

## Ning Ma

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### EDUCATION:

**University of California, Irvine, Irvine, CA**  
Ph.D. Candidate in **Biomedical Engineering**

G.P.A: **3.92**  
Sep.2014--present

**University of California, Irvine, Irvine, CA**  
Master of Science in **Chemical and Biochemical Engineering**

G.P.A: **3.68**  
Graduation date: **Dec.2013**

**Dalian University of Technology (DUT), Dalian, P. R. China**  
Bachelor of Science in **Chemical Engineering**  
Bachelor of Arts in **English literature**

Graduation date: **Jun. 2012**

### RESEARCH PROJECTS:

**Graduate Student Researcher**, Digman Lab, Department of Biomedical Engineering University of California, Irvine

**Sep. 2014-Present**

Ph.D. Thesis PROJECT: The Phasor-FLIM Approach to Detect Metabolic Shifts in complex Mammalian Developmental Systems

Development of quantitative, safe and rapid techniques for assessing embryo quality provide significant advances during assisted reproduction. Instead of assessing the embryo quality by the standard morphologic evaluation, we describe the phasor-FLIM (Fluorescence Lifetime Imaging Microscopy) method to capture endogenous fluorescent biomarkers of pre-implantation embryos as a readout of embryo quality. Here, we identify unique spectroscopic trajectories at different stages of mouse pre-implantation development which reflects significant metabolic changes that occur during early mouse embryogenesis in NADH and ROS production. Using the parameters derived by the fluorescence lifetime histograms distributions via a binary classification algorithm, we have defined an Embryo Viability Index (EVI), which is a non-morphological index that distinguishes pre-implantation embryo quality. We show that the phasor-FLIM combined with the EVI provides a much-needed alternative non-invasive quantitative technology for identifying healthy embryos at the early compaction stage and thus may be useful in the future for assisted reproduction.

PROJECT: Non-Invasive live imaging of stem cell signature metabolic states

To model human development, we need to recapitulate developmental processes by mimicking growth factor production from a source and monitor metabolic responses to GFs on a cell-by-cell basis. To do this we propose to test whether stimulation of growth factor pathways, including the WNT and BMP pathway, alters the metabolic output of human Embryonic Stem cells (hESCs) and to study metabolism in living pluripotent cells both in vitro and in vivo.

**Junior Specialist**, Laboratory of Fluorescence Dynamics, University of California, Irvine

**Jan. 2014-Sep.2014**

PROJECT: Metabolic mapping of different cell lines via 2-Photon fluorescence lifetime imaging of the coenzyme NADH

Biochemical estimation of NADH concentration is a useful method for monitoring cellular metabolism, because the NADH/NAD<sup>+</sup> reduction-oxidation pair is crucial for electron transfer in the mitochondrial electron chain. Our aim is to use two-photon fluorescence lifetime imaging (FLIM) to derive functional maps of intracellular reduction-oxidation ration in vivo via measurement of the fluorescence lifetimes and the ratio of free and protein-bound NADH.

**Research Assistant**, Dr. Tonghua Wang's Carbon Research Lab of a key National Laboratory of Fine Chemicals, Dalian University of Technology, Dalian, China

**Sep.2008-Jun.2012**

PROJECT: Manufacture of Biodiesel Oil from Waste Acidic Grease

— **Project Leader for the preparation of carbon-based biodiesel catalyst and process design**

Project was supported by a key State University Innovation Research and Training Program with Grant (No. 2009018)

— **Manufactured biodiesel oil from waste acidic grease treated with a carbon-based solid acid catalyst prepared from biomass**

## PUBLICATIONS:

— **Ning Ma\***, Gopakumar Kamalakshakurup\*, Michelle Digman and Abraham. **High-Efficiency Single Cell Encapsulation in Droplets and Label-Free Characterization using Fluorescent Life-time Imaging Microscopy** Cytometry A journal special issue on Metabolism. 2018. (submitted)

— Hongtao Chen, **Ning Ma**, Keiichiro Kagawa, Michelle Digman and Enrico Gratton. **Widefield multi-frequency fluorescence lifetime imaging using a two-tap CMOS camera with lateral electric field charge modulators** Biophotonics. 2018. (submitted)

— **Ning Ma\***, Nabora Reyes de Mochel\*, Paula Pham, Tae Yoo, Ken Cho, Michelle Digman, **Label-free assessment of pre-implantation embryo quality by the Fluorescence Lifetime Imaging Microscopy (FLIM)-phasor approach** Nature. 2018. (submitted)

—**Ning Ma\***, Nabora Reyes de Mochel\*, Paula Pham, Tae Yoo, Ken Cho, Michelle Digman, **Label-free assessment of pre-implantation embryo quality by the Fluorescence Lifetime Imaging Microscopy (FLIM)-phasor approach** bioRxiv 286682; doi: <https://doi.org/10.1101/286682>

— Do-Hyun Lee, Xuan Li, **Ning Ma**, Michelle Digman, Abraham Lee, **Rapid and label-free identification of single leukemia cells from blood in a high-density microfluidic trapping array by Fluorescence Lifetime Imaging Microscopy**, Lab on a chip. 2018. (accepted)

—**Ning Ma**, Michelle A. Digman, Leonel Malacrida, and Enrico Gratton, **Measurements of absolute concentrations of NADH in cells using the phasor FLIM method**, Biomed. Opt. Express 7, 2441-2452 (2016)

— Chunlei Wang, Tonghua Wang, Rinan Wu, **Ning Ma**, Jieshan Qiu, **Carbon-based solid acid catalyst from biomass for biodiesel production**, 4<sup>th</sup> International Symposium on Carbon for Catalysis, Dalian, China, 2010, 11

— **Ning Ma**, Wei Lu, Panpan Mi, Chunlei Wang, Tonghua Wang, Zhilong Xiu, **Preparation of carbon-based solid acid catalyst and its application in manufacturing biodiesel**, 2011's academic symposium on environmental sciences sponsored by the environmental science academy of China, Wulumuqi, China, 2011, 8

## PATENTS:

Record of Disclosure Form (IP) submitted: “Label Free Assessment of Embryo Vitality by the Phasor FLIM Method and Third Harmonic Generation Microscopy”. Inventors: Michelle Digman, Ken Cho, **Ning Ma**, & Nabora Mochel UC case No.: 2018-517

“Microfluidic Label-free Isolation and Identification of Mammalian Cancer cells from Blood and Single Plant”. Inventors: Abraham Lee, Michelle Digman, Do-Hyun Lee, Xuan Li, **Ning Ma** UC case No.: 2017-815

Cells based by Fluorescence Lifetime Imaging (FLIM)

Record of Disclosure Form (IP) submitted: “Label Free Assessment of Embryo Vitality by the Phasor FLIM Method”. Inventors: Michelle Digman, Ken Cho, **Ning Ma**, & Nabora Mochel UC case No.: 2015-99x

## DOMESTIC SEMINAR, CONFERENCE AND WORKSHOP PRESENTATION

— Selected Poster Presentation: “Quiescent metabolism identification in 1-1 encapsulation droplet via Fluorescence Lifetime Imaging Microscopy (FLIM)”. ASME 2018 NanoEngineering for Medicine and Biology Conference. Los Angeles, California. August 22-23, 2018.

— Selected Poster Presentation: “Fluorescence Lifetime Trajectory of the Mouse Pre-implantation Embryo Predicts its Viability.” Cell Symposia: Multifaceted Mitochondria. San Diego, California, USA. June 4 – 6, 2018.

— Selected Poster Presentation: “Quiescent metabolism identification in 1-1 encapsulation droplet via Fluorescence Lifetime Imaging Microscopy (FLIM)”. TechConnect WORLD INNOVATION conference & EXPO. Anaheim, California. May 13-16, 2018.

— Oral Presentation: “Fluorescence Lifetime Trajectory of the Mouse Pre-implantation Embryo Predicts its Viability” Biomedical Engineering, Henry Samueli School of Engineering Student Seminar. Irvine, California, USA. February 23, 2018.

— Selected Poster Presentation: “Fluorescence Lifetime Trajectory of the Mouse Pre-implantation Embryo Predicts its Viability.” 62<sup>nd</sup> Biophysical Society Annual Meeting. San Francisco, California, USA. February 17 – 21, 2018.

— Selected Poster Presentation: “Quiescent metabolism identification in 1-1 encapsulation droplet via Fluorescence Lifetime Imaging

Ning Ma, Ph.D. candidate

Microscopy (FLIM)". Center for Advanced Design and Manufacturing of Integrated Microfluidics (CADMIM) Industrial Advisory Board Meeting, Chicago, Illinois. February 14-15, 2018.

— Selected Poster Presentation: "Label-free Identification of Single-Cell encapsulated in droplet by Phasor-Fluorescence Lifetime Imaging (FLIM)" Center for Advanced Design and Manufacturing of Integrated Microfluidics (CADMIM) Industrial Advisory Board Meeting, Chicago, Illinois. September 12-13, 2017.

— Selected Poster Presentation: "Fluorescence Lifetime Trajectory of the Mouse Pre-implantation Embryo Predicts its Viability." Japan-UCI Meeting on 3D Morphogenesis conference, July 10-11, 2017.

— Selected Poster Presentation: "Fluorescence Lifetime Trajectory of the Mouse Pre-implantation Embryo Predicts its Viability." The 18th Annual UC Systemwide Bioengineering Symposium, June 28-30, 2017.

— Selected Poster Presentation: "Non-invasive Fluorescence Lifetime Imaging (FLIM) of stem cell signature metabolic states." 60<sup>th</sup> Biophysical Society Annual Meeting, Los Angeles, California, USA. February 27 – March 2, 2016.

—Selected Poster Presentation: "Fluorescence Lifetime Imaging Microcopy of Extravasating Cancer Cells Inside the Mouse Microenvironment." Los Angeles, California. March 27-29, 2015.

— Selected Poster Presentation: Chao Family Comprehensive Cancer Center's Scientific Retreat; "Fluorescence Lifetime Imaging Microcopy of Extravasating Cancer Cells Inside the Mouse Microenvironment." Hyatt Regency Suites, Palm Springs, CA. September 26–27, 2014.

— Selected Poster Presentation: "Spectroscopic Profiling and Metabolic Mapping of Cancer Cells using endogenous fluorescence." The 15th Annual UC Systemwide Bioengineering Symposium, June 18-20, 2014.

## PROFESSIONAL AND ACADEMIC MEMERSHIPS

—Biophysical Society

—Chao Family Comprehensive Cancer Center, UC Irvine

—The Center for Complex Biological Systems, UC Irvine

## WORK EXPERIENCE:

**Teaching Assistant**, Department of Biomedical Engineering, University of California, Irvine

**Sep. 2016-Dec. 2016**

**Oil Refinery Process Engineering Internship**, Liaoyang Petrochemical Company, China National Petroleum Corporation, Liaoyang, China

**Jul.2010-Sep.2010**

— Quality control and problem shooting of transport equipment for the sulfur removal unit

— Reviewed PID (Piping and Instruments Diagrams)

— Developed and implemented a program for overhauling sulfur removal

**Chemical Engineering Internship**, Dalian Petrochemical Company, China National Petroleum Corporation, Dalian, China

**Jun.2009-Sep.2009**

— Designed a propylene-propane fractional distillation tower with AutoCAD

— Learned production processes through hands-on learning

## ACTIVITIES & Education/Training Services

— Mentor for Pathways to Biophotonics and Biomedical Engineering (PBBE)" Training Program since 2017

— Project Leader for MCB Bio Bootcamp at UCI since 2016

— Project Leader for Laboratory for Fluorescence Dynamics (LFD) workshop since 2014

— Project Leader for Undergraduate Student Initiative for Biomedical Research (USIBR) since 2014

— Project Leader for COSMOS: California State Summer School for Math & Science since 2014

— Lecturer for Laboratory for Fluorescence Dynamics (LFD) workshop since 2016

— Orange County Science and Engineering Fair Judge. Mar. 2017.

— Senior Design graduate student mentor. 2016.

— "Ask-A-Scientist Night". Science Fair Advisor for Middle School Students. Sponsored by the Irvine Unified School District (IUSD). Rancho San Joaquin Middle School, Irvine; Oct. 2015.

— Team leader of debate team, Manager of speech and debate department, Dalian University of Technology

— Volunteer for Dalian Environmental Protection Volunteers Association (learned sign language and taught children for outreach)

— Event programmer for freshman and junior classes in the Chemical Engineering Department, Dalian University of Technology

## HONORS/AWARDS

— **Foundation of Reproductive Medicine Young Investigator Award**, New York, New York, USA.

**Nov. 2018**

— **Maschoff Brennan Announces Innovator Scholarship**, Irvine, California, USA.

**Sep.2018**

Ning Ma, Ph.D. candidate

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- **Student Startup Fund micro-grant**, University of California, Irvine. Irvine, California, USA. **Jun. 2018**
- **Selected group for Wayfinder incubator program 2018 (Cycle)**, University of California, Irvine. Irvine, California, USA. **Jun. 2018**
- **Selected team for NSF I-corps Spring 2018**, University of California, Irvine. Irvine, California, USA. **Apr. 2018**
- **Finalist of Beall student design & Butterworth product development competitions**, University of California, Irvine. Irvine, California, USA. **Jun. 2018**
- **UC Irvine Associated Graduate Students - UCI AGS Travel Grant**, University of California, Irvine. Irvine, California, USA.
- **Award in University Innovation Research and Training Program**, Dalian University of Technology (DUT), Dalian, P. R. China
- **Award for Outstanding Contribution to The Student Union**, Dalian University of Technology (DUT), Dalian, P. R. China

### **SKILLS:**

**LANGUAGE:** Mandarin Chinese

**SOFTWARE:** R, Python, MATLAB, C programming Language, AutoCAD, Origin, ChemBioDraw, Mathematica, Labview