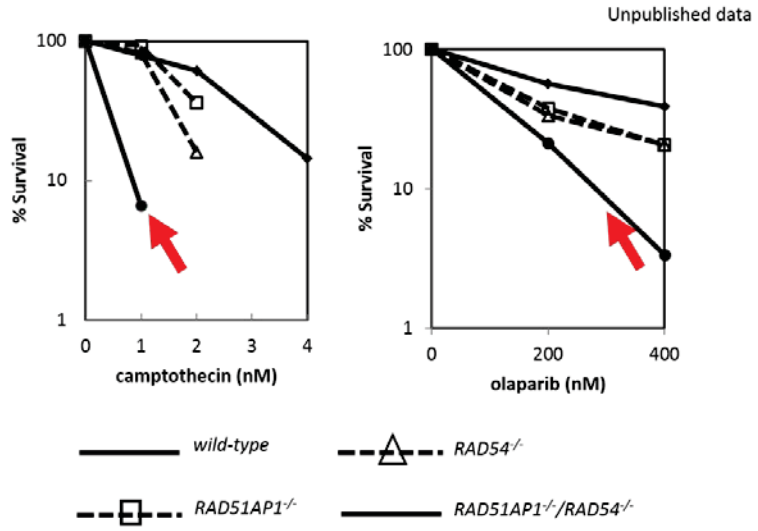


Figure.2 *RAD54*$^{-/-}$/*RAD51AP1*$^{-/-}$ cells exhibit hypersensitivity to chemotherapeutic agents

Future plan

I would like to use the data from our experiments ("wet data") for clinical application, but results at cellular levels are not always applied to clinical practice. My research aim is to develop an in silico approach for utilization of wet data and evaluate the data obtained from data mining. If a correlation is revealed between the mutation or expression level and prognosis, I can apply my wet data into clinical practice. For this purpose, I need to learn datamining techniques in order to manage big data.

(2) Attended conference

I attended an international conference named "10th 3R International Symposium" which was held in Matsue city from November 13 to November 17, 2016.

Many people came to my poster presentation to ask questions and also to give me advice. It was exciting and motivating to discuss my work with other participants, and their suggestions will be very helpful for my research. I met one Ph.D. student from Tokyo Institute of Technology and asked him some questions because I was interested in his results relating to my research. His presentation was great. I admired his work. Eventually he got a poster prize. Altogether, I had an amazing experience to know the latest research, and meeting other participants inspired me in many ways.

Development of the method of predicting the oncogenic potential of mutations found in the BRCA1 gene in healthy females

Department of Radiation Genetics
Graduate School of Medicine
Salma Akter

(1) Summary of research finding

Background

Loss of heterozygosity of the BRCA1 null mutation causes carcinogenesis in breast and ovarian tissues. BRCA1 plays the critical role in double-strand break (DSB) repair by homologous recombination (HR). It is unclear why inactivation of BRCA1 results in oncogenesis only in the female organs, since HR prevents mutagenesis in every organ and tissue. We recently found another important role for BRCA1 in the repair of the DSBs that are generated as a consequence of abortive topoisomerase 2 (Top2) catalysis. This observation led us hypothesize that failed repair of the Top2 mediated DSBs is responsible for the female-organ-specific oncogenesis in BRCA1, based on the fact that female hormones triggers transcription of some genes in a Top2 dependent manner. A possible scenario is that a defect in BRCA1 causes small deletion in transcriptional regulatory sequences in response to progesterone, the anti-oncogenic female hormone. In this situation, the effects of various mutations on the repair of Top2 mediated DSBs should be identified. Two types of separation-of-function mutations are yet to be determined: The first type impairs only the repair of Top2 mediated DSBs but not DSB repair by HR, and the second type impairs only DSB repair by HR but not the repair of Top2 mediated DSBs.

In the LIMS program, I wish to start the following project. While the null inactivation of BRCA1 enhances the oncogenesis of breast and ovarian tissues, a majority of the BRCA1 mutations found in healthy females having the genetic counseling are the point mutations, and the effect of each point mutation on the oncogenesis is unclear. If the point mutations found in healthy females would strongly enhance the oncogenesis, a majority of them may choose the very tough decision, surgical removal of breast and ovary. It is therefore vitally important to develop the method of accurately predicting the oncogenic potential of individual mutations found in the BRCA1 gene in healthy females. To this end, I am going to do data-mining concerning the relationship between BRCA1 mutations and the occurrence of breast and ovary malignant tumors. If the first type, but not the second type, of the separation-of-function mutations show a significant increase in the female-organ specific oncogenesis, I would be able

to conclude that a defect in the repair of Top2 mediated DSBs, but not DSB repair by HR, is responsible for this oncogenesis. If this is the case, I would do the following two projects. (i) I would examine the effect of BRCA1 mutations on the repair of Top2 mediated DSBs in more detail. (ii) I will develop a computer assisted system by which I can automatically collect information about the relationship of BRCA1 mutations and clinical outcome. If I found that the extent of a defect in the Top2 mediated DSB repair closely correlates with the occurrence of oncogenesis in breast and ovarian tissues, I would be able to accurately predict the incidence of the oncogenesis from the coding sequences of the BRCA1 gene.

Results

CellMiner™ is a web application generated by the Genomics & Bioinformatics Group, LMP, CCR, NCI that facilitates systems biology through the retrieval and integration of the molecular and pharmacological data sets for the NCI-60 cell lines. The NCI-60, a panel of 60 diverse human cancer cell lines used by the Developmental Therapeutics Program of the U.S. National Cancer Institute to screen over 100,000 chemical compounds and natural products (since 1990).

I am using CellMiner database for datamining. Recently I used this database and found the characteristics of breast cancer cell line like drug activity, ploidity of the BRCA1 gene in the cell line, p53 mutation. My future plan is to use this database to find out the effect of drug (especially etoposide) on different cell line.

(2) Publication: Last year a publication as a co-author Molecular Cell.

Mre11 Is Essential for the Removal of Lethal Topoisomerase 2 Covalent Cleavage Complexes

Nguyen Ngoc Hoa, Tsubasa Shimizu, Zhong Wei Zhou, Zhao-Qi Wang, Rajashree A. Deshpande, Tanya T. Paull ,Salma Akter, Masataka Tsuda, Ryohei Furuta, Ken Tsutsui, Shunichi Takeda, Hiroyuki Sasanuma

(3) Conference attendance and poster presentation

- International Council of Chemical Associations' Long-Range Research Initiative (ICCA-LRI) and Japan'sNational Institute of Health Sciences (NIHS) Workshop, "Meeting the Global Challenge of Applying New Scientific Methods to Improve Environmental and Human Health Risk Assessments," held in Awaji Island, Japan on 2016 June 15-16.
- I attended the 10th 3R (Replication, Recombination, Repair) symposium held in November 13th to 17th in Matsue city, Shimane. I presented poster on my research.

Elucidation of the molecular mechanisms underlying aging-associated muscle atrophy using zebrafish

Department of Growth Regulation, Institute for Frontier Medical Sciences
Graduate School of Kyoto University
Wang Zi

(1) Views of my 1st year in LIMS program

The first year in LIMS program, I took all compulsory classes of the Doctoral course. Even though many lectures, practices and visiting have occupied much of my time, I really learned a lot from these classes. For example, I now know more details about the structure and function of human body than before by taking the "Human anatomy" course. This practical lecture gave us the chance to learn from actual human body, which was a valuable experience and could also help us to think about how we can improve medical treatments. In the "Medical and life support systems" course, I visited some corporations, day care centers and hospital rehabilitation unit, and studied new equipments used in medical treatment and acquired knowledges on the rehabilitation system of current aging society and occupational therapy of disabled children. I also took the "Minimally invasive therapeutics" course, which I studied and observed many non-invasive treatments for disease such as Radiation therapy for cancer, Catheter-based treatment for cardiovascular disease, Robot-assisted urological surgery (laparoscopic surgery), and so on. I have learned and experienced many wonderful things in these courses. I'm glad to have this opportunity to study more knowledge outside of my research field. These experiences are sure to be useful for opening my eyes to a wider world and inspiring me to a new insight or direction that can help improve my researches.

(2) Research progress

There are various different types of muscle atrophy. I mostly focus on two types "sarcopenia" during aging, and "disuse muscle atrophy" due to long-term immobilization or exposure to microgravity. Understanding the molecular mechanisms of sarcopenia is my project at LIMS program. Previous studies in my lab have analyzed the gene expression of three different conditions fishes (immobilization, aging, and space stay) by RNA-seq. During the first year of LIMS program:

① I have analyzed these data, and selected several genes, which are predicted to be essential to cause muscle atrophy. My plan is to investigate their expression pattern and function using gene knockout zebrafish in order to understand the molecular and cellular mechanisms of muscle atrophy. (Selected genes not shown)

② I tried to establish two muscle atrophy models of juvenile fish.

・Sarcopenia model: juvenile fishes of 4 dpf (days post fertilization) were treated with 1 mM H_2O_2 for 1 or 3 days

・Disuse muscle atrophy model: juvenile fishes of 4 dpf were treated with 0.0045% Tricaine water for 3 days

I extracted total RNA and examined several genes' expression at these samples by qPCR. These genes are well known as sarcopenia or disuse muscle atrophy markers, but the results were different from what I expected. For example, the expression of *murf1* and *atrogin1* from the ubiquitin-proteasome system should increase in disuse muscle atrophy model, and expression of *murf1* should decrease in sarcopenia model, but some samples showed completely different or opposite results (Fig.1). I think there were too many phenomenons to consider during fish development, so it was very difficult to make muscle atrophy models at juvenile fish stage.

③ I established an easy method using fluorescence labeled transgenic fishes (actin-mcherry) to observe and analyze control and drug treated models (Fig.2). So I can check the difference of body size and muscle fibers between both fishes to see if the muscles from these models have atrophied or not in a more direct way. The results revealed that body size are longer (Fig.3) and numbers of muscle fiber are decreased (Fig.4) in drug treated fishes compared to control fishes. The increased body size maybe due to fishes' lack of exercise (swimming) during drug treatment, and decreased number in muscle fibers maybe due to starvation, because fishes didn't get enough nutrition for growth. Anyway, these results also indicated that there're various things need to be consider during fish development. It was too complicated, so I stopped making the muscle atrophy models using juvenile fish.

Recently, I'm designing the sgRNA to make knock-in fishes using CRISPR-Cas9 system. These knock-in fishes will provide new ways to observe and analyze muscle fibers and gene function easier and faster in the future.

Fig.1

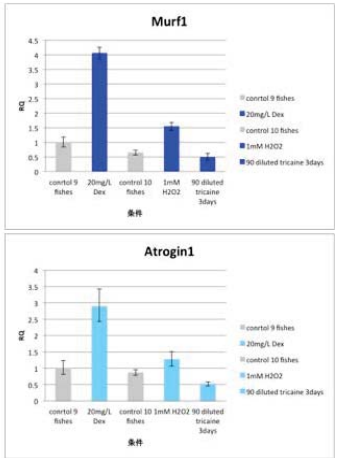


Fig.2

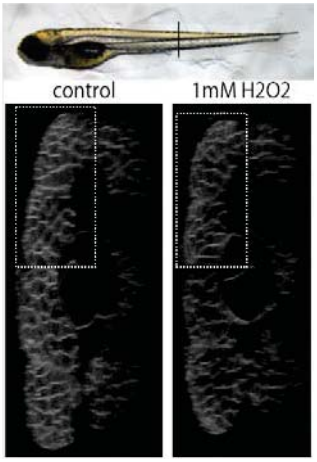


Fig.3

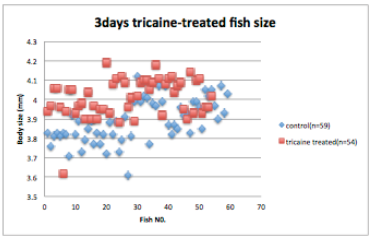
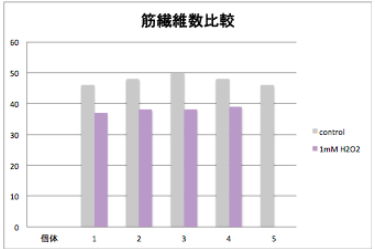


Fig.4



Exploration of the risk factors for drug's side effects using adverse drug event database FAERS

Department of Molecular Pharmacology Graduate
School of Pharmaceutical Sciences
Takuya Nagashima

(1) Background

The FDA Adverse Event Reporting System (FAERS) is one of the largest databases of the self-reports of adverse drug events. By analyzing its 8 million patient reports, I can evaluate the involvement of various confounding variables such as age, sex, primary disorders and concomitant drugs in adverse drug reactions. For example, I discovered the efficacy of vitamin D (Drug B) against quetiapine (Drug A)-induced hyperglycemia (Event X) using FAERS data mining prediction followed by experimental validation both *in vivo* and *in vitro* (Nagashima T *et al*. *Sci Rep*. 2016 May 20; 6:26375). Thus, the analysis of FAERS medical big data has a potential to become a revolutionary tool for pharmacological research. However, although I showed one good example that the analysis of FAERS offered not only a practical approach to managing the Drug A-induced Event X but also a novel efficacy of Drug B, the generalizability of data mining algorithm has not been established yet.

(2) Objective

The objective of this study is to propose the optimal algorithm to identify (i) the applicable Drug A-Event X pairs and (ii) concomitant Drug B as a critical risk factor.

(3) Method

FAERS adverse event reports were obtained from the FDA website (http://www.fda.gov/Drugs/GuidanceComplianceRegulatoryInformation/Surveillance/AdverseDrugEffects/). I wrote a series of computer programs with relational database management system MySQL, R statistical software and Bash script and executed them in the large-scale workstation system (UNI-i7HX/Silent).

(4) Result

(i) Algorithm to identify applicable Drug A-Event X pairs

The conventional approach to evaluate the association between the use of Drug A and the occurrence of Event X is to analyze 2 × 2 contingency table (see Figure 1). However, the results include numerous biases such as indication bias and coexisting drug bias. Therefore, I devised novel algorithm to extract appropriate Drug A-Event X pairs by

setting following five flags.

Flag 1. Evaluate the association between the use of Drug A and the occurrence of Event X using 2 × 2 contingency table (conventional method).

$$\text{Flag 1} = \begin{cases} 1 \text{ (if } a > 1000,\ \text{OR} > 3) \\ 0 \text{ (else)} \end{cases}$$

Flag 2. Set an additional condition of *a* to Flag 1 that the Drug A is the primary suspect drug (role_cod = "PS") for Event X to eliminate coexisting drug bias.

$$\text{Flag 2} = \begin{cases} 1 \text{ (if } a > 500,\ \text{OR} > 3) \\ 0 \text{ (else)} \end{cases}$$

Flag 3. Evaluate the association between the use of Drug A and Indication X instead of Event X using 2 × 2 contingency table to eliminate indication bias.

$$\text{Flag 3} = \begin{cases} 0 \text{ (if } a > 500,\ \text{OR} > 3) \\ 1 \text{ (else)} \end{cases}$$

Flag 4. Confirm whether Event X is recorded as the side effect of Drug A using package insert database SIDER.

$$\text{Flag 4} = \begin{cases} 1 \text{ (if the pair is recorded in SIDER)} \\ 0 \text{ (else)} \end{cases}$$

Flag 5. Determine appropriate Drug A-Event X pairs using Flag 1-4.

$$\text{Flag 5} = \begin{cases} 1 \text{ (if Flag 1 = Flag 2 = Flag 3 = Flag 4 = 1)} \\ 0 \text{ (else)} \end{cases}$$

Figure 1 shows some examples of filtering Drug A-Event X pairs. Among 16 Drug A-Event X pairs, the proposed algorithm extracted 4 pairs (quetiapine-induced obesity, quetiapine-induced neuroleptic malignant syndrome, quetiapine-induced diabetes mellitus, olanzapine-induced diabetes mellitus), all of which are the great issues in clinical practice. There should be theoretical background for the thresholds of each flag because they are empirically chosen at present.

Figure 1: Algorithm to identify applicable Drug A-Event X pairs

Entire FAERS	Event X +	others
Drug A +	*a*	*b*
others	*c*	*d*

$$\text{OR} := \frac{a \times d}{b \times c}$$

$$\text{SE} \approx \sqrt{\frac{1}{a} + \frac{1}{b} + \frac{1}{c} + \frac{1}{d}}$$

$$Z := \frac{\log(\text{OR})}{\text{SE}} \sim N(0,1)$$

#	Drug A	Event X	Flag 1	Flag 2	Flag 3	Flag 4	Flag 5
1	Quetiapine	Fatigue	0	0	1	1	0
2	Quetiapine	Multiple endocrine neoplasia	0	0	1	0	0
3	**Quetiapine**	**Obesity**	**1**	**1**	**1**	**1**	**1**
4	**Quetiapine**	**Neuroleptic malignant syndrome**	**1**	**1**	**1**	**1**	**1**
5	**Quetiapine**	**Diabetes mellitus**	**1**	**1**	**1**	**1**	**1**
6	**Olanzapine**	**Diabetes mellitus**	**1**	**1**	**1**	**1**	**1**
7	Risperidone	Diabetes mellitus	1	0	1	1	0
8	Aripiprazole	Diabetes mellitus	1	0	1	1	0
9	Ziprasidone	Diabetes mellitus	1	0	1	0	0
10	Clozapine	Diabetes mellitus	0	0	1	1	0
11	Quetiapine	Bipolar disorder	1	1	0	0	0
12	Quetiapine	Insomnia	1	1	0	1	0
13	Quetiapine	Schizophrenia	0	0	0	1	0
14	Quetiapine	Major depression	0	0	0	0	0
15	Quetiapine	Drug dose omission	1	1	1	0	0
16	Quetiapine	Off label use	0	0	1	0	0

(ii) Algorithm to identify concomitant Drug B as a risk factor

To identify the concomitant Drug B that can be a critical risk factor for Drug A-induced Event X, I restricted the patient population to Drug A users and evaluated the association between the use of concomitant Drug B and the occurrence of Event X using 2 × 2 contingency table (see Figure 2). However, I realized that there were some cases that the mean of standard score Z_1 deviated far from 0; *i.e.*, most of the concomitant Drugs B might be biased to increase/decrease the risk of Drug A-induced Event X. It depends on Drug A-Event X pairs and the selection criteria of Drug B. Therefore, it is desirable to establish the more appropriate index to demonstrate the interaction between Drug A and B than conventional odds ratio (OR). To solve this problem, I came up with a novel mathematical approach using two-dimensional space and least-square technique. Now I am challenging to give mathematical proof to verify my idea.

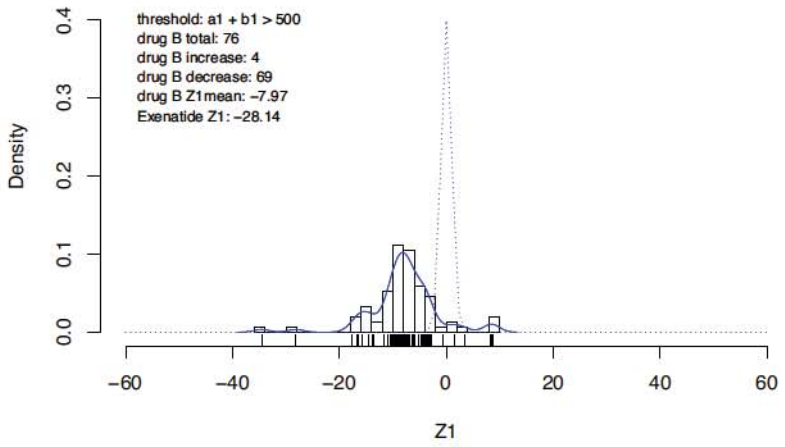
Figure ti: Algorithm to identify concomitant Drug B as a risk factor

Drug A users	Event X +	others
Drug B +	a_1	b_1
others	c_1	d_1

$$\mathrm{OR}_1 := \frac{a_1 \times d_1}{b_1 \times c_1}$$

$$\mathrm{SE}_1 \approx \sqrt{\frac{1}{a_1}+\frac{1}{b_1}+\frac{1}{c_1}+\frac{1}{d_1}}$$

$$Z_1 := \frac{\log(\mathrm{OR}_1)}{\mathrm{SE}_1} \sim N(0,1)$$



(5) Future plan

While the medical big data like FAERS have been explosively growing in recent years, the effective way to make the most of them has not been fully understood yet. Therefore, I need to establish the optimal algorithm to analyze FAERS database first. After that, I will apply this novel approach to meet the concrete medical needs of elderly people in Japan to realize a fruitful healthy-longevity society.

(6) Closing remarks

My main research field at the graduate school is molecular pharmacology. However, this LIMS research is trying to solve the problem of pharmacology using the techniques of other academic fields such as epidemiology, informatics and mathematics. I am confident that this highly interdisciplinary research will be the pioneering work to revolutionize future pharmacotherapy.

DNA repair and genome maintenance

Department of Radiation Genetics
Graduate School of Medicine
Rahman Md Maminur

(1) Academic

It is my pleasure to say that I am walking step by step to reach my dream. It is a great opportunity for me to be part of Kyoto University and LIMS program. It is a great year for me that I will be a graduate from Kyoto University. During my master courses I have attended some courses which are very exciting to me. The courses of LIMS gave me the opportunity to know about research of other fields. The laboratory practical courses were very useful to know about very high throughput research techniques of various fields.

(2) Research activities

The role of mismatch repair (MMR) factors, the MLH3 and PMS2 nucleases in resolution of Holliday Junction.

The DNA mismatch repair (MMR) removes mispaired nucleotides, such as base-base and insertion/deletion mismatches, misincorporated by replicative DNA polymerases. Some of the MMR proteins are involved in double-strand break (DSB) repair. Among the MMR proteins

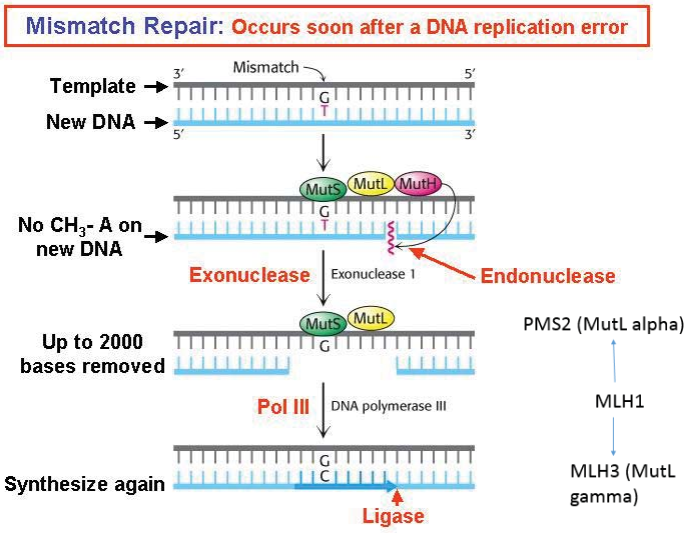


Fig. 1: Mismatch Repair after replication error.
Source: http://cbc.arizona.edu/classes/bioc461/GRAPHICS/Chapter27/Slide80.JPG

MLH1, MLH3 and PMS2 are essential for progression of meiotic homologous recombination (HR) in mice. But their role in mitotic crossover is not well understood. To investigate the role for MLH3 and PMS2 as nucleases in DSB repair of somatic mammalian cells (Fig. 2), we inserted point mutation into the DQHA$(X)_2$E$(X)_4$E motif of the endogenous *MLH3* and *PMS2* genes, and generated *MLH3*$^{D1223N/D1223N}$ and *PMS2*$^{E705K/E705K}$ cells from the human TK6 B cell line. We have checked the cell viability, using different DNA damaging agents. We found that these two proteins have some role in HR. Later we checked the gamma H2AX foci and Rad51 foci, which suggest that these two proteins have some role in late step of HR. Now we are analyzing further to understand the mechanism of these proteins in late step of HR.

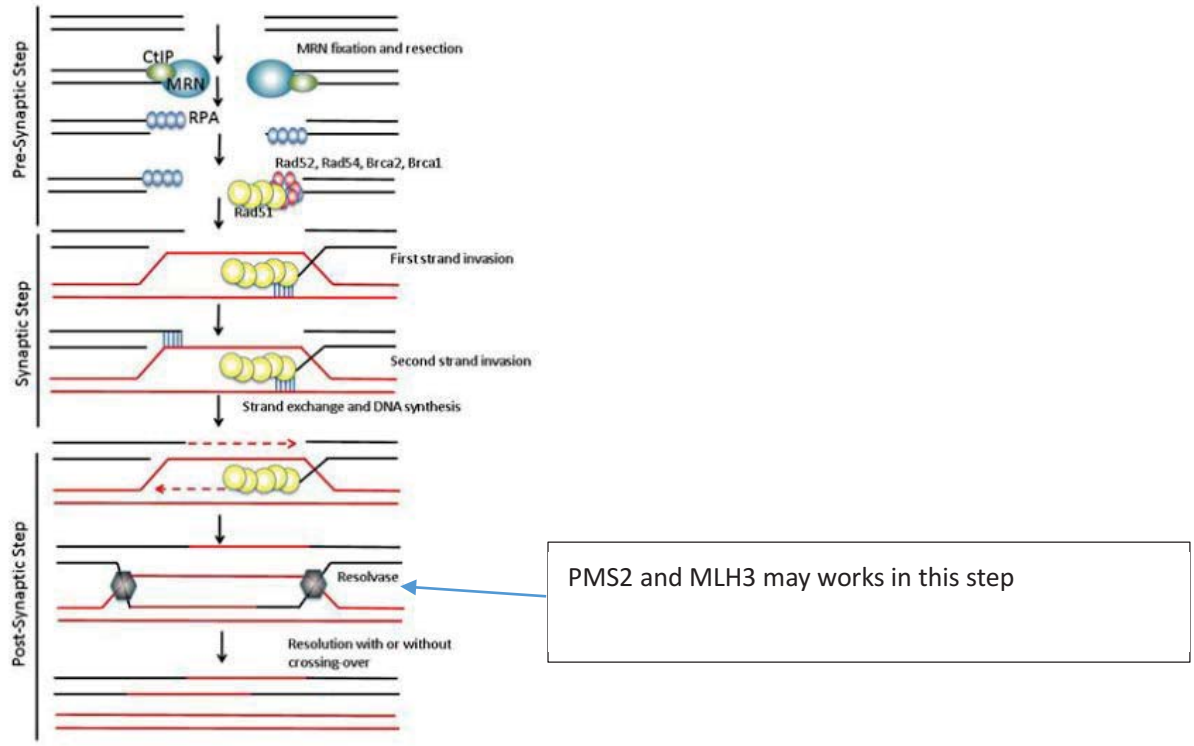


Fig. 2: Steps of homologous recombination.
Modified figure from Fig. 1 of Axelle *et al*.,

The role of Ubc13 ubiquitin-conjugating enzyme in the promotion of translesion DNA synthesis.

Different types of DNA lesions are caused by ubiquitous environmental and endogenous genotoxic agents. These lesions can interfere with normal DNA metabolism including DNA replication, eventually resulting in mutations that lead to carcinogenesis and/or cell death. To maintain the integrity of the genetic material, cells possess multiple pathways to repair various types of DNA damage, such as nucleotide excision and base excision repair pathways.

However, not all lesions on the genome can be repaired efficiently by these processes in time for DNA replication, and some types of lesion are repaired very inefficiently. To prevent acute

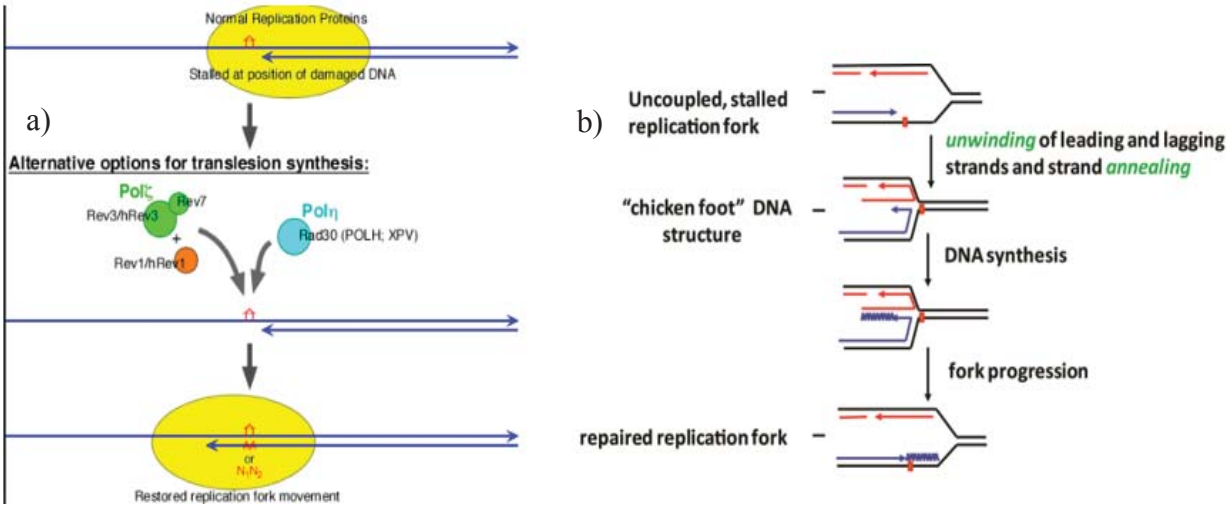


Fig. 3: a) DNA damage repair by translesion DNA synthesis. b) DNA damage repair by template switching.
Source: http://sites.psu.edu/benkoviclab/research/translesion-dna-synthesis/

cell death through arrested DNA replication at unrepaired lesions, cells have a mechanism, referred to as translesion synthesis, which allows DNA synthesis to proceed past lesions (Fig. 3).
UBC13 is an important enzyme for the successful translational synthesis but the exact role of UBC13 is not well characterized yet. In our experiments we will focus on the role of UBC13 in translesion DNA synthesis. To this end we have generated a RAD18 knock out cell line in TK6 cells, which is also an important gene for translesion DNA synthesis and may function in collaboration with UBC13. We will generate the UBC13 and RAD18 double knock out cells to identify the collaborative function and mechanism of UBC13 in translesion synthesis.

SUMO E3 ligases PIAS1 and PIAS4 promote error-free template switching in restoring replication blockage by promoting SUMOylation of PCNA at lys164.

Small **U**biquitin-like **Mo**difier (SUMO) proteins are a family of small proteins that are covalently attached to and detached from other proteins in cells to modify their function. PIAS1 and PIAS4 are two SUMO E3 ligase which facilitate the transfer of SUMO molecule to its substrate. During replication blockage (e.g. TT dimer) in the template strand cells can bypass the lesion through different mechanism like translesion DNA synthesis or template switching.

The modification in the replication machinery helps to decide which pathway will be dominated. The Proliferating cell nuclear antigen (PCNA) is an important protein to choose

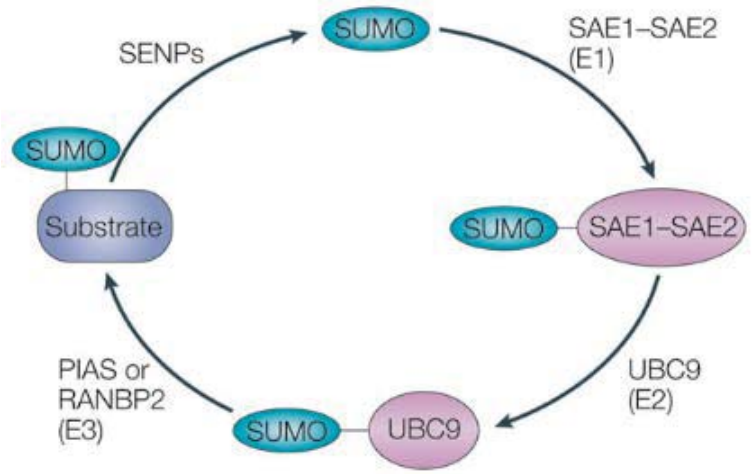


Fig. 4: SUMOylation pathway. Source: Ke Shuai *et al*.

the pathway. The PCNA can be ubiquitinated or SUMOylated by different enzymes and lesion bypass is occurred in the cell depending on the modifications. We found that if SUMOylation occurs in the PCNA, the error free template switching pathway predominates in bypassing the lesions.

Now we are working to reveal the molecular mechanism of PCNA SUMOylation and role of PIAS1 and PIAS4 proteins in this process. hope I can continue my research work successfully. The different extra curriculum of LIMS program like leading forum was giving me the opportunity to know different peoples all over Japan, which was a great opportunity for me to build my carrier in right direction. My participation in some international conferences and the support from LIMS provided inspirations for my future work. I hope by using all these opportunity and achieving proper knowledge I will be able to contribute my knowledge for the social welfare.

(3) Reference

1. http://cbc.arizona.edu/classes/bioc461/GRAPHICS/Chapter27/Slide80.JPG

2. New Potential Therapeutic Approaches by Targeting Rad51- Dependent Homologous Recombination Axelle et all DOI: 10.5772/53973
http://sites.psu.edu/benkoviclab/research/translesion-dna-synthesis/

3. Regulation of gene-activation pathways by PIAS proteins in the immune system.
Ke Shuai and Bin Liu Nature Reviews Immunology 5, 593-605 (August 2005)
doi:10.1038/nri1667

Development of network-based, remote reading system of digital-electroencephalogram

Department of Clinical Neurology
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Shamima Sultana

A. LIMS Research:

Research Progress of the fiscal year 2016: My research topic is Establishment of network-based, remote reading system of digital-electroencephalogram in nationwide- or global area. The objective of this study is to accumulate knowledge about the implementation of the global design of the network based remote reading system of digital electroencephalogram (dEEG) and in near future to establish this system in other Asian countries (e.g., Bangladesh).

During this 2016 fiscal year, I have been continuing to do literature survey to find out the way to evaluate the preliminary system. From the literature survey, I have learned that clinical utility, cost effectiveness, privacy, rapidity and so on are presumably the essential important practical factors for successful implementation of this system. This remote dEEG reading system has planned to be setup with the cooperation between Kyoto University hospital, other remote hospitals and Japanese EEG manufacturer by using infrastructures of EEG manufacturer and commercially provided information technology services. In 2016, the contract between Kyoto University, 2 other remote hospitals, and the EEG manufacturer (Nihon Kohden Corporation) has been signed. The ethical approval of the institutional review board of Kyoto University has been also acquired.

In September 2016, the preliminary network based remote reading system of digital electroencephalogram has been started. After the system has been started, the EEG has been reviewing weekly. Till now around 100 EEGs were reviewed. Among the EEGs almost 90% were routine EEGs and less than 10% were emergency cases. The diagnosis was mainly epilepsy or suspected cases of epilepsy. The report after reviewing the EEG is uploaded within a week except in emergency cases which is done usually within 1 or 2 days.

Internship at EEG manufacturer: Progression of this remote review system of digital EEG mainly depends on medico-engineering collaboration. In order to strengthen the knowledge on the system from the view point of engineering side, which cannot be obtained by learning only at Kyoto University, I went to Nihon Kohden Corporation, the famous manufacturer, developer and distributor of digital EEG in Japan during last November for my one month internship training.

Details of activities:

- ✓ First stage: taking the following lectures from Nihon Kohden's staffs
  ・EEG Hardware/Software・Neuroworkbench network system. ・Cases of remote review system・Remote review system at Kyoto University. ・Measure EEG with 10-20 amp and Headset (lecture and actual practice)
- ✓ Second stage: practice as an engineer of their team work
  ・Installing Server (Windows Server and Hyper-V). ・Installing XenDesktop & app; Develop Kyoto System Server. ・Created Server and Client system based on Citrix XenApp and LAN (Local area network) environment. ・Create Physical PC with same environment. ・Evaluate this system.

Achievement: I have gathered knowledge about the engineering aspect of digital EEG machine like analog to digital converter, difference between analog and digital EEG machine, Neuroworkbench and Neuroreport. I have learned about network (LAN, WAN, WWW) application protocol (HTTP, TCP, FTP), security protocol (SSL, FTPS), virtualization (VPN, XenDesktop/XenApp, Hyper-V) and cloud computing. I tried to develop practically an environment of remote dEEG reading system with different network conditions by applying the network simulator. These are very innovative practices that will help me to develop the system as a leader in Bangladesh and other Asian countries in the near future and to analyze dEEG signal for diagnosis of the patients with neurological disorders.

B. LIMS Activities:

During this fiscal year, I took debate classes in which I improved my communication skill in English, the ability of giving presentation and answering to the questions coming from the audience of different disciplines**.** I also attended three laboratory practice courses on high field MRI; multi-color flow cytometry and on Ultrasound Elastography. During the practice course on high field MRI, I got the experience about the basic operation of MRI scanner and practice how to identify the specific region of the brain responsible for a specific function by the use of functional technique. In multi-color flow cytometry course, I have introduced to the fundamental aspects and basic operation of flow cytometry. From the practical course on ultrasound elastography, I got the opportunity to gain practical experience about this technology and its practices especially in the field of rehabilitation.

Meeting with Japan Society for the Promotion of Science:

I participated in the meeting with Japan Society for the Promotion of Science on 12th July, 2016 and exchanged my opinions as being a LIMS student.

Using LIMS research allowance:

I attended the 50th Congress of the Japan Epilepsy Society which held at Shizuoka, Japan on 7-9 October, 2016 and made oral presentation about the research of my Graduate School. I was asked several questions after my presentation. I also tried to gather knowledge about Stereo electroencephalography and epilepsy surgery.

The pathological role of diet in a mouse model of chronic cystitis

Department of Pharmaceutical Sciences Graduate
School of Pharmaceutical Sciences
Shohei Oyama

(1) Introduction

Interstitial cystitis/bladder pain syndrome (IC/BPS) is a chronic bladder disorder, characterized by various symptoms, such as urinary frequency, incontinence, urgency, nocturia and discomfort or visceral pain, which lead impaired quality of life. The prevalence of IC/BPS is considered to range from 0.01% to 2.3%, with an approximately five-fold patients in female. In Japan, 1.0% of the general people experience abdominal discomfort or pain every day, and there are an approximately 4500 IC/BPS patients taking medical care[1]. Although many patients are suffering from irritating symptoms, the pathological processes is not completely understood and reliable treatments or drugs are not available. Recent studies suggest that diet may play a pathological or etiological role in IC/BPS. Nearly 90% of people with IC/BPS noted they are sensitive to a variety of the dietary comestibles in particular spicy or acidic ones, such as capsaicin, lemon, grapefruit and so on.[2] Web-based study also demonstrated that items making symptoms worse were citrus fruit, tomatoes, alcohol, spicy food *etc*.[3] In addition, I heard from the doctors who were expert of IC/BPS that avoiding acidic urine generation improved patient's symptoms. Thus, it is quiet likely specific diet play an important role in the pathology of IC/BPS. However, the detailed mechanism still remains unclear. Therefore, I investigated whether and how diet affects chronic bladder disorders using chronic cystitis animal model and acidic drinking.

(2) Method

Chronic cystitis animal model was made in accordance with previous report, slightly modified.[4] In briefly, 5-6 weeks aged mice were intravesically injected with 50 μL of 1.0% hydrogen peroxide (H_2O_2) for 30 min. Acidic urine was induced in the way previously reported.[5] In briefly, mice were given 0.28 M NH_4Cl + 0.5% sucrose in drinking water for 7 days right after the injection of H_2O_2. The urine spots were counted during 15 min as the number of voids.

(3) Result and Discussion

To confirm acidic urine was successfully generated, I assessed pH of mice urine with a litmus paper 1 and 7 days after the injection. Both on day 1 and 7, NH_4Cl-given group

exhibited lower pH than water-given control group. The difference was not observed between saline-injected group and H_2O_2-injected group (data not shown). This result supports that NH_4Cl drinking induces mice urine acidification. Next, the effects of acidic urine on the number of voids were examined 1, 7, 14 and 28 days after the injection. On day 1, H_2O_2-injected NH_4Cl-given group showed slightly larger the number of voids than H_2O_2-injected water-given group but not significantly (Fig 1). On day 7, 14 and 28, there are no differences among the groups (Fig 1). Moreover, the histological examination with hematoxylin and eosin staining was conducted on day 28. Among the groups, I could not determine the pathohistological changes (data not shown). These results suggest that acidic urine play little role in the pathology of chronic inflammatory bladder. In this study, I only conducted the evaluation of the micturition function and the bladder morphology, but of the pain-related behaviors. Taken together with many patients explained they felt the bladder pain after specific food intake, acidic urine may not have an influence on the bladder itself but on sensory function. Therefore, I next should perform the assessment of nociceptive behavior in NH_4Cl-given group.

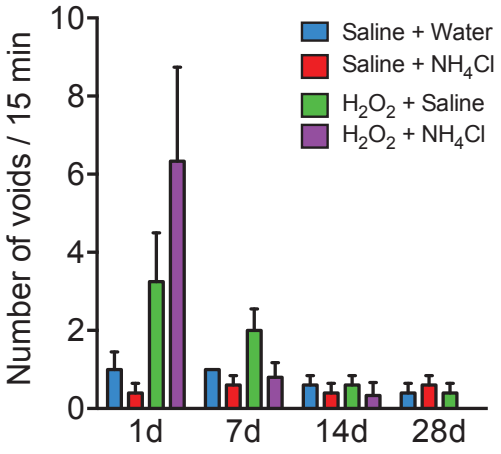

Figure 1 | The number of voids 1, 7, 14, 28 days after injection of H_2O_2 Mice were intravesically injected with 1.0% H_2O_2 and 0.28 M NH_4Cl + 0.5% sucrose in drinking water. The number of voids was counted during 15 min. Values are means ± S.E.M. for a group of 3 - 5 mice.

(4) References

1. Homma, Y. *et al. Int. J. Urol.* **23,** 542–549 (2016).
2. Shorter, B., Lesser, M., Moldwin, R. M. & Kushner, L. *J. Urol.* **178,** 145–152 (2007).
3. Bassaly, R. et al. Female. Pelvic. Med. Recounstr. Surg. **1**, 36-9 (2011).
4. Homan, T. *et al. J Pharmacol Sci* **121,** 327–337 (2013).
5. Reisinger, A. J. *et al. J. Am. Assoc. Lab. Anim. Sci.* **48,** 144–146 (2009).

Development of exosomes-based drug for elderly people

Graduate School of Pharmaceutical Sciences
Akihiro Matsumoto

(1) Overview

In this report, I would like to summarize the activities I contributed in the LIMS program 2016. I applied for and earned grant for LIMS research project in July. Writing an application form was a good practice for me to become an independent researcher. I designed and performed experiments according to the research plan, and everything has proceeded as scheduled. On 8th and 9th June, I participated in a leading student forum in Chiba. Exchanging ideas with other graduate students gave me inspiration for my project.

(2) Research theme for LIMS program

Exosomes are nano-sized cellular vesicles and are thought to play significant roles in intercellular communication by transferring mRNA, micro RNA, and proteins between cells. In addition to their biological characteristics, exosomes are thought to be potential candidates for endogenous drug carriers. In our previous work, we discovered macrophages play pivotal roles in the recognition and clearance of intravenously injected exosomes. In order to develop exosomes-based drug carriers, it is important to regulate the uptake of exosomes by macrophages. Macrophages recognize nanoparticles in a size-dependent manner. Therefore, I hypothesized that assembling exosomes could regulate the uptake of exosomes by macrophages. In this study, I considered exosome assembly could be developed by utilizing DNA nanotechnology. Using different length of DNA linkers and conditions, I prepared exosome assemblies and used transmission electron microscopy to optimize the conditions.

(3) Student meeting of Leading Graduate Schools (2016.7.8.-7.10, Chiba)

Leading graduate students from all over the country came together to discuss and work towards one goal (Fig 1.). During this meeting, I exchanged business cards with more than thirty people from other leading graduate programs and companies for effective networking. In particular, one student from Osaka Prefecture University had a common research interest, and we shared ideas on research as well as on leaderships.

Fig 1. Group discussion with leading graduate students from other programs

Development of new molecular target anticancer agents against UCHL-1-HIFs

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Graduate School of Pharmaceutical Sciences, Kyoto University
Li Xuebing

(1) Background

Low oxygen in tissues, which is called hypoxia has always been a target of cancer chemotherapy. Hypoxia induced factors (HIFs) are activated under hypoxic conditions and are transcription factors that contributes to aggressiveness of tumor. HIFs are usually composed of 2 types of isoforms, HIF-α and HIF-β. The activation of HIFs needs the intranuclear localization of HIF-α and it's binding to HIF-β and the HRE area of target genes. Under hypoxia, HIF-α is always stabilized while under normal oxygen level which is called normoxia, HIF-α is labelled and in addition, decomposed by a process called ubiquitination. Von Hippel-Lindau (VHL) is an E3 ubiquitin ligase that helps proteasome to identify the hydroxylated oxygen-dependent degradation (ODD) domain of HIF-α and promotes the decomposition of the latter to keep HIF-α at a low expression level under normoxia.

Carboxyl-terminal hydrolase L1 (UCHL1) is a member of the UCH family and has been so far mainly identified in brain and neuronal tissues, serving as a multifunctional protein of both deubiquitinating enzyme (DUB) and ubiquitin ligase. Recently however, UCHL-1 had been identified as a stabilizer of HIF-α by inhibiting the VHL dominant ubiquitination. For this reason, UCHL-1 promotes the expression of HIF related oncogenes and furthermore, causes the proliferation and metastases of tumor cells.

The purpose of this study is to construct a screening system to find UCHL-1 inhibitors to block the UCHL-1-HIF axis and ultimately suppress the progression of tumor proliferation and metastases.

(2) Methods

Ub-AMC Assay: To find the inhibitors of UCHL-1, we set up a screening system by using ubiquitin-7-amido-4-methylcoumarin (Ub-AMC), a substrate of UCHL-1 that releases fluorescence when the AMC part of its C-terminus is cleaved by UCHL-1. UCHL-1 enzyme was first incubated with chemical compounds in an adequate buffer and then added with UCHL-1 recombinant protein. The difference of fluorescence within a constant time was measured.

5HRE-Luciferase Assay: To determine the transcriptional activity of HIF, we made a stable transfectants by inserting luciferase gene into the downstream of HRE domain in HeLa cells and furthermore transfected these cells with or without UCHL-1 genes. The luciferin luminescence was then measured to determine the 5HRE activity of these cells.

ODD-Luciferase Assay: To identify the relationship between UCHL-1 and HIF's stability, we inserted luciferase gene into the downstream of ODD domain of HIF-α and transiently transfected these cells with UCHL-1 expressing plasmids. The luciferin luminescence was then measured to determine the ODD stability of these cells.

Cell Migration Assay: In the cell migration assay, MDA-MB-231 and MDA-MB-436 cell lines were used. Both two types of cell originate from human breast tissue and belong to MDA-MB cells. A main difference between these 2 types is the expression of UCHL-1 gene. In the case of MDA-MB-436 cells, UCHL-1 is permanently expressed while in MDA-MB-231 cells it is not. Hence, we chose them to set up a cell migration assay to identify the relationship of UCHL-1 and cell metastasis ability. A wound was stimulated perpendicularly by scratching and the recovery was then measured after constant time periods.

(3) Result

We used an existing UCHL-1 inhibitor, LDN57444 to identify the utility of the in vitro screening system. As a result, LDN57444 inhibited the enzymatic activity of UCHL-1 at an IC50 of 1.2μM, which is 10 times lower than that of UCHL-3, a control group that shares a 53% configuration similarity with that of UCHL-1. Using this assay system, we subsequently, screened 4,000 FDA approved drugs and found 8 of them to have an inhibitory effect on UCHL-1's enzymatic activity.

In 5HRE-luciferase assay, cells expressing UCHL-1 showed a much higher luminescence activity than its counterpart both under normoxia and hypoxia and the increase was even higher under hypoxia. Moreover, when treated with LDN57444, luminescence of cells that express UCHL-1 dramatically decreased dose-dependently. By using this cell to screen the 8 candidate compounds above, we found 3 of them which are PD16157, NH125 and CGP71683 to inhibit HIF-1α's transcriptional activity. Besides, all of these 3 compounds had a relatively higher specificity towards UCHL-1 than another UCH member UCHL-3.

In ODD-luciferase assay, cells transfected with UCHL-1 showed a higher luminescence than that of the E.V transfection group and this increase was later on counteracted by the treatment of LDN57444. Furthermore, all 3 candidate compounds above had a similar inhibitory effect with that of LDN57444.

In wound healing assay, when incubated in medium with 10% FCS, both cells recovered after a 72 hour incubation with DMSO treatment. On the other hand, an obvious recovery delay was observed when cells were incubated with 0.2% FCS medium. Besides, MDA-MB-436 cells showed a similar delay of recovery rate when treated with LDN57444, while MDA-MB-231 cells was restored much more quickly and thoroughly even with the treatment of LDN57444. Among 3 candidate compounds above, although PD16157 inhibited cell migration independent of cell types, a dose-dependent inhibition on migration was only found in MDA-MB-436 cells.

NH125 and CGP71683 on the other hand showed migration inhibitory effect only on MDA-MB-436 cells rather than MDA-MB-231 cells dose-dependently.

(4) Conclusion

In our research we confirmed UCHL-1's effect on stabilizing HIF-α and increasing its transcriptional activity. On this basis, we focused on UCHL-1's deubiquitin activity and developed a screening system to find inhibitors of UCHL-1 and also HIF-α to ultimately restrain tumor cells from metastasis and infiltration.

In drug development, compounds screening is a basic but important phase. Recent years, High-throughput screening (HTS) has been developed to efficiently search for hit compounds among various chemical libraries. Therefore, an appropriate method for HTS screening is indispensable and crucial. As the first step of our screening system, we used Ub-AMC, an UCHL-1's fluorogenic substrate to quantify the deubiquitinating activity of UCHL-1 as well as the inhibitory effect of candidate compounds on UCHL-1's enzymatic activity. By comparing the enzymatic inhibitory effect of LDN57444 on UCHL-1 and UCHL-3, the specificity of this experiment system was also determined. Secondly, in our reporting assay system using 5HRE-HeLa/Luc cells, we identified the LDN57444's UCHL-1 dependent inhibitory effect on HIF-α's transcriptional activity. Furthermore, in HeLa/ODD/Luc cells, LDN57444 also UCHL-1 dependently restored the stability of HIF-α. In cell migration assay, LDN57444's inhibitory effect of UCHL-1's prometastatic role was identified illustrating the serviceability on a cellular level. By developing this evaluation system, a massive screening of UCHL-1 inhibitors has become possible.

In recent years, the conception of drug repositioning has become an efficient method to apply known drugs or compounds to treat new symptoms. The success of thalidomide and sildenafil are good examples of drug repositioning. So in the second part of our experiment, we tested 4000 FDA approved drugs in order to find potential UCHL-1 inhibitors and found 3 of them to be promising. In our following research, we will continue to improve this screening assay by designing a 3D culture system and also in vivo tests to finally find novel UCHL-1 inhibitors.

Investigation into the locomotive syndrome of elderly people

Department of Micro Engineering
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Yasuyuki Matsumura

(1) Introduction : Osteoporosis

I focused on the prevention of locomotive syndrome of elderly people. “Locomotive syndrome” is the condition of musculoskeletal disorders or decline[1]. Musculoskeletal disorders (Osteoarthritis, Osteoporosis, Sarcopenia *etc.*) cause the pain or decline in bodily function. These also cause ADL (Activity of daily living) restriction or QOL (Quality of life) decline of old people. Therefore, the prevention of these diseases is expected to provide aged people with longevity and healthy life.

In LIMS research, related to my graduate school research, I focused on the bone diseases, in particular, osteoporosis. Osteoporosis is the disease that causes loss of bone mass and fracture. One of the methods for the prevention of osteoporosis is thought to be the ”Exercise”. However, it remains unclear what condition of exercise is suitable to prevent old people from getting osteoporosis.

In the future, I will establish the mechanical loading system, using a long bone of aged mouse, and compare the bone conditions with or without the loading state. Then, I will evaluate the relationship between the mechanical conditions such as the strain and the stress subjected to the long bone and the bone mechano-responsivity such as the gene expressions specific to osteoporosis.

(2) LIMS activities

In “Minimum invasive surgery” class, I learned the roles and functions of medical instrument such as the catheter, the endoscope, the robot surgery (da vinci), and so on through lessons and practical lectures. Although I am majoring in the engineering, I do not know in practical clinic site. This class enabled me not only to learn what roles the medical instruments have to realize the surgery kind to patients, but also to learn how important the development of medical technology is.

In the future, I want to practically use my knowledge (engineering and medical subjects) for developing the medical instrument and solve the problems for fruitful healthy-longevity society.

Reference

[1] K. Nakamura.,*J Orthop Sci*, 2008; 13(1):1-2.

Development of Functional Particles for Cancer Vaccine

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Risako Miura

(1) Background

In cancer therapy, chemotherapy with anti-cancer drugs has been mainly used, but these harm not only tumor cells but also normal cells and cause unexpected side effects. To avoid this, cancer immunotherapy, which activates the patient's immune system to attack the cancer cells, has been developed. Cancer vaccine has the advantage of high specificity against cancer cells and less side effects. In particular, prophylactic cancer vaccines are actively researched because they can successfully prevent associated cancers. On the other hand, most clinical trials for therapeutic cancer vaccines have failed to achieve clinical effectiveness, because most of them induce only Th2 type immune reaction and get low activation of cytotoxic T lymphocyte (CTL). Therefore an effective antigen delivery system, which can accurately and efficiently deliver antigen to its target position is desperately needed.

As the material for the antigen delivery system, we have developed CHP (cholesterol-bearing pullulan) self-assembled nanogel (nanometer-sized gel (~100 nm)). The hydrophobic cholesteryl moieties of CHP self-associate by hydrophobic interaction and form physical crosslink points in the network of nanogel structure in water. As a protein carrier, CHP nanogel has the ability to trap proteins by hydrophobic interaction. CHP nanogel is useful for medical application such as cancer vaccine and nasal vaccine[1], and it is known that CHP nanogel can induce not only Th1 type but also MHC class I pathway immune reaction. To develop a more efficient vaccine system, it is necessary to define their mechanism of immune reaction and effect.

In this research, we developed an antigen delivery system using nanogel as a carrier and ovalbumin (OVA) as a model antigen protein, and evaluated the immunological enhancement effect. We used CH-CDex (cholesteropl-bearing cluster dextrin) nanogel as a new nanogel in addition to conventional CHP nanogel. We have previously reported that CH-CDex nanogel was smaller in size and activated CTL more effectively than CHP nanogel. We thus evaluated the distribution of nanogels in the lymph node.

(2) Experiment

CHP (M_w=100,000, 1.2 cholesteryl groups per 100 glucose units) and CH-CDex (M_w=100,000, 3.8 cholesteryl groups per 100 glucose units) polymers were dissolved in phosphate-buffered saline (PBS) and stirred overnight. Denatured OVA- Cy5 was added to the nanogel solution to form the complex of nanogel with OVA. The encapsulation ratio of OVA in

the complex was evaluated by HPLC. The complexes (OVA-Cy5/CHP or OVA-Cy5/CH-CDex) were then subcutaneously administered to mice. We examined the distribution of the complexes in the lymph node by confocal laser scanning microscope (CLSM) and their incorporation with immune cells by flow cytometry.

CLSM observation of lymph node: We collected lymph node from mice 6h after administration, and observed the distribution of OVA-Cy5 by CLSM.

Incorporation with immune cells: We collected lymph node from mice 1 day after administration, and macrophage, dendritic cell (DC) and B cells were stained by fluorescent dye-labeled antibodies. Fluorescent intensities of cells were measured through flow cytometric analysis.

(3) Result and Discussion

The encapsulation ratio of OVA in OVA-Cy5/CHP was 88.2% and that in OVA-Cy5/CH-CDex was 84.5% respectively. Contrary to their significant difference of diameter (50.4 nm and 22.1 nm), they had almost the same encapsulation ability of proteins. This result suggested that stronger hydrophobic interaction in CH-CDex nanogel affected small packing and high encapsulation.

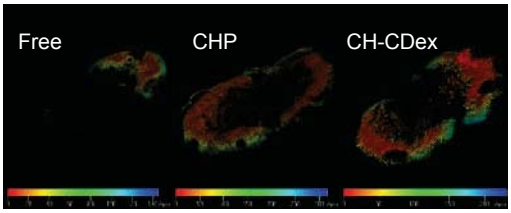

Figure 1. Distribution of OVA-Cy5 free or complexes in lymph node after 6h from administration.

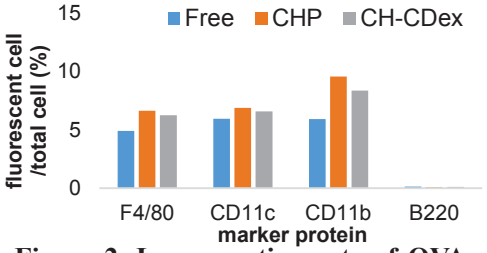

Figure 2. Incorporation rate of OVA-Cy5 free or complexes with immune cells after 1 day from administration.

CLSM observation showed that OVA-Cy5/CHP and OVA-Cy5/CH-CDex had deep and wide infiltration into the lymph node compared to free OVA-Cy5 (**Figure 1**). However, the presence of nanogels had no significant effect on the incorporation of OVA-Cy5 with immune cells (**Figure 2**). $F4/80^+$, $CD11b^+$ and $CD11c^+$ cells (macrophage and DC) interacted and incorporated with OVA-Cy5, whereas $B220^+$ cells (B cells) did not. These results suggested that encapsulation with nanogels enabled the effective delivery and infiltration of antigen to the lymph node without diffusion, and most of the complexes were distributed at the extracellular matrix or other cells 1 day after injection.

As reported previously, CH-CDex nanogel elicited the immune system and activated CTL more than CHP nanogel. However, the distribution in the lymph node and interaction with immune cells were almost same. We will next evaluate the mechanism underlying the strong immune response in future LIMS research activity.

(4) Reference

[1] Y. Tahara, K. Akiyoshi, *Advanced Drug Delivery Reviews*, **2015**, 95(1) (2015) 65–76.

Natural killer cells from human pluripotent stem cells

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(1) Objective of this study

Natural killer (NK) cells are new candidate sources for immunotherapies in various malignancies. NK cells are a one of innate lymphocytes and show cytotoxicity against tumor cells without prior antigen specific stimulation. More recently, NK cells induction from human pluripotent stem cells (hPSCs), taking the advantage of their unlimited growth potential, has been reported. Although previous studies regarding hPSC-derived NK cells seems impressive and successful, most systems used a bovine and human serum, which might result in the unstable yield and efficiency in the production of HPCs and NK cells. To resolve those problems, we tried to induce functional NK cells from hPSCs under a completely chemically defined condition free from any non-autologous serum or stroma.

(2) Previous data

The frequency of CD56 positive cells showed no significant differences between two serum-containing medium (79.15 ± 5.30%) and chemically defined medium (80.90 ± 1.27%). In both conditions, NK cells expressed CD56 (NCAM) and specific receptors such as CD161, NKG2D, killer immunoglobulin-like receptors (KIRs), NKG2a (CD94/CD159a heterodimeric inhibitory receptor), NKp44 and NKp46. hPSC-derived NK cells showed the compatible size and morphology to NK cells isolated from peripheral blood NK (PB-NK) cells. PB-NK cells showed 49.65 ± 3.46% of killing activity against K562 target cells, while the killing potential of PSC-derived NK cell's showed killing potential against K562 cells (medium A: 25.4 ± 5.52%, medium B: 23.25 ± 9.26%) which was slightly lower than that of PB-NK cells (49.65 ± 3.46%).

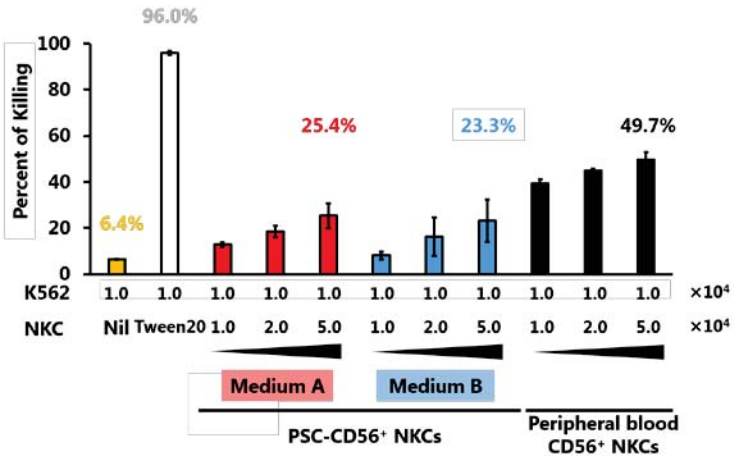

Fig1 Killing assay against K562

(3) New trial

To overcome the problem that induced PSC-NK cells have low potential to lysis target cells like leukemia, we selected IL-18 and IL-21 as candidate cytokines. IL-18 make NK cells to mature activated NK cells (*Blood, 2008*). Also, IL-21 lead NK cells secret IFN-γ and differentiate into mature state (*Immunity, 2002*). Before apply these cytokines to NK differentiation protocol, first we did that using CB derived $CD34^+$ cells as a control. As a result, CB- NK cells highly express NK-specific receptors and lysis leukemia cells in the presence of IL-18 and IL-21 compare to condition of IL-18 and IL-21 examination.

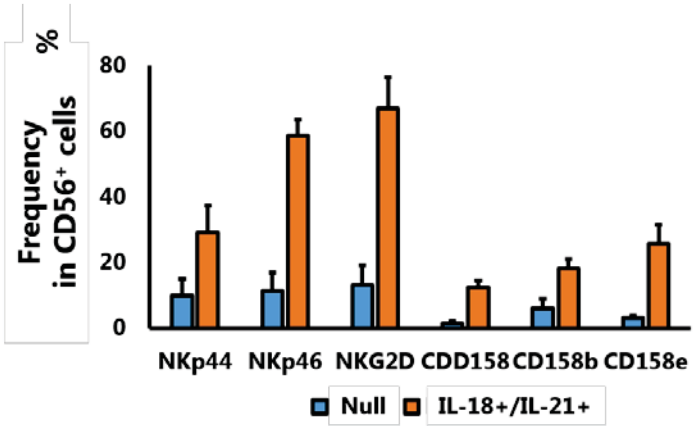

Fig2 Surface markers of CB-NK cells

(4) Conference

I got an opportunity to attend American society of hematology (2016, 11). At that time, I presented my research to Professor Kaufman who most famous researcher in this field. Then, he suggested that hPSC-derived NK cells should be co cultured with dendritic cells to mature NK cells. Dendritic cells are a one of antigen-presenting cells that presence antigen materials on their surface toward immune cells. Also, they secret cytokines like IL-12 can be promote NK cell activation.

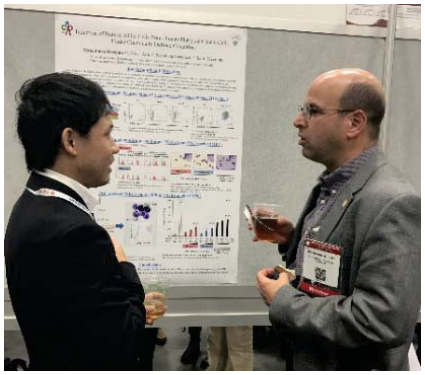

Fig3 ASH poster presentation

Learning the development of computational methods on large-scale compound data mining

Department of Radiation Genetics
Graduate School of Medicine
Liton Kumar Saha

(1) Learning life science informatics

I have attended some introductory lectures on chemoinformatics and bioinformatics, delivered by Dr. JB Brown(Graduate School of Medicine, Center for Medical Education & Leader, Life Science Informatics Research Unit, Kyoto University) which could be helpful for 'Hands-On Data Processing Sessions for Empowering the Experimentalist'. I have learned how to use database for data mining and how to do data processing.

To continue the learning of life science informatics, I have been successfully collaborated with the department of Life Science Informatics at the B-IT Institute of the University of Bonn, Germany. I will study under Professor Jurgen Bajorath. His group mostly focuses on the chemoinformatics, computational medicinal chemistry & chemical biology. They are doing research on the development of computational methods for pharmaceutical research and chemical biology and on large-scale compound data mining. I am very interested in molecular similarity concepts for informatics applications. Entering the 'big data' era in medicinal chemistry is very exciting. I hope I will go to his department/laboratory for few months in this year.

(2) Attending at 3R meeting

I have attended 'The 10th 3R (Replication, Recombination and Repair) Symposium' which was held in Matsue city, Japan from Nov 13 to Nov 17, 2016. It is the biggest symposium in the world in DNA replication, repair and recombination area. In this meeting, I presented a poster on "Establishment of a Method of Characterizing DNA Lesions Caused by Industrial Chemical Compound". I was appreciated by several international scientists for presenting new approach to detect the mutagenic potential of chemical compound to which we expose in environment.

Now I am preparing the manuscript on this topic and planning to submit soon in 'Genetic Toxicology & Environmental Mutagenesis'.

Here is the summary of the findings:

To detect mutagenic potential in industrial chemical compounds, regulators have used several *in vitro* bioassays including the micronucleus (MN) test. The sensitivity and specificity of the conventional MN test are still major concern for the regulators. A major reason for the limited sensitivity is the usage of only *wild-type* cells, which accurately repair DNA damage caused by chemical compounds. To overcome this problem, we disrupted genes encoding DNA-damage-response (DDR) factors in the TK6 B cell line, a unique human cell line widely used for the MN test. We disrupted the following five DDR factors, which cover a wide range of DNA lesions. The disrupted genes encode FANCD2 for interstrand crosslink repair, DNA polymerase ζ (REV3) for translesion DNA synthesis (TLS), and XRCC1 for base excision repair and single-strand break (SSB) repair, leading to generation of *FANCD2*$^{-/-}$, *REV3*$^{-/-}$, and *XRCC1*$^{-/-}$ cells. We also simultaneously disrupted two genes involved in double-strand break (DSB) repair and generated *RAD54*$^{-/-}$/*LIG4*$^{-/-}$ cells. We conducted the MN test for four typical DNA damaging agents, methyl methane sulfonate (MMS), hydrogen peroxide (H_2O_2), γ-rays and mitomycin C (MMC). The percentages of *RAD54*$^{-/-}$/*LIG4*$^{-/-}$ cells having micronuclei induced by γ-rays, H_2O_2, MMS and MMC are 6.3, 6.4, 7.1 and 7.5 times, respectively, higher than those of parental wild-type TK6 cells. The percentages of *XRCC1*$^{-/-}$ cells having micronuclei induced by H_2O_2, MMC and MMS are all more than 5 times higher than that of *wild-type* cells. In summary, a combination of *RAD54*$^{-/-}$/*LIG4*$^{-/-}$ and *XRCC1*$^{-/-}$ cells increases the sensitivity of the MN test. The DNA-repair-proficient *wild-type* cells would serve as a negative control in this analysis, providing higher specificity than the conventional MN test. These results demonstrate the utility of this genetic approach for screening environmental mutagen and also for re-evaluating the genotoxicity of chemical compounds detected by the conventional MN test.

Finding clues to effective medicinal treatment by meta-analysis

Department of Biofunctional Chemistry
Graduate School of Pharmaceutical Sciences
Kouki Shinoda

(1) Overview

Aging causes many changes including drug metabolism and biorhythm and hampers the therapeutic efficacy of current medical treatments for elderly people. In this year in my LIMS research, I tried to perform meta-analysis based on the factors influenced by biorhythm such as dose time and duration, in order to propose more effective medicinal treatment. I chose two medicines, “Pregabalin” and “Prednisone” and searched database but could not complete meta-analysis because I could not found enough data for analysis.

(2) Pregabalin

Diabetic Neuropathic Pain occurs in approximately 20% of all diabetics (in especially about 50% of people having diabetes over 25 years). Main symptom is numbness and/or pain in the extremities, which lowers quality of life (QOL) of the patients. Therefore, relieving the pain is expected to be helpful. Pregabalin (PGN) is one of medicine used to alleviate diabetic peripheral neuropathy. However, more effective treatment is needed, because about 50% of patients are non-responders to PGN[1]. In 2015, one group found that the antiallodynic effect of PGN on diabetic mice was modulated by circadian changes in its intestinal absorption[2]. I expected that night-time use of PGN might enhance its efficacy and searched database. 19 records were identified through database searching, but PGN was dosed two or three times a day in almost all clinical trials. In general, the night-time use is included in both dosing methods. Thus it was impossible to compare the effectiveness of night-time use of PGN with that of day-time use. If significant differences in the effectiveness of PGN among dosing methods would be confirmed in clinical trials, PGN may become categorized to the medicine for chronotherapy in future.

(3) Prednisone

Rheumatoid arthritis is a chronic inflammatory disease that can cause joint damage. The symptoms of rheumatoid arthritis are known to show circadian change, which are most severe in the early morning following the increase of pro-inflammatory cytokines such as IL-6 and TNF-α. Prednisone is synthetic corticosteroid, one of therapeutic agents for rheumatoid arthritis and already sold as modified release medicine, which release approximately 4 h after ingestion[3]. This enables to deriver drug during night while asleep

for effective treatment. I decided to search this medicine to confirm the effect and influence such as QOL and side effects. 141 records were identified through database searching. Unfortunately, I found only 2 records of double blind clinical trials. This was inadequate for meaningful meta-analysis. Thus, it is needed to improve the searching and analyzing method.

(4) Discussion

There are three main problems in my search. One is database. I used only one database and couldn't access some of records. So, it would be better to search multiple databases (*i.e.* Cochran, EMBASE). Second is search terms. Terms I used for searching database might be inadequate to find related papers. Third is target of analysis. Though molecular mechanisms or circadian rhythms of diseases/medicines are already known, most of new chrono-biological findings are not applied to clinical trials. And it would be better to investigate what is the problem of the medicines and how often they are used for treatment of the disease. From the above, I am going to reconsider the target for performing meta-analyses with the defined purpose.

(5) Reference

1. Cory Toth. Pregabalin: latest safety evidence and clinical implications for the management of neuropathic pain. *Therapeutic Advances in Drug Safety* (2014), 5 (1): 38-56.

2. Akamine, T. *et al*. Dosing time-dependent changes in the analgesic effect of pregabalin on diabetic neuropathy in mice. *The Journal of pharmacology and experimental therapeutics* (2015), 354, 65-72.

3. Buttgereit, F. *et al*. Low-dose prednisone chronotherapy for rheumatoid arthritis: a randomised clinical trial (CAPRA-2). *Annals of the rheumatic diseases* (2013) 72, 204-210.

Research for pharmaceutical intervention in Shift Worker-related diseases

Department of Systems Biology
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Kumiko Dojo

(1) Entrainment of circadian clock by phase-dependent phase shift

In Japan, there are 27% of labors working as shift workers and/or midnight workers, and the number is increasing. Many cohort studies have alerted that shift workers have higher risks to get critical diseases[1-3]. One of the main reasons to get those diseases is the discrepancy between the body clock and the environmental light dark (LD) cycle.

Most of living beings on the earth including human beings have a body clock (circadian clock), which controls sleep-wake cycle and various physiological functions. The clock resides in the hypothalamic suprachiasmatic nucleus (SCN), which gets light information as a glutamatergic signal via retinohypothalamic tract (RHT), and entrain the clock by phase-dependent phase shift; the light exposed at CT14 (early night) causes phase delay, and that at CT22 (late night) causes phase advance. In our lives, since we human beings possess a clock which is longer period than 24 hour, the light entrains (resets) the clock every morning by phase advance.

Carbachol, a canonical agonist of acetylcholine receptor, is known for its light-mimicking effect on clock entrainment. The pathway of the effect has been thought to be different from RHT since the acetylcholine is less likely a neurotransmitter of it[4,5]. As for the site of action of carbachol, it is controversial due to the reports that isolated SCN slice *in vitro*[6] and intra-SCN injection of carbachol *in vivo*[7] only induced phase advances, whereas light stimuli induces both phase advance and delay. In this research, I performed carbachol administration to SCN slice prepared from mice carrying a *Per1*-promoter fused luciferase gene (*Per1-luc*) and analyzed the effect of carbachol on phase shift in the SCN.

(2) Carbachol-induced phase dependent phase shift via muscarinic receptor

After monitoring *Per1-luc* luminescence rhythmically oscillates in SCN slice, carbachol was added to the medium at various time after the second peak (**Fig.1**). Carbachol applications at 2-4 hours after the peak caused phase delay, whereas that at 8-12 hours caused phase advance. Administration of carbachol at other time points did not affect the phase shift. As

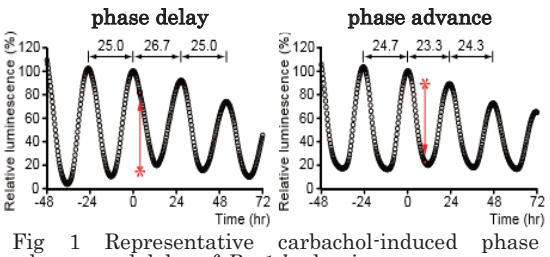

Fig 1 Representative carbachol-induced phase advance and delay of *Per1-luc* luminescence.

shown in **Fig.2**, I could built the phase-response curve with SCN slices, and found the directions and magnitude of carbachol-induced phase shifts are dependent on the circadian phase at the time of treatment.

Since carbachol is an agonist for both muscarinic and nicotinic acetylcholine receptors, either atropine or mecamylamine, the antagonist of muscarinic and nicotinic receptor, was administrated with carbachol to confirm which receptor induces phase shifts. As shown in **Fig. 3**, the carbachol-induced phase advance was completely suppressed by atropine, but not by mecamylamine. Moreover, muscarinic receptor subtype M3 and M4, but not M1, M2 and M5, are abundantly expressed in the SCN (**Fig. 4**). These results suggest involvement of M3 and M4 for carbachol-induced phase shift.

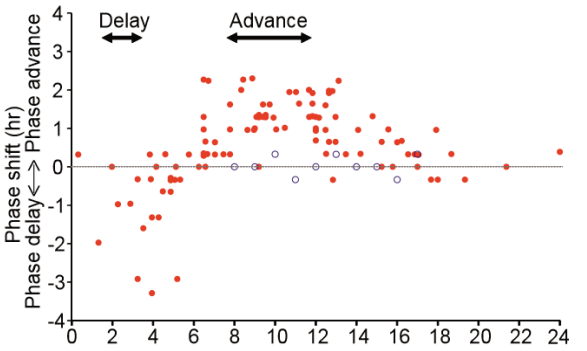

Fig. 2 Phase response curve (PRC) obtained with SCN slice cultures stimulated by carbachol (red closed circle) and vehicle (open blue circle)

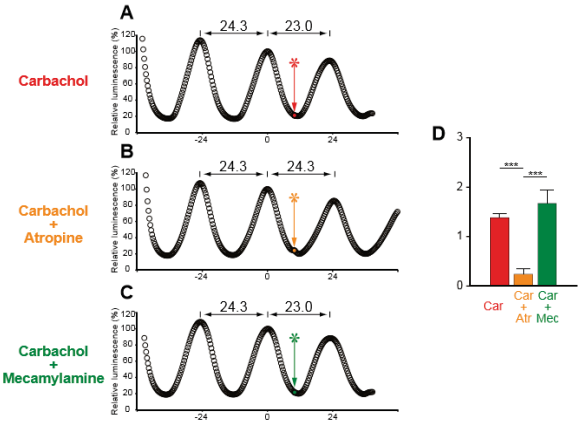

Fig. 3 The effect of cholinergic receptor antagonists on carbachol-induced phase-shift of *Per1-luc* SCN slice cultures at advance phase.

This research suggests a novel drug for shift workers to re-entrain to the environmental LD cycle via different pathway from RHT. As for accomplishment throughout this year, I made a poster presentation of this research at Japanese society for chronobiology (November 12th 2016, Nagoya). These works are now accepted to be published in Journal of Biological Rhythms (in press). I will continue my research to elucidate the mechanism of entrainment system of the SCN for pharmaceutical intervention in shift worker-related disease.

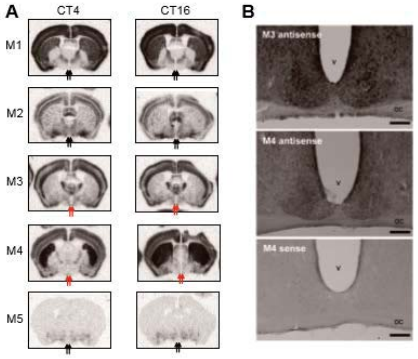

Fig. 4 Topographic analysis of muscarinic receptor mRNA (M1-5) in the mouse SCN by *in situ* hybridization

1. Sung et al. J Hypertens. 2012. 30: 587-91.
2. Deanna M. A. et al. Sleep. 2015. 38: 1849-60
3. Davis et al. J of the Nat Canc Inst. 2001. 93: 1557-62.
4. Cahill and Menaker. Brain Res. 1987. 410: 125-9.
5. Shibata et al. Neurop. 1986. 25: 403-9.
6. Liu and Gillette. 1996. J Neurosci. 16: 744-51.
7. Buchanan and Gillette. 2005. Exp Neurol 193: 489-96.

Development of Functional Optical Materials for Quantifying Biomolecules Based on Organic-Inorganic Hybrids

Department of Polymer Chemistry
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Kazumasa　Suenaga

(1) Internship for Cornell University (Department of Materials Science and Engineering)

○Objectives

The step-wise synthesis provides the opportunity to generate polymers with precise sequence controls. This strategy was pioneered using solid supports by Merrifield for peptide synthesis and has also been developed for the synthesis of DNA, RNA and a variety of resin-bound organic structures. However, the extension of these techniques to create sequence-defined non-natural polymers of significant main chain lengths has been a longstanding challenge. The monomer coupling reactions used to make such polymers need to have nearly quantitative yields in order to synthesize large, well-defined polymer chains. Peptidomimetic *N*-substituted glycine polymers, or peptoids (Figure 1), break this yield barrier and have thus opened up a new class of sequence-defined polymers. Peptoid polymers thus straddle the boundary between biological materials and synthetic polymers: Their biomimetic structure and precision sequence control provides a breadth of opportunities to produce sequence programmable, folded polymers with the robustness typical of synthetic materials.

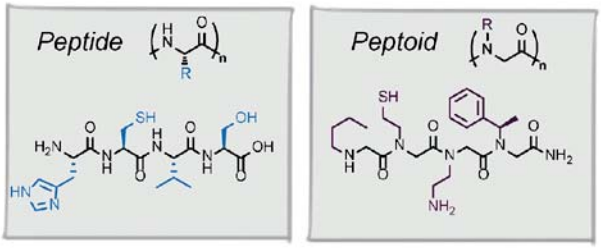


Figure 1. Comparison of chemical structures between peptides and peptoids.

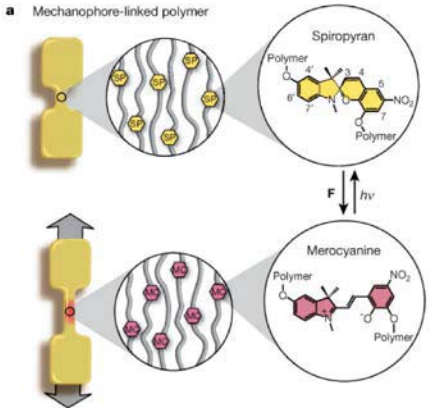
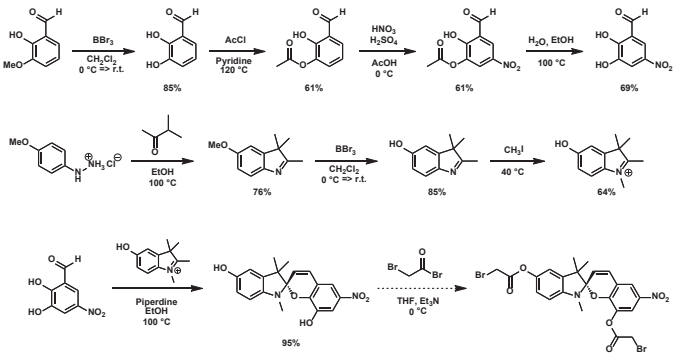


Figure 2. Schematic model of the detection for mechanical stress by luminescent changes on the basis of spiropyrane-modified peptoids.

The precise designed foldermers have been recognized as a platform of the probe for mechanical stresses at the local spot under biological conditions by measuring the shape of molecules. By introducing emissive dyes into the foldermers, the molecular motions can be monitored by their optical property changes. Thus, these properties are advantageous for realizing stimuli-responsive probes with mechanofluorochromism.

○Internship tasks

The foldermers having emissive dyes based on the peptoid structure were designed and synthesized (Figure 2). The peptoid backbone was prepared with an automated-peptide synthesizer via the solid-support method. Moreover, the stimuli-responsive luminescent unit was synthesized by employing the spiropyrane structure.



Scheme 1. Synthesis of the spiropyrane unit

○Details of Activities

The foldermers having emissive dyes based on the peptoid structure were also prepared. The peptoid backbone was obtained through an automated-peptide synthesizer via the solid-support method. Moreover, the spiropyrane dye for modification with the peptoids was also synthesized according to Scheme 1.

○What did you learn from your internship?

(1) How did your viewpoints on society expand?

Information on a topic with high relevance in the molecular imaging and the critical strategy for the design of the practical molecular probes can be obtained.

(2) What original new ideas were you able to come up with through this social experience?

The several fundamental issues on the bio-mimetic materials, surface modification for improving bio-compatibility and fusion of technology with biological and material science were learned in this visitation. These would be feasible for material design along the LIMS project.

(3) Have you found a new direction during this internship?

In the previous versions, only small molecules were used as a scaffold for constructing probes. During this visitation, the molecular design with oligomers and polymers was inspired.

(4) Flexibility (Including challenges encountered and your strategies for coping)

Because of intrinsic instability of the spiro compounds, the limited reactions are applicable. Since the stable compound can be obtained, it is presumed that the conjugation could proceed in good yields.

○Achievements

90%. The most of synthetic conditions for the target molecule were optimized. Furthermore, the peptoid synthesis was also performed.

○Self-evaluation

I achieved 10-steps synthesis within 3 months under different circumstances. Additionally, I treated with the materials which have not been used before. These experiences are valuable for further extending my research in near future.

Functional analysis of TIARP for treatment of rheumatoid arthritis

Department of molecular engineering
Graduate School of engineering
Masatoshi Uno

(1) Research objectives

Rheumatoid arthritis (RA) is a systematic auto-immune disease. Its main symptoms are joint deformation and systematic inflammation[1]. Recently, some anti-rheumatoid antibody drugs targeting inflammatory cytokine signals were developed, and they improved sweep efficiency. However, these drugs are very expensive (¥2,000 ~ 5,000 /day) and require long term use. So my research presentation objective, is presenting cheaper therapeutic drugs that target small molecules.

(2) Previous activities

I researched inflammatory cytokine signals, in particular the TNF-α/NF-κB pathway and the IL-6/Jak-STAT pathway because activation of these signal pathways plays an important role in the pathomechanism of RA[2]. I found that an interesting protein called TNF-α induced adipose related protein (TIARP). TIARP was known as a membrane protein associated with metabolic regulation, but it was reported that TIARP inhibited inflammatory cytokine signals related to RA[3,4]. In detail, TIARP inhibited downstream targets in the TNF-α/NF-κB and IL-6/Jak-STAT pathways and overexpression of TIARP inhibited joint deformation in RA mice. Therefore, I thought this protein would make an ideal drug target.

However, known functions of TIARP and related proteins could not exacerbate inflammatory responses, but inhibited inflammation[5,6]. Moreover, TIARP might not be able to interact directly with transcriptional factors because TIARP is a membrane protein. So, I proposed that there could be unknown molecules which were able to inhibit inflammatory transcriptional factors and interact with TIARP (Fig.1).

In order to find the proposed molecules, I planned experiments based on pull down method.

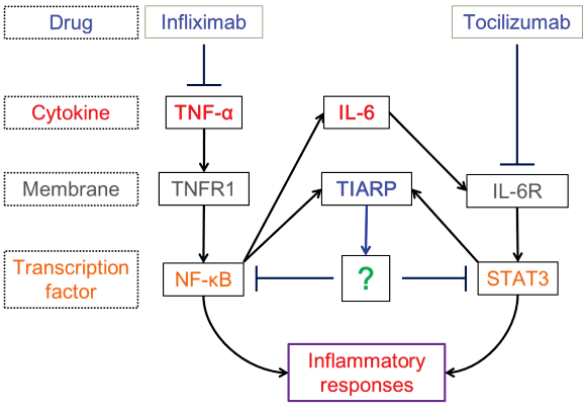


Fig. 1 Signal diagram of TIARP and related molecules

(3) Activities this year 1 : Constructing cell expression system of TIARP

Because a large amount of TIARP molecule and target proteins are required for pull down assays I had to construct cell expression system of TIARP before the pull down experiments.

Firstly, I built a cell culture system of a mouse macrophage cell line, RAW264.7 given by Dr. Miyuki Nishi. RAW264.7 is a very stable cell line and mouse macrophage cells are known to express TIARP. I learned basic cell culture techniques and constructed RAW264.7 culture system from cellular experiments.

Secondly, I performed transfection and expression experiments. I bought multi-tag fusion TIARP expression DNA from GenScript (Fig. 2,3). Because RAW 264.7 has very solid plasma membrane, I tried transfection by electroporation. TIARP expression was successfully achieved, but the transfection efficiency was approximately 45% (Fig. 4). This result was not bad, but not enough. Therefore I will next construct a stable expression cell line with virus mediated transfection method.

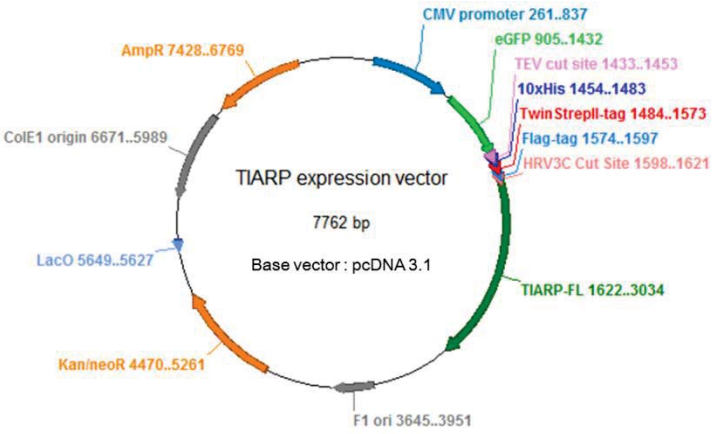


Fig. 2 Vector map of TIARP expression vector

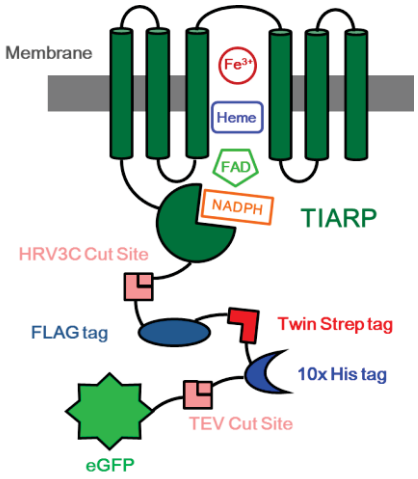


Fig. 3 Shematic structure of multi-tag fusion TIARP

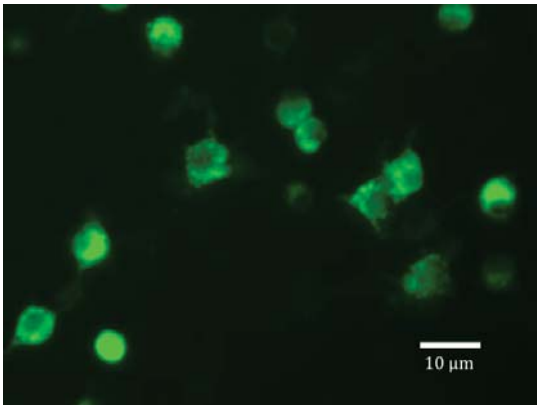


Fig. 4 Fluorescence image of transfected RAW264.7 cells

(4) Activities this year 2 : Internship at TORAY

My internship as part of the LIMS curriculum was at the pharmacological laboratory in TORAY basic research center in Kamakura city (Fig.5). TORAY is a textile manufacturing company developing not only synthetic fibers but also drugs and medical devices. So, I negotiated with the head of the laboratory to do an internship through the Innovative HR Development Matching System.

During the four-week internship, I learned many things, for example, the importance of safety, differences in research policies and environment between business and academia. However, I cannot discuss the details of my internship here because they are confidential corporate information.

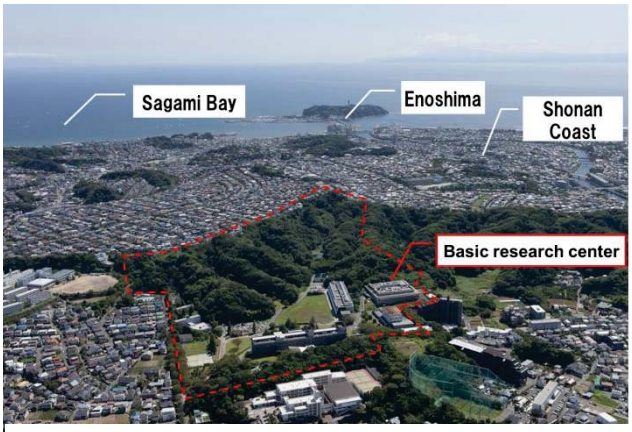


Fig. 5 Helicopter shot of TORAY basic research center

© TORAY Industries, Inc.

(5) Reference

1. Iain B. McInnes, G.S. The Pathogenesis of Rheumatoid Arthritis. *The New England Journal of Medicine* **365**, 2205-2219 (2011).
2. Malemud, C. Differential activation of JAK enzymes in rheumatoid arthritis and autoimmune disorders by pro-inflammatory cytokines: potential drug targets. *International Journal of Interferon, Cytokine and Mediator Research*, 97 (2010).
3. Inoue, A. et al. Tumor necrosis factor alpha-induced adipose-related protein expression in experimental arthritis and in rheumatoid arthritis. *Arthritis Res Ther* **11**, R118 (2009).
4. Inoue, A. et al. Murine tumor necrosis factor alpha-induced adipose-related protein (tumor necrosis factor alpha-induced protein 9) deficiency leads to arthritis via interleukin-6 overproduction with enhanced NF-kappaB, STAT-3 signaling, and dysregulated apoptosis of macrophages. *Arthritis Rheum* **64**, 3877-85 (2012).
5. Wong, V.W. et al. Focal adhesion kinase links mechanical force to skin fibrosis via inflammatory signaling. *Nat Med* **18**, 148-52 (2012).
6. Zhou, J., Ye, S., Fujiwara, T., Manolagas, S.C. & Zhao, H. Steap4 plays a critical role in osteoclastogenesis in vitro by regulating cellular iron/reactive oxygen species (ROS) levels and cAMP response element-binding protein (CREB) activation. *J Biol Chem* **288**, 30064-74 (2013).

Investigation into Nucleation–Elongation Processes on 2-D Surface

Department of Synthetic Chemistry and Biological Chemistry
Graduate School of Engineering
Nobuhiko Nishitani

(1) Introduction: Self-assembly and Amyloid β Formation

Self-assembly is a process that molecules aggregate via noncovalent interactions and form periodic nano structures. Amyloid beta (Aβ) is one of the self-assembled biomolecules, and is associated with various neurodegenerative diseases. The key component of Aβ is the β sheet that has two dimensional (2-D) self-assembled structures, and it is known that the formation is promoted by surfaces. I envision that the fundamental research of the early stage of Aβ formation on a surface will allow for development of a remedy or an inhibitor against Alzheimer's disease.

In my LIMS research, I focused on a cooperative self-assembly of 2-D structure. By using scanning tunneling microscopy (STM), we can observe surface structures of 2-D self-assembly at the single-molecule level, and can discuss effects of molecular-molecular and molecular-surface interactions on β sheet formation. In my previous research, I proposed the method that enables us to quantify and estimate the effects of intermolecular interactions on stabilization of self-assembled structure.

(2) Results and Discussion

In this year, I synthesized rod-coil-like aromatic compounds bearing various hydrogen bonding groups: amide, urea, and hydroxy group, to discuss the effect of multidirectional hydrogen bonds on 2-D self-assembly process. Their self-assemblies at octanoic acid/ graphite interface were investigated by STM. I found that critical concentration was lowered by 40% by introducing hydroxy group. Furthermore, one compound bearing urea and hydroxyl group properly formed a needle-shaped domain while others formed domains having a small aspect ratio. The results suggest that the competition between intracolumnar and intercolumnar interactions may attribute to morphology at a liquid/solid interface. Similar anisotropic growth could be observed in Aβ formation, therefore this information is important for investigation of Aβ formation. The results are under preparation for publication.

(3) LIMS activities

As a LIMS activity, I conducted LIMS internship in Amar Flood group in Indiana University (June–August, 2016). In addition, I participated in the Program for Leading Graduate Schools Forum 2016 (November, 2016). I reported about these activities individually.

Molecular mechanism of cognitive impairment in mice

Department of Molecular Pharmacology
Graduate School of Pharmaceutical Sciences
Jun Miyanohara

(1) Internship program in Boston and Academic conference in San Diego

Last year I went Massachusetts General Hospital (MGH) and Harvard Medical School in Boston for about a month. This program was supported by Dr. Arai and Prof. Lo. Their invaluable assistance enabled me to have such a precious time. I thank them very much. In the last week of the internship program, I participated in Society for Neuroscience in San Diego to give a poster presentation. It was a good opportunity to consider how to achieve my doctoral research, what to do in my future career, and what I could do for my country.

(2) Molecular mechanism of cognitive impairment in mice

I have been dedicated to studying on vascular dementia in mice, as a LIMS research. I found that mice subjected to bilateral common carotid artery stenosis (BCAS) for 8-12 months showed significant decrease in hippocampal-dependent reference memory compared to those for 28 days. Recently, I have been interested in broader field in dementia. Dementia contains a variety of forms such as Alzheimer's disease, vascular dementia, Lewy body dementia, and so on. Especially, I have a keen interest in the upstream of these forms: ageing, which is largely hinted by internship and academic conference last year. Ageing is a universal factor for cognitive decline following various forms of dementia. As a matter of fact, there are many evidence that aged mice shows cognitive impairment related to reference and working memory, similar to human. In my preliminary data, middle-aged mice also slightly decrease in cognitive performance compared to young 8 weeks mice. Furthermore, these mice depleted TRPM2 gene, which is reported to be involved in many neuroinflammation-associated disease showed a tendency to improve in cognitive test. In my future study, I would like to pursue the histological change and detail molecular mechanism for the onset of the cognitive decline.

(3) From this year to final screening

From this year I have to study harder to summarize researches both in pharmaceutical sciences and in LIMS. I modified my LIMS research theme from last year so that the study will be more clinically demanded one, which seems not so easy to shape for final screening. Thanks to teaching staff, office workers, and my colleagues, I had a fruitful time this year. I am looking forward to your ongoing support, thank you.

Roles of microbiota on healthy aging

Department of Synthetic Chemistry and Biological Chemistry
Graduate School of Engineering
Takuto Suito

(1) Introduction

Inside human body, hundreds of trillions of microbes exist. They make a microbial community which called “microbiota”. Recently, thanks to the development of high-throughput DNA next generation sequencer and other technologies, we could understand the entire image of human microbiota and the relationships between microbiota and their host organisms. According to the studies, microbiota plays important role for host metabolism, immune development, intestinal homeostasis and neurological function. In addition, several studies also suggested that microbiota affects aging.

Recent studies showed that microbiota of elderly people represents more inter-individual variation than that of younger people. In addition, elderly people who has health problem has less diversity of microbiota or loss of several kinds of bacteria compared to healthy elderlies. But, no studies have figured out the clear relationship between aging and specific bacteria species.

As the LIMS research theme, I focused on the relationships between aging and gut microbes. I have attempted to elucidate the role and effect of microbiota in healthy aging using simple Drosophila model.

(2) Experiment and Results

①Microbiota affects host lifespan

To seek the role of microbiota on lifespan, germ-free flies which means flies without microorganisms were generated and lifespans were compared with conventionally reared flies. The lifespan of germ-free flies was shorter than that of conventionally reared flies (fig. 1).

②Microbiota changes in aging

In order to elucidate the changes of bacterial community in aging, I collected samples of flies aged in 0, 5, 11, 24, 36 days old (their average lifespan is nearly 25 days) and compared the differences of microbiota of each age using next generation sequencer. From the analysis, microbiota of drosophila consisted of small kind of bacterial genus, Orbus, Acetobacter and other about 20 bacteria genus. In addition, compositions of microbiota changed and diversity of microbiota decreased in aging. These results may mimic the changes of microbiota in aging similar to human.

③Environmental temperature affects host lifespan and microbiota

To confirm the effect of environmental temperature on the lifespan, flies were reared at 18℃ or 25℃ and lifespan was measured. As reported previously, lifespan got longer when flies reared at cooler temperature. Subsequently, number of bacteria was assessed by quantitative PCR targeting to the bacterial 16S rRNA sequence of 16S rRNA V2 region (Total bacteria), Acetobacter, Bacilli and Corynebacterium (fig2). In flies cultured at 25℃, numbers of total bacteria and bacilli was once decreased but increased in 40d. Corynebacterium was decreased in 10d and low level until 40d. Acetobacter was, however, drastically increased in 10d and continued to exist in high level until 40d. In flies reared at 18℃, numbers of all kind of bacteria were small compared with 25℃ and increase in the number of total bacteria on 40d have not observed.

(3) Discussion

This study showed ①microbiota affects host lifespan and ② microbiota changes in aging like human. These results suggested that this model study is valid for analyzing the relationship between aging and microbiota. In addition, I determined a few bacterial genus which appear only in young or old age. These bacteria may have important role for the determination of lifespan.

I also showed ③Environmental temperature affects host lifespan and microbiota. In particular, levels of bacteria of flies reared at 25℃ increased in 40d but this tendency was suppressed at 18℃. This data suggested that low level of total bacteria or suppression of the number of specific kind of bacteria may confer longer lifespan in flies reared at cooler temperature.

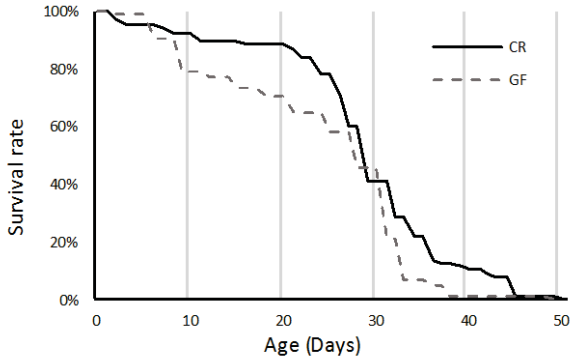
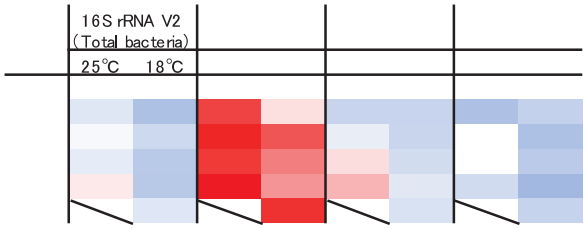


Fig. 1. Shorter lifespan of germ-free fly.
Survival curves of conventionally reared (CR) (n = 95, median survival is 29days) (blue) and germ-free (GF) (n = 90, median survival is 28 days) (red) flies. GF flies showed shorter lifespan compared to CR ($p < 0.05$).



color scale shows the fold changes of bacterial amount from 0 days old. Bacterial amount was assessed by qPCR of 16Sr RNA normalized with actin.

Learning about the development of neuronal networks in the brain

Department of Biological Chemistry and Synthetic Chemistry
Graduate School of Engineering
Kazuma Yamaguchi

(1) Learn the techniques to observe and research the synapse.

Neurodegeneration is one of the biggest problems in aged societies, and my researches at LIMS program is focused on SCAs that is one of the neurodegenerations. Neurons die in the brain of patients. The death of neuron is tightly related with neural activities. Communication between neurons is done at the synapses. To learn about synapse is very important for understanding neuronal activities and death.

Therefore, I had planed internship to learn how synapses are developing in the brain morphologically and electrophysiologically. Thanks to the cooperation of Professor Lu Yang Wang, I could learn about synapse at the Hospital for Sick Children in Toronto, Canada. Professor Wang is the best expert in patch clamp at the calyx of held in the world. Normally, synapses are very small, but the calyx of held is very large pre-synapse, we can directly record the ion current from the pre-synapse. I stayed in Toronto and practiced how to do patch clamp with the brain slice of mouse and record at synapse. Actually, pre-synaptic recording is too difficult to accomplish in only one month, Prof. Wang recommended post-synaptic recording. Post-synapse against the calyx of held is called MNTB neuron. Patch clamp at post-synapse is also difficult, but easier than pre-synapse. I tried recording calcium current from post-synapse, because calcium ion has a lot of very important roles in the cell and often related to cell death. Finally, I managed to be able to do patch clamp at MNTB neuron in the final week of this internship, but it was not perfect for me. I should practice a lot more if I want to use the technique for the experiments.

This internship was also a good chance to learn in other country about the customs, religion, philosophy, economics, and so on. Fortunately, there are a lot of peoples in Canada, I could learn how to live in the highly internationalized society, and we cannot learn it in Japan. It was shocked for me that professors and students call each other by first name. Even though I agree with Japanese manner, their manner is good for being friends with older or younger people. I also learned how important to communicate with colleagues. Colleagues could understand the difficulties or stresses that I faced, because they had experienced like that situation before. They advised, helped and released me from stresses by talking or chatting. In his lab, they eat lunch together everyday. Prof. Wang said that it is very important to communicate everyday.

(Form 3)

Student Internship Report

Program for Leading Graduate Schools
Training Program of Leaders for Integrated Medical System for Fruitful Healthy-Longevity Society, Kyoto University

Name	Kazumasa Suenaga	Date of Birth	08/24/1990
Graduate Course	Graduate School of Engineering	Major	Department of Polymer Chemistry
Department	Polymer Chemistry	Grade	1st grade of Ph. D.

Research Theme at the Graduate School	Synthesis of Element-Block Polymers Containing Boron Element
Supervising Professor (Name, Position, Department)	Yoshiki Chujo Full professor Department of Polymer Chemistry
LIMS Research Issues	Development of Functional Optical Materials for Quantifying Biomolecules Based on Organic-Inorganic Hybrids
LIMS Supervisor (Name, Position, Department)	Souichi Adachi Full professor Hematological and Infectious Diseases
LIMS Mentor (Name, Position)	Nobuyuki Higashimori, lecturer

Outline of LIMS Research:

My research purpose is a development of imaging probes and biosensors containing stimuli-responsive luminescent dyes which can show bright emission only in the aggregation states. In the LIMS program, I am particularly focusing on the preparation of quantitative sensing materials for biological events and bio-significant molecules. From the previous studies, the luminescent chromic sensors for protein aggregation were obtained. By using these materials, various kinds of proteins such as BSA and glutathiones can be discriminated. In particular, the oxidation state of glutathiones can be clearly distinguished with this sensing system. This result should be feasible for the assessment of cellar aging. However, although these proteins can be detected qualitatively, quantitative monitoring has not been accomplished yet. Furthermore, it is essential to improve selectivity in the detection. To solve these problems, it is proposed that application of new materials and strategy for detection should be strongly required.

Internship Period	from 06/14/2016 to 09/02/2016
Internship Location	Institution: Cornell University, Department of Materials Science and Engineering
	Address: Ithaca, NY 14853-1501
	Telephone: FAX:
	Email address:
Host Supervisor (Name, Position, Department)	Christopher K. Ober Full Professor Department of Materials Science and Engineering
Accommodation	Name:
	Address:
	Telephone: FAX:
	Email address:

Trip Period	from 06/14/2016 to 09/02/2016			
Date	Place of Departure / Arrival	Destination Site(s) / Venue	Place and Duration of Stay	Purpose / Activity
06/14 ↓ 09/02	Kyoto University, Katsura Campus	Cornell University	USA, NY	

【Please answer the following questions. Summarize your report in two pages, including the following points:】

○Objectives

Step-wise synthesis provides the opportunity to generate polymers with complete sequence control. This strategy was pioneered using solid supports by Merrifield for peptide synthesis, but has also been developed for the synthesis of DNA, RNA and a variety of resin-bound organic structures. However, the extension of these techniques to create sequence-defined non-natural polymers of significant main chain lengths has been a longstanding challenge. The monomer coupling reactions used to make such polymers need to have nearly quantitative yields in order to synthesize large, well-defined polymer chains. Peptidomimetic *N*-substituted glycine polymers, or peptoids (Figure 1), break this yield barrier and have thus opened up a new class of sequence-defined polymers. Peptoid polymers thus straddle the boundary between biological materials and synthetic polymers: their biomimetic structure and precision sequence control provides a breadth of opportunities to produce sequence programmable, folded polymers with the robustness typical of synthetic materials.

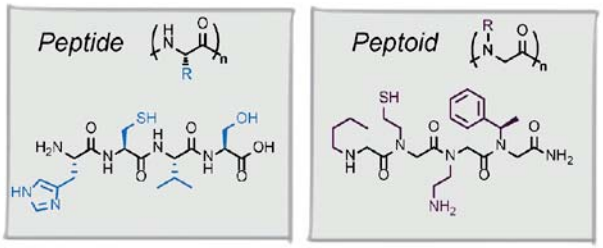


Figure 1. Comparison of chemical structures between peptides and peptoids.

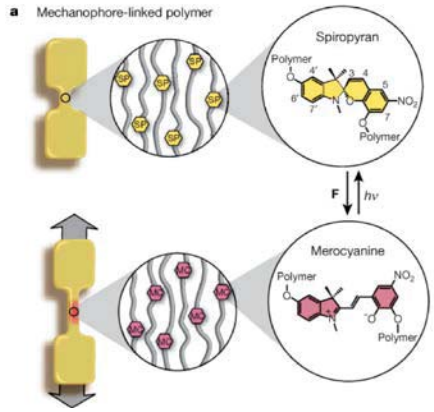


Figure 2. Schematic model of the detection for mechanical stress by luminescent changes on the basis of spiropyrane-modified peptoids.

The precise designed foldermers have been recognized as a platform of the probe for mechanical stresses at the local spot under biological conditions by measuring the shape of molecules. By introducing emissive dyes into the foldermers, the molecular motions can be monitored by their optical property changes. Thus, these properties are advantageous for realizing stimuli-responsive probes with mechanofluorochromism.

○Internship tasks

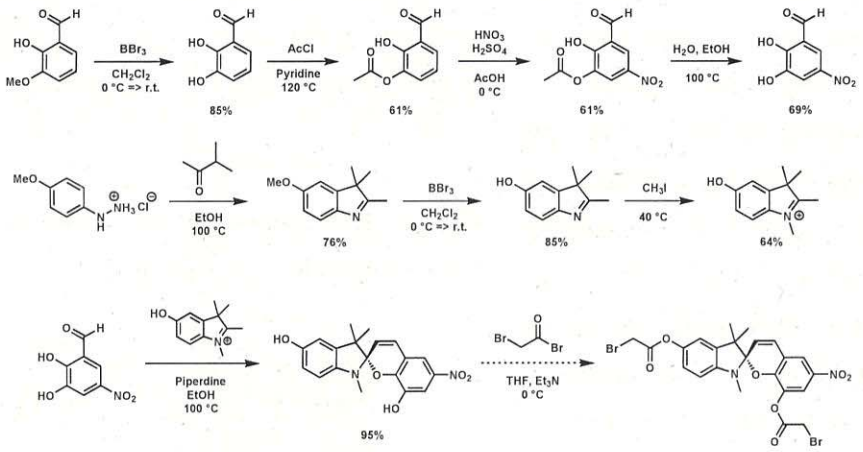
The foldermers having emissive dyes based on the peptoid structure were designed and synthesized (Figure 2). The peptoid backbone was prepared with an automated-peptide synthesizer via the solid-support method. Moreover, the stimuli-responsive luminescent unit was synthesized by employing the spiropyrane structure.

○Details of Activities

The foldermers having emissive dyes based on the peptoid structure were designed and

synthesized. The peptoid backbone was prepared with an automated-peptide synthesizer via the solid-support method. Moreover, the stimuli-responsive luminescent unit was synthesized by employing the spiropyrane structure according to Scheme 1.

Scheme 1. Synthesis of the spiropyrane unit



○ What did you learn from your internship? 【Write in detail】

① How did your viewpoints on society expand?

Information on the hot topic with high relevance in the molecular imaging and the critical strategy for the design of the practical molecular probes can be obtained.

② What original new ideas were you able to come up with through this social experience?

The several fundamental issues on the bio-mimetic materials, surface modification for improving bio-compatibility and fusion of technology with bio and material science were learned in this visitation. These would be feasible for material design in the LIMS project.

③ Have you found a new direction during this internship?

In the previous versions, only small molecules were used as a scaffold for constructing probes. During this visitation, the molecular design with oligomers and polymers was inspired.

④ Flexibility (Including challenges encountered and your strategies for coping)

Because of intrinsic instability of the spiro compounds, the limited reactions are applicable. Since the stable compound can be obtained, it is presumed that the conjugation could proceed in good yields.

○Achievements

90%. The most of synthetic conditions for the target molecule were optimized. Furthermore, the peptoid synthesis was also performed.

○Self-evaluation

I achieved 10-steps synthesis within 3 months under different circumstances. Additionally, I treated with the materials which have not been used before. These experiences are valuable for further extending my research in future.

I hereby submit the internship report.

Date (12 / 09 / 16) Signature of Applicant K. Suenaga.

(Form 3)

Student Internship Report

Program for Leading Graduate Schools
Training Program of Leaders for Integrated Medical System for Fruitful Healthy-Longevity Society, Kyoto University

Name	Nobuhiko Nishitani	Date of Birth	5/24/1990
Graduate Course	Graduate School of Engineering	Major	Physical Organic Chemistry
Department	Department of Synthetic Chemistry and Biological Chemistry	Grade	1st grade of Ph. D.
Research Theme at the Graduate School	Cooperative Self-Assembly and Photoresponsive Behavior of Photochromic Diarylethenes		
Supervising Professor (Name, Position, Department)	Dr. Kenji Matsuda Professor Department of Synthetic Chemistry and Biological Chemistry		
LIMS Research Issues	Control of Cooperative Self-Assembly for Bio-Inspired Supramolecular Materials		
LIMS Supervisor (Name, Position, Department)	Dr. Makoto Noda Professor Department of Molecular Oncology		
LIMS Mentor (Name, Position)	Dr. Yasuharu Hirai Program specific Assistant Professor		

Outline of LIMS Research:

Self-assembly is a process that molecules aggregate via noncovalent interactions such as van der Waals and hydrogen bonding interactions, and form periodic nano structures. Amyloid beta (Aβ) is one of the self-assembled biomolecule, and is associated with neurodegenerative diseases such as Alzheimer's disease and Parkinson's disease.

The key component of Aβ is the β sheet that has two dimensional (2-D) self-assembled structure composed of peptides, and it is known that formation of a hydrogen-bond network is a key driving force for self-assembly. In addition, it is known that formation of β sheet is promoted by surfaces. Therefore, investigation of effects of molecular-molecular and molecular-surface interactions on β sheet formation will allow for a fully understanding of the early stage of Aβ formation.

I focused on cooperative self-assembly of Aβ at a liquid/solid interface. By using scanning tunneling microscopy (STM), we can visualize and access to surface structures of 2-D self-assembly at the single-molecule level. In this research, I established the method that enables us to quantify and estimate the effects of intermolecular interactions on stabilization of self-assembled structure.

Internship Period	from 6/8/2016 to 8/1/2016
Internship Location	Institution: Department of Chemistry, Indiana University
	Address: 800 East Kirkwood Avenue, Bloomington, IN 47405, USA
	Telephone: FAX:
	Email address:
Host Supervisor (Name, Position, Department)	Dr. Amar H. Flood Professor Department of Chemistry
Accommodation	Name:
	Address:
	Telephone:
	Email address:

Trip Period	from 6/8/2016 to 8/2/2016			
Date	Place of Departure / Arrival	Destination Site(s) / Venue	Place and Duration of Stay	Purpose / Activity
6/8-8/1	Japan/USA	Indiana University	Indiana University/55days	Research

【Please answer the following questions. Summarize your report in two pages, including the following points:】

○Objectives

Anion, an atom or a molecule charged negatively, has important role in biological systems and the natural world. As anions are tightly connected to our life activity, even slight amount of existence or change of concentration can lead health problems. Anion recognition chemistry is one of the powerful technology for sensing or trapping anions in the natural world. In that field, artificial anion receptors that have higher selectivity and can be produced cheaply have been developed based on supramolecular chemistry.

Tricarbazolo triazolophanes (Tricarb) are the anion receptors that Amar Flood group and Steven Tait group recently reported. They tries to investigate and control self-assembly behavior of Tricarb both in solution and at the liquid/solid interface for their application as functional organic materials. I have been very interested in a system in which (i) self-assembly process occurs in solution and at a liquid/solid interface simultaneously, and (ii) conditions like temperature and concentration can be changed sequentially. Therefore, learning their strategies to investigate 2-D and 3-D growth mechanism of self-assembled materials is valuable for my LIMS research, the investigation of amyloid β self-assembling mechanism.

○Internship tasks

My task was expanding the series of Tricarb derivatives. Tricarb is a planar macrocycle composed of three carbazole units. In the project, I distributed the building blocks to tune optical properties and self-assemble behaviors of tricarbs.

○Details of Activities

As synthetic targets, three tricarb derivatives were designed. I synthesized four types of building blocks (including three novel compounds) and completed to synthesize one tricarb derivative. Further synthesis and measurement of their properties will be conducted and published by Flood group.

In addition to the synthesis, I attended lab meetings, learned about the analytical methods for supramolecular chemistry in Flood group and about the outreach activity in the group. I also visited Tait group to learn their STM systems and practiced STM observation. The ending part of my stay, I participated the Third Annual Symposium on Materials Research, in which students in the field of material chemistry present their research, I was able to learn research projects in other laboratories and discuss with them.

Fortunately, I was able to participate the meeting of Japanese researcher in Indiana State, called “Indy Tomorrow.” Dr. Masaki Uchida who belongs to Trevor Douglas laboratory (next to Flood group) took me there. The chair of the meeting is Dr. Ei-ichi Negishi at Purdue University, and Japanese researchers were from chemistry, medicine, and pharmaceutical industry. They presented their research, techniques, and hot topics in their field.

○ What did you learn from your internship? 【Write in detail】

① How did your viewpoints on society expand?

I became aware the importance of getting a clear big picture of own research targets. In the field of material chemistry of Indiana University, every group regards the application as important and develops chemistry having social impacts, while each group is based on various fields; organic chemistry, inorganic chemistry, and biochemistry. The philosophy of “material chemistry” is clearer than that in Japan.

② What original new ideas were you able to come up with through this social experience?

I learned the system that shows 2-D and 3-D self-assembly from Flood group, and STM techniques of flow

cell and temperature control system from Tait group. I will construct a new system in Japan, and it will help investigating the complicated self-assemble processes like Aβ formation.

③ Have you found a new direction during this internship?

I decided to learn about the research or technique of other laboratories in my department in detail when I came back to Japan. The groups in Indiana University share their equipment and often conduct a collaborative research. Japanese researchers in Indy Tomorrow also exchange research ideas actively. Such active collaboration seems productive and should be introduced to my research method.

④ Flexibility (Including challenges encountered and your strategies for coping)

I found a problem in the original synthetic route for fluorene building blocks and proposed the new route. The route includes reactions that need a mercury lamp and a mechanical stirrer, they are not often used in the group. Finally, I got them from other laboratories with the help of group members and succeeded to synthesis novel fluorene building blocks.

○Achievements

I synthesized two carbazole building blocks and two fluorene building blocks for novel tricarb derivatives, and completed to synthesize one novel tricarb derivative. Introducing fluorene building block into tricarb was a new attempt in Flood group. I carried out the begging stage of development of tricarbs as new organic materials. The project was taken over by the graduate student in Flood group and will be published. Additionally, collaboration among Flood, Tait, and my group is under discussion.

○Self-evaluation

I achieved over 10 steps synthesis within two months under different circumstances. I advanced the new project enjoying discussion with group members. The discussion with Prof. Flood and Prof. Tait broaden my perspective in chemistry and encouraged my career as a scientist.

I attended several meetings and communicated in English. I experienced the culture and humanity in the U.S. and understand the difference between Japan and the U.S. I regret that I had not noticed the importance of expressing myself in the beginning of the stay. However, I became able to join new communities and communicate more actively at last.

The whole experience in the U.S. had a great impact on my life. The experience trained me hard and leads to my confidence. I appreciate for your hard work. I express my sincere appreciate to Prof. Amar Flood for accepting me and supporting my project, Prof. Steven Tait for discussing with me kindly, Dr. Masaki Uchida for helping my daily life and teaching me many things about the U.S., and group members for giving me enjoyable experiences. I also deeply appreciate to LIMS program for giving me the opportunity to study abroad and financial support.

I hereby submit the internship report.

Date 1/19/2017 Signature of Applicant Nobuhiko Nishitani

(Form 3)

Student Internship Report

Program for Leading Graduate Schools
Training Program of Leaders for Integrated Medical System for Fruitful Healthy-Longevity Society, Kyoto University

Name	SHAMIMA SULTANA	Date of Birth	07/01/1980 month/day/year
Graduate Course	Master's Course	Major	Medical Science
Department	Department of Clinical Neurology	Grade	2nd

Research Theme at the Graduate School	A comparison in after-slow activity of epileptiform discharges and sharp transients among different time constant
Supervising Professor (Name, Position, Department)	Ryosuke Takahashi, M.D., Ph.D. Professor and Chair Department of Neurology Graduate School of Medicine, Kyoto University
LIMS Research Issues	Establishment of network-based, remote reading system of digital-electroencephalogram in nationwide- or global area
LIMS Supervisor (Name, Position, Department)	Prof. Hideaki Kakeya Department of System Chemotherapy & Molecular Sciences, Division of Bioinformatics and Chemical Genomics, Graduate School of Pharmaceutical Sciences, Kyoto University
LIMS Mentor (Name, Position)	Dinh Ha Duy Thuy Program-Specific Assistant Professor (LIMS), Human Brain Research Center, Kyoto University

Outline of LIMS Research:

Objective: To accumulate knowledge about the establishment of the global design of the network based remote reading system of digital electroencephalogram (dEEG) and in near future to establish this system in other Asian countries (e.g., Bangladesh).

Methods: A remote dEEG reading system will be set up at Kyoto University hospital in cooperation with other remote hospitals and the EEG manufacturer (Nihon Kohden) by using infrastructures mainly supplied by the EEG manufacturer and commercially provided information technology services. Then we will do statistical analysis about the effects of important practical factors (clinical utility, cost effectiveness, privacy, rapidity and so on) in running the system, and finally clarify the methodology to maintain and improve our system.

Expected Outcome: The essential important practical factors in establishing the network based remote reading system of dEEG in Japan will be clarified. These will be helpful information when we will introduce and establish this system in the nationwide- or global field, especially in Asian countries (e.g., Bangladesh) in the near future.

Internship Period	From 11/01/2016 month/day/year to 11/30/2016 month/day/year
Internship Location	Institution: Nihon Kohden Corporation R&D Center
	Address: 1-1-6 Kusunokidai, Tokorozawa-shi, Saitama 359-0037, Japan
	Telephone: FAX:
	Email address:
Host Supervisor (Name, Position, Department)	Ryuzo Mase Senior Manager Engineering Department 3, Biomedical Instrument Business Operations
Accommodation	Name:
	Telephone: FAX:
	Email address:

Trip Period	From 10/31/2016 month/day/year to 11/30/2016 month/day/year			
Date	Place of Departure / Arrival	Destination Site(s) / Venue	Place and Duration of Stay	Purpose / Activity
October 31st, 2016	Hyakumenben, Kyoto	Tokorozawa city, Saitama	Tokorozawa city, Saitama, Duration of stay – 31 days	For Internship

【Please answer the following questions. Summarize your report in two pages, including the following points:】

○Objectives

1) To broaden my knowledge on dEEG development from technical viewpoints: This internship gives me the opportunities to broaden my knowledge on controlling of the dEEG machine, maintenance of digital instruments, about analog to digital converters, hardware, basic software development, software maintenance, system analysis, database system for dEEG.
2) To gather the knowledge on network management: I gather knowledge about the safe digital communication in finest way, about web technology, web browser, EEG data server etc.
3) To understand the global design of the network based remote dEEG reading system and integrate the knowledge about dEEG and network, how to operate it and the crucial factors for successful implementation of this system.

○Internship tasks

Learn and practice on setting up a server system, application programs on server, setting up a client PC, application program on a client PC, how to connect clients to server, how to use application program.

○Details of Activities

✓ First stage: taking the following lectures from Nihon Koden 's staffs

・EEG Hardware/Software・Neuroworkbench network system. ・Cases of remote review system・Remote review system at Kyoto University. ・Measure EEG with 10-20 amp and Headset (lecture and actual practice)

✓ Second stage: practice as an engineer of their team work

・Installing Server (Windows Server and Hyper-V). ・Installing XenDesktop & app; Develop Kyoto System Server. ・Created Server and Client system based on Citrix XenApp, based on local LAN (Local area network) environment. ・Create Physical PC with same environment. ・Evaluate this system.

○ What did you learn from your internship? 【Write in detail】

① How did your viewpoints on society expand?

I have learned that for successful implementation of this remote system in the society, the teamwork and cooperation between three disciplines such as medical science, medical engineering and information technology; technical facilities such as high speed and stable network, good infrastructure, human resources in every department are required. Furthermore, though the system (virtualizing system) is little bit expensive than LAN, I think it is possible to establish this system in Bangladesh and other Asian countries which can be very applicable way to evaluate the neurology patients remotely, reducing the time of diagnosis which is necessary to improve the outcome of this type of critical patients.

② What original new ideas were you able to come up with through this social experience?

During my internship period I have learned that this remote digital EEG reading system does not depend on the type of digital machine, any level of volume of data size can be transferred, no artifact will be produced and no change or loss of the data during transferring, it is secured and can ensure patient privacy which are the new concepts for me.

③ Have you found a new direction during this internship?

For effective application of this remote review system, I have to be concerned about the network system (no delay or delay), infrastructure, security and knowledge about the technical aspect of the system. Virtualizing system (expensive) may produce stable services than local area network (not so expensive) if the distance between 2 hospitals is longer or in the condition of slow network system.

④ Flexibility (Including challenges encountered and your strategies for coping)

As a medical doctor, this technical environment of the internship is very different and new for me. Initially I have a little problem to understand the technical terms. But later I tried to learn about these matters and everyone in my team taught and helped me a lot to understand.

○Achievements

This is the first time for me to visit such a famous manufacturer, developer and distributor of digital EEG in Japan. I have been introduced with different types of medical instruments such as digital EEG machine, camera used in long term video EEG monitoring, EMG/EP measuring system. I have tried to gather knowledge about the following things which are very new matters for me to be dealt with:

1) dEEG related knowledge from engineering, manufacturing and developing viewpoint

I have gathered knowledge about the engineering aspect of digital EEG machine like analog to digital converter, difference between analog and digital EEG machine, junction box, noise, filters used in EEG hardware, safety measures for operating EEG machine, EEG software such as filters, montages, wide band EEG analysis, FFT mapping, ECG filter, Neuroworkbench and Neuroreport.

2) Network related knowledge from technical viewpoint

I have learned about network (LAN, WAN, WWW) application protocol (HTTP, TCP, FTP), security protocol (SSL, FTPS), virtualization (VPN, XenDesktop/XenApp, Hyper-V) cloud computing.

3) A global design of the system

I have been introduced to the remote EEG reading system of other countries (domestic, between overseas countries) as well as the one in Kyoto University. I have experienced about development of the remote digital EEG reading system practically by virtualization and using local area network and evaluate the system in different network conditions by applying the network simulator.

○Self-evaluation

During this internship period I had a new experience about measuring EEG by using headset. I obtained an idea about designing, establishing and handling the network based remote digital EEG reading system and how to work in a team of different disciplines which are very valuable experiences for further expanding the system in other areas. I tried to develop practically an environment of remote dEEG reading system with different network states. These are very innovative practices that will help me to develop the system as a leader in Bangladesh and other Asian countries in the near future and analyzing dEEG signal for diagnosis of the patients with neurological disorders.

I hereby submit the internship report.

Date (/ /) Signature of Applicant S. Sultana

Report of attending Leading Forum

L2 Li Xuebing

On 11.11 and 11.12, I attended the leading forum held in Tokyo.

On the 1st day of this time's leading forum, we first listened to 2 invited speech made by the Japanese education department to learn about the importance of doctor education. As one of the speaker has said, japan is now experiencing an undergoing of economy because of its aging society. The absence of workers has already become a key problem for the government to solve. One solution that the Japanese government has given is to raise the education level of its talents to raise their competence in the society and in the whole world. IN A word, by education high level talents instead to a high number of talent has already become one of the policies that Japanese government is implementing to raise the competitive power among the world, and this is the background of the establishment of leading program. On the other hand, a doctor's degree in Japan nowadays usually means a pass permit to research and development in universities as corporations don't need a student at his age of 30 with no working experience. Because of the time expense and cost of doctor education, it has been considered as a risk for many Japanese people to enter the doctor course and this is absolutely harmful to the high quality talent strategy of Japanese government. To solve this problem in this time's leading forum, doctor course students were arranged to meet the representatives of cooperation to match a job in the future. As a student I listened to speeches made by the leader of many cooperation and made myself clear about what aspects cooperation values in working conditions. For L3 students, there was actually a matching conference for students and cooperation to meet with each other. It's very meaningful and I am looking forward to attending a same match meeting like this in the next year if it is possible.

On the second day, a symposium was held discussing a similar topic in the first day. The main purpose of this symposium was to help foreign students to find jobs in Japan. During the 2nd day's symposium, A HR from Minebea Co., Ltd was invited to give us a speech about what talents are needed in mordent Japanese society. On the same time, an international student also gave us a speech and then discussed with us about the career of students in japan. For students who are determined to be leaders in firms and corporations, this is absolutely a good chance for them to learn about Japanese firms and workplaces.

After the symposium, we took a picture in front of the symposium hall. (Photo Above)

I learnt a lot in this time's forum and I will always keep the information I learnt this time in mind in my research and study.

Program for Leading Graduate Schools Forum 2016

November 11-12, 2016, Tokyo, Japan

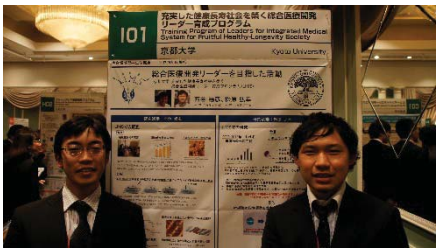
Department of Synthetic Chemistry and Biological Chemistry
Graduate School of Engineering
Nobuhiko Nishitani

Description of the conference

"Program for Leading Graduate Schools Forum 2016" is aimed to share the implementation status and challenges of each Leading Programs and further improve them. The participants were from 62 programs of 30 Universities, government agencies, and private companies. I participated the Poster Session titled "A gathering of doctoral students desiring employment in private enterprises, corporate managers and/or HR personnel" to present my activities and research in LIMS, and the Career Path-specific Sessions.

Report of our presentation

I and Mr. Matsubara made the poster presentation for managers or human resources personnel in industry, national research institutes, and government ministries and agencies. I introduced my research in LIMS: STM investigation on initial growth process of amyloid, and activity in LIMS: the 7th Techno-Renaissance Japan and LIMS internship in the U.S. The audiences were from Panasonic Corporation, Shiseido Company, Limited, RIKEN, and AIST. They told me about the career path of doctoral graduates. Audiences, particularly from private companies, emphasized that specialty is not always the most required ability for doctoral graduates, but managerial ability is important in the future. They also focused on our experiences studying abroad or teaching at our own laboratories. Audiences, particularly from national research institutes, focused on what I plan to do next or how I set a goal in my research. From these responses, I recognized the importance of the ability of gaining perspective or foreseeing the future.



Report of other presentations

I participated Career Path-specific Sessions (4): Academia & national research institutes (science & technology). At the session, four speakers from national research institutes and government ministries and agencies. They told us what they had done in their career and how they had changed their career. What was impressive to me was that at any point in time, they always try to clarify their intention and value it. Their stories encouraged me in my career goals.

リーディングフォーラム(2016/11/11,12)

作成日：2016/11/16

京都大学医学研究科　秤谷 隼世

リーディングフォーラムで私が参加したセッションそれぞれについて簡単な事後所感を述べることにしてレポートとする。

[第 1 日目]

- 招聘講演 1

  丸紅株式会社会長の朝田氏を迎えた講演として、商社の機能やビジネスモデルについて、および、リーディング大学院の学生に期待することについてお話しいただいた。普段の研究生活では馴染みのない商社の機能などについて知ることができたのは良い機会であった。また、博士号をもった学生が丸紅株式会社へ今年初めて採用されたということで、産業界への博士学生の進出が進んできている風潮を感じ取ることもできた。

- 招聘講演 2

  橘・フクシマ・咲江氏からのご講演として、これから求められる人財、およびリーディング大学院の学生に期待する素質についてお話しいただいた。私が慶應義塾に属していた時に、実は橘氏と 3 時間ほど対話と議論をさせていただく機会をいただいた。本招聘講演は、そのダイジェストのようなものであったため、橘氏の思考軸等について再び触れる機会となった。それでも、外柔内剛という考え方や、適所適材の考え方などは何度聞いても個人的にとても共感することができた。

- 産学ラウンドテーブル

  産業界やアカデミア、また行政会からの有識者を招いて、5 年目という節目を迎えたリーディングプログラムについて、およびこれからの博士人財について議論が交わされた。個人的に最も印象に残っているのは、「グローバルな視点でみたときに、博士号というものはなくてはならない」という時代を迎えているということである。ヘルスケアや医療産業においてはこの流れがきていることに気づいていたが、領域を限らずともグローバルでは博士人財が求められていることに少し驚きを感じるとともに、日本でそうした流れがきていないことに危機感や残念な感情を抱いた。

- 学生ラウンドテーブル

  リーディング大学院のプロジェクトチームが始まって 5 年目ということで、今年産業界へ進まれる先輩方がこれまでのリーディングを振り返り、その良かった点や課題について議論するセッションとなった。学生のみでのセッションということで、本音を打ち明

ける発言の多いセッションであったため、おもしろくはあった。ただ、登壇者はきっとリーディングに属している学生の中でも一段とキラキラした学生ばかりであったので、普通の学生の意見も聞きたかった。

[第 2 日目]

・ 学生討論会

リーディング大学院の学生が独自に取り組むプロジェクトとして、「Gulliver Project」、および「LEADING PLAT」というサービスを紹介いただき、そうしたサービスをより充実させていくにはどうすればよいのかという点について会場を交えて議論を行った。両サービスはリーディング大学院に属する学生のネットワーキングサービスであるが、両者とも立ち上げの段階にあり、多くの課題があるような印象を受けたし、場内からもかなり厳しい意見が交わされていた。

・ 分科会②産業界（研究職）・シンクタンク

博士号を取得して現役世代として産業界で活躍されている先輩 4 人の人生経験をお話いただき、これから社会に出て行く学生のためにメッセージをいただいた。どの先輩方も generalist として生きていくのか、specialist としていきていくのかなどといった葛藤をいだいていた時期があったなど、現在社会で働かれている方々も、現在の自分のアイデンティティを確立されつつも、持っている博士号をどう活かすかについては模索しながらここまでこられたのかなという所感をもった。自分も 5 年間というロングスパンを惰性で過ごさず、常に「自分は何をすべきか」を問答しつつ、リーディングでの活動や普段の研究活動に勤しんでいきたい。

[1 日目：基調講演]

[1 日目：終了後の集合写真]

The 4th Student Meeting of leading graduate schools 2016

July 8th to 10th, 2016, Makuhari Messe International Conference Hall

(Chiba Prefecture), Japan

Department of Radiation Genetics

Graduate School of medicine

AKTER Salma

The 4th student meeting of Leading Graduate Schools was considered as the largest meeting in history, meeting of the students, by the students, for the students. The meeting was from 8th to 10th July, 2016 at Makuhari Messe International Conference Hall (Japan's largest convention center).The theme of this year's student meeting was "Matsuri", meaning festival hosted collaboratively by three different programs; the Nature of Creative Research Leaders in Immune System Regulation and Innovative Therapeutics Program from Chiba University Human Biology Program from the University of Tsukuba, and Empowerment Informatics Program from the University of Tsukuba. The future leaders of Japan shared their different views and experiences in that meeting 0f two and half days festival. The main attraction of the meeting was the workshop" Operation Pumpkin King" which was combination of fun and innovation. On the other hand, the lectures from respected leaders of Japan were not only inspiring but also gave the meeting a different dimension.

President and CEO Mr. Yoshihiko Hatanaka of leading pharmaceutical company Astellas Pharma Inc. was there to motivate and inspire the young researchers in different fields and he focused on social networking, acquiring knowledge and adopting with changes. He spread his thoughts to the future leaders by his valuable speech especially the most inspiring quotes "Be sensitive to changes", and "Dreams come true by own will, own perspective and own words". Dr. Jun Suzuki, the President and CEO of Teijin Limited was also there in the second day of the program to share his personal achievements and the process of running of TEIJIN's in different field in different countries with a huge number of staffs. Dr. Suzuki focused on the operation of TEIJIN's DNA and the motto of TEIJIN's that is "Enhancing the quality of life." Both of these successful people basically try to motivate the leading program students to become a leader in their own field of interest. He mentioned a famous quotes of Japan which was very encouraging for the students "He who is ashamed of asking will be ashamed all his life of his ignorance- so express your thoughts ".He also told that "Good deed never goes unrewarded". At the final day, Professor Kadokura Akira (National Institute of Polar Research) presented his last Antarctica expedition, where he was the expedition leader and the researches going on under the JARE (Japanese Antarctic Research Expedition) in the Polar Regions.

The actual funnovative (Funny + Innovative) part was the workshop where about 200 students from different universities participates in 32 groups under the theme of "*Operation Pumpkin King ~Hijack Forbes Japan!!*" Within two and a half hour, all the 32 groups were prepared 32 different innovative reports along with funny ideas. We had to prepared a theme that would not only be funny but also innovative. Our group report was on making a special kind of device called "Memory Glass Toe Ring". This ring would have the capacity of acting as a navigator,

relaxing muscle during tiredness especially for the students, killing fungus and bacteria of shoes, absorbing sweat from the body during hot summer days, and it would also have the specialty to memorize someone's love. The funniest part of the ring was that it would be worn in toe of the feet instead of finger. From a puzzle of alphabets, we found out two words Glass and Toe and there was a given word Memory. We merged the three words to create a new story with some innovative ideas. We were six students from different universities (Kyoto, Kyushu, Yamanashi, Osaka, Tohoku University and Nagoya University) in our group. We passed two days with lots of fun and sharing our current researches with each other. The ice breaking session was vital for all of us to participate in the workshop very actively. The most innovative and the funniest article prepared in this workshop will be published in Forbes, Japan. Another interesting part was to meet many Bangladeshi students who are in different leading graduate school programs in different universities of Japan.

The opening reception was awesome and everybody enjoyed a lot and exchanged their views with different university students and also gets some information from the President of Astellas Pharma Inc. The Banquet party was really enjoyable with different Japanese traditional foods. Actually, the party was a great opportunity to be introduced with different Japanese foods and with students from different universities in Japan. This is very important for creating strong network among the leading graduate students to challenge the future world.

The three day long program ended with the "Makuhari Protocol", which actually express the goal of the future leader for upcoming days in Japan and all over the world. The "Makuhari Protocol" is like; the three essential qualities of successful leader which we have to obtain are "Flexibility", "Frontier Spirit" and "Feasibility", Tackle global issues through interdisciplinary communications, Begin and Continue, Take the initiative: we are educating, inspiring and empowering the next generation leaders from Japan.

In conclusion, it can be said that the meeting provided an extraordinary experience and the various activities at the student meeting will help the future leaders to challenge themselves to step out of their comfort zone and will also help to engage themselves to think creatively form various perspectives. On the other hand the participants will have a different view of solving their problems effectively inspired from the workshop. The meeting was a great experience for me. I experienced of riding shinkansen (rapid speed train) and also to visit Tokyo for the first time. The meeting was not only inspiring but also memorable to me.

Report on Forum 2016, Program for Leading Graduate Schools

On Nov.11-12 (Fri.-Sat.) in Hilton Tokyo Odaiba

L1 Rika Kojima

Objectives

The Leading Forum 2016 was held at the time when the first students of the leading programs leave school and go out into the world. The forum focused on a career plan as a student of leading program. There were many guests from industry, government, academia and organizations invited to interact with leading students and create brand-new career paths.

The first day

The main theme of the first day was the collaboration of industry and academia. What was the most impressive for me on the first day was round-table discussion from a student perspective. There were five students who will graduate their programs this year on the stage, talking about their experiences in the programs and job hunting. I was interested in a student from Tokyo Institute of Technology, who started his own companies. I think starting a business is one of the most innovative ways to make use of the experience in the programs. It was meaningful for me to hear about his experience and career path.

The second day

The purpose of the second day was sharing information between students and others involved. I attended career path-specific sessions (5), academia and national research institutes (humanity and social sciences). There were three guests who have obtained Ph.D. degree and are succeeding in their fields. The most interesting speaker for me was Tomoko Wakui, a researcher of Tokyo Metropolitan Institute of Gerontology. She works in a laboratory owned by administrative corporation. I haven't known the way working as a researcher in administrative laboratory. I could find a new career path through the discussion.

Conclusions

Since I am a L1 student and have just started my research, I haven't much thought about my career after complete the program. This leading forum was a good opportunity for me to turn my interest to my career plan. And I also learned that to be a global leader, we should try to tackle whatever we get interested in. I felt that students of other leading programs are taking part in various activities. I'd like to gain a wide variety of experience in LIMS program and link it to my career path.

The 4th student meeting of Leading Graduate Schools

July 8-10, 2016, Chiba, Japan

Department of Biopharmaceutics and Drug Metabolism
Graduate School of Pharmaceutical Sciences
Akihiro Matsumoto

On July 8-10, The 4th student meeting of Leading Graduate Schools was held in Chiba, Japan. About 200 graduate students, which is the largest turnout to date, from around the nation gathered at Makuhari Messe International Conference Hall. From LIMS, Ms. Salma and I joined this conference. The theme of the conference was "祭" (Matsuri, meeting festival), and the goal was to engage ourselves to think creatively from various perspectives as well as to enjoy interacting with people from different backgrounds. There were three lectures by Mr. Hatanaka, president and CEO of Astellas Pharm Inc., Dr. Suzuki, President and CEO of TEIJIN LIMITED, and Mr. Kadokura, Expedition Leader of the 57th Japanese Antarctic Research. We also took part in a workshop. In this report, I would like to summarize several points that interested me.

First, there is a great deal to learn from jumping into a foreign country alone. Mr. Hatanaka and Dr. Suzuki both went abroad for business when they were young. At that time, there were not many Japanese people living abroad and so they had to do everything by themselves. With very limited resources and know-how, they had to consider how to expand their business. They, in fact, confessed to some failures for the first time as well as success stories. Although their background and missions for business were different, they shared one characteristic in common; they went abroad alone and trained themselves. Putting themselves into tough environments made them strong and well trained.

Second, doing your favorite thing is the easiest way to foster innovation. An editor of Forbes Japan, gave us a special lecture. He has talked with a number of innovators worldwide and found one characteristic in common among them; they all developed world-changing innovations with the things they got interested in. He introduced two interesting stories cited from TED talks. (Links are listed below.)

https://www.ted.com/talks/simon_sinek_how_great_leaders_inspire_action?language=ja
https://www.ted.com/talks/derek_sivers_how_to_start_a_movement?language=ja

Third, English is just a tool to communicate. In LIMS, I sometimes feel sorry for my colleagues when they have difficulty expressing themselves in English. In this conference, the situation was totally different. Regardless of their nationality, every participant actively expressed their opinions in English and contributed to the discussion. I was happy to contribute and share my thoughts and ideas with my members in the workshop.

Conference report

Hiroyuki Matsubara (D1, L3)

Place: Hilton Tokyo Odaiba, Floor1, Tokyo Japan
Date: November 11-12, 2016

The Leading Graduate Schools Forum2016 disseminates the progress of this educational initiative and showcases the diversity of understanding the students have been able to attain. We aim to further enhance the program by sharing the implementation status and challenges of each program to a broader constituency. In Japan.

On behalf of LIMS member, I presented the our LIMS's idea and my study in LIMS. Some companies from Panasonic and Shiseido, and researchers from Riken were interested in our posters. Actually, they hardly know the Leading program like what program is, or who this program joins in (background) etc. Then, I said the importance of this program that we can get or share the knowledge deeply to collaborate with students have different backgrounds (engineering, medical, pharmacy). During discussing this, they could understand the concept and got the motivation they want to recruit leading program members I think.

At the last, I would like to thank LIMS program for giving me an opportunity to attend Leading Graduate Schools Forum 2016 in Tokyo. I could meet the new person (researchers, businessman and students from Leading program) who teach me how to apply our study into the society. If this forum will be held also next year, I would like to join.

リーディングフォーラム 2016 レポート課題（2016/11/11,12）

医学研究科人間健康科学系専攻
修士課程 1 回生　西山美咲

今回、リーディングフォーラムに参加し、初めて学外のリーディングプログラム履修者の意見や、考え、将来へ向けての自身のあるべき姿について聞く機会を得ることができた。

1 日目では、各大学が行っているプログラムの概要について聞き、取り組み方法は多種多様であることを知った。特に、慶応大学では、企業や行政の方をメンターとし、現代社会における生の課題や、真に必要とされているものを学生が認識し、討論をしあう機会を設けており、学生の段階から、そのような現状を目の当たりにして、意見を交換し合うことは、将来、世界で活躍する人材となるためには不可欠な経験であると思った。今の自分には、問題解決能力や、企画力が欠落していると感じているため、このような経験を積むことで、そうした能力も身に着けられるのではないかと考える。また、修士課程の段階から、海外留学を必須とする大学もあり、早い段階で、世界を見て視野を広げていくという取り組みも魅力的に感じた。また、学生ラウンドテーブルでは、各大学のプログラム履修生の生の声を聴くことができた。しかし、ほとんどの学生が、内定先が決まった博士課程の 3 回生の方で、プログラム履修生が抱えるリアルな悩み、苦悩などを聞くことができなかったのが少し物足りなく、残念に感じた。

2 日目では、学生討論会においてリーディングプログラムの在り方に関する討論を聞いた。ここでは日本の博士学生のいまを知るメディア「LEDING PLAT.」というものが特に議題とされていたが、このようなシステムがあることをこの場で初めて知った。このシステムが多数の学生に知られない原因が何かについての議論があり、メリットが分からない、伝え方に問題があるのではなどの学生からの意見がある一方で、〜がないから駄目だ、〜しないからうまくいかないという消極的な考え方ではなく、どうしたらうまくこのシステムを促進させることができるのか、何をすればもっと良いシステムとなるのかという積極的な視点でとらえ、議論していかなければ、前進しないのではないかといった、企業の方からの意見があった。最終的に解決策があまり見えないまま終わってしまったが、こうした取り組みは、なかなか得ることが難しい学外との学生間の交流を深め、現代社会をよりよくしていくための貴重な機会となるに違いないと思うため、これから、どのように推進すべきかをまずは大学ごとに学生が積極的に討論していくべき活動ではないかと考える。加えて、分科会では、アカデミア、行政、国研の方々の、求める人材についてのお話を聞き、修士卒業生よりも、より多くの知識や教養を得た多数の博士卒業生を求めているということを知ることができた。また、各職業の主な仕事について詳しく知ることもでき、自分の将来に対する考え方を改めて見直す機会となった。

リーディングフォーラムに参加したことは、今の自分や、将来必要とされている人物像をもう一度見つめなおすことのできる、意義のある経験となった。この経験を活かし、研究に励み、リーディングプログラムの目指すべき方向性について真摯に考えていきたい。そして、世界で活躍できる人材となれるよう、より一層努力していきたい。

58th ASH annual meeting
December 3-6, 2016, San Diego, California, USA

Department of Human health science
Graduate School of medicine
Shintaro Maeda

Meeting description

The annual meeting of American Society of Hematology (ASH) is the largest meeting of Hematologic research in the world. This meeting provides an invaluable educational experience and an opportunity to review thousands of scientific abstract highlighting updates in the hottest topics in Hematology. That is to say, network with top minds in the field, as well as a global community of more than 20,000 hematology professionals from every subspecialty.

Report of my presentation

I made the poster presentation titled "Targeting Philadelphia chromosome positive acute lymphoblastic leukemia with a novel transcriptional inhibitor." Many participants had an interest to my research and asked me a question. It was great and valuable experience for me. One of them asked me whether our new material had a reversibility in binding and if it does so, there is a possibility to toxicity to body. I answered that our new reagent binds to DNA via hydrogen bonding and crosslinks by alkylation, so that our material has no reversibility but damage DNA. This effect of damage DNA made us speculated that it is not completely non-toxicity. In fact, there is few toxicity, but thrombopenia was detected by our toxic test *in vivo*.

Useful information for future research

Mr. Sugihara, from Keio University, commented that a finding in regulation of BCR-ABL by RUNX1 is very interesting. He suggested that our biological model of treatment is less reliable, and offered his transgenic leukemia model *in vivo*. As it is true, I would like to use his mouse model for my research if our concept is applicable in his model.

Report of other useful information for the members of the LIMS program.

"Very rapid production of CAR^+T upon non-viral gene transfer using the Sleeping Beauty System."

Lenka V et al. The university of Texas MD Anderson Cancer Center Children's Cancer Hospital.

CAR^+T treatment is one of the gene therapy. To prepare gene transduced T cells, it takes 7-28 days for preparation. Moreover, persistence and engraftment of T cells are clinical issue. In their research, application of Sleeping Beauty system for CAR^+T cell treatment shortened manufacturing time and sustained T cell persistence. I expect that this technology will be applied to clinical soon.

5.

課外活動

Activities outside a Curriculum

Kyoto University-Industry Exchange Research Workshop and Internship-Matching Meeting

June 29, 2016, Kyoto University

Yasuharu HIRAI, Program-Specific Assistant Professor, LIMS

LIMS program obligates internship for students in order to expand their mind outside the academic research, have an experience of work in the field of industry/public institution and learn special technique/knowledge valuable for their LIMS researches. To find the internship partner, we are encouraging students to take advantage of IDM (Innovative Human Resource Development Matching) system, which is medium- and long-term research internship matching system conducted by the consortium called Industry-Academia Collaborative Innovation Human Development Association (C-ENGINE: Collaborative Education for Next-Generation INovators & Exploration of knowledge intersections; 産学協働イノベーション人材育成協議会). According to the announcement, more than 800 students were registered in IDM, and among them, about 150 are the students of Kyoto University and 19 students of LIMS. Some LIMS students practically utilize this system to determine the internship at this point (July 1st, 2016).

By Kyoto University and C-ENGINE, graduate school research workshop and internship matching meeting was held at 5th floor of International Science Innovation Building on June 29th. Cooperating 17 companies were participated and introduced their work, research, and their internship programs/policies. From LIMS, 5 teachers/staffs and 10 students were participated (totally *ca.* 30 and 73 from Kyoto University, respectively) and 5 LIMS students (15 students overall) made poster presentations about their researches. After the companies' introduction and students' poster presentation, students freely visited the company's booth of their interest. They listened to more detail explanation and discussed about the company's research and internship. One unfortunate was that a medicinal company to which many LIMS students might interest was not so many. However, a direct conversation with companies' research representatives must be fruitful not only for their internship but also their career plan. We expect LIMS students to take much opportunities of industry-academia exchange like this and acquire the non-academic cultures.

LIMS students (4 from the left) talking at company's booth

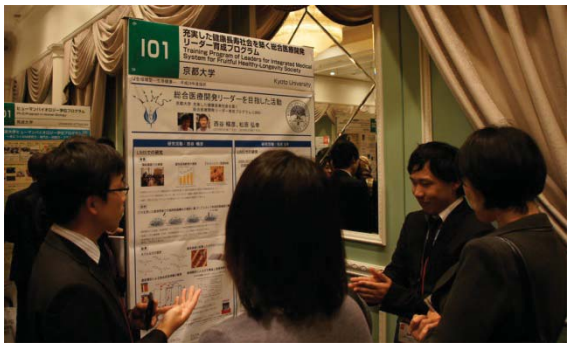
Forum 2016, Program for Leading Graduate Schools

November 11-12, 2016, Tokyo

Yu KIMURA, Program-Specific Associate Professor, LIMS
Yasuharu HIRAI, Program-Specific Assistant Professor, LIMS

Annual Leading Programs' meeting, Forum 2016 was held in Hilton Tokyo Odaiba, hosted by Keio University with the co-host Keidanren (Japan Business Federation). A total 62 programs across 33 universities were gathered. Participants were 1086, including 149 from industries, research institutes and governments etc. From LIMS, 7 students and 3 teachers participated in the forum. Facing the time when the first students of programs selected in AY 2011 are nearing the end of their course, this year's forum was especially focused on providing the opportunities for students to know what kind of skills, experiences, and minds are sought by employers as doctoral graduates, what careers their colleagues are planning, and what future approaches should be taken to develop their talent more in the leading graduate schools. From this perspective, the present forum consisted of following key sessions: two invited talks by the guests from the business communities; two round-table discussions (one by the representatives from industry and academia, and another by the students of AY2011-selected-programs who have decided their career paths after the end of their programs in next spring); poster presentations by the students who will graduate in the coming years, and 6 career path-specific talk sessions.

Two L3 students of LIMS, Mr. Nishitani and Mr. Matsubara, participated in the poster session and exhibited their LIMS studies for many participants from industry. All attended students, especially two poster presenters, must have developed incentives to grow their own talents and to gain a successful future career, and had the idea what is necessary to achieve it through taking the leading program. We hope similar meeting for industry-academia matching will be continued and much more students will attend it to secure their carrier paths successfully. Also we recognized again the importance of carrier path supports for students, to launch their graduated carriers hopefully as leaders to realize fruitful healthy-longevity society.



Students at Poster session: L3 Mr. Nishitani (left) and L3 Mr. Matsubara (2 from right)

Scene of Main Venue (Pegasus) and Opening speech by President of Keio Univ. (Day1)

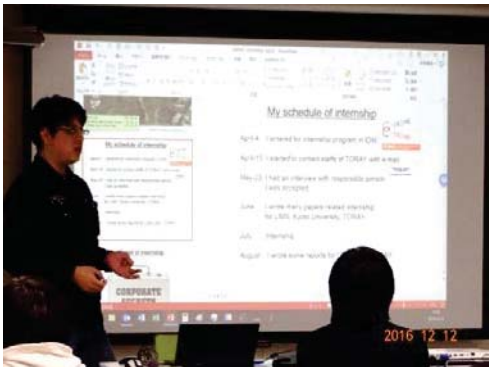
Instruction meeting for LIMS internship and Research Internship Matching System (IDM system)

December 12, 2016, Kyoto University

Yu KIMURA, Program-Specific Associate Professor, LIMS

As an extension of knowledge and skills in specialized and related fields acquired during the 1st and 2nd grades, each student serves his/her internship in a domestic industrial or public organization, also in a laboratory or company abroad. Students are expected to improve their practical abilities of research and development (R&D), judgment and communication.

On Dec. 12, 2016, We had instruction meeting for the internship, including orientation of IDM system for L1 and L2 students. At first, Professor Michinori Suginome (University director assistant for education) talked about positioning of internship on leading graduate school and about orientation of IDM system. Then, Mr. Masatoshi Uno (L3 student) introduced not only experience in the internship at Toray Industries Inc., but also his stories getting internship opportunities by using IDM system. Finally, Mr. Yoshihiro Fujimori (person in charge, C-ENGINE conference) explained the usage and outlines for matching between companies and students on IDM system. It would be a good opportunity for attended students to build a concrete image of internship. We continuously support and make these opportunities to encourage internship consulting and planning by students themselves.



(Upper left)
Instruction speech by Professor Suginome.
(Upper right)
Presentation of internshipexperience by Mr. Uno
(Lower left)
Introduction of IDM system by Mr. Fujimori.

記者会見・医療工学特別講演会　開催概要

平成 28 年 11 月 30 日(水)

12:30～13:15
毎日新聞社医療福祉部　編集委員　高野 聡氏 インタビュー
（本部構内総合研究 8 号館 2 階　小会議室）

LIMS プログラム開始の経緯に始まり、どのような人材を輩出するか、参考にしているモデルケースはあるのか、高齢化社会への対応で既存技術での限界はどこにあるのか、といった細部に渡るご質問から、プログラムの大学に対するメリット、医学部への好影響はあるのか、外部からの反響は、以前に比べてグローバルな競争が激しくなっている現状も動機に挙げられるか、LIMS が目指す健康長寿社会とは、などの第三者視点からのご質問に上本医学研究科長、渡邉 LIMS ユニット長、近藤 LIMS 協議会委員が熱心に対応された。

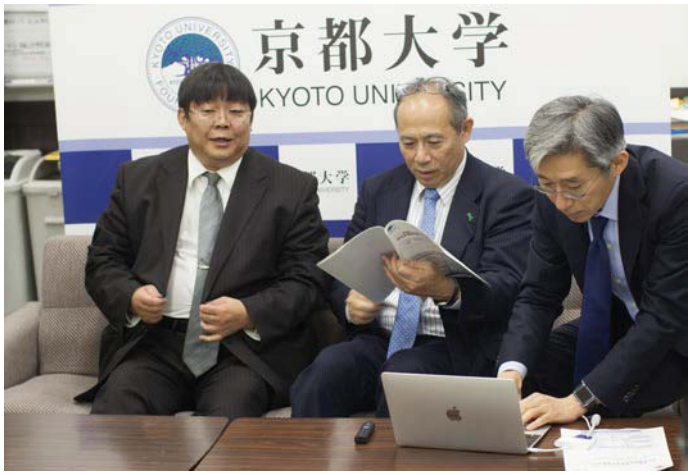
移動中（本部構内総合研究 8 号館から本部構内 百周年時計台記念館へ）

吉田南キャンパス

本部構内図↓

13:30～14:30

記者会見（本部構内 百周年時計台記念館 1 階 大学記者室）




（上左）司会の大菊医学 URA 室長
（上中央）概要説明をされる上本医学研究科長
（上右）プログラムの特徴について
説明される渡邉 LIMS ユニット長と
参加記者の方々
（下左）大学における医工連携の歴史
について説明される近藤 LIMS 協議会委員
（下右）LIMS プログラムへの期待を述べられる野田外部評価委員


（左右）記者らから質問を受ける医学研究科長と渡邉 LIMS ユニット長

続いて行われた会見には、読売新聞、毎日新聞、京都新聞、産経新聞、化学工業日報、日経 BP 社、日刊工業新聞、医療経済社、QLife 編集部 の記者の方々に LIMS プログラムの概要、特徴と独自の教育・活動、京都大学における医工連携教育・研究の取り組みと LIMS プログラムへの展開、患者からのプログラムおよび履修生への期待について、説明を行った。記者の方からは履修生の数と最初の卒業生輩出の年について、単位取得の難しさはないのか、などの質問がなされ、上本研究科長、渡邉ユニット長、近藤協議会委員が対応された。

12/28 には毎日新聞社にて下記のように報じられ、関心の高さが伺われた。

2017/2/27　　医学教育：「国際基準のカリキュラム」拡大　国際医療福祉大「米国流の実習に」 - 毎日新聞

海外先行「医工連携」　技術者に患者の視点を　京大大学院

京都大で大学院生に講演する野田真由美さん＝京都市左京区の京都大で、高野聡撮影

「がんは患者自身の価値観が治療選択に大きく関わる病気。治療ではさまざまな職種が関与するチーム医療が重要だ。チーム医療同様、医学と工学の連携によって患者にやさしい画期的な技術革新を生み出してほしい」

がん患者らでつくるＮＰＯ法人「支えあう会α」の野田真由美副理事長は１１月３０日、京都大のキャンパスで語りかけた。野田さん自身、乳がんを患い、家族をがんで亡くした。野田さんは、京都大大学院の工学系の学生に医学部卒業生と同程度の医学・医療知識を教え、革新的な医療機器などを開発する人材育成を目指す「総合医療開発リーダー育成（ＬＩＭＳ）プログラム」で、外部評価委員を務める。

プログラムは文部科学省の支援で２０１２年に始まった。工学研究科などの大学院合格者からＡＯ試験で選抜された現在計３１人が学ぶ。上本伸二医学研究科長・医学部長は「現代の医学、工学の学問は細分化されているが、医療・健康・介護分野の課題を解決するため社会全体を見渡して対処できる能力が求められる」と、「医工連携」を進める背景を説明する。

上本伸二・京大大学院医学研究科長・医学部長

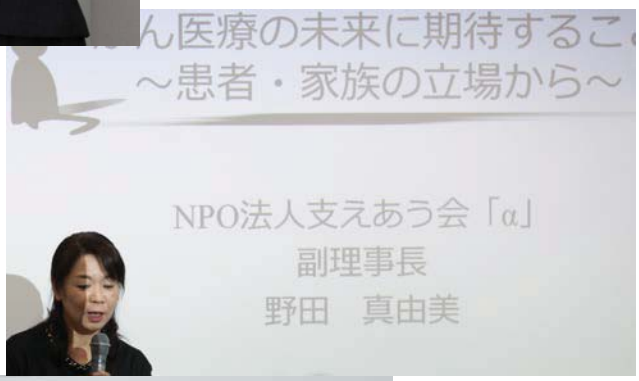
医工連携の取り組みは海外が先行する。このため、５年間の英語ディベートを必修とした。医療のニーズを知るには患者の視点も重要と考えて野田さんのような患者の講演会も開催する。

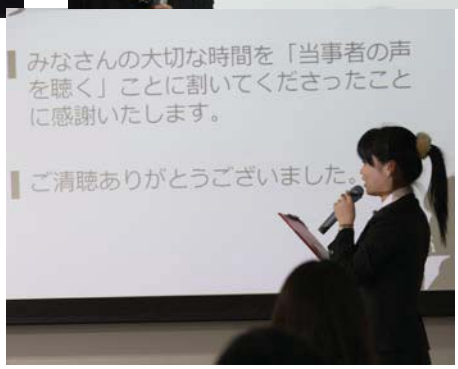
上本科長は「幅広い知識を身につけ、高齢者の社会参加が可能な社会システムや新産業を創出する人材になってほしい。起業に関心を持つ人材も育てたい」と話す。

15:00～16:30

医療工学特別講演会（医学部構内 Ｇ棟セミナー室Ａ）

（上左）会見前に準備する杉山さんと野田真由美さん
（上右）司会をする杉山さん
（下左、下右）ご講演をされる野田真由美さん





（左）質問をされる近藤 LIMS 協議会委員
（右）質問をされる司会の杉山医学・病院地区 URA

医学部構内に場所を移して行われた第１回医療工学特別講演会では、LIMS プログラムの外部評価委員にも就任いただいた NPO 法人支え合うかい「α」副理事長の野田真由美先生から、「がん医療の未来に期待すること～患者・家族の立場から～」と題し、ご自身の患者としてのご体験・お父様を家族として看取られたご経験から、がん治療における問題点、や患者の思い、期待することについてわかりやすくお話いただいた。履修生含め約 30 名の学生、スタッフが参加し、治療中・治療後の患者の方々の不安や、治療技術の変遷などについて認識を改めるとともに新たな医療技術の可能性について思いを巡らせるよい機会となった。

以上

Publicity Activities for recruitment of excellent enrollee

We performed drastic improvement of LIMS homepage including the top page (Unfortunately only Japanese pages have been set up so far). The summary and objectives are belows:

1. The new LIMS homepage is mainly designed for undergraduate students wishing application to LIMS program.
2. The homepage is also supposed to support activities of LIMS alumni, with providing useful information for them.

Concrete examples are indicated below:

[1] “Highlight（ハイライト）” position was newly added in top page. Some photos and articles from lecturer on “Medical engineering special seminar”, or from other topics would appear in this highlight position. Their articles would be renewed frequently and their archives would be prepared in LIMS homepage.

[2] Some links have been added for citation of LIMS homepage contents on Facebook and twitter.

<New designs>

[3] “Introduction of activities (活動紹介)” pages were prepared and introduced below activities:

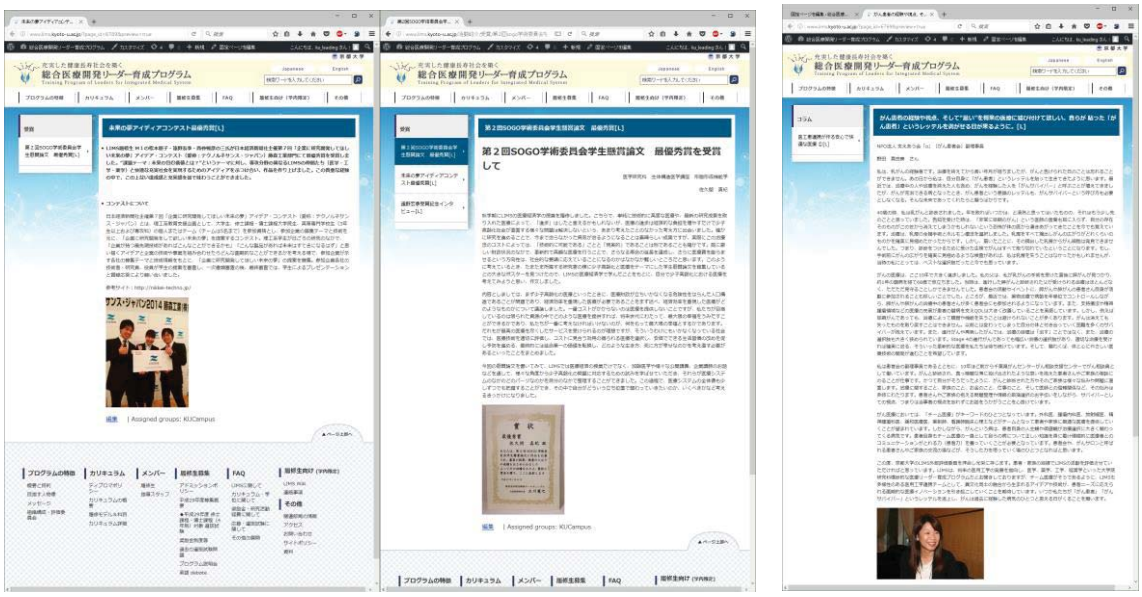
(1) Reports of internship

(2) Pre-research laboratory rotation course

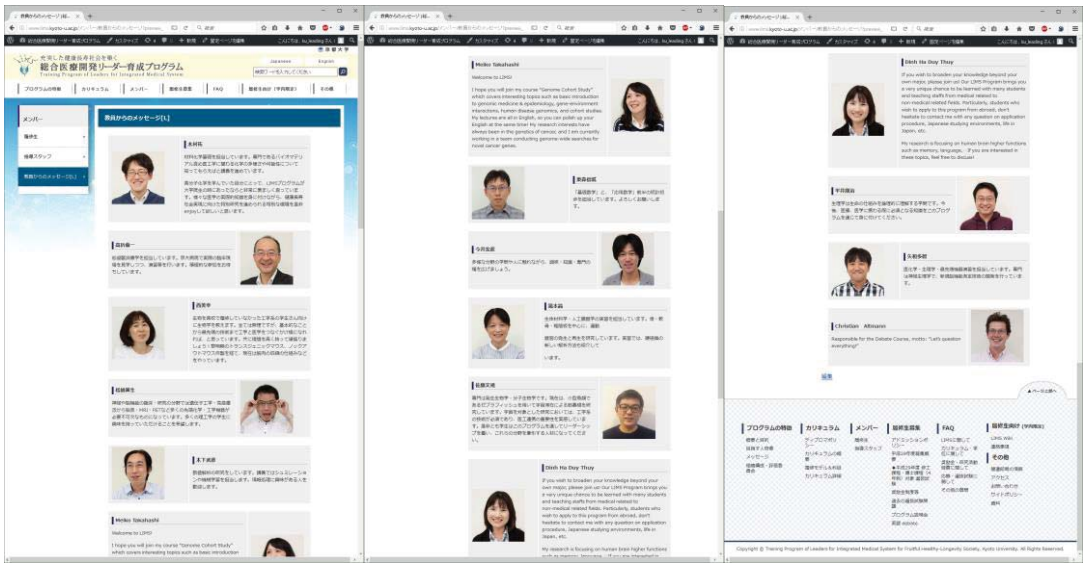
(3) Lectures and Instructors (Medical Engineering Special for Society etc..)

(4) Award-winning by LIMS students and program-specific staffs

(5) Column articles including general topics around medicine, medical devices and medical engineering etc..)



[4] “Message to applicants for program admission（教員からのメッセージ）” page has created in “Member”-“Staff” layer. This page contains portraits and messages of program-specific teaching staffs.



6.

産公学連携

Industry-Public-Academia Cooperation

Industry-Public-Academia Cooperation

Yu KIMURA, Program-Specific Associate Professor, LIMS

We have been referring to opinions and comments from companies and local governments since during planning LIMS Program. Twenty some of them are now supporting LIMS program as Cooperators. In collaboration with lecturers from the cooperating organizations, we prepared three subjects in which students can receive interactive lecture, discussion, problem solving practices on practical issues in the real world. Some situations of classes were reported in LIMS home page as "News" in this year (http://www.lims.kyoto-u.ac.jp/news/%E5%8C%BB%E7%99%82%E5%B7%A5%E5%AD%A6%E7%89%B9%E5%88%A5%E8%AC%9B%E7%BE%A9%E2%85%A0%EF%BC%88%E7%AC%AC5%E5%9B%9E%E3%80%81%E7%AC%AC6%E5%9B%9E%EF%BC%89%E3%82%92%E9%96%8B%E5%82%AC%E3%81%97%E3%81%BE%E3%81%97.html).

Subjects:

I. Medical Engineering for Society I:
Seven lecturers from 7 companies (14 periods including 4 at outside of Kyoto University)
Theme of class:
1. Introduction to the Standardization
2. R&D Based Home Medical Care (Omron Healthcare Co. Ltd.)
3. R&D for in vitro diagnostics and diagnostic imaging
(Center for Technology Innovation-Healthcare Research & Development Group, Hitachi,Ltd.)
4. Strategies for Intellectual Property and Global Standardization
(Toyota Technical DevelopmentCorporation)
5. R&D for State of Art Biomedical Optics Techniques (Hamamatsu Photonics K.K.)
6. R&D in Orthopedic and Dental Fields
7. R&D in Biomaterials and Bio-devices

II. Medical Engineering for Society II:
Nine lecturers from 6 companies (14 periods including 4 at outside of Kyoto University)
Theme of class:
1. Building social infrastructure for healthy, ageless society utilizing the brain information cloud (CSTI, ImPACT)
2. Cognitive Computing for Medical Innovation (IBM Japan, Watson)
3.Global Technological Development and Marketing Strategy on Healthcare Business Safety and Human Factors of Car Driving (GE Healthcare Japan)
4. Collaboration for Social Experiments (Omron Healthcare Co. Ltd.)
5. Strategies to Improve Health through Daily Life Environment (Daiwa House Industry Co., Ltd., Central Reaserach Laboratory)
6. Virtual Human Body Model for Integrated Safety and Brain Injury Prediction
(Toyota Central R&D Labs., Inc.)

III. Intellectual Property & Global Standardization

Nine lecturers from an independent administrative agency, public organizations, and a company + Kyoto University Staff (14periods)

Theme of class:

1. Introduction
2. Overview
3. Outline of the patent system
4. Drug discovery and development processes I Drug Discovery
5. Key points of patent practice
6. Drug discovery and development processes II Preclinical stage
7. Patent specification
8. Drug discovery and development processes III Clinical stage
9. Search for prior art
10. R&D Process Medical Devices
11. Global Standardization of Medical Devices
 (National Institute of Advanced Industrial Scinece and Technology (AIST))
12. Major International Standards
 (National Institute of Advanced Industrial Scinece and Technology (AIST))
13. Regulation of Medical Devices
 (Pharmaceuticals and Medical Devices Agency (PMDA))
14. Regulation of Medical Devices/ International Development of Medical Devices
 (Pharmaceuticals and Medical Devices Agency (PMDA))

Scene of Medical Engineering for Societies I (on Nov. 10)

Scene of Medical Engineering for Societies I (on Oct. 27)

”一番大事なことは、僕たちが作りたいものではなく患者さんが必要としているものを作る、ということ”

浜松ホトニクス(株) 中央研究所第７研究室 室長代理　上田之雄
聞き手：LIMS 広報　西　美幸

―LIMS は工学部の人に医学部の知識を、医学部の人には工学部の知識をもってもらい、リーダーになって健康長寿社会を牽引するというのが LIMS の基本概念です。私も医学系の方の出身で、機械の原理とかになると及び腰になってしまうのですが、そのへんのところはどうお考えですか？

実は東京女子医大に一年間医学を学ぶという講座(注１)があるのですが、僕が NEC グループの会社にいた頃それに参加させていただいていました。

―それで解剖とかをなさったのですか？

まあ解剖は犬ぐらいですけれども。そこで基礎から臨床まで、医学的知識を一通り学びました。

―そのときに先程講義でおっしゃっていた１．患者が必要としているものを、２．それを実現させるための医師を探して、３．共に実際的な開発を行なう、ということを学んだのですね？

そうです。

―大事ですよね。

ああ、そうなんだなと思いました。知っていると知らないではかなり違う、僕らメーカーの研究者は、就職してすぐに研究所に配属されることが多く専門分野しか知らない人が多いんです。もっと広く医学のことを学んでそれを生かしてくれっていうことだと思いました。

―それって、LIMS と近いですね。

結局医療機器というのは医療分野のことが分からないと作れないと思います。家電だったら自分がよく使っているものだから、どうなれば使いやすい洗濯機や掃除機になるかわかりますけれど。

―患者さんの想いがファーストだということに感銘を受けたということで開発に対しての気持ちは変わりましたか？

たとえば乳がんの薬物療法というのは数ヶ月ぐらい経って、がんが小さくならないと薬が効いているかどうか分からない。知り合いの方の奥様に「がんが小さくなるかならないかの不安の中で、どんどん髪の毛が抜けたり嘔吐したりするのはつらく、夫婦で精神的に物凄く沈みましたが、それでも本当に一週間か一か月程度でその薬が効いていることが分かれば、辛い副作用も乗り越えられます。」と言っていただいたんです。

―そういうことを聞くと頑張ろうって気になりますね。

ええ、本当にそうです。もちろんがんを小さく

するのは薬の作用ですが、自分たちの開発した装置が辛い状況の中で希望を与える光なのだと感じた瞬間です。

―具体的にお聞きすると、どういう学生を企業は欲してらっしゃるのですか？

大げさに言うと真理を求める探求心でしょうか。先ほど先代の社長ができないと言わずにやってみろという言い方をするのは、そうやって高学歴の人ほどすぐに言うのが、これ、どこかの論文を読んだときにできないって書いてありましたよ、だからできませんよって。だけどもそこは一旦離れてやってみましょう、そういうことが大事だと。自分の持っている技術をなんとかこれに使えないかと考えたとき、誰も思いつかない全く違うものを結びつけるということは、おそらくグーグルで検索しても出てこない。そういうものは自分が苦労して見つけるしかないんです。

―できないと言わずにやってみろ、でも経費と成果を合わせろ、by 畫馬会長ですね。

そしてやっぱり一番は本人のモチベーションです。こう言ってしまうと身も蓋もないですが、本当に必要な事と感じれば自分から積極的に行動を起こすものです。大学の役目はそのきっかけを与えるものだと思います。僕には信条があって医師は目の前の患者を救い、良い医療機器の開発は何万人も救うことができるというものです。

―医学畑からいわせていただくと、基礎研究もそんな感じですよ。目の前の患者を救えなくてどうするのだって考える人もいるかもしれないですし、対処療法しかできない自分に無力感を感じて基礎研究へ、という人もいて、色々な人がいて良いと思うんですけれども。

そうですね。そういう意味で光技術を用いた医療機器の開発、生体医用光学という分野は最近まで注目されていなかったんです。境界の学問ですからね。僕は小学生の時にスタートレックをみてこういうものをつくりたいと思ったんですが 30 年、40 年前の話ですね。やっぱりそういう気持ちを持ち続けているかどうかということも、ものを作る上で大切ではないかと思います。

―わかりました。上田さんの原点はスタートレックのトリコーダー(注２)ですものね。今日はお疲れのところ本当にありがとうございました。

注１：東京女子医科大学バイオメディカルカリキュラム：企業、研究所、病院などで業務に従事している工学系、薬学系等の技術者などを主な対象として、これらの人たちが日常業務に従事しながら、医学全般についての系統的な知識を学べるようにスケジュールされた、１年コースの公開講座

注２：トリコーダー：SF・TV ドラマシリーズ宇宙大作戦（スタートレック）に登場。エンタープライズの乗組員が使用する携帯用小型探知装置。医療用トリコーダーは生物学的解析はもちろん、末端神経に至るまでモニターする事が出来るので、ほとんどの体内状況を把握することが可能。

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