College of Biomedical Engineering
Taipei Medical University, Taiwan

Scientific Report 2019-2020

臺北醫學大學 TAIPEI MEDICAL UNIVERSITY

臺北醫學大學 醫學工程學院 TMU BIOMEDICAL ENGINEERING

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Taipei Medical University (TMU)

Taipei Medical University (TMU) is a collegiate academic institution with an extensive history in Taiwan.

Established in 1960, over the past half-century, TMU was able to grow under challenging circumstances without regular official financial support from the government or funding from foundations. It went through the challenges allowing to building the foundation, flourishing, expansion and transformation via innovation. Today, TMU has expanded into a world-class university with 11 colleges, 6,500 students per year, 6 hospitals (TMU Hospital, Wan Fang Medical Center, Shuang Ho Hospital, Taipei Cancer Center, TMU NingBo Medical Center and Neuromedical Center), and more than 40,000 alumni around the world, serving the society and humankind and also cultivating the future talents for the nation. These are TMU's most concrete contributions and most important responsibility and mission.

In July 2018, Global Views Monthly Magazine released the ranking for Taiwan's Best Universities in private University section, in which TMU was ranked 1st. In particular, TMU was ranked top 1 in both faculty-student ratio section (1:9.5) and average annual budget per student section. In 2018. Cheers Magazine published the list of the Top 20 Universities of Excellence Performance:TMU was at the 9th place in overall national ranking. Moreover, according to the Times Higher Education (THE) Asia University Ranking 2018, TMU was ranked as 83rd place, for the first time. Last but not least, our College of Biomedical Engineering was for the first time listed in the top 150 in Academic Ranking of World Universities in 2018, after only 3 years of existence.

In the future, TMU's core of education lies in tradition and innovation. The strong foundations that TMU has established in internationalization of teaching and research, information management, translational research on cancer, neurodegenerative and medical humanities will be passed down. Areas for innovation include interdisciplinary education, biotechnology entrepreneurship, neurology and caring industry.

Dean's Message

The College of Biomedical Engineering is one of the newest addition to the 55-year-old Taipei Medical University with a creation in August, 2015. CBME is dedicated to cultivate new generation work force for biotechnology industry with both sound biomedical engineering education and internship programs in the 6 TMU-affiliated hospitals.

We wish to build in thinking processes of engineers and medical professionals in our students so that they may be able to serve in the healthcare and biotechnology industry with an understanding of clinical needs. CBME features globalization, clinical translation, and industrial collaboration for a multidisciplinary task force to promote welfare of human beings. With these training programs, we expect students to become competitive and productive talents in all branches of biomedical engineering industry.

Biomedical technology is the flagship in Taiwan's economy development roadmap. Taiwan Society of Biomedical Engineering is actively formulating a board certification mechanism for biomedical engineers. Meanwhile, market for medical devices for the aged and the handicapped will explosively expand as the local and global society is rapidly aging. We envision the convergence of both trends will create urgent needs for engineers with solid medical exposure experiences. CBME hosts SBME, GIBMTE, GINME, GIBOM and IPBME institutes to accommodate domestic and international undergraduates, master, PhD and postdoctoral trainees. We hope the diverse, clinical needs-centered research and educational environment will generate strong growth momentum for Taiwan's industry of biomedical technology and biomedical engineering research.

Sincerely

CH Chen

Chih-Hwa Chen
Professor and Dean
College of Biomedical Engineering
Taipei Medical University

Vice Dean's Message

Our College has the vocation and the motivation to become an “international hub” in the field of Biomedical Engineering research and teaching in the Asia-Pacific area, with multiple connections to the rest of the world. We are actively working in that direction, as revealed by numerous concrete actions that have taking place and already bearing fruits.

Our Graduate Institutes and the International Ph.D. Program in Biomedical Engineering are providing all their classes in English. Our undergraduate program is expanding continuously, and our students actively engaged in internships abroad, and mutual exchanges. We have established solid and concrete working relationships in various research fields with sister Universities in USA, France, Japan, Australia, and Iceland. We have research contracts with the local and international industries developing new biomedical technologies. The number of foreign students from Asia, Africa, Central America applying and joining CBME is increasing on a yearly basis to reach almost 50% for Ph.D., and close to 20% at the Graduate level. The proportion of scientific publications with foreign laboratories, that reflects our active collaborations with international teams, is steadily increasing on a yearly basis and will continue to do so in the near future. This is illustrated by the always-increasing quality of CBME scientific publications in top-quality journals in the field of biomedical engineering and life sciences, as well as by the progress we are seeing in the international academic ranking of our college. We will also continue to recruit capable foreign professors who can enrich our research and teaching capacity, expand our international connections and stimulate our international developments.

Through continuous efforts, through the unique links our university has with its affiliated hospitals, through its location in the dynamic and friendly environment of Taiwan, our College has all the potential to develop into a successful biomedical engineering spotlight. We are all striving for it.

Sincerely

Thierry Burnouf
Professor and Vice Dean
College of Biomedical Engineering
Taipei Medical University

Vice Dean's Message

College of Biomedical Engineering (CBME) draws from core disciplines such as clinical engineering, basic sciences, bio-design, nanotechnology, biomaterials, and tissue engineering emphasizing an interdisciplinary approach to research and education. The goal of CBME is dedicated to solving clinical needs through advanced biomedical engineering technology and toward translational commercialization. CBME actively coordinates and interfaces with other departments, research centers and TMU-affiliated hospitals to facilitate biomedical engineering opportunities in areas such as bioengineering, biotechnology, medical AI, biomaterials, assistive devices, wearable technology, drug delivery, and medical devices. We have established research laboratories and clinical trial centers in the affiliated TMU teaching hospitals to streamline clinical applications in the area of diagnosis, therapeutics, medicine, nanotechnology, and public health fields. Through cooperating with the industry-university-research platform of pre-clinical study in the development of medical device, and provides the co-operation/co-development services, CBME could create a mini innovative ecosystem across disciplines and enable the faculty to achieve multiple effects based on their research achievements and educate students to be contributors to medical science and nanotechnology with global vision.

Sincerely

Jen-Chang Yang
Professor and Vice Dean
College of Biomedical Engineering
Taipei Medical University

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09 **Hsiang-Ho Chen** : Medical Devices
10 **Chih-Wei Peng** : Neural Engineering Assistive Technology (NEAT)
11 **Jian-Chiun Liou** : Nano Bioengineering and Bio-ASIC Chip
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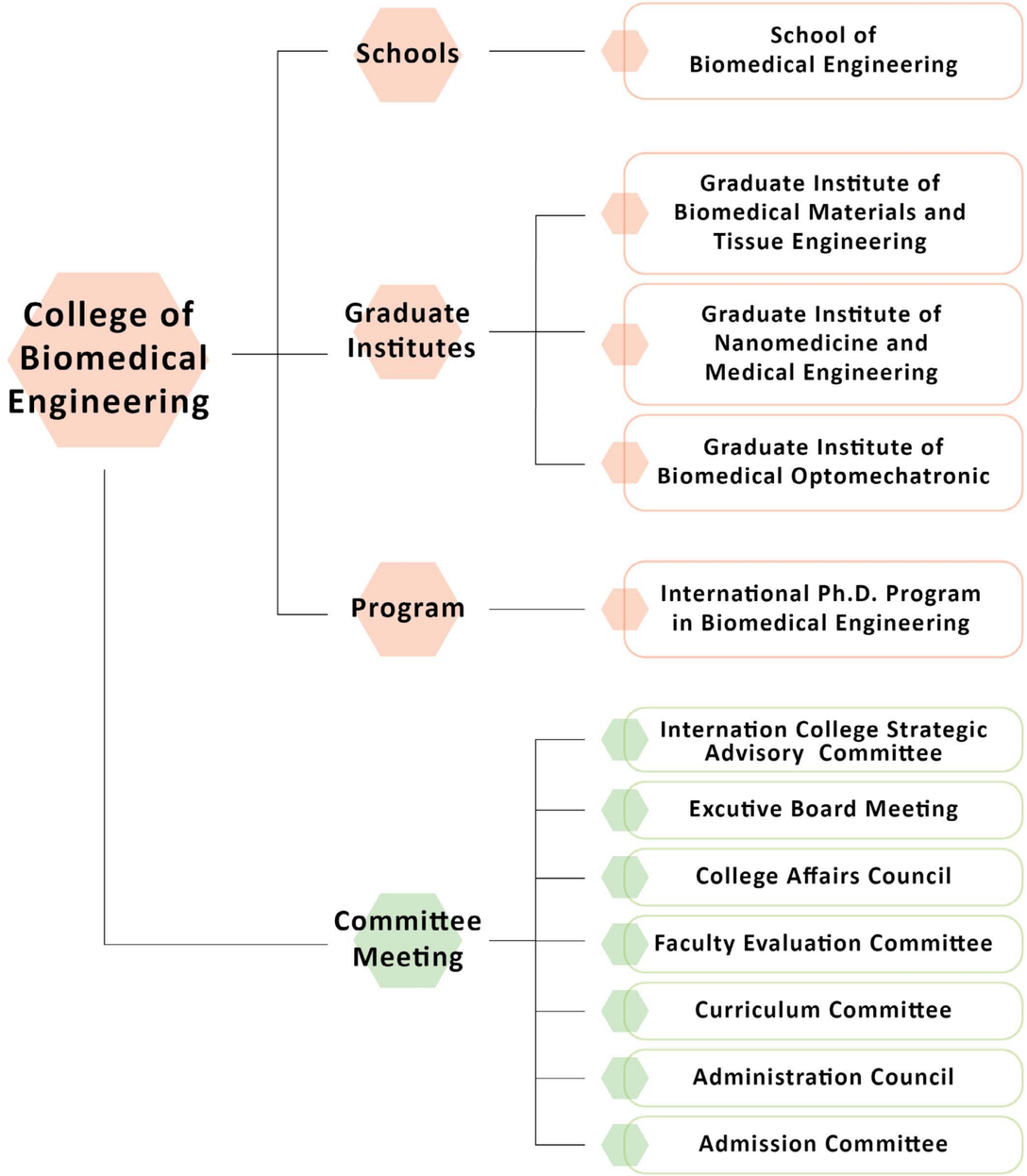
ORGANIZATION CHART



SCHOOL, GRADUATE INSTITUTES, AND PROGRAM

School of Biomedical Engineering

Graduate Institute of Biomedical Materials and Tissue Engineering

Graduate Institute of Nanomedicine and Medical Engineering

Graduate Institute of Biomedical Optomechatronics

International PhD Program in Biomedical Engineering

SCHOOL OF BIOMEDICAL ENGINEERING

About

The School of Biomedical Engineering (SBME) was newly established in August 2016. SBME aspires to be a first-rated and leading BME-school worldwide. SBME offers student a high-quality, medical- driven learning environment with excellence in undergraduate education. Students will acquire basic ability to use mathematics, chemistry, engineering, biological, physics and medical knowledge. We encourage students to explore medical problems and unmet clinic needs. We stress the need for students to develop their ability to design, execute experiments, analyze and interpret data, and solve these problems. Students have a unique opportunity to understand and get familiar with the means to apply advanced technology to the complex problems of clinical medicine. We emphasize a clinically-oriented education to prepare students to excel as professionals in biomedical engineering. We expect students to contribute to the academic and industrial development of biomedical engineering.

Hsiang-Ho Chen, Ph.D.
Chairman

Eligibility

1. Admissions
   - General Category
   - Foreign Category
   - Special Talents (e.g. Design, Protyping, etc.)
2. Entrance Test

Missions

1. Enhance students' basic knowledge and professional skills in biomedical engineering and have the competence to integrate multidisciplinary technologies.
2. Educate student to comprehensively specialize in the field of biomedical engineering by hands-on and clinic problem-based oriented teaching approaches.
3. Foster student with humanities and noble character for the promotion of social care and social well-being.
4. Nurture student to be an innovative biomedical engineer with prospective and international vision.

Requirement for B.S. Degree

The BS degree in biomedical engineering requires 130 credits.

- Required (70 credits)
- Selective (32 credits)
  - A. Track of Medical Mechanics & Materials
  - B. Track of Bio-optomechatronics
- Humanities and Social Sciences (28 credits)

Major Publications

1. Chen SC, Chu PY, Hsieh TH, Li YT, Peng CW. Feasibility of Deep Brain Stimulation for Controlling the Lower Urinary Tract Functions: An Animal Study. Clinical Neurophysiology, 2017 ; 128:2438-2449.
2. Liou JC, Chang YT .Inves tigated of the Reproducibility of Upper-Limb Motor Function in Stroke Patients. Journal of Nanoelectronics and Optoelectronics .2017 ;12: 862-867.
3. Chen YJ, Kuo KK, Ting LL, Lu LS, Lu YC, Cheng AJ, Lin YT, Chen CH, Tsai JT, Chiou JF. Piperlongumine inhibits cancer stem cell properties and regulates multiple malignant phenotypes in oral cancer. Oncology Letters 2018 ;15:1789-1789.
4. Chung PS, Fan YJ, et al., Real-time dual-loop electric current measurement for label-free nanofluidic preconcentration chip .Lab on a Chip. 2015 ;15: 319-330
5. Liu HS, Shen H, Luo Y, Hoffer BJ, Wang Y, Yang Y. Post-treatment with Cocaine- and Amphetamine-regulated Transcript Enhances Infarct Resolution, Reinnervation and Angiogenesis in Stroke Rats - A Magnetic Resonance Imaging Study. NMR Biomed. 2016; 29: 361–370.

Staff and Contact Information

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GRADUATE INTITUTE OF BIOMEDICAL MATERIALS & TISSUE ENGINEERING

About

The Graduate Institute of Biomedical Materials and Tissue Engineering (GIBMTE) was established in 2006 under the College of Oral Medicine. This institute was moved to the newly College of Biomedical Engineering, which was set up in 2015 reflecting the broad scope of BMTE in biomedical and therapeutic fields. We offer both Master and PhD degrees in Sciences, as well as dual diploma with Universities in Europe, Japan, USA, etc. GIBMTE provides an international, multidisciplinary teaching courses, also equipped with various kinds of instruments to offer a good research environment to educate students with basic /advanced knowledge in the field of biomedical materials, tissue engineering, and cell-based regenerative medicine. Our connections with the TMU system of hospitals provide students chance to work with clinics inspiring critical thinking and novel findings. A special program of fellowships is also available to support foreign students to become an excellent researchers/leaders in the field of BMTE.

Ching-Li Tseng, Ph.D.
Director

Eligibility

1. Domestic and foreign students
2. MS applicants: Hold a Bachelor degree in science/engineering, related to biomedical engineering (biology, biotechnology, pharmacy, medicine, chemistry, biomedical engineering, chemical engineering, material engineering, electrical engineering etc.)
3. PhD applicants: Hold (a) a MS in science/engineering, related to biomedical engineering (biology, biotechnology, pharmacy, medicine, chemistry, biomedical engineering, chemical engineering, material engineering, electrical engineering etc.), or (b) a MD degree and least two years of documented clinical training with publication(s) equivalent to a MS thesis

Missions

1. Broaden the vision and experience of MS students in the field of biomedical engineering, and meet the expectations of global research. Establish the knowledge, skills and confidence of students to serve in biomedical/biotech company, or hospitals, or to pursue further study in PhD program.
2. Training doctoral candidates with critical thinking, creativity, and wisdom to become an independent researcher, conduct post-doctoral fellow studies, then become faculty in University, principle investigator in academic institute, or manager in biomedical and biotech company.

Master Degree Requirements (2 Years)

- 24credits in Required Courses (including 6 credits for MS Thesis) and 6 credits in Elective courses
- Research Ethics (no credit)
- Thesis
- Pass oral thesis defense

Staff and Contact Information

Ching-Li Tseng, Ph.D., Associate Professor and Director
Erin Huang, Secretary

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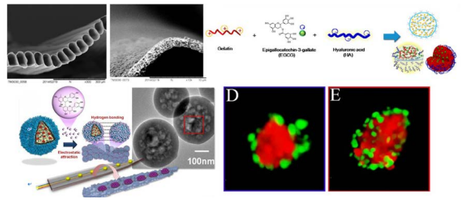
URL: https://www.facebook.com/GIBMTE/

Representative Figures



PhD Degree Requirements (3-4 Years)

- 24 credits in Required Courses (including 12 credits for PhD Thesis) and 6 credits in Elective courses Research Ethics (no credit)
- Present an oral PhD progress report each year, one being considered as Qualification Examination, making the candidate eligible for PhD thesis presentation.
- SCI Publication as first author with total cumulative impact factor ≥ 5
- PhD dissertation and Pass oral dissertation defense.

Major publications

1. ML Chou, JW Wu, F Gouel, A Jonneaux, K Timmerman, TY Renn, C Laloux, HM Chang, LT Lin, JC Devedjian, D Devos, T Burnouf. Tailor-made purified human platelet lysate concentrated in neurotrophins for treatment of Parkinson's disease. Biomaterials, 2017; 142: 77-89
2. MY Chien, CH Chuang, CM Chern, KT Liou, DZ Liu, YC Hou, YC Shen. Salvianolic acid A alleviates ischemic brain injury through the inhibition of inflammation and apoptosis and the promotion of neurogenesis in mice. Free Radic Biol Med, 2016; 99: 508-519.
3. HC Chen, FD Mai, KH Yang, HY Tsai, CP Yang, CC Chen, CH Chen, YC Liu. An environmentally friendly etching agent: vapor from hot electron-activated liquid water. Green Chemistry, 2016; 18(10): 3098-3105.
4. CY Chang, MC Wang, T Miyagawa, ZY Chen, FH Lin, KH Chen, GS Liu, CL Tseng. Preparation of RGD modified biopolymeric nanoparticles containing epigalloccatechin-3- gallate for targeting vascular endothelial cells to inhibit corneal neovascularization. Int J Nanomedicine, 2017; 12: 279–294.
5. TH Chen, MY Chung, DC Tien, RY Wang, JF Chiou, KH Chen, KH Tseng, LS Lu. Personalized Breast Holder (PERSBRA): A New Cardiac Sparing Technique for Left-sided Whole Breast Irradiation. International Journal of Radiation Oncology Biology Physics, 2017, 99 (2): E646-E646.
6. FL Mi, T Burnouf, SY Lu, YJ Lu, KY Lu, YC Ho, CY Kuo, EY Chuang. Self-Targeting, Immune Transparent Plasma Protein Coated Nanocomplex for Noninvasive Photothermal Anticancer Therapy. Adv Healthc Mater, 2017;6(14). 1700181(1- 10).
7. WC Huang, F Ali, JS Zhao, K Rhee, CC Mou, CJ Bettinger. Ultrasound-Mediated Self-Healing Hydrogels Based on Tunable Metal-Organic Bonding. Biomacromolecules, 2017; 18(4): 1162- 1171.

GRADUATE INSTITUTE OF NANOMEDICINE AND MEDICAL ENGINEERING

About

Graduate Institute of Nanomedicine and Medical Engineering (GINME) has been established to focus on translational research for addressing clinical needs through innovations and advances in nanotechnologies. Nanomaterials for medical device and drug delivery as well as the nanotechnology based diagnostics are two major focused areas of GINME. The implementation of nanomaterials into medical device applications and long-term translational research toward clinical trials are our main tasks.
For the course design, we focus on the connection of nanomaterials and clinical applications. Each student has two advisors included one basic research professor and one clinical doctor. GINME is also an internationally-oriented institute, implementing dual degree programs, scholar exchange programs and research collaborations in association with leading institutes. We aim to establish an internationally visible program known for research excellence and track record in nano-product incubation.

Jen-Chang Yang, Ph.D.
Director

Major Achievements

In GINME, students will learn how to apply electrical, electronics and systems engineering in medicine and biology, and also gain experience in developing and using new technologies, including medical, instrumentation and prosthetic devices, and discover the properties of materials used in the formation of these medical devices such as caries prevention and ENT hemostasis.

The Missions of GINME Are:

Advanced and spread knowledge for students in the area of health, medicine, and nanotechnology.

1. Provide students opportunities as visitors and interns in affiliated hospitals.
2. Educate students to be contributors to medical science and nanotechnology.
3. Integrate research resources and lectures to improve students' skills, performance, and global vision.

GINME Highlights:

1. Dual degree program with Tokyo University of Science (TUS)
2. Two tracks: (1) Innovations in Nano/Biomedical Materials and (2) Nanotechnology Applied in Medical Diagnosis and Therapy
3. Dual advisors: (1) one basic research professor and (2) one clinical doctor

Career Opportunities After Graduation

Our graduates will be eligible to attend board certification examinations for biomedical engineers, and may develop a career in biotechnology, pharmaceutics, cosmetics, material science, healthcare, public service, and research faculty in universities.

GINME Has Ten Core Research Fields Including:

1. Medical devices toward preventive and the minimally invasive applications.
2. Electrospun silk polymers for biomimetic researches.
3. Biological applications of porous silica nano-platform.
4. Catcher in the Rel protein: Nanoparticles-antibody conjugate as NF-κB nuclear translocation blocker.
5. Impacts of protein corona on biological effects of mesoporous silica nanoparticles.
6. Peptide-mediated delivery of pH-sensing mesoporous silica nanoparticles into lysosome in living cells.
7. Screening and harnessing stem cell behavior.
8. Gold nanoclusters as a fluorescent probe for assessment of cancer progression.
9. SERS substrate for detection of disease biomarkers.
10. Flexible and wearable devices for point-of-care tests (POCT)

Staff and Contact Information

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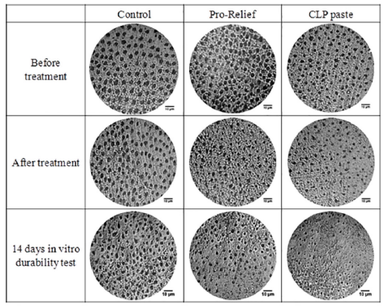
Representative Figures

1.



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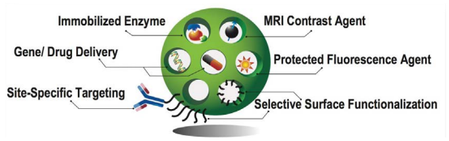

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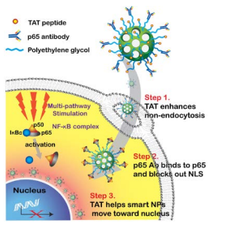

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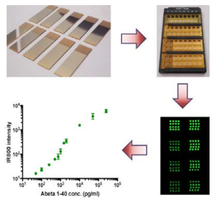

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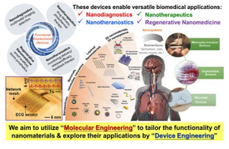

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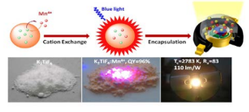

1. The optical micrographs of occlusal dentin disk surface pre-treatment, immediately post-treatment, and 14-day post-treatment of various desensitizing pastes.
2. Biological applications of porous silica nano-platform.
3. Catcher in the Rel: Nanoparticles-antibody conjugate as NF-κB nuclear translocation blocker.
4. SERS platform for biomarker detection
5. Flexible and stretchable bioelectronic devices integrated with nanomaterials.
6. Synthesis, analysis and device package of the luminescent materials.

GRADUATE INSTITUTE OF BIOMEDICAL OPTOMECHATRONICS

About

The aims of GIBOM are to integrate optical, electronic, mechanic, and materials fields in order to develop bio-medical instruments for use in life sciences and clinical medicine. We offer Master degree in Sciences, as well as dual diploma with Universities in Europe, Japan, USA, etc. The students in GIBOM will be trained with a broad, flexible, inter-disciplinary, and international education which is rooted in engineering, biological sciences, and medicine. GIBOM has two main training components. One is medical optoelectronic and mechatronic engineering which focus on pursuing innovative and impactful research of diagnostic sensors. The second one is biological response to physical stimulation which aims to develop a medical device for precision medicine. The course arrangement at GIBOM is suitable for the biology and medical students as well as for engineering students who want to specialize in biomedicine.

Haw-Ming Huang, Ph.D.
Director

Eligibility

1. Taiwanese and foreign students
2. MS applicants: Hold a Bachelor degree in science, related to biomedicine or engineering (biology, pharmacy, medicine, mechanical engineering, electronic engineering, chemical engineering, material science etc.)

Missions

1. GIBOM will connect mature local electronics and optoelectronic industries to leverage quickly with companies developing and manufacturing products with advanced biomedical-optomechatronics-related technologies.
2. GIBOM aims to incubate interdisciplinary experts who are able to integrate various sciences and engineering techniques and can develop novel instrumentation necessary for modern medical treatment and disease prevention.

Master Degree Requirements (2 Years)

- 22 and 8 credits in Required (including 6 credits for MS Thesis) and Elective courses, respectively.
- Research Ethics (no credit)
- Thesis
- Pass oral thesis defense

Staff and Contact Information

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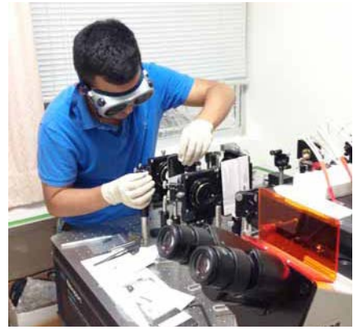
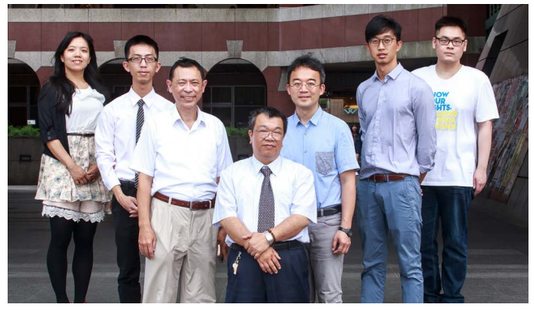
Major Publications

1. Chen TP, Lin CW, Li SS, Tsai YH, Wen CY, Lin WJ, Hsiao FM, Chiu YP, Tsukagoshi K, Osada M, Sasaki T. Self-assembly atomic stacking transport layer of 2D layered titania for perovskite solar cells with extended UV stability. Advanced Energy Materials. 2018; 8(2): DOI: 10.1002/aenm.201701722.
2. Shih MC, Li SS, Hsieh CH, Wang YC, Yang HD, Chiu YP, Chang CS, Chen CW. Spatially-resolved imaging on photocarrier generations and band align-ments at perovskite/ PbI2 hetero-interfaces of perovskite solar cells by light-modulated scanning tunneling microscopy. Nano Letters 2017;17:1154-1160.
3. Manga YB, Ko FS, Yang YS, Hung JY, Yang WL, Huang HM, Wu CC. Ultra-fast and sensitive silicon nanobelt field-effect transistor for high-throughput screening of alpha-fetoprotein. Sensors & Actuators: B. Chemical 2018;256:1114-1121
4. Lew WZ, Huang YC, Huang KY, Lin CT, Tsai MT, Huang HM. Static magnetic fields enhance dental pulp stem cell proliferation by activating the p38 mitogen-activated protein kinase pathway as its putative mechanism. Journal of Tissue Engineering and Regenerative Medicine. 2018;12:19-29.





INTERNATIONAL PhD PROGRAM IN BIOMEDICAL ENGINEERING

About

The International PhD Program in Biomedical Engineering (IPBME) was created in 2015 under the newly established College of Biomedical Engineering of TMU. All professors of the College of Biomedical Engineering belong to IPBME, thereby offering to Foreign PhD students a unique opportunity to develop and apply their skills in the multidisciplinary sciences of biomedical engineering. The students can conduct their PhD degrees as a dual diploma with Universities in Europe, Japan, USA, etc. Our mentoring system is also unique by allowing students to have one overseas collaborating professor and by strongly supporting overseas research collaborations. Our teaching and research environment is truly stimulating to students interested in biomedical materials, tissue engineering, nanotechnologies and nanomedicine, and/or bio-optomechatronics. The close links existing with the TMU group of hospitals constitute a strong incentive to students to test, evaluate and apply their research ideas for most successful translational medicine applications. International students enrolled in this program can receive fellowships, helping them to pursue their professional or academic dreams. Pursuing a PhD degree within IPBME truly represents an excellent opportunity in career development in safe and hospitable Taiwan, while being an "eye-opener" on how biomedical engineering is changing the quality and accuracy of treatment of patients worldwide.

Thierry Burnouf , Ph.D.
Director

Eligibility

1. Foreign students
2. Degree: Hold (a) a MS in science, related to biomedical engineering (biology, pharmacy, medicine, biomedical engineering, chemical engineering, etc.), or (b) a MD degree and least two years of documented clinical training with publication(s) equivalent to a MS thesis.

Missions

1. Be an actor of the developments of biomedical engineering worldwide and Asia.
2. Provide the intellectual knowledge and creative capacity to pursue postdoctoral studies or an academic or industrial career in biomedical and biotech industry.
3. Share critical thinking, creativity, and intellectual independence to foster leadership in biomedical engineering and science.

PhD Degree Requirements (3-4 Years)

- Share critical thinking, creativity, and intellectual independence to foster leadership in biomedical engineering and science.
- 6 credits in Elective courses
- Research Ethics (no credit)
- Present an oral PhD progress report each year, one being considered as Qualification Examination, making the candidate eligible for PhD thesis presentation
- SCI Publication as first author with total cumulative impact factor≥5
- PhD dissertation
- Pass oral dissertation defense

Illustrations:
the IPBM research focus

Major Publications

1. Burnouf T*, Dye JM, Abayomi, A. Convalescent plasma and the dose of Ebola virus. New England Journal of Medicine, 2017; 376: 1296-1297. (IF: 72.406)
2. Chen TP, Lin CW, Li SS, Tsai YH, Wen CY, Lin JW, Hsiao FM, Chiu YP, Tsukagoshi K, Osada M, Sasaki T, Chen CW. Self-Assembly Atomic Stacking Transport Layer of 2D Layered Titania for Perovskite Solar Cells with Extended UV Stability. Advanced Energy Materials .2017:1701722-. (IF: 16.721)
3. Shih MC, Li SS, Hsieh CH, Wang YC, Yang HD, Chiu YP, Chang CS, Chen CW. Spatially-resolved imaging on photocarrier generations and band align-ments at perovskite/ PbI2 hetero-interfaces of perovskite solar cells by light-modulated scanning tunneling microscopy. Nano Letters, 2017. (17):1154-1160. (IF: 12.712)
4. Chou ML, Wu JW, Gouel F, Jonneaux A, Timmerman K, Renn TY, Laloux C, Chang HM, Lin LT, Devedjian JC, Devos, D, Burnouf T.Tailor-made purified human platelet lysate concentrated in neurotrophins for treatment of Parkinson's disease. Biomaterials, 2017 (142):77-89. (IF: 8.402)
5. Kuo TR, Chen WT, Liao HJ, Yang YH, Yen HC, Liao TW, Wen CY, Lee YC, Chen CC, Wang DY. Improving Hydrogen Evolution Activity of Earth-Abundant Cobalt-Doped Iron Pyrite Catalysts by Surface Modification with Phosphide. Small,2017.(13):-. (IF: 8.315)
6. Lin PY, Chuang EY, Chiu YH, Chen HL, Lin KJ, Juang JH, Chiang CH, Mi FL, Sung HW. Safety and efficacy of self-assembling bubble carriers stabilized with sodium dodecyl sulfate for oral delivery of therapeutic proteins. J Control Release,2017;259:168-175. (IF: 7.786)
7. Chen WT, Li SS, Chu JP, Feng KC, Chen JK. Fabrication of ordered metallic glass nanotube arrays for label-free biosensing with diffractive reflectance. Biosensors and Bioelectronics,2017. (102):129-135. (IF: 7.78)
8. Kuo TR, Chen YC, Wang CI, Shen TH, Wang HY, Pan XY, Wang DY, Liou CC, Change YH, Chen YC, Wu YH, Liu YR, Lin YH, Hu CC, Chen CC. Highly oriented Langmuir-Blodgett film of silver cuboctahedra as an effective matrix-free sample plate for surface-assisted laser desorption/ionization mass spectrometry. Nanoscale, 2017.(9):11119-11125. (IF: 7.76)
9. Lee KT, Lu YJ, Mi FL, Burnouf T, Wei YT, Chiu SC, Chuang EY, Lu SY. Catalase-Modulated Heterogeneous Fenton Reaction for Selective Cancer Cell Eradication: SnFe2O4 Nanocrystals as an Effective Reagent for Treating Lung Cancer Cells. ACS applied materials & interfaces,2017(9):1273-1279. (IF: 7.504)

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TMU BIOMEDICAL ENGINEERING RESEARCH

Chih-Hwa Chen : Bone & Joint

Hsiang-Ho Chen : Medical Devices

Chih-Wei Peng: Neural Engineering Assistive Technology (NEAT)

Jian-Chiun Liou: Nano Bioengineering and Bio-ASIC Chip

Hua-Shan Liu : Magnetic Resonance Imaging Technique

Yu-Jui (Ray) Fan : Total Analysis System on Tissue and Cell (FanTASTiC)

Yin-Ju Chen : Cancer Translational Research Laboratory

Thierry Burnouf : Platelet Biomaterials

Ching-Li Tseng : Biomaterial Design For Drug Delivery, Tissue Regeneration- Ophthalmology

Der-Zen Liu : Liposomal Vaccine

Chien-Chung Chen : Microtube Array Membrane (MTAM)

Er-Yuan Chuang : Drug Delivery

Long-Sheng Lu : Translational Radiation Biology

Wei-Chen Huang : Soft Biomaterials & Bioelectronics

David J. Lundy : Drug delivery, nanomedicine and tissue engineering

Jen-Chang Yang : Dental Materials & Medical Devices

Chih-Yu Chang : Multifunctional Nanomaterials & Nano-Bioelectronics

Yi-Ping Chen : Nano Theranostic

Tsung-Rong Kuo : Nanomaterials & Nanotechnology

Chun Che Lin : Luminescent Materials

Si-Han Wu : Hybrid Silica

Haw-Ming Huang: Bioelectromagnetics and Related Material

Li-Chern Pan : Microfluidic Biochips

Tzu-Sen Yang : Molecular Dynamics

Shao-Sian Li : 2 Dimensional Atomic Materials

Yu-Cheng Hsiao : Photonics & Soft Matters

TMU BIOMEDICAL ENGINEERING RESEARCH TEAM

CHIH-HWA CHEN : BONE & JOINT

Chih-Hwa Chen, M.D., MBA
Professor

Major Research Aims

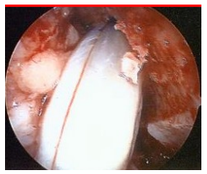
TMU bone and joint research team focus on tendon, bone, cartilage tissue regeneration using different biomaterials, cell types and technologies and invent novel strategy to enhance tendon to bone healing. Anterior cruciate ligament (ACL) repair with biological agents have been an option for future treatment of acute ACL injuries. Successful ACL reconstruction with tendon graft requires solid tendon to bone healing in the bone tunnels and progressive graft ligamentization for biological, structural, and functional recovery of ACL. interface fibrocartilage formation as translational structure from tendon to bone is more physiological and functional after implantation of tendon graft into the bone tunnel. Biological enhancement techniques for tendon graft healing in the bone tunnel have been proposed by means of various biomaterials. Our strategy is to use periosteum, periosteal progenitor cell, hydrogel, cell sheet, and biotube to enhance tendon to bone healing.

Major Achievements

1. Periosteum enhances bone and fibrocartilage ingrowth into interface zone of tendon and bone.
2. PPC-BMP-2 hydrogel provides a powerful inductive ability to enhance tendon-bone healing through fibrocartilage.
3. Bioengineered PPC sheets offer a novel approach to enhance tendon-bone junction healing.
4. Satisfactory results can be achieved with the periosteum-enveloping hamstring tendon graft in single-bundle ACL reconstruction with minimal tunnel widening.

Representative Figures

1.



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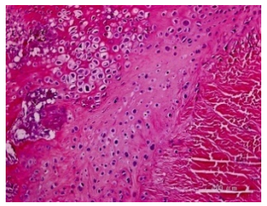

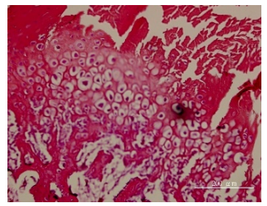

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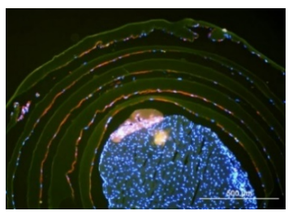

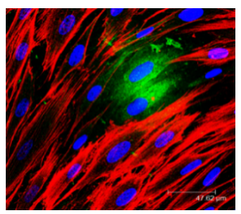

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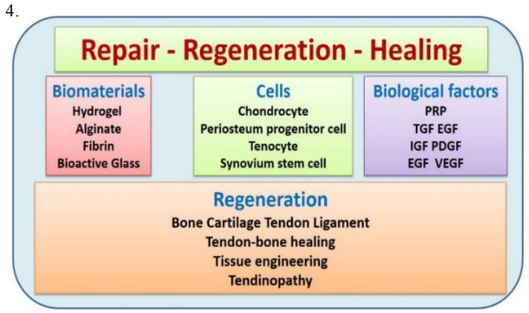

1. Arthroscopic ACL reconstruction with hamstring tendon-periosteum autograft as a clinical application from the result of periosteum-tendon to bone healing in animal model.
2. Fibrocartilage formation in the interface between tendon and bone with strong anchorage strength to improve the tendon to bone healing
3. Periosteum progenitor cell sheets wrapped around tendon to enhance tendon-bone tunnel healing.
4. The research focuses are biomaterials in orthopedics, tissue engineering in bone and cartilage, healing of tendon and healing after sports injury, tendinopathy, and development of novel biomedical device.

Major Publications

1. Chen CH, Chen WJ, Shih CH, Chou SW. Arthroscopic posterior cruciate ligament reconstruction with quadriceps tendon autograft - minimal 3 years follow-up. Am J Sport Med 2004, 32(2): 361-368.
2. Liu HW, Chen CH, Tsai CL, et al. Heterobifunctional PEG-tethered growth factor stimulated bone marrow mesenchymal stem cells differentiation and osteogenesis. Tissue Eng 2007, 13(5):1113-1124.
3. Chen CH, Liu HW, Tsai CL, et al. Photoencapsulation of bone morphogenetic protein-2 and periosteal progenitor cells improve tendon graft healing in a bone tunnel. Am J Sports Med, 2008, 36(3): 461-473.
4. Lin BN, Whu SW, Chen CH, et al. Bone marrow mesenchymal stem cells, platelet rich plasma and nanohydroxyapatite-type I collagen beads were integral parts of biomimetic bone substitutes for bone regeneration. J Tissue Eng Regen Med, 2013, 7(11):841- 854.
5. Chen CH, Chang CH, Su GI, et al. Arthroscopic single-bundle anterior cruciate ligament reconstruction with periosteum-enveloping hamstring tendon graft, clinical outcome in 2 to 7 years. Arthroscopy 2010, 26(7),907-917.

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HSIANG-HO CHEN : MEDICAL DEVICES

Hsiang-Ho Chen, Ph.D.,
Professor

Major Research Aims

To develop better medical devices, our team utilizes useful tools in biomechanical evaluation. Viscoelastic properties at bone-implant interface were evaluated by measuring the implant stability quotient using resonance frequency analysis and by measuring the Periotest values using the Periotest device. The bone/implant specimens were evaluated histopathologically and histomorphometrically to determine the degree of osseointegration. Evaluation of viscoelastic properties at bone-implant interface and are reliable for indirectly predicting the degree of osseointegration. This effort has set up an evaluation system for future development of dental implants.
The other methodology is the numerical simulation of mechanical responses. In prevention of sports injury, model-predicted strain and strain rate in the corpus callosum correlating with changes in indices of concussion's white matter integrity have been confirmed preliminarily. Our study estimates the response of the human brain to soccer-heading impacts using the finite element method. It can help us understand the risk of concussion during heading, and design efficient protection devices.

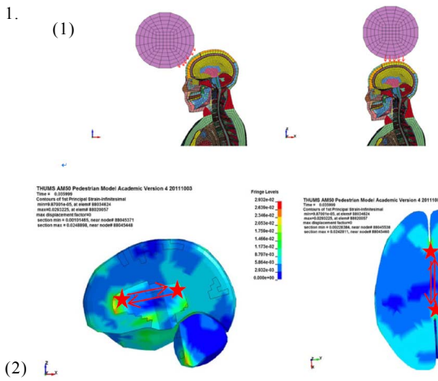
Major Achievements

1. Finite element to investigate brain responses to soccer-heading impacts.
2. Biomechanical comparison of axial load between cannulated locking screws and noncannulated cortical locking screws.
3. Bone remodeling characteristics of a short-stemmed total hip replacement.
4. Ultrastructure of anterior cruciate ligament graft by atomic force microscopy.
5. Monitor the changes of viscoelastic properties at bone-implant interface via resonance frequency analysis

Representative Figures

1.

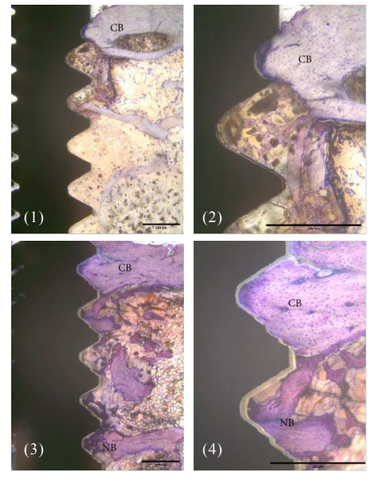
(1)



(2) (3)

(1) Section view of the 3D model for simulation of forehead heading. (2) Strain distribution of the brain on the sagittal plane and (3) the coronal plane in the simulation of forehead heading; Locations of peak maximum principal strain are shown by red stars, and the time sequence is numbered.

2.



Histological findings of the tested implant after healing. (1) 0 days: The implant is partly surrounded with original cortical bone (CB). No peri-implant new bone (NB) formation was observed in a bone marrow cavity. (2) 14 days: The implant is surrounded by cortical bone and newly formed bone in the bone marrow cavity. (3) 28 days: The implant is surrounded by dense cortical bone (CB) and newly formed bone in the bone marrow cavity. Moreover, woven bone (WB) combined with lamellar bone (LB) was observed in direct contact with the implant surface without the presence of fibrous tissue. (4) 56 days: The implant is surrounded by dense cortical bone (CB) and dense lamellar bone in the bone marrow cavity. Scale bar: 500 μm.

Major Publications

1. Chen HH, Lai WY, Chee TJ, Chan YH, Feng SW. Monitoring the Changes of Material Properties at Bone-Implant Interface during the Healing Process In Vivo: A Viscoelastic Investigation. BioMed research international 2017, 2017.
2. Chen HH, Chung CH, Lee CC, Yang CS, Wen YS, Lee CL, Chiang KT. ANALYSIS OF INTERVERTEBRAL ANGULATIONS AND MUSCULOSKELETAL SYMPTOMS OF THE SPINE IN THE MILITARY AIRCREWS OF TAIWAN. Biomedical Engineering: Applications, Basis and Communications 2017, 29 (02), 1750010.
3. Liu X, Chen HH, Lin YC, Nabilla SC, Liu WC, Wang WC, Shih SJ, Li Y, Lin CP, Zhao G. Composite Polyelectrolyte Multilayer and Mesoporous Bioactive Glass Nanoparticle Coating on 316L Stainless Steel for Controlled Antibiotic Release and Biocompatibility. Journal of Biomedical Nanotechnology 2018, 14 (4), 725-735.
4. Chen PY, Chou L, Hu CJ, Chen HH. In Finite element simulations of brain responses to soccer-heading impacts, 1st Global Conference on Biomedical Engineering & 9th Asian-Pacific Conference

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TMU BIOMEDICAL ENGINEERING RESEARCH TEAM

CHIH-WEI PENG : NEURAL ENGINEERING ASSISTIVE TECHNOLOGY(NEAT)

Chih-Wei Peng, Ph.D.,
Professor

Major Research Aims

My research employs engineering approaches to understand and restore neural function. I work on fundamental animal research and applied development in electrical stimulation of the nervous system to restore function to individuals with neurological impairment or injury. Current projects include:

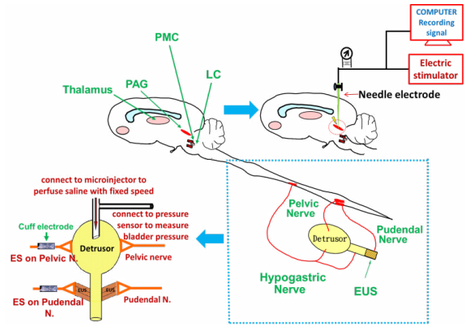
- developing novel transcranial direct current stimulator (t-DCS) system for neural rehabilitation.
- developing advanced approaches to pudendal (peripheral) neuromodulation to treat bladder functions.
- developing intelligent drop foot stimulator with real-time adaptive feedback control to adaptively generate stimulation intensity to enhance the walking ability in stroke patient with drop foot.
- understanding the mechanisms of and developing advanced approaches to deep brain stimulation to treat bladder disorders.

Major Achievements

1. Chronic pudendal neuromodulation using an implantable microstimulator improves voiding function in diabetic rats.
2. Design and evaluation of potentiometric principles for bladder volume monitoring bladder volume sensor.
3. Developing systems and apparatuses for transcranial burst electrostimulation.
4. Setup a new quantization of traumatic brain injury model.
5. Novel use of theta burst cortical electrical stimulation for modulating motor plasticity in rats

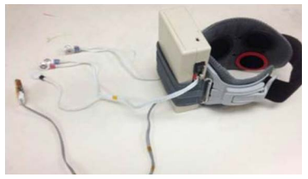
Representative Figures

1. Impact of Central and Peripheral Neuromodulation on Bladder Functions in Animal and Clinic Studies.



2. Our Prototype Novel Transcranial Direct Current Stimulator.

3. Prototype Intelligent Drop Foot Stimulator with Real-Time Feedback Control.



1. **Neural Engineering for Bladder Dysfunction**
   We study the impact of central and peripheral neuromodulation on bladder functions. Various electrical stimulation (ES) schemes are developed to treat various bladder disorders that resulted from SCI, TBI, DM, and etc. The developed pudendal neuromodulation approach has been applied in clinic trials.
2. **Novel transcranial direct current stimulator**
   We are developing a novel transcranial direct current stimulator (t-DCS) system for rehabilitation therapy and other applications. Our developed system has been passed the safety certification and now used in animal and clinical studies to verify its therapeutic effects and the underlying mechanisms.
3. **Intelligent drop foot stimulator with real-time adaptive feedback control**
   We are developing and testing an intelligent drop foot stimulator with real-time adaptive feedback control to enhance the walking ability in stroke patient with drop foot.

Major Publications

1. Chen SC, Hsieh TH, Fan WJ, Lai CH, Chen CL, Wei WF, Peng CW. Design and evaluation of potentiometric principles for bladder volume monitoring: a preliminary study. Sensors 2015, 15 (6), 12802-12815.
2. Chen SC, Hsieh TH, Fan WJ, Lai CH, Peng CW. Does pharmacological activation of 5-HT1A receptors improve urine flow rate in female rats? American Journal of Physiology-Renal Physiology 2016, 311 (1), F166-F175.
3. Hsieh TH, Huang YZ, Chen JJJ, Rotenberg A, Chiang YH, Chien WS C, Chang V, Wang JY, Peng CW. Novel use of theta burst cortical electrical stimulation for modulating motor plasticity in rats. Journal of Medical and Biological Engineering 2015, 35 (1), 62-68.
4. Hsieh TH, Lin YT, Chen SC, Peng CW. Chronic pudendal neuromodulation using an implantable microstimulator improves voiding function in diabetic rats. Journal of neural engineering. 2016, 13 (4), 046001.
5. Lin YT, Hsieh TH, Chen SC, Lai CH, Kuo TS, Chen CP, Lin CW, Young ST, Peng CW. Effects of pudendal neuromodulation on bladder function in chronic spinal cord-injured rats. J Formos Med Assoc. 2016;115:703-13.

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JIAN-CHIUN LIOU : NANO BIOENGINEERING AND BIO-ASIC CHIP

Jian-Chiun Liou, Ph.D.,
Associate Professor

Major Research Aims

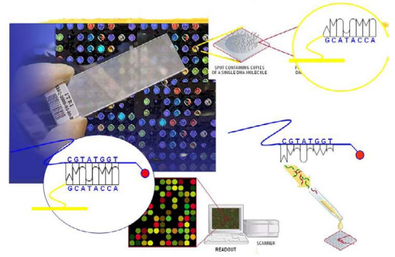
Our Nano Bioengineering and Bio-ASIC Chip system research team focuses on DNA, cDNA and RNA micro-array topics – specifically investigating a new DNA droplet injection design. We have created a thermal inkjet (TIJ) printhead using an application-specific integrated circuit (ASIC) system and bulk micromachining technology (microelectromechanical systems). We have designed these DNA jet printhead chips with a new structure and subsequently investigated their properties. In this new structure, we have integrated complementary metal-oxide-semiconductors (MOSs) and enhancement-mode devices, as well as power switches and a TIJ heater transducer, enabling logic functions to be executed on-chip. This capability is used to address individual jets with even fewer input lines than in matrix addressing. Other research topics include electrical stimulation therapy for use in stroke patients, medical minimally invasive surgery technologies, an ultrasonic probe chip with imaging technology, and integration of high-resolution bio-in vivo blood vessel imaging with WiFi transmission.

Major Achievements

1. Next-generation Intelligence an application-specific integrated circuit(ASIC) design for medical DNA sequence genes addressing system
2. Pulse Modulation Special Chip System for Quantitative DNA Gene Sequencing.
3. Nano-micro sensing heart rate EMG platform integration of human -tablet interaction control system.
4. Clinical vascular monitoring / ECG medical integrated wireless transmission system patch in clinical outcome studies predict chronic hemodialysis patients.
5. Medical electronic ultrasonic photoelectric imaging system chip technology.

Representative Figures

1.



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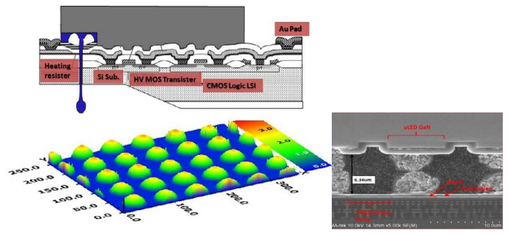

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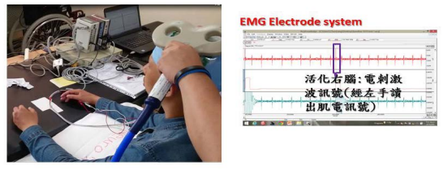

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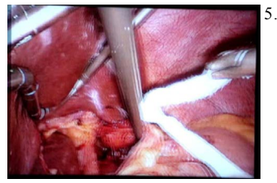

5.

1. The study is the subject of DNA, cDNA, RNA and other cloth placed on a glass slide. It is an application-specific integrated circuit(ASIC) designed to spray liquid medical wisdom DNA gene sequencing system technology transfer fabric onto the glass slide.
2. It combined with the high frequency of high-density microfluidic structure design.
3. This study is a stroke patient receiving electrical stimulation therapy.
4. The research focuses are medical minimally invasive surgery technology for optical electromechanical systems.
5. This study is an ultrasonic probe chip imaging technology.

Major Publications

1. Liou JC. Investigations of adhesion between waveguide and InP-laser with finger structure bonding. Computational Materials Science 2016, 122, 30-37.
2. Liou JC, Yang CF, Gong CS. Design and fabrication of identification inkjet print head chip fuse sensors. Sensors and Materials 2016, 28 (5), 493-501.
3. Liou JC, Chang YT. Investigated of the Reproducibility of Upper-Limb Motor Function in Stroke Patients. Journal of Nanoelectronics and Optoelectronics 2017, 12 (8), 862-867.
4. Liou JC, Su TJ, Lin WC, Wen WJ. A novel printhead multiplexer data registration chip system with injection cavity design. Microsystem Technologies 2018, 24 (1), 27-32.
5. Liou JC, Wu CC. Design and fabrication of microfluidic inkjet chip with high voltage ESD protection system for DNA droplets arrangement and detection. Microsystem Technologies 2017, 23 (1), 199-213.

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TMU BIOMEDICAL ENGINEERING RESEARCH TEAM

HUA-SHAN LIU :
MAGNETIC RESONANCE IMAGIING TECHNIQUES

Hua-Shan Liu, Ph.D.,
Assistant Professor

Major Research Aims

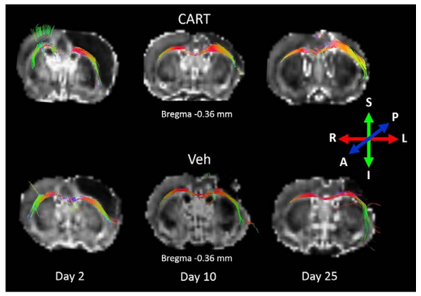
My research interests encompass the development of multimodal in vivo magnetic resonance (MR) imaging techniques in the fields of clinical and translational research, mainly focusing on the central nervous system, its related physiology and functions, and pathophysiology by using advanced MR imaging and spectroscopic techniques. Based on my extensive research experience and interests, I continue the accomplishments on MR perfusion-weighted imaging, quantitative susceptibility mapping and spectroscopy in application of the field for clinical and translational research. I hope to apply those techniques to study brain diseases and functioning in neuroscience and to develop more expertise related to studies of mental and neurobiological disorders, or psychological/psychiatric investigations.

Major Achievements

1. Use MR diffusion-tensor imaging (DTI) and susceptibility-weighted imaging (SWI) to detect the changes of white matter plasticity and angiogenesis in animal model of stroke.
2. Use MR SWI to demonstrate the iron depletion of dentate nuclei in ataxia-telangiectasia.
3. Use ASL-MRI to investigate the pathophysiological effects of chronic kidney disease (CKD) on brain function in children with CKD by correlating cerebral blood flow (CBF) with clinical and behavioral indices.
4. Assess the therapeutic efficacy of superparamagnetic erlotinib nanoparticles in lung cancer by using quantitative magnetic resonance imaging.
5. Use the first-pass pharmacokinetic model of permeability imaging of the MR perfusion-weighted imaging to effectively tumor grading in patients with gliomas.

Representative Figures

1.



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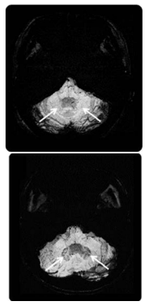

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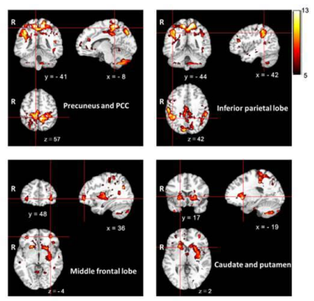

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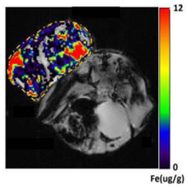

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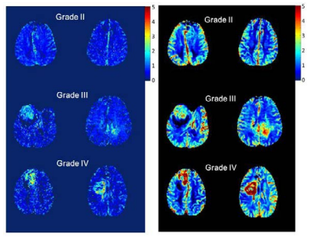

(1.) Post-stroke treatment with CART increased fiber growth in the ipsilateral cortex as revealed in diffusion-tensor imaging. (2.) Susceptibility-weighted images reveal an absence of hypointensity of the iron signal in the dentate nuclei of the patient with ataxia-telangiectasia (left). (3.) Overlapped clusters from all individual CKD subjects with positive extrema in CBF in the subject-specific voxel-wise analysis. (4.) Voxelwise estimates of the intratumoral iron concentration derived from changes in the ΔR2* signal, which correlates to the amount of intratumoral erlotinib content. (5.) Representative histograms of K^{trans} and vp from patients with high- and low-grade gliomas.

Major Publications

1. Liu HS, Shen H, Luo Y, Hoffer BJ, Wang Y, Yang Y. Post-treatment with Cocaine- and Amphetamine-regulated Transcript Enhances Infarct Resolution, Reinnervation and Angiogenesis in Stroke Rats - A Magnetic Resonance Imaging Study. NMR Biomed. 2016; 29: 361–370.
2. Liu HS, Hartung EA, Jawad AF, Ware JB, Laney N, Port AM, Gur RC, Hooper SR, Radcliffe J, Furth SL, Detre JA. Regional Cerebral Blood Flow in Children and Young Adults with Chronic Kidney Disease. Radiology. 2018; In Press.
3. Liu HS, et al. Regional Cerebral Blood Flow in Children and Young Adults with Chronic Kidney Disease. Radiology. 2018; In Press.
4. Liu HS, Jawad AF, Laney N, Hartung EA, Furth SL, Detre JA. Effect of Blood T1 Estimation Strategy on Arterial Spin Labeled Cerebral Blood Flow Quantification in Children and Young Adults with Kidney Disease. J Neuroradiol. 2018. S0150-9861(17)30402-9.
5. Liu HS, Chiang SW, Chung HW, Tsai PH, Hsu FT, Cho NY, Wang CY, Chou MC, Chen CY. Histogram Analysis of T2-Based Pharmacokinetic Imaging in Cerebral Glioma Grading. Comput Methods Programs Biomed. 2018. 155:19-27.
6. Hsu FT, Liu HS, Ali AAA, Tsai PH, Kao YC, Lu CF, Huang HS, Chen CY. Assessing the Selective Therapeutic Efficacy of Superparamagnetic Erlotinib Nanoparticles in Lung Cancer by Using Quantitative Magnetic Resonance Imaging and a Nuclear Factor Kappa-B Reporter Gene System. Nanomedicine. 2018. S1549-9634(18)30021-2.

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YU-JUI (RAY) FAN :
TOTAL ANALYSIS SYSTEM ON TISSUE AND CELL (FAN TASTiC)

Yu-Jui (Ray) Fan, Ph.D.,
Assistant Professor

Major Research Aims

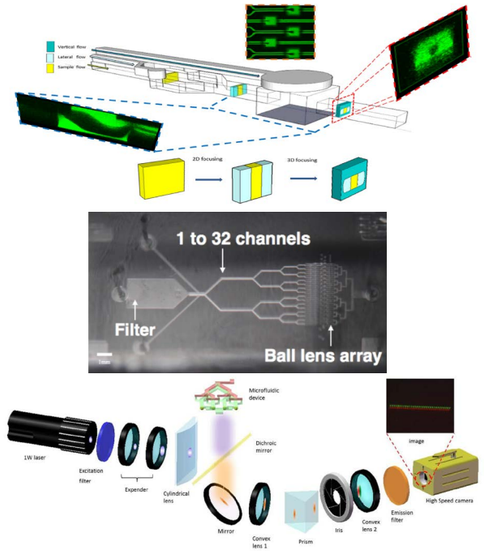
We are exploiting multi-couple physics that is able to achieve micro-environmental control or showed the potential for automation associated with miniaturized systems for biomedical applications including basic biology, medical diagnostics, and cellular engineering. Current studies are focusing on (1) vessel mimicking microfluidic system to investigate cellular responses after cyclic stretch force coupling with programmable sheath force, (2) lattice light sheet illuminated cell and tissue analyzer, (3) portable biosensors.

Major Achievements

1. High throughput and parallel micro-flow cytometer.
2. Vessel mimic microfluidic platform.
3. Smartphone-based biosensors integrated with Nanofluidic preconcentrator.

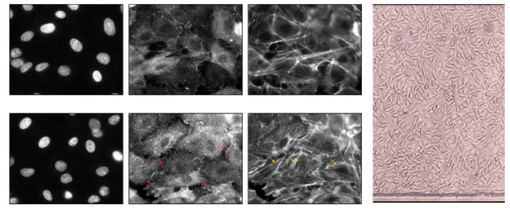
Representative Figures

1.



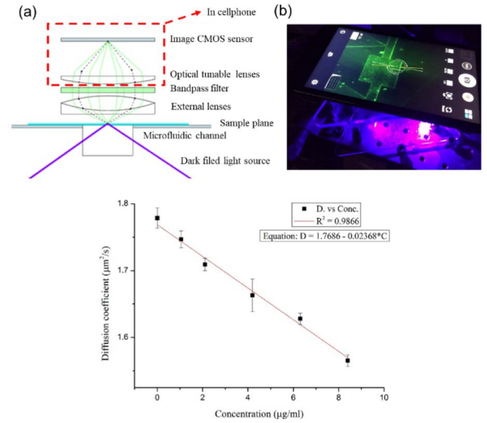
High throughput flow cytometer integrating parallel 3D microfluidic device with microball lens array. The optical system with epi-fluorescence detection and using 4F optical system to transport fluorescent signals to high speed camera. The prism is used to separate different color of fluorescent signals. The highest throughput of 1,000,000 cell/s was achieved.

2.



Vessel mimic flicrofluidic device for cell mechanics study.

3.



Smartphone based biosensors.

Major Publications

1. Chung PS, Fan YJ, Sheen HJ, Tian WC. Real-time dual-loop electric current measurement for label-free nanofluidic preconcentration chip. Lab on a Chip 2015;15:319-330.
2. Fan Y, Wu Y, Chen Y, Kung Y C, Wu T, Huang K, Sheen HJ, Chiou PY. Three dimensional microfluidics with embedded microball lenses for parallel and high throughput multicolor fluorescence detection. Biomicrofluidics 2013;7:44121.
3. Fan YJ, Deng CZ, Chung PS, Tian WC, Sheen H J.A high sensitivity bead-based immunoassay with nanofluidic preconcentration for biomarker detection. Sensors and Actuators B: Chemical 2018 ;272:502-509.
4. Fan YJ, Sheen HJ, Liu YH, Tsai JF, Wu TH, Wu KC, Lin S. Detection of C-reactive protein in evanescent wave field using microparticle-tracking velocimetry.Langmuir.2010;26: 13751-13754.
5. Chung PS, Fan YJ, Sheen HJ, Tian WC. Real-time dual-loop electric current measurement for label-free nanofluidic preconcentration chip. Lab on a Chip 2015, 15 (1), 319-330.

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YIN-JU CHEN : CANCER TRANSLATIONAL RESEARCH LABORATORY

Major Research Aims

My research interest in gaining insights into the processes that underlie cancer initiation, progression and therapeutic resistance to discover potential biomarkers, therapeutic targets and drugs.

- Identify cancer associated or chemo-resistance genes. A broad array of technologies that include cellular, molecular biology techniques were utilized.
- Expansion and characterization of circulating tumor cells (CTCs) for searching of circulating tumor markers and development personalized cancer drug screening platform.
- Integration of genomic information and drug database to find potential therapeutic drugs to improve the efficacy of therapy.

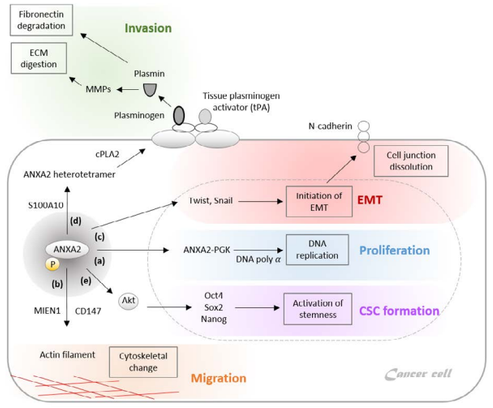
Yin-Ju Chen, Ph.D.,
Assistant Professor

Major Achievements

1. Characterization of cancer associated genes CHES1, DSG3, Annexin A2, Cyr61 contribute to cancer progression.
2. Establish in vitro CTC expansion model and drug screening platform.
3. Genomic approach to Identify potential compound to reverse cancer malignant and cancer stemness.

Representative Figures

1.



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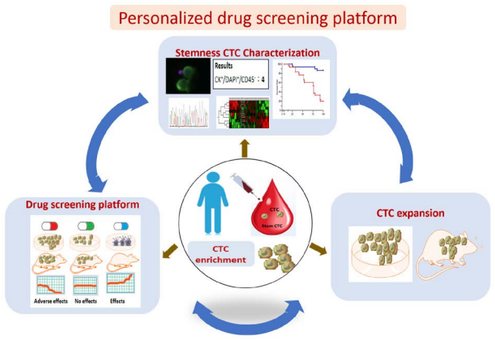

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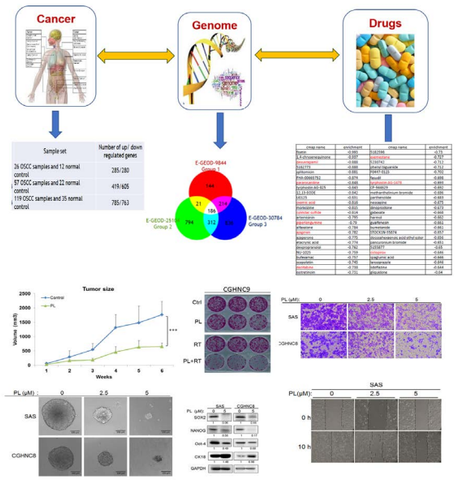

1. ANXA2 promotes cancer progression. ANXA2 initiates the endothelial-mesenchymal transition (EMT) via the Twist/Snail pathway. After initiation of the EMT. ANXA2 mediates the Akt protein to increase stemness-related transcription factors (Oct4, Sox2, and Nanog), which activates cancer stem cell formation.
2. Model illustrating of circulating tumor cells-based drug screening platform. To identify CTCs stemness biomarkers, establish CTC expansion and personalized CTCs drug screening platform.
3. Systemic approach to identify potential therapeutic drugs through systemic bioinformatics approach.

Major Publications

1. Chen YC, Lin YS, Chen CH, Chen YJ. Annexin A2-mediated cancer progression and therapeutic resistance in nasopharyngeal carcinoma. J Biomedical Sci 2018 Mar 29;25(1):30.
2. Chen YJ, Kuo KK, Ting LL, Lu LS, Lu YC, Cheng AJ, Lin YT, Chen CH, Tsai JT, Chiou JF. Piperlongumine inhibits cancer stem cell properties and regulates multiple malignant phenotypes in oral cancer. Oncology Letters.2018; 15(2): 1789–1798.
3. Chen CY, Lin YS, Chen CL, Chao PZ, Chiou JF, Kuo CC, Lee FP, Lin YF, Sung YH, Lin YT, Li CF, Chen YJ**, Chen CH*. Targeting annexin A2 reduces tumorigenesis and therapeutic resistance of nasopharyngeal carcinoma. Oncotarget 2015 29;6(29):26946-59. (Co- corresponding author)

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THIERRY BURNOUF : PLATELET BIOMATERIALS

Major Research Aims

Human blood is a source of essential cellular and protein therapeutics to treat diseases resulting from accidents as well as congenital or acquired deficiencies. Our research aims at improving the quality of blood products, and expanding the range of blood-based therapies serving human health. With translation medicine applications in mind, our research focuses on (a) exploring applications of tailor-made platelet lysates and growth factors in regenerative medicine (neurological disorders) and cell therapy (mesenchymal stromal cell expansion), (b) using of blood cells and cell-derived extracellular vesicles as drug delivery system and therapies, and (c) developing novel bioprocessing technologies for the chromatographic purification and virus inactivation of blood proteins. Our research has a strong international focus with close collaborations with foreign universities and research centers (Universities of Lille, Bourgogne Franche-Comté, Sorbonne Paris Cité-Paris 13, and Lyon/Saint-Etienne, France; Uppsala University, Sweden; University of Saskatchewan, Canada) as well as international industry. The lab research was awarded by the MOST for Recruitment and Retention of Special and Outstanding Talents in 106 academic year.

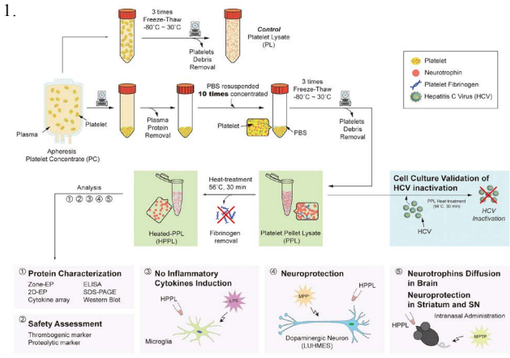
Thierry Burnouf, Ph.D.,
Professor

Major Achievements

1. Tailor-made platelet lysate rich in neurotrophins to treat neurodegenerative diseases of the CNS, and traumatic brain injury.
2. Procedure to prepare and use platelets as drug delivery system.
3. Characterization of platelet-derived microvesicles.
4. Clinical grade, virally-inactivated human platelet lysates for human cell (e.g. mesenchymal stromal cells) propagation ex viv.
5. Procedure to remove prions and non-enveloped viruses from platelet lysates for cell therapy.
6. Virus inactivation process of convalescent plasma and immunoglobulins against infectious diseases.

Representative Figures

1.



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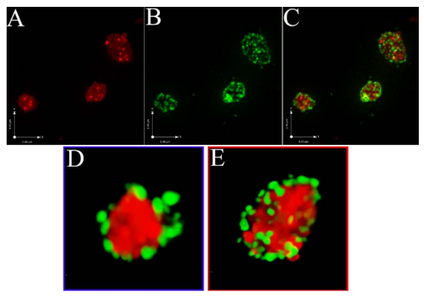

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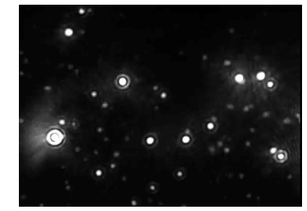

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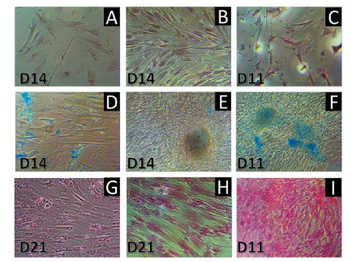

1. Tailor-made human platelet lysate concentrated in neurotrophins for treatment of neurodegenerative disorders.
2. Entrapment of doxorubicin within a platelet microcarrier for targeted cancer treatment.
3. Observation of platelet-derived microvesicles by Nanoparticle Tracking Analysis.
4. Differentiation capacity of Wharton Jelly MSC expanded in human platelet lysates treated for prion and virus removal.

Major Publications

1. Faber JC, Burnout T*, Bitter progress in the treatment of haemophilia A in low-income countries. Lancet Haematology, 2018; 5:e239.
2. Burnouf T*, Burnouf PA, Wu YW, Chang EY, Lu LS, Goubran HA. Circulatory cells-mediated nanotherapeutics approaches in disease targeting. Drug Discovery Today, 2018;23:934-943.
3. Chou ML, Wu JW, Gouel F, Jonneaux A, Timmermann K, Renn TY, Laloux C, Chang HM, Lin LT, Devos D, Burnouf T*. Tailor-made purified human platelet lysate concentrated in neurotrophins for treatment of Parkinspn's disease. Biomaterials 2017, 142, 77-89.
4. Burnouf T*, Dye JM, Abayomi, A. Convalescent plasma and the dose of Ebola virus. New England Journal of Medicine, 2017; 376: 1296-1297.
5. Gouel F, Do Van B, Chou ML, et al. The protective effect of human platelet lysate in models of neurodegenerative disease: involvement of the Akt and MEK pathways. Journal of Tissue Engineering and Regenerative Medicine, 2017; 11: 3236-3240.
6. Burnouf T, Strunk D*, Koh M, et al. Human platelet lysate: replacing fetal bovine serum as a gold standard for human cell propagation? Biomaterials 2016; 76:371-87.

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CHING-LI TSENG : BIOMATERIAL DESIGN FOR DRUG DELIVERY, TISSUE REGENERATION- OPHTHALMOLOGY

Ching-Li Tseng, Ph.D.,
Associate Professor

Major Research Aims

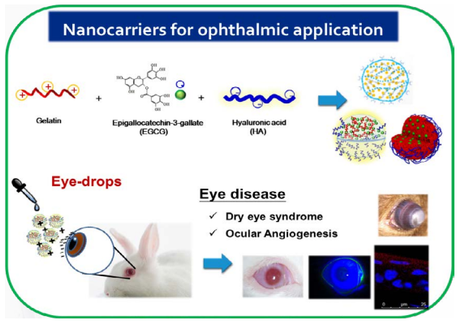
Biomaterials have broad application in medical device, tissue regeneration, and drug delivery. The same material can have totally different influence on cell function depending whether it is fabricated in micro- or nano- scale. In this lab, biological polymers such as gelatin, collagen, chitosan and hyaluronic acid are used to be drug carriers, cell scaffold etc. for disease treatment. We focused on novel formulation development for non-invasive drug delivery, especially on ophthalmology and lung cancer. New formulation with better patient compliance and targeting efficiency can be the way to improve therapeutic effect in clinics. These years, we designed and developed gelatin nanoparticles to treat dry eye syndrome, cornea neovascularization in an eye drop formulation. It is proven that nanoparticles can increase the bioavailability of drug on ocular surface, then effectively treat these diseases via one time dosing daily. The therapeutic effect of these nanoformulation in retina disease is tested now. Inhalation delivery of nanomedicine for treating lung cancer in situ is also proven due to highly increase chemodrug concentration in lung with targetable capacity for cancer tissue only.

Major Achievements

1. Targetable drug carrier design for ocular diseases treatment.
2. Controlling stem cell differentiation by nanotechnology for retina regeneration
3. Degradable biopolymer synthesis for tissue regeneration.
4. Inhalation delivery of nanomedicine for lung cancer diagnosis and treating.
5. Preclinical test for evaluation of therapeutic effect in dry eye syndrome, cornea angiogenesis, and lung cancer.

Representative Figures

1.



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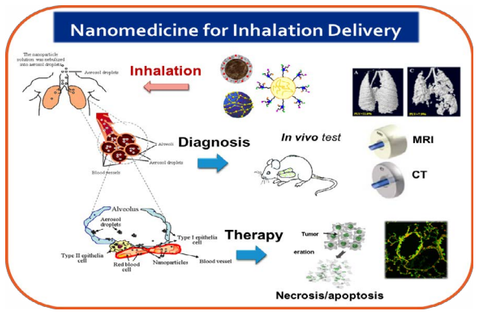

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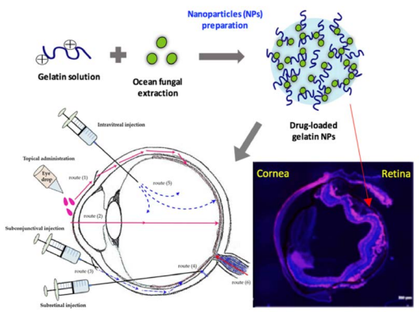

1. Self-assembling nanoparticles with antiinflammation/ antiangiogenesis agent (tea polyphenol/gp91 peptide) encapsulation as eye drops can effectively treating dry eye syndrome and cornea neovascularization.
2. Gelatin nanoparticle with epithelium growth factor (EGF) modification could targeting to EGF receptor (EGFR) overexpressed lung cancer cells by inhalation delivery. Meanwhile, MRI contrast agent (Iron oxide) or CT contrast agent (gold/ iodine based NPs) can also be packaged in it for theronostic cancer treatment.
3. Investigating the delivery efficacy of nanoformulation delivered in variant ways (eye drops, subconjunctiva/vitreous injection) to the posterior eye-retina.

Major Publications

1. Huang HY Huang, Wang MC, Chen ZY, Chiu WY, Chen KH, Lin IC, Tseng CL*. Gelatin–Epigallocatechin Gallate Nanoparticles with Hyaluronic Acid Decoration as Eye Drops Can Treat Rabbit Dry-Eye Syndrome Effectively via Inflammatory Relief. Int J Nanomed (2018):13 7251–7273.
2. Chang CY, Wang MC, Miyagawa T, Chen ZY, Tseng CL*. Preparation of RGD modified Biopolymeric nanoparticles containing epigalloccatechin-3- gallate for targeting vascular endothelial cells to inhibit corneal neovascularization. Int J Nanomed. (2017) 12: 279–294.
3. Tseng CL*, Hung YJ, Chen ZY, Fang HW, et al. Synergistic Effect of Artificial Tears Containing Epigallocatechin Gallate and Hyaluronic Acid for the Treatment of Rabbits with Dry Eye Syndrome. PLoS ONE (2016); 11(6).
4. Tseng CL, Shih IL, Stobinski L, Lin FH*. Gadolinium Hexanedione Nanoparticles for Stem Cell Labeling and Tracking via Magnetic Resonance Imaging. Biomaterials (2010); 31:5427-5435.
5. CL Tseng, Su WY, Yen KC, Yang KC, et al. The use of biotinylated-EGF-modified gelatin nanoparticle carrier to enhance cisplatin accumulation in cancerous lungs via inhalation. Biomaterials (2009); 30: 3476-3485.

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DER-ZEN LIU : LIPOSOMAL VACCINE

Der-Zen Liu, Ph.D.,
Professor

Major Research Aims

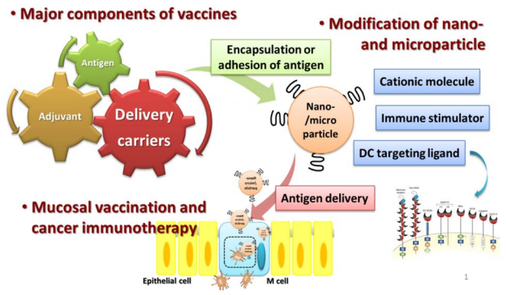
The mucosal surfaces, such as the gastrointestinal and respiratory tracts, represent the main entry site for most infectious agents. Thus, mucosal immunity provides the first line of defense against harmful microorganisms. Mucosal surfaces contain specialized dendritic cells (DCs), which play a critical role in recognizing environmental pathogens, as well as in initiating and regulating adaptive immune responses. Therefore, it is important to develop effective mucosal DC-targeted vaccines to induce protective immunity against cancer or viral infection. Thus, we develop novel targeted-liposomal delivery platform to delivery of antigens across mucosal membranes and target to dendritic cells. Thus, targeted-liposomes are able to achieve more effective protective effects that will be useful for the prevention of infectious diseases and treatment of mucosal tumors.

Major Achievements

1. Galactose-DLPE targeting ligand (formed by the covalent conjugation of galactose to DLPE) incorporated into liposomal bilayer to form a targeted galactosylated liposome carrier.
2. Galactosylated liposomes effectively facilitated antigen uptake by DCs in vitro and in vivo.
3. Intranasally administrated galactosylated liposomal vaccine led to an efficient anti-OVA immune response against EG7 tumor challenge.

Representative Figures

1.



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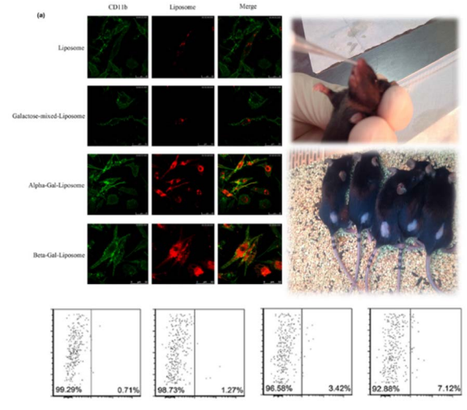

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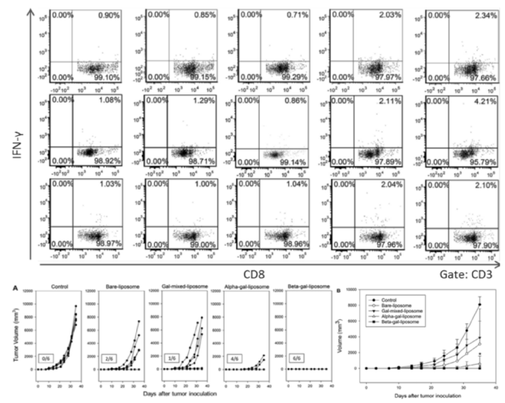

1. Design concept of functionalized targeted liposomes for mucosal vaccine.
2. Galactosylated liposomes effectively facilitated antigen uptake by DCs in vitro and in vivo via the intranasal route.
3. The number of IFN-c producing CD8+ T cells was increased in mice immunized with alpha-gal-liposomes and significantly increased in galactosylated liposomes. Five sixths and six sixths mice receiving alpha-gal-liposomes and beta-gal-liposomes, respectively, completely rejected the EG7 tumor challenge.

Major Publications

1. Jiang PL, Lin HJ, Wang HW, Tsai WY, Lin SF, Chien MY, Liang PH, Huang YY, Liu DZ*. Galactosylated liposome as a dendritic cell-targeted mucosal vaccine for inducing protective anti-tumor immunity. Acta Biomaterialia. 2015; 11:356-67.
2. Wang HW, Jiang PL, Lin SF, Lin HJ, Ou KL, Deng WP, Lee LW, Huang YY, Liang PH, Liu DZ*. Application of galactose-modified liposomes as a potent antigen presenting cell targeted carrier for intranasal immunization. Acta Biomaterialia. 2013;9(3):5681-8
3. Cheng HC, Chang CY, Hsieh FI, Yeh JJ, Chien MY, Pan RN, Deng MC, Liu DZ*. Effects of tremella-alginate-liposome encapsulation on oral delivery of inactivated H5N3 vaccine. J Microencapsul. 2011;28(1):55-61.
4. Chiou CJ, Tseng LP, Deng MC, Jiang PR, Tasi SL, Chung TW, Huang YY, Liu DZ*. Mucoadhesive liposomes for intranasal immunization with an avian influenza virus vaccine in chickens. Biomaterials. 2009;30(29):5862-8.

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TMU BIOMEDICAL ENGINEERING RESEARCH TEAM

CHIEN-CHUNG CHEN : MICROTUBE ARRAY MEMBRANE (MTAM)

Chien-Chung, Chen, Ph.D.,
Associate Professor

Major Research Aims

Core to the research interest of the group revolves around the development of the novel electrospun microtube array membrane (MTAM). Depending on the intended application, materials and key microstructures can be modified to fulfill the requirements and produces unique membrane properties. Applications of MTAMs have been demonstrated in areas such as anti-cancer drug screening (personalized medicine & drug development) where a novel platform with highly translatable outcome, extremely rapid screening process and significant reduction in screening cost have been demonstrated. Another key area of focus is the tissue engineering area where the use of the MTAMs as a novel co-culture substrate has been demonstrated. In regards to tissue engineering, a key area revolves around the development of a vitro model for drug release study that can potentially replace animals. Additionally, the group also work on project related to the hemodialysis and endotoxin removal where the MTAMs have demonstrated excellent and improved filtration efficiency while reducing the overall time and cost associated.

Major Achievements

1. Holds/part of over 15 international patents.
2. Published over 80 abstracts and peer reviewed journals.
3. Spin-off company based on MTAM technology.

Patents:

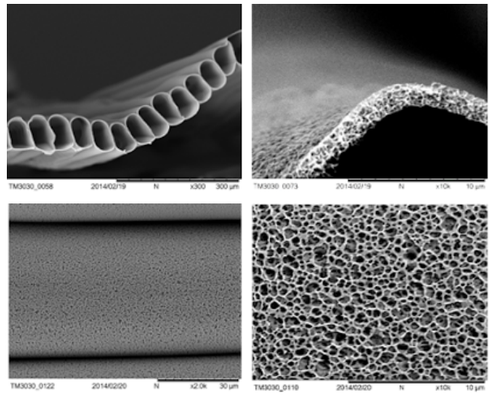
(1) MTAM: US & Taiwan IPs
- USP 8540504, 2013
- USP 9139935, 2014
- USP 9091007B2, 2015
- TWN I315358, 2009
- TWN I445856, 2014
- TWN I508836, 2015

(2) MTAM-Aplication based-neuroregeneration
- TWN I374037

(3) MTAM-Application-Fermentation/Immobilization
- USP 9758778
- TWN I592488, 2017

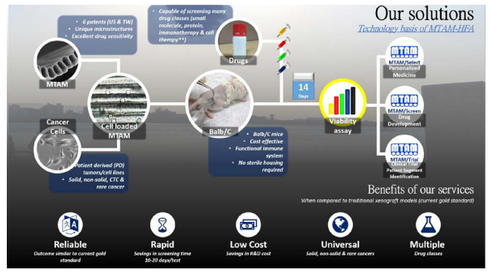
Representative Figures

1.



SEM images of electrospun MTAMS with highly unique microstructures; ultra-thin, homogenously porous and high-aligned fibers arranged in an arrayed formation.

2.



Electrospun Microtube Array Membrane (MTAM) and its applications in the anti-cancer drug screening for personalized medicine and drug development.

3.

Snapshot of awards and trade shows participated in past years.

Major Publications

1. Tseng CH, Chew CH, Huang WT, Wang YK, Chen K, Chou S, Chen CC. An Effective Cell Coculture Platform Based on the Electrospun Microtube Array Membrane (MTAM) for Nerve Regeneration. Cells Tissues Organs 2017, 204(3-4):179-190.
2. Morelli Sabrina,Piscioneri Antonell,Salerno Simona,Chen CC,Chew CH,Giorno Lidietta, Drioli Enrico, De Bartolo Loredana. Microtube array membrane bioreactor promotes neuronal differentiation and orientation. Biofabrication 2017, 9(2):025018.
3. Chew CH,Wu CC,Chen CC. A novel electrospun Microtube Array Membrane (MTAM) based low cost conceptual tubular Microbial Fuel Cell (MFC). European Polymer Journal 2016, (83):138-147.
4. Chen CC,Wu CH,Wu JJ,Chiu CC,Wong CH,Tsai ML Lin HT. Accelerated bioethanol fermentation by using a novel yeast immobilization technique: Microtube array membrane. Process Biochemistry 2015, 50(10): 1509–1515.
5. Yang SH,Lin HY,Chang VH,Chen CC,Liu YR,Wang J Zhang K Jiang X, Yen Y. Lovastatin overcomes gefitinib resistance through TNF-α signaling in human cholangiocarcinomas with different LKB1 statuses in vitro and in vivo. Oncotarget 2015, 6(27):23857-73.

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ER-YUAN CHUANG : DRUG DELIVERY

Er-Yuan Chuang, Ph.D.,
Assistant Professor

Major Research Aims

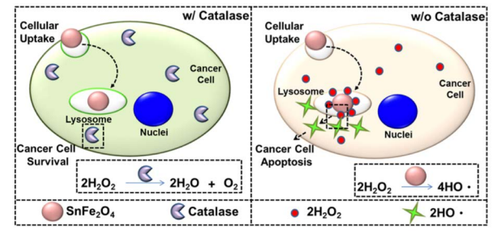
We are interested in drug delivery and biomaterials. Our team work is particularly focused on developing innovative nanobiomaterials, which are expected to enhance the efficacy of treatment against human diseases. We are studying formulated materials characteristics, physiochemical property, impact on cell viability, and biomolecular mechanisms. We try to invent cost-effective processes to fabricate useful next-generation therapeutic materials. Our guidelines of development include biocompatibility, bioefficacy, clinical value, and meaningful industrial needs. We have been developing partnerships with clinicians and industry scientists to optimize our biomaterials, prepare superior formulations and conduct pre-clinical animal studies. Carbon based nanomaterials are currently our main field of research.

Major Achievements

1. The carbon based nanomaterials are currently main researches.
2. Genipin-crosslinked adipose stem cell derived extracellular matrix-nano graphene oxide composite sponge for skin tissue engineering has been developed.
3. In addition to study of potential administration, the proposed nanocarrier systems have potential applications as a platform for different administrations of other therapeutic substance.

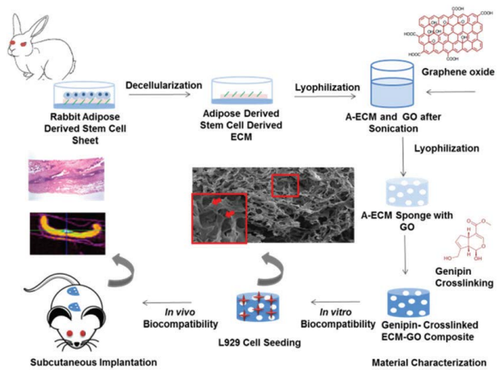
Representative Figures

1.



The development of nano-biomaterials are used for biomedical applications.

2.



The biomedical materials are developed for tissue engineering and regenerative medicine.

Major Publications

1. Nyambat, B., Chen, C. H., Wong, P. C., Chiang, C. W., Satapathy, M. K., & Chuang, E. Y. (2018). Genipin-crosslinked adipose stem cell derived extracellular matrix-nano graphene oxide composite sponge for skin tissue engineering. Journal of Materials Chemistry B, 6(6), 979-990.
2. Mi, F. L., Burnouf, T., Lu, S. Y., Lu, Y. J., Lu, K. Y., Ho, Y. C., et al. (2017). Self-Targeting, Immune Transparent Plasma Protein Coated Nanocomplex for Noninvasive Photothermal Anticancer Therapy. Advanced healthcare materials, 6(14), 1700181.
3. Lee, K. T., Lu, Y. J., Mi, F. L., Burnouf, T., Wei, Y. T., Chiu, S. C., et al. Catalase-modulated heterogeneous Fenton reaction for selective cancer cell eradication: SnFe2O4 nanocrystals as an effective reagent for treating lung cancer cells. ACS applied materials & interfaces, 9(2), 1273-1279.
4. Satapathy, M. K., Nyambat, B., Chiang, C. W., Chen, C. H., Wong, P. C., Ho, P. H., et al. A Gelatin Hydrogel-Containing Nano-Organic PEI–Ppy with a Photothermal Responsive Effect for Tissue Engineering Applications. Molecules, 23(6), 1256.
5. Chuang, Er-Yuan, Lin, Kun-Ju, Huang, Tring-Yo, et al. An Intestinal “Transformers”-Like Nanocarrier System for Enhancing the Oral Bioavailability of Poorly Water-Soluble Drug. ACS Nano 2018 (Accepted).

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TMU BIOMEDICAL ENGINEERING RESEARCH TEAM

LONG-SHENG LU : TRANSLATIONAL RADIATION BIOLOGY

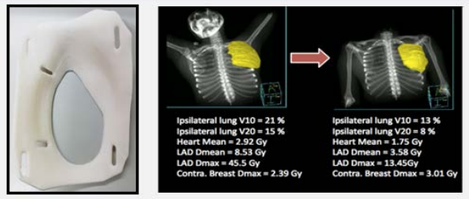
Long-Sheng Lu, M.D, Ph.D.,
Assistant Professor

Major Research Aims

The Lu lab is interested in understanding how ionization radiation alters mitochondrial function and tumor-host interaction to achieve long-term control of cancers without late cardiovascular complications. We dedicate efforts to identify unanswered problems in radiation oncology clinics, and solve these issues with an integrated multidisciplinary approach from bench to bedside. In the lab, we use live cell microscopy, image cytometry, molecular biology, explant culture, smart biomaterials and murine models to explore the non-canonical effects of ionizing radiation. These bench findings are actively translated to new strategies for normal organ protection, rapid and personalized diagnosis, targeted drug delivery, and anticancer immunity in the settings of metastatic breast and colorectal cancers. In the clinics, we are interested in two major area. The first is on the management of oligometastatic cancers with advanced radiotherapy techniques as well as molecular and cellular predictive diagnostics that guide judicious use of radiotherapy and biologically targeted agents. The second is on the cardiovascular protection for curative cancer treatment

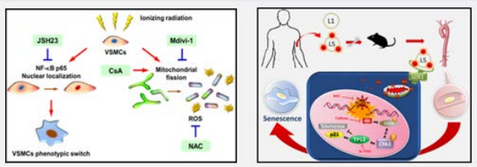
Our Significant Contributions

Application of 3D Printing in Radiation Oncology



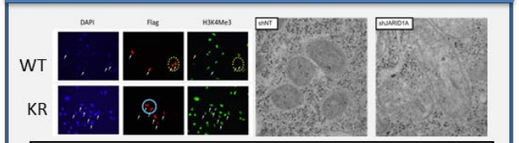
3D printing decentralizes the fabrication process and marks the trend of personalized medical devices in the era of precision medicin. Our lab is interested in applying 3D printing technology in developing personalized novel medical devices to address unmet needs of radiotherapy. Currently, we are devoting efforts to make personalized holder to minimize radiation exposure of the heart and the lungs during the process of adjuvant radiotherapy after partial mastectomy.

Mitochondria and Vascular Protection



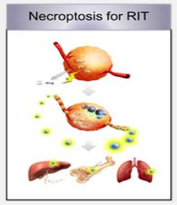
Vascular dysfunction is an important contributor to cardiovascular diseases, aging and cancers. Mitochondria is not only the essential power plant for a cell but also controls cell fate. Our lab found that biased mitochondrial dynamics towards fission is critical in pathogenesis of radiation-induced vascular disease and vascular aging induced by electronegative LDL. Ongoing efforts are to develop LDL-inspired biomimetic nanoparticles as novel therapeutics for mitochondriopathy and senolytics.

Epigenetic Regulation of Mitochondrial Respiration



Trimethylated lysine 4 of histone H3 (H3K4Me3) is a histone code associated with transcriptional activation. This methyl mark is erased by JARID1 family of α-ketoglutarate-dependent dioxygenases. Mutation of a major SUMO accepting lysine leads to defective chromatin recruitment and a complete loss of its enzymatic activity in vivo. Expression profiling and genome-wide localization analysis predict that JARID1A controls mitochondrial oxygen consumption through nuclearly encoded mitochondrial genes.

Cancer Radioimmunotherapy



Cancer immunotherapy not only controls the primary tumor but also work systemically to destroy distant metastatic lesions. Our lab is trying to develope novel in situ tumor vaccination strategy with precision radiation plus intratumoral drug delivery that collectively promote programmed necrosis of cancer cells and reprogramming of tumor microenvironment.

Major Publications

1. Lu LS, Pan CH, Lin YH, et al.: Salvage Concurrent Chemoradiation Therapy Stabilizes Progression of Recurrent Intimal Sarcoma of the Left Atrium: A Case Report. Therapeutic Radiology and Oncology 2016;23:265-70
2. Bawa-Khalfe T, Lu LS, Zuo Y, et al.: Differential expression of SUMO-specific protease 7 variants regulates epithelial-mesenchymal transition. Proc Natl Acad Sci U S A. 2012;109:17466-71.
3. Wu CC, Liu YB, Lin CW, Lu LS: Imaging reactive oxygen species dynamics in living cells and tissues Frontiers in Bioscience (scholar edition) 2009;s1:39-44.
4. Lu LS, Wu CC, Hung LM, Chiang MT, Lin CT, Lin CW, Su MJ: Apocynin alleviated hepatic oxidative burden and reduced liver injury in hypercholesterolaemia. Liver Int 2007;27:529-537.

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WEI-CHEN HUANG : SOFT BIOMATERIALS & BIOELECTRONICS

Wei-Chen Huang, Ph.D.,
Assistant Professor

Major Research Aims

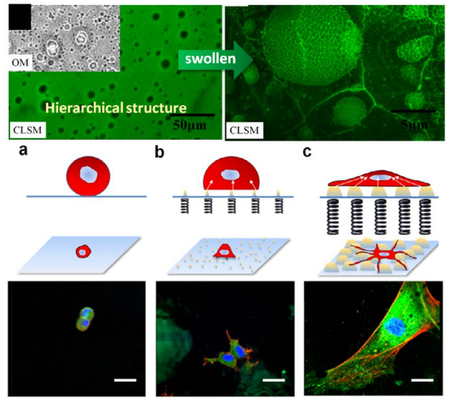
Design and fabrication of multifunctional polymeric networks is beneficial for the development of tissue engineering and next-generation bioelectronics. Precise controlling over the chemical and physical cues of polymer-based materials can permit the efficient promotion on the cell adhesion, growth and the extensive proliferation for tissues regeneration, but also can reduce inevitable tissue responses of implantable electronics. Strategies covering the incorporating novel biomimetic materials, nonconventional microelectronic fabrication techniques, and comprehensive device integration strategies are used to develop next-generation brain-machine interfaces, i.e ultra-compliant bioelectronics. We believe that next-generation bioelectronic interfaces will seamlessly meld tissues and devices to exhibit unprecedented functionality and reliability.

Major Achievements

1. Development of bioactive polymer networks for tissue engineering.
2. Design of functional nanomaterial-based bioelectrodes. to enhance brain implanted therapy.
3. Microfabrication process design for developing ultra-compliant bioelectrodes.
4. Engineering bio-inspired stretchable bioelectronic devices.

Representative Figures

1.



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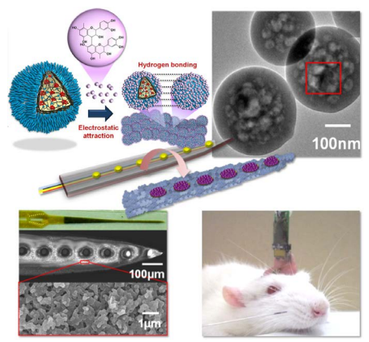

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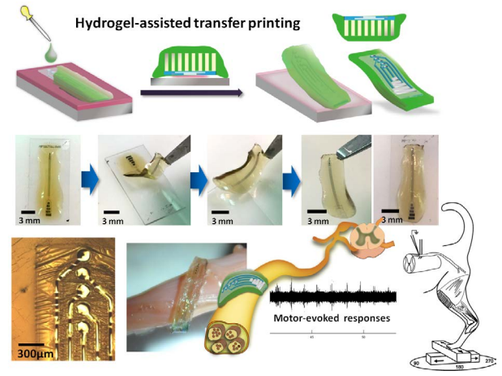

1. Hierarchical polymeric substrates can form localized adhesive motifs as the adhesion agents for providing the stable immobilization to cell adhesion.
2. Printed polyphenal-embedded nanocarrier-based interfaces to enhance signal recording and reduce neuron degeneration in chronic neural implantation.
3. Hydrogel-medirated transfer printing complex microelectrode arrays on swollen hydrogels to develop an ultra-compliant peripheral neural microelectrodes.

Major Publications

1. Huang WC, Ong XC, Kwon IS, Gopinath C, Fisher LE, Wu H, Fedder G, Gaunt RA, Bettinger CJ, Ultra-Compliant Hydrogel-Based Neural Interfaces Fabricated by Aqueous-Phase Microtransfer Printing. Adv. Funct. Mater. 2018; 28, 1801059.
2. Huang WC, Lo YC, Chu CY., Chen YY, Chen SY, Conductive nanogel-interfaced neural microelectrode arrays with electrically controlled in-situ delivery of manganese ions enabling high-resolution MEMRI for synchronous neural tracing with deep brain stimulation. Biomaterials 2017; 122: 141-53.
3. Huang WC, Lai HY, Kuo LW, Liao CH, Chang PH, Liu TC, Chen SY, Chen YY, Multifunctional three-dimensional patternable drug- embedded nanocarrier- based interfaces to enhance signal recording and reduce neuron degeneration in chronic neural implantation, Adv. Mater. 2015; 27(28):4186-93.

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DAVID J. LUNDY : DRUG DELIVERY, NANOMEDICINE AND TISSUE ENGINEERING

David J. Lundy, Ph.D.,
Assistant Professor

Major Research Aims

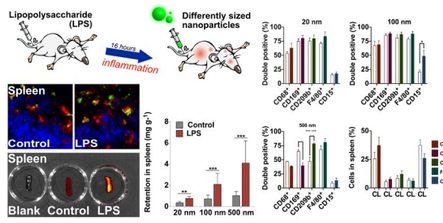
I am new to the department for the academic year beginning 2018 and I look forward to establishing myself and collaborating with others. My research interests lie in the fields of drug delivery – particularly the delivery of passive and active targeted nanomedicines to ischaemic tissues and tumours. I have previously worked on the development of a drug capture system for improved delivery of therapeutics to critical limb ischaemia, myocardial infarction and brain disorders, and most recently my work has focused on increasing delivery of nanotherapeutics through the blood brain barrier for the treatment of glioma. I also have a background in tissue engineering where I aided in the development of a human epidermal equivalent for in vitro testing of cosmetic or pharmaceutical compounds.

Major Achievements

1. Understanding mechanisms of altered, size-dependent distribution of nanomedicines during systemic inflammation.
2. Determination of optimal nanoparticle retention at site of cardiac ischaemia-reperfusion injury.
3. Demonstration of anti-PEG antibody-based reloadable drug capture system in a porcine model of limb ischaemia.
4. Improved delivery of nanotherapeutics to brain parenchyma via transient weakening of blood-brain barrier.

Representative Figures

1.



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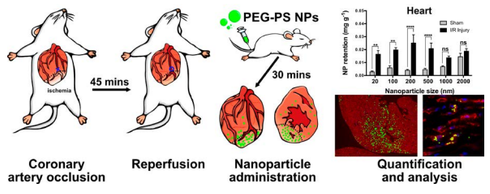

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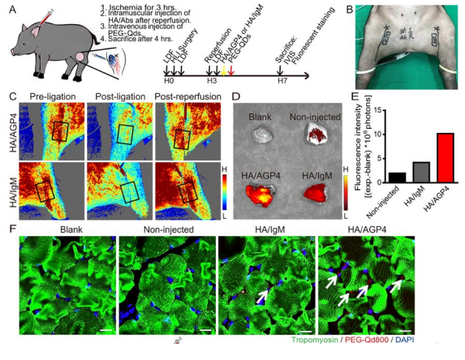

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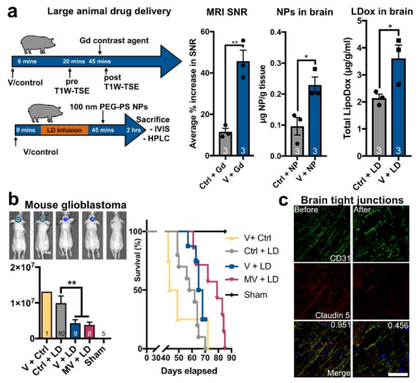

1. During systemic inflammation, nanoparticles are increasingly retained by the spleen due to uptake by a specific lineage of splenic leucocytes.
2. Systemically-injected nanoparticles are retained at the ischemia-reperfusion injured heart in a size-dependent manner.
3. Demonstration of reloadable drug capture system in porcine model of limb ischaemia. Systemically injected PEG-modified quantum dots were retained at the injection site.
4. Large animal demonstration of enhanced delivery of Gadolinium, nanoparticles (NPs), LipoDox (LDox) to the brain. Delayed tumour growth and improved survival in mouse glioblastoma model. BBB permeability enhanced by reducing tight junction integrity.

Major Publications

1. Lundy DJ et al, 2017. Inducing a transient increase in blood brain barrier permeability for improved therapy of glioblastoma multiforme. Submitted, pending publication.
2. Wu PJ, Cheng B, Roffler SR, Lundy DJ, et al. Reloadable Multi-Drug Capturing Delivery System for Targeted Ischemic Disease Treatment. Sci Trans Med 2016, 8, 365ra160-365ra160. DOI: 10.15252/emmm.201606558.
3. Lundy DJ, Chen KH, Toh EK, Hsieh PC. Distribution of Systemically Administered Nanoparticles Reveals a Size-Dependent Effect Immediately following Cardiac Ischaemia-Reperfusion Injury. Sci. Rep. 2016, 6, 25613; DOI: 10.1038/srep25613.
4. Chen KH & Lundy DJ et al, 2015. Nanoparticle distribution during systemic inflammation is size-dependent and organ-specific. Nanoscale 2015, 7(38):15863-72. DOI: 10.1039/C5NR03626G.

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JEN-CHANG YANG : DENTAL MATERIALS & MEDICAL DEVICES

Jen-Chang Yang, Ph.D.,
Professor

Major Research Aims

The implementation of nanomaterials into medical device applications and long-term translational research toward clinical trials will be the main tasks. My personal interested fields are the dental materials and medical devices toward preventive and minimum invasive medical applications. Bio-inspired and digital design (MGI+AI) driven silk protein fibers in design, synthesis, fabrication for translational researches are under development for new applications.

Major Achievements

1. **Fast-setting Root Canal Filling Materials**

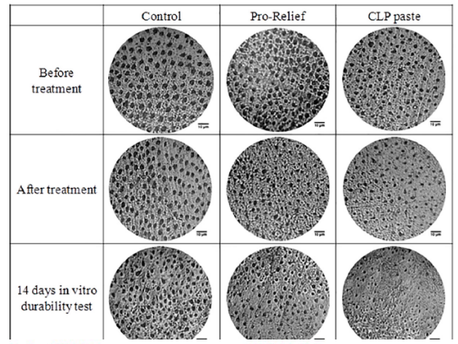
   Root canal therapy is a common dental procedure to treat the inside of the tooth. Endodontic treatment is necessary when the pulp becomes inflamed or infected. Mineral trioxide aggregate (MTA) has been successfully used in multifaceted endodontic applications such as root end filling, apexification, pulpotomy, and vital pulp therapy because of its unique biocompatibility, antibacterial nature, sealability, and its capacity to promote hard tissue formation. However, MTA is difficult to use for practitioners because of its properties of granular consistency, slow setting time, and initial looseness. The SavDen® MTA developed at TMU using a proprietary dual-function additive resulting in a fast setting, cement based filling material.

1. **Long Lasting (CLP) Based Desensitizing Agent**

   Dentinal hypersensitivity (DH) has been researched extensively due to its widespread prevalence and is a painful oral health problem that affects many individuals. To take advantages of remineralizing agents as a desensitizing agent, calcium lactate phosphate (CLP), a soluble calcium salt of calcium oxide, lactic acid, and phospheric acid, was developed in our laboratory. Figure 1 showed that using CLP pastes as desensitizing agents offers good prospects for instant and 14 days constant-increasing dentinal tubule occlusion. The newly developed CLP paste may be a good alternative treatment for dentin hypersensitivity relief.

Representative Figures

1.



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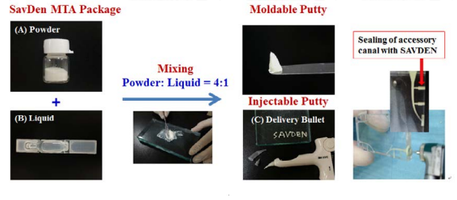

1. The optical micrographs of occlusal dentin disk surface pre-treatment, immediately post-treatment, and 14 days post-treatment of various desensitizing pastes.
2. The results suggest that the novel accelerator provides improvement in sealing ability as well as clinical manageability of dental filling materials.

Major Publications

1. Ji DY, Kuo TF, Wu HD, Yang JC#, Lee SY# A novel injectable chitosan/ γ-polyglutamic acid polyelectrolyte complex hydrogel with hydroxyapatite for soft-tissue augmentation. Carbohydrate Polymers. 2012; 89 (4), 1123-1130.
2. Yang, JC, Hu, HT, Lee, SY, Hsieh, SC, Huang, PC, Ma, CF, Ji, DY, Chang, LY, and Teng, NC. In Vitro Evaluation of Dentin Tubule Occlusion for Novel Calcium Lactate Phosphate (CLP) Paste. Materials 2017; 10, 228: 1-7.
3. Wu, HC, Quan, DN, Taso, CY, Liu, Y, Terrell, JL, Luo, XL, Yang, JC, Payne, GF, Bentley, WE. Conferring Biological Activity to Native Spider Silk: A Biofunctionalized Protein-Based Microfiber. Biotechnology and Bioengineering. (2016), 9999:1-13.
4. Behera K, Chang YH, Chiu FC, Yang JC. Characterization of poly(lactic acid)s with reduced molecular weight fabricated through an autoclave process. Polymer Testing 2017(60):132-139.

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CHIH-YU CHANG : MULTIFUNCTIONAL NANOMATERIALS & NANO-BIOELECTRONICS

Chih-Yu Chang, Ph.D.,
Associate Professor

Major Research Aims

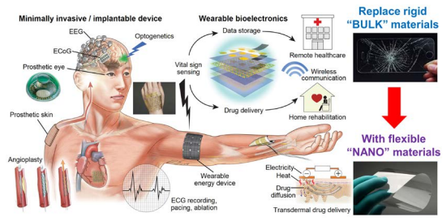
Existing bioelectronic devices based on conventional materials are not intrinsically compatible with biological systems and do not efficiently convert ionic signals to from electronic signals. The structural and functional similarity of organic materials to biological ones is the most promising option for next-generation bioelectronics devices. My research aims to develop functional organic biointegrated devices through the precise programming of nano-bio interactions, especially with regard to the rational assembly of constituent nanomaterials on multiple dimension scales, in order to leverage their respective intrinsic merits for different functions. Emerging nanotechnological strategies at nano-bio interfaces are also developed, such as multimodal diagnosis, sequential therapeutics delivery, stretchable flexible nanoelectronics, and their implementation into a broad range of biointegrated devices (e.g., implantable, minimally invasive). When utilized as functional modules of biointegrated devices, these programmable nano-bio interfaces will open up a new chapter for precision nanomedicine.

Major Achievements

1. Nanoparticles: synthesis, functionalization & applications.
2. Flexible organic electronics for highly sensitive low-cost wearable biosensors and bioelectronics applications.
3. Surface engineering of triboelectric nanogenerators (TENGs).
4. Bio-inspired nanomaterial for multifunctional electronic skins.
4. Self-healing polymeric materials as biomedical scaffolds for cell, gene, and drug delivery.

Representative Figures

1.



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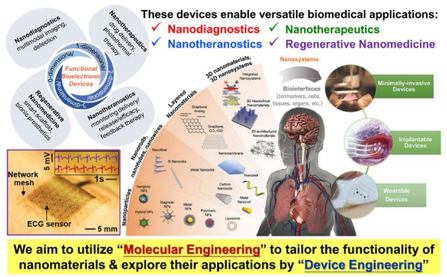

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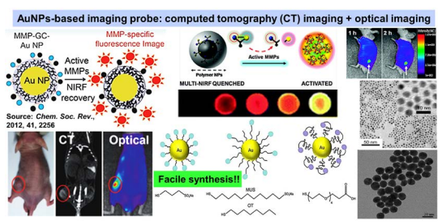

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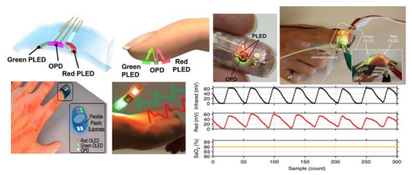

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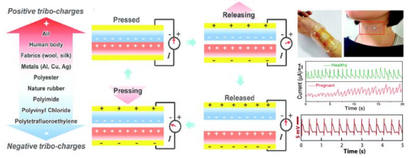

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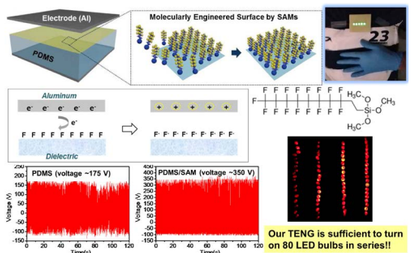

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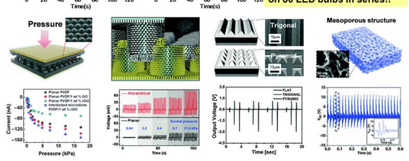

1. Flexible bioelectronic devices integrated with nanomaterials uniquely address major challenges in biomedicine.
2. Our strategies to achieve flexible & wearable bioelectronic devices.
3. Synthesis and functionalization of Au nanoparticles (NPs) for multimodal imaging probe applications.
4. An emerging area: biomedical applications of flexible TENGs.
5. Surface engineering of TENGs via self-assembled monolayers (SAMs).
6. Surface molecularly engineering to improve the functionality of organic electronics-based oximeter.
7. High-performance piezoelectric self-powered electronic skins with bio-inspired structures.

Major Publications

1. Chang CY, Tsai BC, Lin MZ, et al. An integrated approach towards the fabrication of highly efficient and long-term stable perovskite nanowire solar cells. J. Mater. Chem. A, 2017; 5:22824-22833.
2. Chang CY, Huang WK, Chang YC. Achieving high efficiency and improved stability in large-area ITO-free perovskite solar cells with thiol-functionalized self-assembled monolayers, J. Mater. Chem. A, 2016; 4:7903-7913.
3. Chang CY, Huang WK, Chang YC. Highly-Efficient and Long-Term Stable Perovskite Solar Cells Enabled by a Cross-Linkable n-Doped Hybrid Cathode Interfacial Layer, Chem. Mater., 2016; 28:6305-6312.

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YI-PING CHEN : NANO THERANOSTICS

Yi-Ping Chen, Ph.D.,
Assistant Professor

Major Research Aims

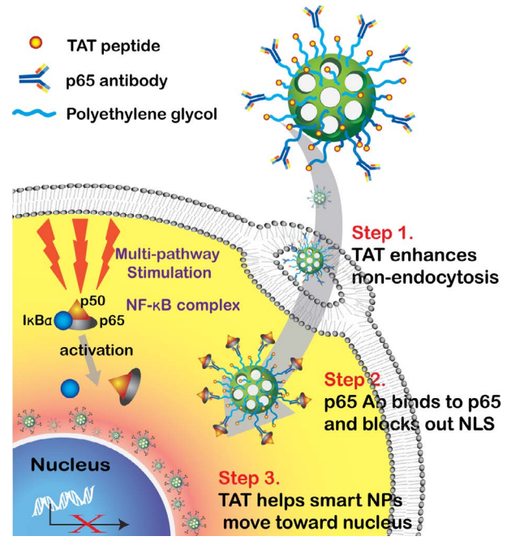
Multifunctional mesoporous silica nanoparticle (MSN) has become a promising and widely applicable platform for different biomedical applications on bioimaging, biosensing, drug delivery, and so on. Our groups aim to design an ideal MSN for use in vivo to achieve the characteristics of biocompatible, stability, and not accumulate in organs after administration. Our research interests lie in the nanoscale therapeutics and diagnostics focused on the approach to deliver protein or antibody into cells using silica nanoparticle strategies for enzyme replacement therapy (ERT) and targeting therapy. The results include: (1) denatured proteins conjugated onto MSN are capable of refolding and enhancing delivery efficiency because of decreasing steric hindrance, followed by an activation of enzyme that triggers a cascade reaction, leading it to prevent ROS induced cell death; (2) a MSN-antibody complex is employed to catch the Rel protein (NF-κB p65) in perinuclear region thus blocking the translocation near the nuclear pore gate because the size of the p65 bound nanoparticle becomes too big to enter nucleus. We expect our studies would push the nano carrier into preclinical, as well as attempt to address the current developmental and therapeutic challenges.

Major Achievements

1. Developed biocompatible and therapeutic MSN applied in medicine, especially in cancer and neurodegenerative disease.
2. Investigated enzyme replacement therapy (ERT) using MSN-based protein delivery strategies .
3. Designed MSN as a smart antibody-targeting nanoparticle to block nuclear translocation of the activated NF- κB p65 for cancer therapy
4. Conjugated biological peptides onto MSN, which enhanced tumor targeting, intracellular uptake, and lysosomal targeting.

Representative Figures

1.



1. Catcher in the Rel: Nanoparticles-antibody conjugate as NF-κB nuclear translocation blocker.
2. Impacts of protein corona on biological effects of mesoporous silica nanoparticles.
3. Peptide-mediated delivery of pH-sensing mesoporous silica nanoparticles into lysosome in living cells.

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URL: https://tmu.pure.elsevier.com/en/persons/yi-ping-chen

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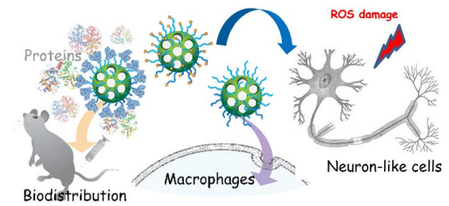

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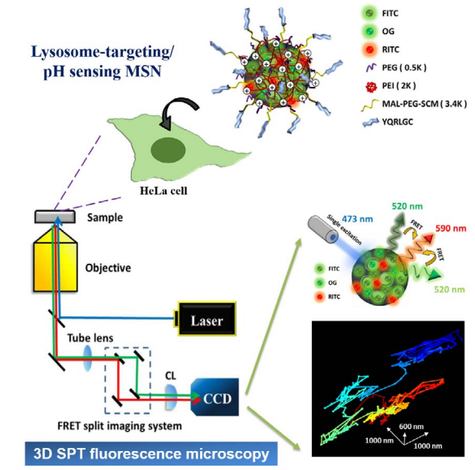


Major Publications

1. Chen YP, Chen CT, Hung Y, et al. A new strategy for intracellular delivery of enzyme using mesoporous silica nanoparticles: superoxide dismutase. J. Am. Chem. Soc. 2013; 135, 1516-23.
2. Chen YP, Wu CH, Wu SH, et al. Enhanced non-endocytosis cellular uptake of medium-size mesoporous silica nanoparticles by shortening the peptide transporter arginine side chain. ACS Appl. Mater. Interfaces 2013; 5, 12244–48.
3. Chang FP, Chen YP, and Mou CY. Intracellular implantation of enzymes in hollow silica nanospheres for protein therapy: cascade system of superoxide dismutase and catalase. Small 2014; 10, 4785-95.
4. Lin YH, Chen YP*, Liu TP, et al. Approach to deliver two antioxidant enzymes with mesoporous silica nanoparticles into cells. ACS Appl. Mater. Interfaces 2016; 8, 17944-54.
5. Chen YP, Wu SH, Chen IC, et al. Impacts of crosslinkers on biological effects of mesoporous silica nanoparticles. ACS Appl. Mater. Interfaces 2017; 9, 10254-265.

TSUNG-RONG KUO : NANOMATERIALS & NANOTECHNOLOGY

Tsung-Rong Kuo, Ph.D.,
Assistant Professor

Major Research Aims

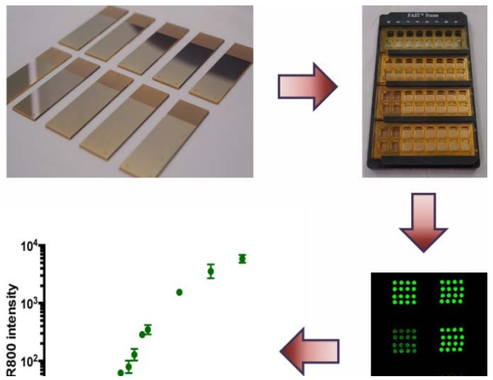
We have developed a rapid, reliable and sensitive platform to detect the disease biomarkers for the early diagnosis of diseases based on surface-enhanced Raman spectroscopy. To solve the issue of the low sensitivity of Raman, we have designed the surface-enhanced Raman scattering-based substrate by two-dimensional silver nanocrystals Langmuir Blodgett film to increase the signal intensity of Raman spectroscopy. Afterward, the substrate surface of the silver nanocrystals Langmuir-Blodgett film was conjugated with antibodies of disease biomarkers for the rapid screening test of diseases in the early stage by surface-enhanced Raman spectroscopy. Recently, we have successfully used our highly sensitive platform for the detection of Alzheimer's disease biomarkers included Aβ1-40 and tau proteins. Eventually, we hope that we will be able to develop a rapid, sensitive and reliable detection platform using silver nanocrystal Langmuir Blodgett films as the substrate for the detections of different disease biomarkers by surface-enhanced Raman spectroscopy.

Major Achievements

1. We have developed the platform based on surface-enhanced Raman scattering for the early detection of disease biomarkers.
2. The shape-controlled polyhedral silver nanocrystals included cubes, cuboctahedra and octahedra were synthesized by the polyol process.
3. The two-dimensional silver nanocrystals Langmuir Blodgett film has been applied as the substrate for surface-enhanced Raman spectroscopy.
4. The detection platform based on surface-enhanced Raman scattering has been successfully used to detect the Alzheimer's disease biomarkers included Aβ1-40 and tau proteins.
5. We have investigated the temporal and spatial variation of polyvinylpyrrolidone surface-enhanced Raman scattering signals from the silver nanocrystals Langmuir Blodgett films.
6. We have analyzed the enhancement probability distribution with a model allows quantitative characterization of the SERS substrates of silver nanocrystals Langmuir Blodgett films.

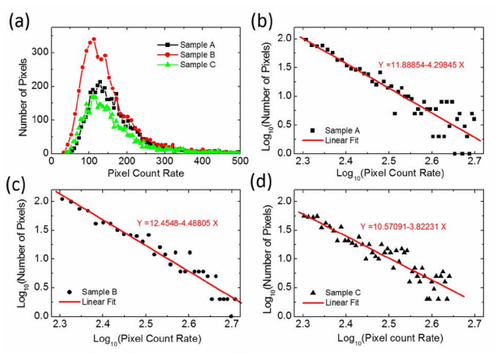
Representative Figures

1.



Ready-to-go chips have been developed by silver nanocrystals Langmuir Blodgett films as the surface-enhanced Raman scattering substrates for the detection of Alzheimer's disease biomarker included $A\beta_{1\text{-}40}$, $A\beta_{1\text{-}40}$, tau proteins using surface-enhanced Raman spectroscopy.

2.



(a) Histogram plot of PMT mapping for sample A (18 mN/m), B (22 mN/m) and C (26 mN/m). (b)-(d) Log-log plot of high enhancement regions of the histogram plot shown in (a) for Sample A, B, and C.

Major Publications

1. Kuo TR, Chen WT, Liao HJ, et al. Improving hydrogen evolution activity of earth-abundant cobalt-doped iron pyrite catalysts by surface modification with phosphide. Small 2017; 13:1603356.
2. Kuo TR, Hung ST, Lin YT, et al. Green synthesis of InP/ZnS core/shell quantum dots for application in heavy-metal-free light-emitting diodes. Nanoscale Res Lett 2017; 12:1-7.
3. Kuo TR, Chen YC, Wang CI, et al. Highly oriented Langmuir-Blodgett film of silver cuboctahedra as an effective matrix-free sample plate for surface-assisted laser desorption/ionization mass spectrometry. Nanoscale 2017; 9:11119-11125.
4. Cheng TM, Chu HL, Lee YC, et al. Quantitative analysis of glucose metabolic cleavage in glucose transporters overexpressed cancer cells by target-specific fluorescent gold nanoclusters. Anal Chem 2018; 90:3974-3980.
5. Kuo TR, Liao HJ, Chen YT, et al. Extended visible to near-infrared harvesting of earth-abundant FeS2–TiO2 heterostructures for highly active photocatalytic hydrogen evolution. Green Chem 2018; 20:1640-1647.
6. Chen WL, Huang YH, Cheng HY, et al. Statistical analysis of cuboctahedral silver nanocrystals Langmuir–Blodgett film SERS substrate. J Raman Spectrosc 2018; 49:792-799.

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CHUN CHE LIN : LUMINESCENT MATERIALS

Chun Che Lin, Ph.D.,
Assistant Professor

Major Research Aims

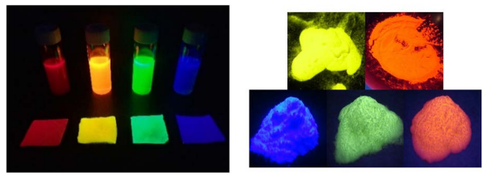
Assistant Professor Chun Che Lin received his PhD in 2011 at the National Taiwan University under supervision of Prof. Ru-Shi Liu. Afterwards he joined the group of Prof. Andries Meijerink at Utrecht University in Netherlands as a post-doctoral fellow. In 2018 he is establishing luminescent materials research team in the Graduate Institute of Nanomedicine and Medical Engineering of Taipei Medical University. He leads an active research group that focuses on the optical spectroscopy of lanthanide ions and of semiconductor quantum dots. In the field of lanthanide ions, his recent work involves fundamental research on new phosphors for light emitting diodes (LEDs) lighting and displays. The research on new perovskite quantum dots is aimed at unraveling the influence of quantum confinement and surface ligand effects on the electronic structure of quantum dots through optical spectroscopy. His current research interests include synthesis of phosphors and quantum dots for LEDs and bioapplications.

Major Achievements

1. Synthesis of novel phosphors and perovskite quantum dots by the solid-state reaction and the hot injection reaction.
2. Crystal growth controlled synthesis of intense emission phosphors through surfactant assisted sol-gel route.
3. A concise model was proposed to explain the luminescence mechanism of activators by collocating characteristic analysis and theoretical calculations.
4. Device performance of fabricated white LEDs based on the highly efficient non-rare-earth red emitting phosphor.

Representative Figures

1.



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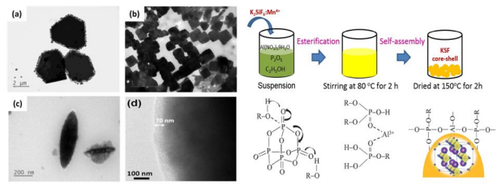

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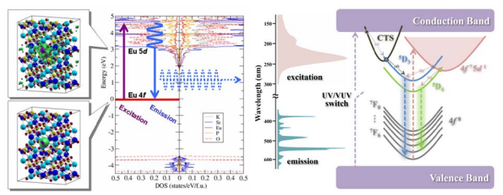

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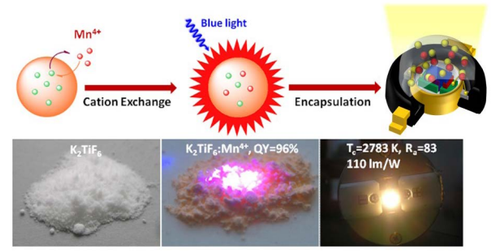

1. Versatile Phosphate Phosphors $ABPO_4$ recently been made available as phosphors that combine with near-UV lighting chips for use in solid-state white LEDs. $CsPbX_3$ (X = Cl, Br, and I) perovskite nanocrystals were encapsulated with stretchable [poly(styrene-butadiene-styrene); SBS] fibers by electrospinning to prepare water-resistant hybrid membranes as multicolor optical active layers.
2. A sol-gel approach using various surfactants to control crystal growth and boost quantum efficiency of $K_2TiF_6:Mn^{4+}$ red phosphors.
3. Density functional calculations were performed using the generalized gradient approximation plus an on-site Coulombic interaction correction (GGA+U) scheme to investigate the electronic structures of the $KSrPO_4$ system.
4. We fabricate a high performance white LEDs with low correlated colour temperature (3,556 K), high-colour-rendering index (Ra = 81) and luminous efficacy of 116 lmW^{-1}.

Major Publications

1. Lin CC, Jiang DH, Kuo CC, et al. Water-resistant efficient stretchable perovskite-embedded fiber membranes for light-emitting diodes. ACS Appl. Mater. Interfaces 2018; 10:2210-2215.
2. Lin CC, Chen WT, Chu CI, et al. UV/VUV switch-driven color-reversal effect for Tb-activated phosphors. Light-Sci. Appl. 2016; 5:e16066.
3. Nguyen HD,‡ Lin CC,‡ Liu RS, Waterproof alkyl phosphate coated fluoride phosphors for optoelectronic materials. Angew. Chem. Int. Ed. 2015; 54:10862-10866. (‡:Nguyen HD and Lin CC contributed equally)
4. Lin CC, Liu RS, Advances in phosphors for light-emitting diodes. J. Phys. Chem. Lett. 2011; 2:1268-1277.
5. Lin CC, Xiao ZR, Guo GY, et al. Versatile phosphate phosphors $ABPO_4$ in white light-emitting diodes: collocated characteristic analysis and theoretical calculations. J. Am. Chem. Soc. 2010; 132:3020-3028.

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PO-KANG YANG : SMART MATERIALS & DEVICES

Po-Kang Yang, Ph.D.,
Assistant Professor

Major Research Aims

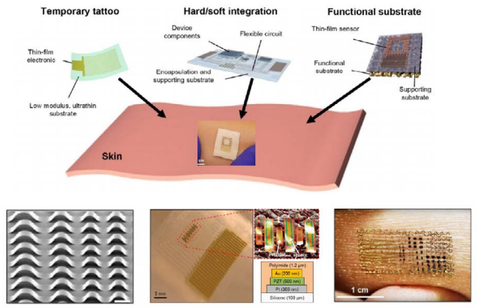
Wearable devices are essential for next-generation micro/nanosystem applications, including healthcare monitoring, medical rehabilitation, athletic training, and outdoor equipments. Conventional wearable devices are mainly powered by batteries and thus challenged by a limited lifetime usage. Energy renewal or battery recharge for the devices is too inconvenient to satisfy the demands for the present consumer markets. To address this issue, the self-powered technology, in which the device's power is supplied by an attached wearable energy harvester, is increasingly attracting attention. The basis of such a self-powered scheme lies in the fact that the energy sources comes from the "ambience". Our researches mainly focus on applying smart materials into developing advanced energy harvesting device, biomedical sensing platforms, and bio-integrated systems, which can pave the way for future human-machine interface, nanomedicine, antibacterial, diagnosis, and even artificial intelligenece applications.

Major Achievements

1. Develop new type sensing platforms, which could be attached to human body to monitor the phyichemical status.
2. Realize the concept of a self-powered healthcare monitoring system, including humidity, sweat and gait phase sensors.
3. Utilize functional materials to build up future wearable biomedical devices.
4. Design renewable, widely-applicable energy harvesting and storage device for future biointerface applications.

Representative Figures

1.



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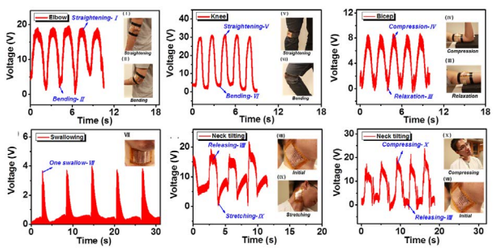

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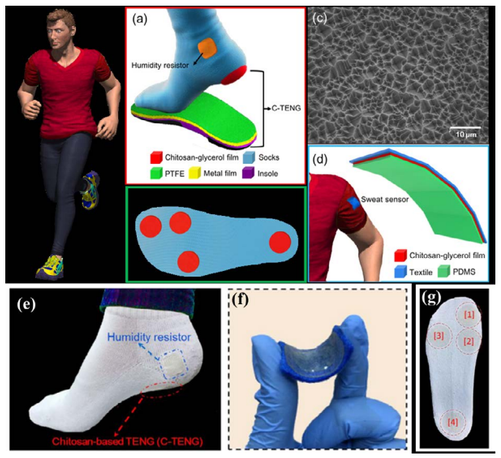

1. Bio-integrated sensing system/platform with advanced semiconductor fabrication process.
2. Multi-functional biomedical sensor design. Relative changes in voltage versus time for monitoring various kinds of human motions.
3. The schematic configuration of (a, b, d) A self-powered humidity sensor, gait phase detector, and sweat sensor. (c) SEM images of the hydrogel surface. (e-g) The corresponded images of the as-fabricated devices.

Major Publications

1. Yang, P.-K.; Chang, W.-Y.; Teng, P.-Y.; Jeng, S.-F.; Lin, S.-J.; Chiu, P.-W.; He, J.-H. "Fully transparent resistive memory employing graphene electrodes for eliminating undesired surface effects," Proc. IEEE 2013, 101, 1732–1739.
2. Yang, P.-K.; Lin, L.; Yi, F.; Li, X.; Pradel, K.; Zi, Y.; Wu, C.-I.; He, J.-H.; Zhang, Y.; Wang, Z. L. "A Flexible, Stretchable and Shape-Adaptive Approach for Versatile Energy Conversion and Self-Powered Biomedical Monitoring," Adv. Mater., 2015, 27, 3817-3824..
3. Jao, Y.-T.; Yang, P.-K.; Chiu, C.-M.; Lin, Y.-J.; Chen, S.-W.; Lin, Z.-H. "A Textile-based Triboelectric Nanogenerator with Humidity-Resistant Output Characteristic and its Applications in Self-Powered Healthcare Sensors," Nano Energy 2018, 50, 513-520. (*co-first author).

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SI-HAN WU : HYBRID SILICA

Si-Han Wu, Ph.D.,
Assistant Professor

Major Research Aims

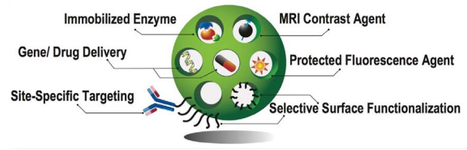
Nanomedicine is promising and capable of integrating therapeutics with nanocarriers to improve treatment for cancers. However, a review paper published recently in Nature Reviews Materials highlighted that only 0.7% (median) of a systemically administrated dose of nanoparticle-based drugs ends up in the tumor, and the targeting efficiency has not been improved in the past ten years. In addition, hypoxia is crucially involved in tumor progression, resulting in resistance to cancer therapy. Consequently, efforts only focus on solving one issue at a time is not enough to meet the emerging field of nanomedicine. Mesoporous and hollow silica nanoparticles (MSN/HSN) are intriguing nanocarriers for efficient and cell-specific delivery of proteins, enzymes, and anti-cancer drugs to improve treatment of diseases. However, despite often highly promising in vitro findings, such as enhanced uptake and intracellular processing as well as efficacy, practical applications of MSN/HSN are usually limited due to poor stability, serious aggregation and short in vivo circulation lifetimes in biological media. Our research is aimed towards clarifying the relationship between synthetic identity and physiological responses, with a focus on developing clinically translatable MSN/HSN-based nanomedicine to eradicate hypoxic tumor cells.

Major Achievements

1. The first report of directly injecting MSN into mice and in vivo visualizing the localization of MSN via MRI.
2. The first report of utilizing a microemulsion system to fabricate uniform HSN, which can encapsulate both organic and inorganic materials for biological and catalytic reactions.
3. Investigation of size, charge and cross-linkers effects of MSN on biological responses in cells, zebrafish, and mice.
4. Development of compartmentalized HSN for encapsulating both hydrophobic and hydrophilic molecules.
5. Development of highly dispersed PEGylated silica nanoparticles in physiological media for tumor targeting.

Representative Figures

1.



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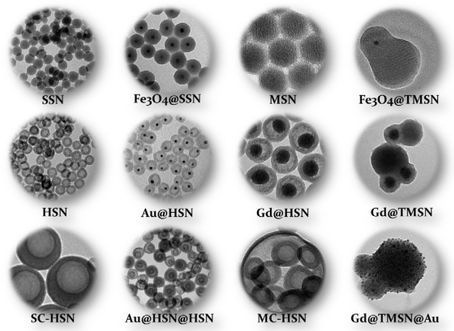

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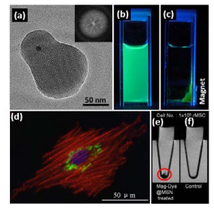

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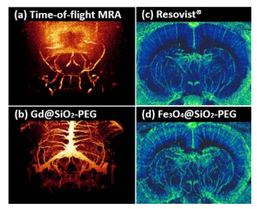

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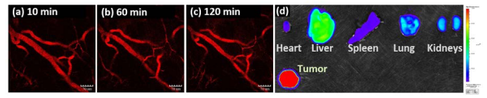

1. Biological applications of porous silica nano-platform.
2. TEM images of various hybrid silica nanoparticles.
3. (a) TEM and (b) photographs of Mag-Dye@MSN after UV-light irradiation and (c) magnetic capture; (d) confocal image of Mag-Dye@MSN in rMSC cells; (e-f) T2-weighted MR images of rMSC.
4. (a) Time-of-flight magnetic resonance angiography (MRA) images of vasculature in rat brains; (b) contrast-enhanced MRA with Gd@SiO2-PEG; (c) volume rendering 3DΔR2-mMRA of Resovist® and (d) Fe3O4@SiO2-PEG.
5. (a-c) Time-dependent two-photon fluorescent images of PEGylated MSN in blood circulation; (d) Ex vivo IVIS images 24h post-injections of PEGylated MSN into a tumor-bearing mouse.

Major Publications

1. Wu SH, Hung Y, Mou CY. Mesoporous Silica Nanoparticles as Nanocarriers. Chem. Commun. 2011, 47, 9972-9985.
2. Wu SH, Hung Y, Mou CY. Compartmentalized Hollow Silica Nanospheres Templated from Nanoemulsions. Chem. Mater. 2013, 25, 352-364.
3. Wu SH, MouCY, Lin HP. Synthesis of Mesoporous Silica Nanoparticles. Chem. Soc. Rev. 2013, 42, 3862-3875.
4. Liu TP, Wu SH, Chen YP, Chou CM, Chen CT. Biosafety Evaluations of Well-Dispersed Mesoporous Silica Nanoparticles: Towards in Vivo-Relevant Conditions. Nanoscale, 2015, 7, 6471-6480.
5. Chen YP, Wu SH, Chen IC, Chen CT. Impacts of Cross-Linkers on Biological Effects of Mesoporous Silica Nanoparticles. ACS Appl. Mater. Inter. 2017, 9, 10254–10265. (*co-first author)

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HAW-MING HUANG : BIOELECTROMAGNETICS AND RELATED MATERIALS

Haw-Ming Huang, Ph.D., Professor

Major Research Aims

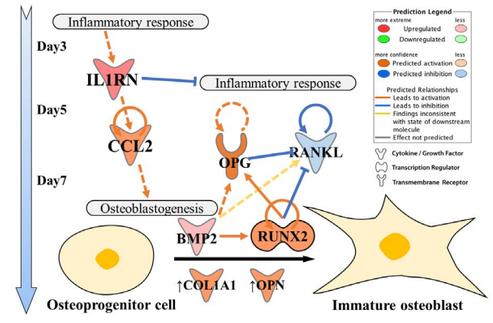
As the static magnetic field (SMF) can re-orientate liquid crystal molecules, the membrane should be affected by external SMFs. This effect induces the membrane distortion, as well as mechanotransduction pathway across the membrane. The deformation of the lipid bilayer affects membrane proteins, such as growth factor receptors and ion channels and account for changing the regulatory functions for growth factors and the rate of cell proliferation and differentiation. In addition, since the cytotoxicity material, such as LPS, also can not bind to its receptor, SMF exposure can be used as a physical resource to attenuate LPS-induced immune host response. Furthermore, SMF affects the alignment of phospholipids results in the increase of membrane rigidity. According to these rational, the research topics of Bioelectromagnetic and Material Research Team focused on the researches of biological effect of SMFs as well as the new biomaterial development using nano-magnetic particles.

Major Achievements

1. Develop a novel radiopaque, biodegradable, and 3D printable bone screw.
2. SMF pretreatment before LPS challenge reduced tissue damage.
3. SMF coupled with the slow cooling procedure increased survival rates of frozen-thawed erythrocytes.
4. The proliferation of stem cells enhanced by the SMF is considered as a model of the p38 MAPK signalling pathway.
5. The proliferation of stem cells enhanced by the SMF is considered as a model of the p38 MAPK signalling pathway.
6. Damping factor analysis can be used as a tool to evaluate the healing process of osseointegration.
7. Develop a novel electrical impedance biochip used for point-of-care whole blood clotting time detection.

Representative Figures

1.



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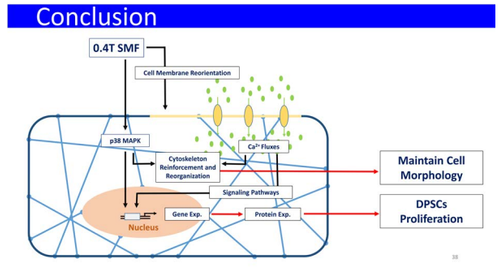

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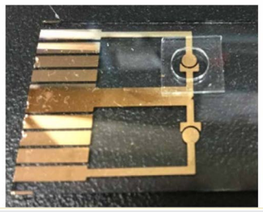

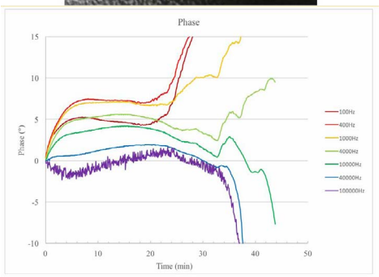

1. The suggested signal pathway of human dentin powder-stimulated IL1RN-CCL2 mediation of osteoblastogenesis. The CCL2 gene predominated in osteoblastogenesis toward immature osteoblast development..
2. The structure of the membrane was affected by the SMF, with a subsequent increase in calcium ion influx. At the same time, the p38 MAPK pathway was activated, and the cytoskeleton underwent reorganization in association with the calcium ions..
3. POC whole blood clotting time detecting chip and the measured signals

Major Publications

1. Huang YC, Lew WZ, Feng SW et al. Histomorphometric and transcriptome evaluation of early healing bone treated with a novel human particulate dentin powder. Biomed Mat 2016; 12:015004.
2. Wang HT, Chiang PC, Tzeng JJ et al. In vitro biocompatibility, radiopacity, and physical property tests of nano-Fe3O4 incorporated poly-l-lactide Bone Screws. Polymers 2017; 9:191.
3. Feng SW, Ho KN, Chan YH et al. Damping factor as a diagnostic parameter for assessment of osseointegration during the dental implant healing process: an experimental study in rabbits. Ann Biomed Eng 2016;44:3668-3678.
4. Lew WZ, Huang YC, Huang KY et al. Static magnetic fields enhance dental pulp stem cell proliferation by activating the p38 MAPK pathway as its putative mechanism. J Tissue Eng Regen Med 2018; 12:19-29.
5. Lew WZ, Feng SW, Lin CT et al. Use of 0.4-Tesla static magnetic field to promote reparative dentin formation of dental pulp stems cells through activation of p38 MAPK signaling pathway. 2018, Int Endod J 2018 (in press)

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LI-CHERN PAN : MICROFLUIDIC BIOCHIPS

Li-Chern Pan, Ph.D., Associate Professor

Major Research Aims

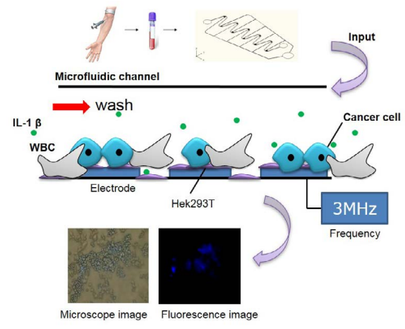
Our lab focuses on the design and development of novel microfluidic biochips for the acquisition of rare biological entities, which has shown advantages over traditional centrifugation-based methods. For example, we have been able to isolate Circulating Tumor Cells (CTCs) using a patented cell-based auto-adherence method, as well as developing a high throughput acquisition assay for sorting progressive spermatozoa. We have made sure to integrate the intrinsic physiological properties of the target biological entities along with the microfluidic flow design. Therefore, we are often able to isolate rare, live cells with minimal damage to their morphology or DNA. To increase the clinical applicability of these new technologies, our laboratory has implemented FDA-compatible protocols relating to the bio-compatibility of our glass-based bio chips. This will allow us to realize the academic research and improve the commercialization of MEMS-based bio chip devices.

Major Achievements

1. High Throughput Sorting of Progressive Motile Sperms from Raw Semen.
2. FDA Biocompatibility Accessibility for Microfluidic Devices.
3. Method for Auto-adherence-based Capture and Analysis of Circulating Tumor Cells.
4. Non-centrifugal Removal Method for Low Damage Blood Sample Purification.
5. Design Microfluidic Automatic Dispenser and Diagnosis Systems.

Representative Figures

1.



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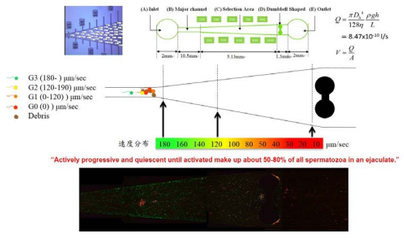

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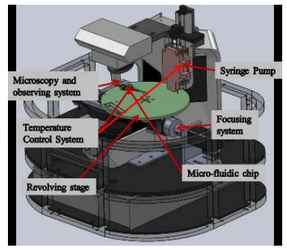


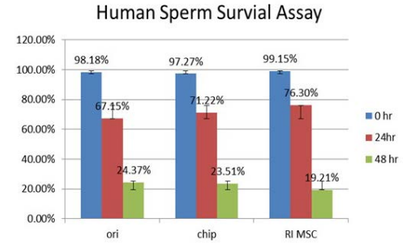
4.

Original count (0 hr):

COUNT SUMMARY Category	Cells Counted	Sample (M)	Concentration (M/ml)	Percent
Total	1770	0.0	30.3	100
Motile	1694	0.0	29.0	96
Progressive	1142	0.0	19.6	65

Chip count (24 hr):

COUNT SUMMARY Category	Cells Counted	Sample (M)	Concentration (M/ml)	Percent
Total	283	0.0	4.5	100
Motile	252	0.0	4.0	89
Progressive	233	0.0	3.7	82



Major Publications

1. Chen YC, Pan LC, Lai CW, Chien YS, Wu TH. Silymarin and protein kinase A inhibitor modulate glucose-mediated mouse sperm motility: An in vitro study. Reproductive biology 2015, 15 (3), 172-177.
2. Pan LC, Hsu FC, Yu WS, Lin YL, Tseng FG, Wang CW, Tzeng CR. Sorting of sperms with reverse progressive characteristic may provide another option for acquiring spermatozoa with significant improvement in fertility related quality for patients with oligospermia. Fertility and Sterility 2014, 102 (3), e353-e354.
3. Pan LC, Liu SY, Yen CC, Hsiu HW, Wang CW, Tzeng CR. Preliminary evaluation of methylcellulose as an alternative rate control medium for the acquiring of high quality spermatozoa in swim-up. Fertility and Sterility 2013, 100 (3), S453.

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TMU BIOMEDICAL ENGINEERING RESEARCH TEAM

TZU-SEN YANG : MOLECULAR DYNAMICS

Tzu-Sen Yang, Ph.D.,
Associate Professor

Major Research Aims

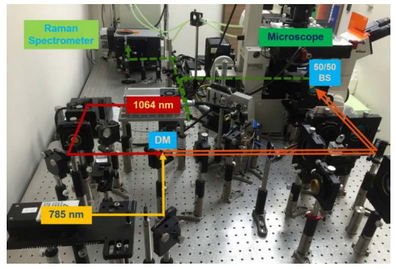
Probing the structure, dynamics, and mechanisms of live-cell systems is fundamental to a quantitative understanding of how biological systems function. Recently, single-molecule techniques including optical tweezers and single-molecule fluorescence microscopy have developed into a widely used method for application in living cells. In addition, surface functionalization and bioconjugation of nanoparticles, e.g., quantum dots, silver nanoparticle, and gold nanoparticles, are attractive for many biomedical applications such as imaging, therapeutics and diagnostics. We have combined optical tweezers, single-molecule fluorescence detection, temperature control system, microfluidics, micro-scale surface enhanced Raman spectroscopy (μSERS) system, and laser-assisted cell printing technique for the construction of versatile biophotonics platform for biomedical applications at the single cell level. We have utilized this six-in-one integrated biophotonics platform to conduct visualization of the effect of the EGFR tyrosine kinase inhibitor PD153035 on cell locomotion, probing the amphotericin B induced permeability changes across ergosterol-containing membrane, disinfection effects of silver-doped ceria nanoparticles, and combined photothermal and surface-enhanced Raman spectroscopy using gold nanoparticles.

Major Achievements

1. Single-molecule dynamics of DNA-drug interactions.
2. Disinfection effects of silver-doped ceria nanoparticles.
3. Single-cell NF-kB dynamics.
4. Effect of low level laser therapy on single-cell NF-kB dynamics.
5. Development of laser-assisted bioprinting techniques.

Representative Figures

1.



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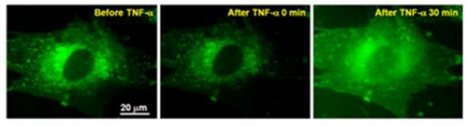

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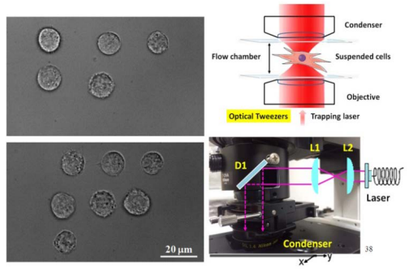

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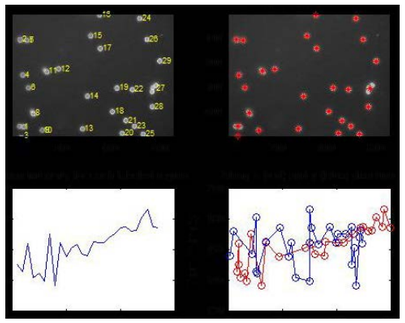

1. Dual-beam optical tweezers system and micro-scale surface enhanced Raman spectroscopy system.
2. Single-cell NF-kB dynamics: response of NIH-3T3 GFP-p65 cells to TNF-α stimulation.
3. High spatial-resolution single cell array via laser-guided direct writing bioprinting system.
4. Micro-scale temperature measurement and its biomedical application.

Major Publications

1. Cheng CM, Lee YJ, Wang WT, Hsu CT, Tsai JS, Wu CM, Ou KL, Yang TS. Determining the binding mode and binding affinity constant of tyrosine kinase inhibitor PD153035 to DNA using optical tweezers. Biochemical and biophysical research communications 2011, 404 (1), 297-301.
2. Peng PW, Ou KL, Lin HC, Pan YN, Wang CH. Effect of electrical-discharging on formation of nanoporous biocompatible layer on t itanium. Journal of Alloys and Compounds 2010, 492 (1-2), 625-630.
3. Tsai DS, Yang TS, Huang YS, Peng PW, Ou KL. Disinfection effects of undoped and silver-doped ceria powders of nanometer crystallite size. International journal of nanomedicine 2016, 11, 2531.
4. Yang TS, Ou KL, Peng PW, Liou BC, Wang WT, Huang YC, Tsai CM, Su CH. Quantifying membrane permeability of amphotericin B ion channels in single living cells. Biochimica et Biophysica Acta (BBA)-Biomembranes 2013, 1828 (8), 1794-1801.

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SHAO-SIAN LI : 2 DIMENSIONAL ATOMIC MATERIALS

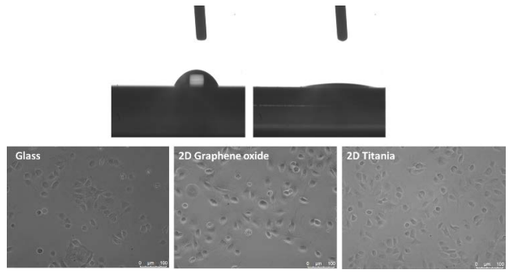
Shao-Sian Li, Ph.D.,
Assistant Professor

Major Research Aims

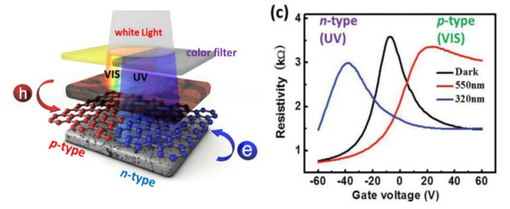
Materials with two dimensional (2D) lattice structure and thickness in atomic or molecular scale has been attractive to academic and industrial researches in recent years. Many materials like graphene, TMD and oxide with the 2D structure has been already discovered to own many promising properties for the future optoelectronics. My research aim focuses on the development of biomedical sensing platform based on these novel 2D materials with unique device feature such as high tunablity for multi-functional sensing, lightweight with high mechanical flexibility and high speeding sensing for quick and non-invasive detection.

Major Achievements

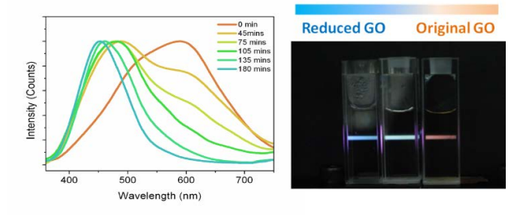
1. 2D atomic layer for surface modification to render the surface properties and stimulate cell growth kinetics.



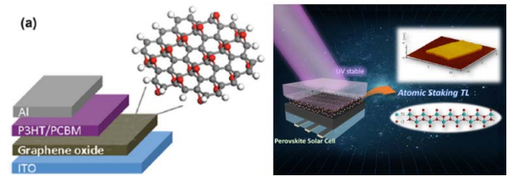
2. Ultra-sensitive photo-activated electronic device based on 2D graphene and 2D semiconductors heterostructures.



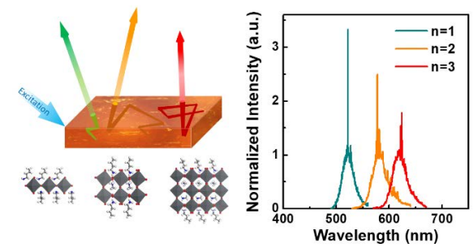
3. Ultra-sensitive photo-activated electronic device based on 2D graphene and 2D semiconductors heterostructures.



4. Novel 2D metal oxide atomic thin film for efficient carrier transport layer in organic and perovskite solar cells.



5. Novel 2D metal oxide atomic thin film for efficient carrier transport layer in organic and perovskite solar cells.



Major Publications

1. Chen TP, Lin CW, Li SS, Tsai YH, Wen CY, Lin W.J, Hsiao FM, Chiu YP, Tsukagoshi K, Osada M, Sasaki T, Chen CW. Self-Assembly Atomic Stacking Transport Layer of 2D Layered Titania for Perovskite Solar Cells with Extended UV Stability. Advanced Energy Materials 2018, 8 (2), 1701722.
2. Chen TP, Lin CW, Li SS, Tsai YH, Wen CY, Lin WJ, Hsiao FM, Chiu YP, Tsukagoshi K, Osada M, Sasaki T, Chen CW. Self-Assembly Atomic Stacking Transport Layer of 2D Layered Titania for Perovskite Solar Cells with Extended UV Stability. Advanced Energy Materials 2018, 8 (2), 1701722.
3. Li SS, Chang CH, Wang YC, Lin CW, Wang DY, Lin JC, Chen CC, Sheu HS, Chia HC, Wu WR, Jeng US, Liang CT, Sankar R, Chou FC, Chen CW. Intermixing-seeded growth for high-performance planar heterojunction perovskite solar cells assisted by precursor- capped nanoparticles. Energy & Environmental Science 2016, 9 (4), 1282-1289.
4. Raghavan CM, Chen TP, Li SS, Chen WL, Lo CY, Liao YM, Haider G, Lin CC, Chen CC, Sankar R, Chang YM, Chou FC, Chen CW. Low-Threshold Lasing from 2D Homologous Organic–Inorganic Hybrid Ruddlesden–Popper Perovskite Single Crystals. Nano Letters 2018, 18 (5), 3221-3228 .

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TMU BIOMEDICAL ENGINEERING RESEARCH TEAM

YU-CHENG HSIAO : PHOTONICS AND SOFT MATTERS

Yu-Cheng Hsiao, Ph.D.,
Assistant Professor

Major Research Aims

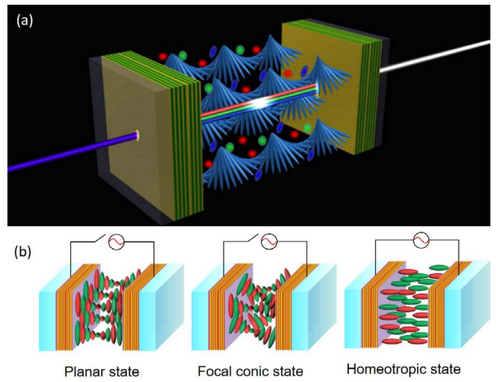
We focus on biosensors and applications of photonics, materials, soft matters, and novel liquid-crystals devices in TMU research team. In addition, we also try to use the optical technology to improve the biomedical field. Prof. Hsiao's expertise is in experimental physics for chiral soft matter, such as cholesteric and blue phase liquid crystals. A demand of green technology devices and biosensors inspired. In recent years. We have shown experimentally a variety of application possibilities using the frontier concepts: 1. Bistable dual-frequency liquid crystals: Fast-switching bistable cholesteric intensity modulator. 2. Electrohydrodynamic instabilities: Polymer stabilization of electrohydrodynamic instability in non-iridescent cholesteric thin films. 3. Photonic crystal spectral manipulations: Electro-optical device based on photonic structure with a dual-frequency cholesteric liquid crystal. 4. Biosensors: Highly sensitive color-indicating and quantitative biosensor based on cholesteric liquid crystal. We try to continue making contributions to this intriguing research areas.

Major Achievements

1. Electrically switchable organo–inorganic hybrid for a white-light laser source.
2. Red, Green, and Blue Reflections Enabled in an Electrically Tunable Helical Superstructure.
3. Highly sensitive color-indicating and quantitative biosensor based on cholesteric liquid crystal.
4. Electrically active nanoantenna array enabled by varying the molecular orientation of an interfaced liquid crystal
5. Liquid crystal-based tunable photonic crystals for pulse compression and signal enhancement in multiphoton fluorescence.

Representative Figures

1.



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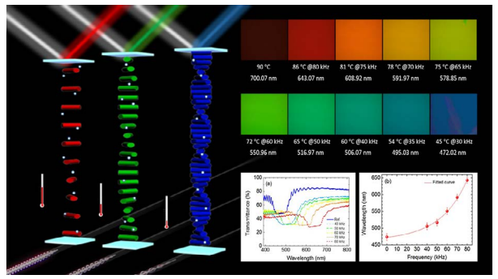

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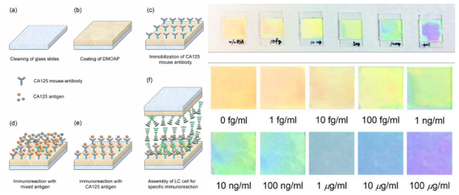

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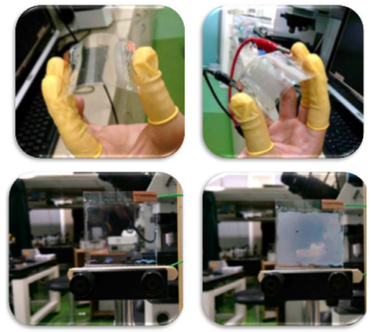

1. Schematics of (a) the CPC and (b) the corresponding configurations of the three CLC states. The red and green ellipsoids represent the dye and the LC molecules, respectively.
2. Colors of a DFTC materials derived from various frequencies at the fixed applied voltage.
3. Representative VAC cells featuring the color-indicating properties of the VAC biosensor at different BSA concentrations.
4. Photographs of the fast-switching bistable cholesteric device in the planar state and the focal conic state at null voltage.

Major Publications

1. Hsiao YC. Liquid crystal-based tunable photonic crystals for pulse compression and signal enhancement in multiphoton fluorescence. Opt. Mater. Express 2016, 6 (6), 1929-1934.
2. Hsiao YC, Su CW, Yang ZH, Cheypesh YI, Yang JH, Reshetnyak VY, Chen KP, Lee W. Electrically active nanoantenna array enabled by varying the molecular orientation of an interfaced liquid crystal. RSC Advances 2016, 6 (87), 84500-84504.
3. Hsiao YC, Sung YC, Lee MJ, Lee W. Highly sensitive color-indicating and quantitative biosensor based on cholesteric liquid crystal. Biomed. Opt. Express 2015, 6 (12), 5033-5038.
4. Hsiao YC, Yang ZH, Shen D, Lee W. Red, Green, and Blue Reflections Enabled in an Electrically Tunable Helical Superstructure. Advanced Optical Materials 2018, 6 (5), 1701128.
5. Huang JC, Hsiao YC, Lin YT, Lee CR, Lee W. Electrically switchable organo–inorganic hybrid for a white-light laser source. Scientific Reports 2016, 6, 28363.

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TMU HEALTHCARE SYSTEM

Taipei Medical University Hospital
Wan-Fang Hospital
Shuang-Ho Hospital
Ningbo Medical Center LiHuiLi Eastern Hospital
TMU Taipei Neuroscience Institute
TMU Taipei Cancer Center

TMU Healthcare System

About

With a total of 4,123 beds in capacity, TMU Healthcare System will be one of the largest healthcare systems in Metropolitan Taipei. It comprises one medical university and four affiliated hospitals and integrates primary and specialty care with research and education. With the line-up of Taipei Medical University Hospital, Wan Fang Hospital, Shuang Ho Hospital and Ningbo Medical Center Lihuili Eastern Hospital, TMU Healthcare System becomes a heavy weight healthcare provider, which emphasizes the quality of medical service, teaching and clinical researches. TMU Healthcare System continuously strives to improve the quality of medical care and research with the goal of becoming the global healthcare destination.

3 JCI and AAHRRP - Accredited Affiliated Hospitals

Taipei Medical University Hospital

- Est. in 1976
- 800 Beds
- No. of Staff : 1,946
- Cancer Excellent Research Center 2011 National Quality Award

Ningbo Medical Center Lihuili Eastern Hospital

- Est. in 2015
- 1,000 Beds

Wan-Fang Hospital

- Est. in 1997
- 743 Beds
- No. of Staff : 1,808
- National Drug Evaluation Center Emergency Operation Center

TMU Taipei Neuroscience Institute

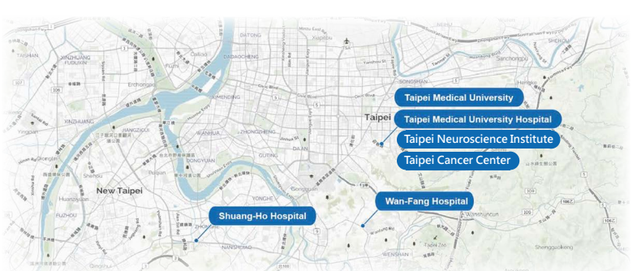
- Est. in 2017

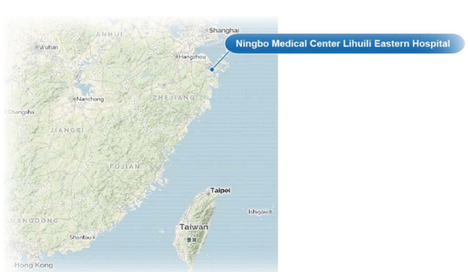
Shuang-Ho Hospital

- Est. in 2008
- 1,580 Beds
- No. of Staff : 2,109
- Emergency Air Medical Transport (EAMT) Hospital 2012 National Quality Award

TMU Taipei Cancer Center

- Est. in 2018





TAIPEI MEDICAL UNIVERSITY HOSPITAL

About

Taipei Medical University Hospital is a nationally recognized health center that serves the community needs as well as those of global guests from every corner of the world. We are a proud member of the JCI family and are dedicated to delivering the most advanced medical treatments available. We are highly committed to our global development and research collaborations on all continents. Our patient first focus is what makes us different and we invite you to experience it.

TMUH in Numbers:

- 800 Beds
- 2300 Employees
- 410 Medical Professionals
- 25 Departments
- 405 Physicians
- 435 Administrators
- 40 Specialities
- 855 Nurses
- 212 Outsourcing Staff

Major Achievements

TMUH has many specialized centers, such as the Reproductive Medicine Center, Weight Management Center, Kidney Center, Bone and Joint Research Center, minimally invasive surgery center and many other diversified international pioneering medical services.
Enhancing the quality and patients' safety has led TMUH to be accredited as the International Safe Hospital by WHO Collaborating Centre on Community Safety Promotion, which is also the first hospital to pass the accreditation in the world. TMUH keeps fulfilling its core value of "high medical service quality' and "patient-centered' approach.

Centers

TMUH has many specialized centers, such as the Reproductive Medicine Center, Weight Management Center, Kidney Center, Bone and Joint Research Center, minimally invasive surgery center and many other diversified international pioneering medical services.

Enhancing the quality and patients' safety has led TMUH to be accredited as the International Safe Hospital by WHO Collaborating Centre on Community Safety Promotion, which is also the first hospital to pass the accreditation in the world. TMUH keeps fulfilling its core value of "high medical service quality' and "patient-centered' approach.

Research

In research, we encourage all our medical staff to continue and further their education with either a Master or PhD degree, continue to promote combined research in the field of clinical and basic science, and provide rewards for journal publications and successful research grants.

Vision

We hope that all staff members of Taipei Medical University Hospital understand that they are doing an extraordinary job, and continue to provide excellent patient service as well as making great achievements in teaching and research. This will allow Taipei Medical University Hospital to become the sole preference in hospital selection for the patients, and thus naturally it would be an honor to all university staff, students and alumni.

Goals

Our goal as Taipei Medical University's main university-affiliated teaching hospital is to strengthen the qualifications of our entire medical faculty, provide adequate teaching resources, and encourage all our medical staff to be enthusiastic in educating our students. This educational structure will be accomplished by recruiting and providing training to resident doctors, intern doctors, nurses, and other medical staff members under the standards established by the "New Teaching Hospital Accreditation."

WAN-FANG HOSPITAL

About

Co-constructed with the Wanfang Hospital Station of the Taipei mass rapid transit system (MRT) Wenhu line (line1), the Hospital has 743 beds and over 300 medical specialists offering comprehensive professional services. Ever since its founding, the hospital has worked for highest attainable quality service to assure that patients receive care of the top standard. It is one of the first Taiwan hospitals to set up an international medical office for providing individualized medical services for patients from the abroad which is more than 38 countries up to now.

Special Medical Care

In order to offer integrated care to patients, other than the dialysis center, cancer center, health management center, nursing home, reproductive medicine center, cosmetic medical service, sport rehabilitation center, laser excimer eye care center, weight control center, we also established different centers with advanced technology on special disease treatment, and to deal with catastrophic/emergency incidents as well as personalized cancer care management to reach the goal of becoming internationally recognized top-class university hospital.

Education and Research

WanFang Hospital Teaching Department adopts the learner-centered approach which aims at nurturing professional knowledge, attitude, and skills for the trainees to provide comprehensive and continuous care to patients. We set up the center for excellent teaching, within which there are units for problem-based learning, evidence-based medicine, clinical skill training. We offer diversified activities such as simulation and clinical skills training, team care training to foster holistic care competence for medical staff.

Other than teaching, we are devoted to comprehensive research areas and integrate basic medicine, biotechnology, medical information technology, quality management with medical and teaching services. Thereby, medical care quality can be improved continuously. We have signed cooperative education agreements with dozens of domestic and overseas medical institutions for conducting academic exchange or medical training. We also cooperate with the top academic research institutions such as the Taiwan National Health Research Institute and the Academia Sinica to strengthen cross-institutional research.

Vision

Taipei Municipal WanFang Hospital is the first public facility managed by private sector in Taipei City Government. Owing to support from all stakeholders and the efforts from all staff, we have proceeded from a local community hospital to medical center in a short time. Teaching, research, service and quality assurance are equally important as the mission of the Hospital. In addition, “Value the Community, Honor the Patients” as well as “Quality of Service Is Our Pride” are our fundamental philosophy and core values. Altogether, these solidify our strong and sustained commitment to carry out the social responsibility to citizens.

SHUANG-HO HOSPITAL

About

Shuang Ho Hospital officially opened on July 1st, 2008, Taipei Medical University

Shuang-Ho Hospital is the first Build-Operate-Transfer (BOT) project (construction / operation / management) commissioned by the Department of Health, Executive Yuan. It has 1,580 beds and is the largest hospital in Taipei County. Now, Shuang-Ho Hospital, Taipei Medical University Hospital, and Taipei Medical University Wan-Fang Hospital form a medical healthcare golden triangle in the Taipei area with a total capacity of 3,000 beds and can support each other whenever needed.

Since our establishment, Shuang Ho Hospital has been moving toward becoming a medical center. But we have not forgotten our mission as a community hospital. Shuang Ho Hospital upholds our belief in "Quality". Since our opening, our quality has been well-recognized. Our medical evaluation performances have been consistently excellent, and have passed the ISO9001, ISO14001, ISO27001 and HIMSS Stage6.0 international certifications. We are also the nation’s first hospital to be awarded the Corporate Social Responsibility dual international certification, the JCI accreditation, and awarded “Excellent” in the New Teaching Hospital Accreditation. In 2013, less than 4 years since our opening, we were the proud winner of the National Quality Award.

The Distinguishing Features of Shuang-Ho Hospital

Shuang-Ho Hospital not only has built up a perfect “Acute Severe Care” system with the unique “Medical Use hospital helipad” which offers 24-hour standby Air-EMS to patients and allocates scarce medical resources for off-shore islands, but also has a passionate ER medical team to provide 24 hours a day, 365 days a year, health care service. With fully and well equipped operation rooms plus strong and professional physical and surgical teams from famous medical centers, Shuang-Ho Hospital has extraordinary capability and good reputation on Neural Medical Center, Minimally Invasive Surgery Center, Ophthalmology and Visual Science Center, Cardiovascular Center, Rehabilitation Center, , Multipolar Radiofrequency Ablation Center and Trauma Center. Moreover, Shuang-Ho Hospital has outstanding achievements on the following aspects.

1. The Dialysis Center has a national-leading control measure to isolate the beds, equipment, and areas in order to prevent from hepatitis C infection.
2. The first “Dental Care Center for Persons with Special Needs” in the country to provide dental care service to about 130,000 physically and mentally handicapped people in New Taipei City.
3. The Cancer Center led by the world well-known Dr. Jacqueline Whang-Peng (member of Academia Sinica) offer the best radiation therapies and comprehensive cares with the most advanced facilities in the world in order to provide the best and most comfortable medical care environment.
4. The Health Management Center in the 12F has professional service team and comfortable environment in order to provide comprehensive personal health management.

In addition to providing quality health care services, our hospital is also committed to research and teaching. We founded the Translational Medicine research lab for innovative research and the Brain and Consciousness research Center for Integrate cognitive neuroscience. We also built the Clinical Skill Center to help our medical staff cultivate professional competence, attitude and skills in their clinical practice, and provide our patients with complete care.

Perspectives of Shuang-Ho Hospital

The visions of Shuang-Ho Hospital are to provide the best health service and medical care to the community, and to be the top center for medical education, research, and service. Moreover, to expand the medical service in Taiwan, we devote to cooperate with medical institutions all over the world. Finally, with the full supports from Taipei Medical University, the commitment of top management, and all employees’ engagement, the long-term mission to become one of the top university hospitals in the world with the best medical quality and performance will come true in future.

NINGBO MEDICAL CENTER LIHUILI EASTERN HOSPITAL

About

LiHuiLi Eastern Hospital provides 1,000 beds with a comprehensive, exceptional, and safe healthcare environment. The hospital commenced operation in Dec. 2015.

Introducing advanced hospital management concepts from Taipei Medical University and its affiliated hospitals, East hospital entrusts TMU to operate and manage for the first 10 years.

LiHuiLi Eastern Hospital pioneered hospital cooperation management model in China: the hospital is established by the government operated by the private sector.

The medical center specializes in tumor treatment, organ transplantation, urinary kidney disease, gynecology surgery and pediatrics, health examinations and international medical care.

Taiwan Hospital Thoughtful Service

TMU management team in Ningbo create a new hospital experience for local people. Simplify the hospital process and combine with high tech resources, utilize information and communication platform to provide convenience clinic experience. One person, one medical consulting room and one nurse who helps doctor to diagnose and treat, which ensures the patient privacy.

User-friendly open counter, free wheelchair, and automatic cashier/registration machine. Cozy waiting area with multiple function information desk, convenient stores, book corner and light music by piano volunteers distress patients and families.

Medical Quality

With the level of first-class comprehensive hospital, LiHuiLi Eastern Hospital will gear to international JCI standard in the early future to build a high quality public hospital which integrates medical treatment, teaching and scientific research. Also the hospital seeks to practice the "medical ethics" and "humanity and art" within its whole medical service system while integrating Taiwan's high medical standards.

Vision

Patient-centered, the hospital will accomplish the mission of service, teaching and research based on the concept of caring, outstanding and innovation.

TMU TAIPEI NEUROSCIENCE INSTITUTE

About

Taipei Neuroscience Institute (TNI) was established in 2017 after the integration of all the departments of neurosurgery, neurology, neuroradiology, rehabilitation and psychiatry of the university's three affiliated general hospitals in Taipei. We hope that through this integration we can promote our standard of practice in clinical neuroscience, improve our quality of clinical training and education, and enhance our research collaboration between clinicians and basic neuroscientists.

Twelve Departments

Built upon its solid foundation, the TMU-TNI has twelve departments, including Neuro-oncology, Radiosurgery, Cerebrovascular Disease, Neurorehabilitation, Degenerative Disease, Neuropsychology and Cognitive Function, Spinal and Peripheral Nervous Disorder, Pain Disorder, Pediatric Neurology, Neurotramatology and Intensive Care, Vertigo, Sleep Disorders, and Headache, and Epilepsy. Inter-disciplinary discussion is emphasized and held to offer patients the best medical service.

Research and Education

In terms of integrating and research, the TMU-TNI collaborates closely with the TMU. Clinicians and scientist work on research projects together and carry out trials with other universities or research institutes in Taiwan and abroad. We promote the collaboration between the university and the medical industry and encourage our teams to host neuroscience seminars and large conferences. Furthermore, we established a neuroscience research institute in TMU and provide training courses for new students, putting in as much effort as possible into nurturing clinical and research talents.

Vision

future with a desire to further improve neuroscience both locally as well as around the world. Not only do we aim to become a vanguard medical center recognized worldwide, we are also devoted to providing the highest level health care to the people of Taiwan and its surrounding countries.

TMU TAIPEI CANCER CENTER

Established in 2013, Taipei Cancer Center at Taipei Medical University is Taiwan's first cancer center providing comprehensive cancer services including cancer prevention, screening, diagnosis, treatment, long-term follow-up, and consultation.

Our multidisciplinary care team, led by expert cancer physicians includes nurses, pharmacists, nutritionists, social workers, psychologists, and other medical professionals, provides personalized care and treatment plans. With the assistance of the Artificial Intelligence systems, Watson for Oncology and Watson for Genomics, the clinicians develop individualized cancer treatments with precision medicine for their patients.

Through the expertise of the internationally recognized Taipei Medical University Translation Research Center, we combine newly developed treatment plans and current therapies to maximize patient outcomes. In addition, the Taipei Cancer Center provides new and effective therapies for difficult-to-treat and late-stage cancer patients.

At Taipei Cancer Center, our goal is to maintain high quality of life for patients and improve survival rate matching the international standard. We expect to provide our patients with the most effective, safest and high quality integration through teamwork within the hospital system of Taipei Medical University. Our vision is to provide excellent quality tumor care consistent with international standard from prevention to diagnosis to treatment. Our core value is rooted in international level of excellence, totally integrated care, high quality of life and improved cure rate.

To offer the cancer treatment and service matching the international standard and quality, Taipei Cancer Center launched the "Taipei International Medical Cancer Special Outpatient Service" program in April 2014 to provide cancer patients with high quality integrated medical services throughout the process including consulting, diagnosis, treatment, care, follow-up and prevention.

The Proton Center, to be completed in 2020, will provide fourth generation proton therapy with pencil-beam technology and cone-bean CT navigation. This new radiotherapy technology will greatly enhance the quality of medical care and outcomes for our patients with cancer.

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The features of the medical services from Taipei Cancer Center include:

World-class Services:

Prestigious local and international specialists above the level of associate professor with various specialties in cancer treatment work as consulting physicians at the center. An optimized treatment suggestion will be provided to individual patients after a comprehensive evaluation.

Personalized Services:

A medical team with consulting physicians as core members will create a customized overall treatment plan for individual patients. Our Navigator will design the navigation services to bring the best possible treatment outcome to the patient.

Integrated Services:

Our team of caregivers including dieticians, pharmacists, psychiatrists and social workers will work under the instructions of the medical consulting team to provide personalized integrated care.

Tradition & Innovation:

Combining both traditional and innovative methods of treatment, we have worked with Taipei Medical University — The Center of Translational Medicine on various clinical trials to provide the most advanced treatment method targeting at the types of cancers involving a great level of treatment difficulty or terminal cancer patients.

TMU CAMPUS LIFE

Sports Facilities

Student Clubs

Library

Food Court and Restaurants

Transportation

TMU CAMPUS LIFE

About

The university facilities include a library which contains 150,000 volumes, a swimming pool, a food court with an Italian restaurant, a convenient store, a dormitory (four students in one air-conditioned room with beds and desks for each student, restrooms, balconies, etc.), a computer lab, meeting rooms, and offices for nearly 80 student club. TMU is within walking distance to the biggest shopping area in Taipei. In ten minutes, one could arrive at Taipei 101, Cinema with six department stores and one 24hour book store.

Sports Facilities

TMU Gymnasium provides a complete range of facilities for indoor sports, such as standard-size swimming pool, whirlpool, sauna, aerobics room, cycling room, weight training room, table tennis and badminton areas. Outdoor sports courts for baseball, softball, basketball, tennis and golf are also available on campus.

Student Clubs

Student clubs are abundant at Taipei Medical University! Eighty-five clubs offer opportunities in service, entertainment, academics, performance and management. TMU leads Taiwan's universities in student activities, which are important parst of the TMU experience, especially medical service activities. Normally nine groups serve in remote villages or foreign countries each winter vacation, while in summer a dozen groups offer help in underserved areas. Students participating in these groups are not only offered free medical services and health care education, but also perform live shows to entertain their host communities. South India and Malawi were the destinations of recent trips.

Library

Taipei Medical University's main library was established in 1962. The collections include printed and electronic books, journals and databases in Chinese, English, Japanese and other languages. The library receives more than 10 newspapers and 230 magazines every day and all the databases can be accessed online. In addition to circulation services, the library provides other services such as library orientation and instruction, reference service, inter-library loan and selective dissemination of information.

Food Court and Restaurants

Inexpensive and nutritious meals are easy to find on campus. The food court in the lower level of the United Medical Building offers sandwiches, hamburgers, Chinese lunch boxes, fresh fruit drinks, noodles, and vegetarian food. The upper level is Mr. J, an Italian-French restaurant sponsored by popular singer and composer Jay Chou and friends. A convenience store next door offers other meal options.

Trasportation

TMU Shuttle Bus

Roads & Streets

A. 220 Lane, WuXing Stree
B. Wusing Street(WuXing Street
C. 284 Lane,WuXing Street
D. 22 Alley, 284 Lane.WuXing Stree

Entrances

i. University Entrance
ii. Hospital Entrance
iii. Ambulance Entrance

▲ TMU hospital shuttle bus stop is at " **ii. Hospital Entrance** ".

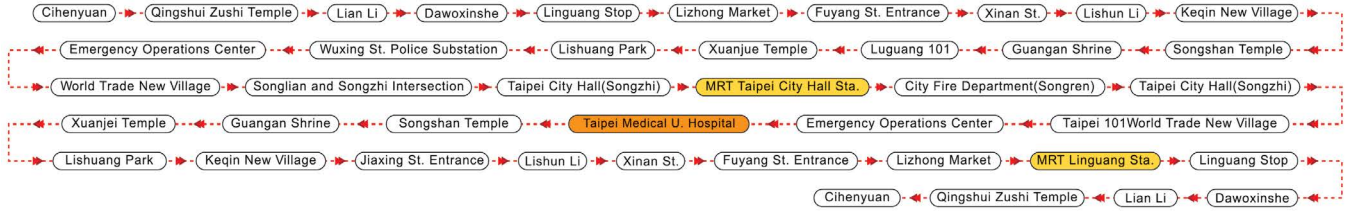
Bus

This is the list of bus lines you may find at the bus stop that serves Taipei Medical University on Zhuang Jing Rd.

- **BUS 1, 22, 33, 37, 226, 266, 266 區 , 288, 288 區 , 藍 5**

- **Citizen MiniBus M7**

  Is the only bus that gets closer to TMU, and its terminal station is MRT City Hall Station.



Ubike

Ubike is a new lifestyle in Taipei. Rent bikes using your transit "EasyCard"and return them wherever you want to go. TMU's rental station with available Ubikes looks like this.

The map shows Ubike rental & retun places near TMU. Check if your destination provides Ubike renting and parking services at http://taipei.youbike.com.tw/en/f11.php

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TAIPEI MEDICAL UNIVERSITY

臺北醫學大學 醫學工程學院
TMU BIOMEDICAL ENGINEERING