CRIN Application Procedure

Eligibility – Domestic and 25% international for graduate students and postdocs combined (NCI R25T rules). If we fully enroll with 8 participants, 2 can be foreign. Initial enrollment may be only 6 participants so only 1 foreign participant will be allowed. For graduate students, 1st or 2nd year students are preferred along with more advanced students who have already taken a combination of biology and engineering/physical sciences courses. We expect initially to have 4 graduate students and 2 postdocs in the program. All Application materials are due Dec 7. We hope to have new participants appointed for winter quarter.

The following materials should be sent to both akummel@ucsd.edu and tjohnston@ucsd.edu

1. Identify two mentors: one clinical and one basic research who are CRIN faculty
2. Submit two short letters of recommendation (<1 page), one from each of the two mentors.
3. Submit three powerpoints for public disclosure (1) the proposed research (remove all intellectual property) (2) a CV (no GPA, GREs etc), and (3) summary of education plan.
4. Submit a ½ page educational plan and a ½ page research plan. For graduate students you need to show which courses you will take which provides cross training. See next slide for details. You are welcome to request substitution from the list of required courses.
5. You must promise in writing to attend CT2 lecture series, attend the Skaggs Nanomedicine lecture series, submit an F31 or supplement proposal to NCI by the end of year 1, and answer fairly detailed surveys required for evaluation of the program.
6. Submit a CV, an unofficial transcript, and unofficial GRE scores (GREs only for graduate students).
CRIN – Faculty and Projects

Theme A- Nanoparticle assisted drug delivery (directors Liangfang Zhang, Steve Howell). (1) BioChemically Triggered Nanoparticle: Liangfang Zhang (NanoE), Sadik Esener (NanoE), Jessica Wang Rodriguez (Pathology), and Dennis Carson (Medicine) (2) Nanoparticles to Overcome Drug Resistance: Liangfang Zhang (NanoE), Andrew Kummel (Chemistry), Steve Howell (Medicine), Roger Tsien (Pharmacology and BioChem), and David Cheresh (Pathology) (3) Inorganic Nanoparticles for Drug Delivery and Cancer William Trogler (Chemistry), Seth Cohen (Chemistry), Robert Mattrey (Radiology), and Steve Howell (Medicine) (4) Virus Based Immunotherapy Thomas Kipps (Medicine), Roger Tsien (Pharmacology and BioChemistry), and Mike Burkart (Chemistry)

Theme B- Guided Nanotherapies (directors Sadik Esener, Robert Mattrey) (5) Sound guided therapy Robert Mattrey (Radiology), and Sadik Esener (NanoEng); (6) Multifunctional Motherships: Sadik Esener (NanoEng), Robert Mattrey (Radiology); and Andrew Kummel (NanoEng & Chem); (7) Ultrasound-Deposited-Enzyme-Therapy Roger Tsien (Pharmacology and Biochemistry), Sadik Esener (NanoEng), and Robert Mattrey (Radiology)

Theme C- Cancer Detection and Monitoring. (Directors William Trogler, Dennis Carson) (8) Detection of Cancer and Circulating Cancer Cells by ex-vivo Blood Analysis. Michael Heller (NanoEng), Sadik Esener (NanoEng), Dennis Carson (Medicine), Thomas Kipps (Medicine), Tony Reid (Medicine), and Jean Wang (Biology). (9) Cancer Detection by nanotechnology enabled in vivo blood analysis: Sadik Esener (NanoEng), Michael Heller (NanoEng), Andrew Lowy (Surgery), and Dennis Carson (Medicine), (10) Cancer Detection by Ultrasound Imaging: William Trogler (Chemistry), Robert Mattrey (SOM), Sadik Esener (NanoEng), Andrew Lowy (Surgery), and Dennis Carson (Medicine),

Theme D- Emerging Technologies for Assisting Cancer Surgery. (Directors Andrew Kummel, Sarah Blair) (11) Automated or Enhanced Imaging for assisting pathologists Andrew Kummel (NanoEng, Chemistry & Mat Sci), Sarah Blair (Surgery), Jessica Wang Rodriguez (Pathology), and Robert Mattrey (Radiology); (12) Biomolecular Imaging for Microsurgery of metastatic disease: Roger Tsien (Pharmacology and BioChem), Michael Bouvet (Surgery), and Sarah Blair (Surgery); (13) Targeted Fluorescent Nanoparticles for Pancreatic Cancer Surgical Navigation: Michael Bouvet (Surgery), Liangfang Zhang (NanoEngineering), Sadik Esener (NanoEngineering-Photonics) and David Cheresh (Pathology); (14) Ultrasound contrast agents for lymph node imaging and surgical markers: Robert Mattrey (Radiology), Andrew Kummel (Chemistry, Materials Science), William Trogler, and Sarah Blair (Medicine)
There will be two tracks for course work one for biologists/biochemists and one for physical scientists/engineers to insure cross training. All trainees will have didactic training in nanomedicine technology commercialization and research ethics.

**Courses Biologists/Biochemists:** (a) two graduate courses in nanoengineering through the NanoEngineering program; (b) two graduate epidemiology and biostatistics courses through the NIH funded CREST program at the UCSD medical school

**Engineers/chemists/physicists:** (c) two quarter courses in cell and molecules biology offered by the bioengineering department; (d) two basic cancer biology classes through the UCSD biology department;

**All Participants:** Both groups of students and the postdoctoral associates will take courses in (e) advanced cancer biology and translational medicine through a lecture series.
CRIN – Course Choices Part 1

(a) NanoEngineering and Physical/Biological Science Course Work

Nano 247C – Bionanotechnology: This is new course that covers nanodevices and biosensors for both clinical diagnostics and biowarfare (bioterror) agent detection; nanostructures for drug delivery; nanarrays and nanodevices; use of nanoanalytical devices and systems; methods and techniques for modification or functionalization of nanoparticles and nanostructures with biological molecules. (new course)

Nano 262 – Nanosensors: This is new course that covers the principles and applications of sensors and biosensors based on the use of nanomaterials such as nanotubes, nanowires and nanoparticles. Special attention is given to transduction modes, various biorecognition elements, and the interface of the biological layer and the physical transducer. (new course)

CENG 207 – NanoMedicine: teaches the latest scientific developments and discoveries in the field of nanomedicine and the use of precisely engineered nanomaterials at the length scale of 1-100 nm to develop novel therapeutic and diagnostic modalities for medical applications. Use nanomedicine-centric applications to teach the underlying engineering principles such as the laws revolved around molecular and particulate transport, sorting and binding.

MatSci 253 – Nanomaterials and Properties: discusses synthesis techniques, processing, microstructural control, and unique physical properties of materials in nano-dimensions that include nanowires, quantum dots, thin films, electrical transport, electron emission properties, optical behavior, mechanical behavior, and technical applications of nanomaterials

Mat Sci 258 – Medical Device Materials: covers the nature, properties, and applications of various medical device materials will be discussed. The devices include coronary stents, catheters, drug delivery vehicles, and other implant, surgery, or therapeutics related devices.

(b) Courses from the Clinical Research Enhancement through Supplement Training (CREST) program.

Data Management and Informatics: teaches the regulatory requirements and best practices for effective and accountable management of data in clinical research settings, and an appreciation for the tools and methods that can be applied to research data management in a hands-on computer laboratory setting. It also covers orientation to database design and management and key issues regarding data handling for clinical research and clinical trials.

Biostatistics I. Understand and apply the principles of measurement of clinical data, data types, and identification of statistical methods appropriate for analysis of a given clinical data set. Assemble clinical datasets in formats suitable for analysis by NCSS or other comparable statistical packages. Conduct graphical and numerical exploratory data analysis, comparative tests of categorical, ordinal and continuous data, linear and logistic regression analysis, and survival analysis by life table and Kaplan-Meier techniques.

Biostatistics II. Understand and conduct more advanced biostatistical analyses including: multiple linear and logistic regression, survival analysis and Cox and extended Cox regression. Familiarity with person-time rate analysis and Poisson regression and longitudinal data analysis in the presence of missing values and varying measurement times.
c) Basic Cell Biology and Biochemistry

BENG 230A – Biochemistry: this is a graduate course especially tailored to the requirements and background of bioengineering graduate students covering the important macro- and small molecules that are either the major constituents or that function as signaling molecules or are involved in molecular machineries in cells. The structures, pathways, interactions, methodologies, and molecular designs using recombinant DNA technology are covered.

BENG 230B – Cell and Molecular Biology: is a general survey of structure-function relationships at the molecular and cellular levels. It places emphasis on basic genetic mechanisms, control of gene expression, membrane structure, transport and traffic, cell signaling, cell adhesion, mechanics of cell division, and cytoskeleton.

d) Cancer Biology

BIMM 134 – Biology of Cancer: covers basic processes of transformation and tumor formation in a two-part format. The first section is focused on molecular and cellular mechanisms of carcinogenesis. The second section discusses tumor pathology and metastasis.

BIMM 150 – Post-Genomics Biology: focuses on large-scale analysis of post-genomics biological systems. Students are introduced to methods for analyzing changes in gene expression, identifying protein-protein interactions, screening for pathway inhibitors, characterizing multiprotein complexes, and probing protein localization and function.

BGGN 235 – Biology and Biochemistry of Cancer Cells: covers recent advances in cell biology, biochemistry, immunology, and virology as they relate to cancer cells and their interaction with the host. Cancer research specialists from outside will be brought in to discuss the most recent evidence and interpretations in key areas of cancer research.

NANO 242 – Biochemistry and Molecular Biology: This course is designed to give nanoengineering students from a variety of backgrounds a working knowledge of biochemistry and molecular biology. While the course covers biochemistry basics and key themes in molecular biology, it will emphasize the role of engineering innovations. (new course)
CRIN – Course Choices Part III

e) CT2 Coursework Each course meets for 2 hours once a week for 10 weeks.

CT2 is a Lecture Series on Principles of Cancer Treatment Development. Topics include target identification and validation, screening, structural modeling and design, Principles of GLP and GMP and toxicology basics, tumor models for preclinical testing, monitoring drug effect on target, pharmacogenomics, preparation and submission of an IND, phase I pharmacokinetic trials, phase II/III trials. Talks for the coming year include: (1) Tyrosine Kinases, Androgen Receptor and Prostate Cancer (Hsing-Jien Kung, UC Davis); (2) Immunology, Apoptosis, Autophagy, and Mitochondria: Life After Cytochrome c Release (Douglas Green); (3) Cellular Actions of Angiogenesis Inhibitors on Blood Vessels in Tumors and Normal Organs (Donald McDonald – UCSF); (4) Regulation of Tumor Angiogenesis by VEGF and Other Mediators (Napoleone Ferrara – Genetech); (5) Mechanisms of Oncogene Addiction: Dr. Jekyll and Mr. Hyde (Dean Felsher – Stanford); (6) Sequenom – Profiling Nucleic Acid Biomarkers in Cancer (Charles Cantor); (7) Functional Analysis of the BRCA1 Gene Product (David Livingston – Harvard); (8) A Malady of Genes (Inder Verma – Salk Institute).

f) Coursework in technology commercialization through the Von Liebig center.

ENG 201 – Venture Mechanics: Provides a deep understanding of the core processes of innovation and new product/market development

ENG 202 – Enterprise Dynamics: teaches how to design, build, manage and grow innovative companies: It focuses on the CTO/VP level of an organization, which is the middle stage of an engineer’s career. There is a strong emphasis on direct exposure to real firms via a major project and through an interactive computer simulation based business competition.

ENG 203 – Applied Innovation: teaches how to plan and build new business ventures: It focuses on the CEO/Governance level of an Organization including the later stage of an engineer’s career as president or owner/founder of a high tech business venturing enterprise. The course concentrates on the development of real business plans in cooperation with real firms on new business projects.

ENG 207 – Corporate Entrepreneurship for Global Competitiveness: uses the medical device industry as an example to explore corporate entrepreneurship and the innovation process...

g) Plan for Instruction in the Responsible Conduct of Research

Training in the responsible conduct of research (RCR) will be provided through both the mentored research and didactic components of the CRIN program. A central premise is that trainees need to gain a full appreciation of the ethical and social responsibilities of research. To this end all trainees will be required to successfully complete one of the Research Ethics Program courses. This will usually be “Ethics and Survival Skills in Academic”, “Scientific Ethics”, “Scientific Integrity”, or “Ethics in Scientific Research”. These courses are intended to satisfy the NIH requirement for instruction in the responsible conduct of research. They emphasize the intersection between the practical aspects of science (e.g. roles and responsibilities, writing grants and papers, and finding a job) and ethical decision-making. Topics include roles and responsibilities of researchers, data collection and ownership, issues relating to use of animal and human subjects, scientific and grant writing, code of ethics for authors, reviewers and editors, conflicts of interest. The specific course will be a joint decision of the mentor and trainee and will be included in the training plan.
Each student has two mentors: basic research and clinical research.

Each faculty mentor (a) is a participating member of the Cancer Center, (b) has peer reviewed cancer or cancer-related research funding, (c) is conducting translational research, (d) is interested in emerging technologies in cancer diagnosis and/or therapy.
Research Hybridizing Translation Cancer Research and Nanotechnology

Mattrey (PI); Kummel (coPI); Alfred (Coordinator)

Executive Committee: Mattrey, Kummel, Esener, Carson, Blair, Sadler, Alfred

Admission/Training Committee – 16 faculty; 6 departments

Theme A: Nanoparticle assisted drug delivery
  (directors Zhang, Howell)
  (1) Biochemically Triggered Nanoparticle
  (2) Nanoparticles to Overcome Drug Resistance
  (3) Inorganic Nanoparticles of Drug Delivery and Cancer
  (4) Virus Based Immuno Therapy

Theme B: Guided Nanotherapies
  (directors Esener, Mattrey)
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  (6) Multifunctional Motherships
  (7) Ultrasound-Deposited-Enzyme-Therapy

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  (9) Cancer Detection by nanotechnology enabled in vivo blood analysis
  (10) Cancer Detection by Ultrasound Imaging

Theme D: Emerging Technologies for Assisting Cancer Surgery
  (directors Kummel, Blair)
  (11) Automated/Enhanced Imaging
  (12) Biomolecular Imaging for Microsurgery
  (13) Targeted Nanoparticles for Cancer Surgical Navigation
  (14) Ultrasound agents for imaging/surgical markers
Outline of Courses – 2 Tracks of Re-Education

Graduate Students with Engineering/Physical Sciences Backgrounds

Basic Cell Biology and Biochemistry
- BENG 230A – Biochemistry
- BENG 230B. Cell and Molecular Biology.

Cancer Biology
- BIMM 134. Biology of Cancer
- BIMM 150. Post-Genomics Biology
- RGGN 235. Biology and Biochemistry of Cancer Cells
- NANO 242. Biochemistry and Molecular Biology

Postdoctoral Associates will take courses as needed after consulting with training committee

Technology commercialization
- Von Leipig Center

CT2 Training Grant Lecture Series
- Principles of cancer treatment development

Graduate Students with Biology/Chemistry Backgrounds

Nano Engineering and Physical Sciences
- Nano 247C. Biomaterials
- Nano 262. Nanoscanners
- CENG 207. Nanomedicine
- MatSci 253. Nanomaterials and Properties
- Mat Sci 258. Medical Device Materials

Clinical Research Enhancement
- Data Management and Informatics
- Biostatistics I
- Biostatistics II

Engineers / Physical Scientists
- 2 courses in basic cancer biology
- 2 courses in cell and molecular biology

Biologists / Biochemists
- 2 courses in nanotechnology
- 2 courses in epidemiology and biostatistics

All
- 1 course in technology commercialization
- lecture series in cancer treatment development
Coursework in technology commercialization – UCSD Von Liebig center

Pre-seed FundingGap funding (up to $75K) to projects via a competitive process. 19 startup companies that have leveraged more than $80M in capital and created over 150 jobs

ENG 201 – Venture Mechanics: Provides a deep understanding of the core processes of innovation and new product/market development

ENG 202 – Enterprise Dynamics: teaches how to design, build, manage and grow innovative companies: It focuses on the CTO/VP level of an organization, which is the middle stage of an engineer’s career. There is a strong emphasis on direct exposure to real firms via a major project and through an interactive computer simulation based business competition.

ENG 203 – Applied Innovation: teaches how to plan and build new business ventures: It focuses on the CEO/Governance level of an Organization including the later stage of an engineer’s career as president or owner/founder of a high tech business venturing enterprise. The course concentrates on the development of real business plans in cooperation with real firms on new business projects.

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UCSD Jacobs Von Liebig Center InflammaGen RHEVISION TECHNOLOGY, INC InhibeX
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<tr>
<th>Date</th>
<th>Speaker</th>
<th>Title</th>
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<td>9/24/10</td>
<td>Mark Stevenson Lifetech Tech</td>
<td>Genomic Medicine Using Biological Insights to Enable the Right Therapy the First Time</td>
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<td>9/28/10</td>
<td>Stephen B. Howell, MD UCSD Hem/Onc</td>
<td>Cancer Therapeutics Development</td>
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<td>10/1/10</td>
<td>John Ryals, PhD Metabolon</td>
<td>Non-Targeted Metabolomic Analysis in Cancer Treatment and Biomarker Discovery</td>
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<td>10/12/10</td>
<td>Tony Reid, MD, PhD UCSD Hem/Onc</td>
<td>Targeting Transcription</td>
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<td>10/19/10</td>
<td>Marianne Manchester, PhD UCSD Pharmacy</td>
<td>Viral Nanoparticles as Scaffolds for Targeted Therapeutics and Vaccines</td>
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<td>10/26/10</td>
<td>Lyudmila Bazhenova, MD UCSD Medicine</td>
<td>Learning from Lung Cancer: Benefits of Adding a Clinician to Your Team</td>
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<td>11/2/10</td>
<td>Michael Karin, PhD UCSD Pharmacology</td>
<td>Cytokines in tumor development, progression, metastasis and therapy</td>
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<td>11/9/10</td>
<td>Catriona Jamieson, PhD, MD UCSD Hem/Onc</td>
<td>The Molecular Evolution of Leukemia Stem Cells</td>
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<td>11/15/10</td>
<td>Norman Greenberg, PhD Pfizer</td>
<td>The Right Medicine for the Right Patient: A New Path for Drug Discovery</td>
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<td>11/16/10</td>
<td>Steve Dowdy, PhD UCSD Cell &amp; Mol Med</td>
<td>RNAi Therapeutics: The Ultimate Personalized Cancer Treatment?</td>
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<td>11/23/10</td>
<td>Philip Bourne, PhD UCSD Pharmacology</td>
<td>Polypharmacology: The Good News and Bad News of Possible Cancer Therapy</td>
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<td>11/30/10</td>
<td>Dennis Carson, MD UCSD Cancer Center, John Hood, PhD Wintherix, LLC</td>
<td>Wnt and Other Stem Cell Pathways as Cancer Drug Targets</td>
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<td>12/6/10</td>
<td>Tom Bumol, PhD Lilly</td>
<td>TBA</td>
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<td>12/7/10</td>
<td>Michael Gilson, PhD Pharmacy</td>
<td>Computer-Aided Drug Design: Concepts, Methods and Applications</td>
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<td>12/14/10</td>
<td>Kelly Frazer, PhD UCSD Pediatrics</td>
<td>An integrated genomic analysis of a Non small cell lung carcinoma</td>
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<td>12/21/10</td>
<td>Barbara Parker, MD Hem/Onc</td>
<td>Opportunities and Challenges in Breast Cancer Clinical Research</td>
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<tr>
<td>1/18/11</td>
<td>Andrew Allen, PhD Clovis</td>
<td>Cancer Drugs and Companion Diagnostics: Tales from the Trenches?</td>
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<tr>
<td>Jan 2011</td>
<td>Kang Zhang, MD UCSD Ophthalmology</td>
<td>Genetics and Stem Cell Based Therapy for Age Related Macular Degeneration</td>
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UCSD-KACST Center of Excellence in Nanomedicine presents
Frontiers in Therapeutic and Diagnostic Delivery

Dennis Bong, Ph.D.
Ohio State University
"Molecular recognition at the lipid-water interface"
October 13, 2010

Debra Augustine, Ph.D.
Harvard University
"Leukocyte Analogues"
November 17, 2010

Yue Zhao, Ph.D.
Université de Sherbrooke
"Photocontrollable Block Copolymer Micelles, Vesicles, Nanogels and Microgels"
December 1, 2010

Glen Kwon, Ph.D.
University of Wisconsin-Madison
"Polymeric Micelles for Multiple Drug Delivery"
January 19, 2011

Mattias Nahendorf, Ph.D.
Harvard University
"Nanoparticles for Molecular Imaging"
January 26, 2011

Joseph DeSimone, Ph.D.
University of North Carolina at Chapel Hill
"Co-opting Moore's Law: Vaccines and Therapeutics on a Wafer"
February 3, 2011

Tejal Desai, Ph.D.
University of California, San Francisco
"Nanostructured Devices for Therapeutic Delivery"
February 9, 2011

Jennifer Lippincott-Schwartz, Ph.D.
National Institutes of Health
"Breakthroughs in Imaging Using Photoactivatable Fluorescent Protein Technology"
February 16, 2011

Erkki Ruoslahti, Ph.D.
University of California, Santa Barbara
"Vascular Zip Codes in Targeted Delivery of Multifunctional Nanodevices"
February 23, 2011

Alexander Kabanov, Ph.D.
University of Nebraska Medical Center
"Polymer Micelles from Bench to the Bedside"
March 2, 2011

Trevor Douglas, Ph.D.
Montana State University
"Protein Cage Architectures as Templates for Hard and Soft Materials in Medicine"
March 9, 2011

Andrea Kasko, Ph.D.
University of California, Los Angeles
"Photodegradable Polymers for Biomedicine"
March 16, 2011

Sean Whelan, Ph.D.
Harvard Medical School
"Biting the Bullet: a Visual Tour of Vesicular Stomatitis Virus Cell Entry"
March 23, 2011

Heather Maynard, Ph.D.
University of California, Los Angeles
"Protein-polymer conjugates for wound healing and cancer drug delivery"
April 6, 2011

Steven Schwendeman, Ph.D.
University of Michigan
"New injectable polymer depot strategies for controlled release of peptides and proteins"
April 20, 2011

Thomas Meade, Ph.D.
Northwestern University
"Molecular Imaging"
April 27, 2011

Francis Szoka, Ph.D.
University of California, San Francisco
"New Polymer and Lipid Materials for Drug and Nucleic Acid Delivery"
May 11, 2011

Jennifer Elisseeff, Ph.D.
Johns Hopkins University
"Translational Tissue Engineering"
May 25, 2011

Justin Hanes, Ph.D.
Johns Hopkins University
"Nanomedicine for Mucosal Tissues"
June 29, 2011
Student and Program Evaluations

Graduate Students Evaluation by Faculty

Year 1 | Year 2 | Year 3 | Year 4 | Year 5
--- | --- | --- | --- | ---
Develop training plan | Present at journal club 12 times | Present at group meeting 12 times | Complete lab rotations an choose research lab | Complete 80% of course work | Write F31 fellowship proposal
Develop thesis outline | Present at group meeting twice per month | Present a poster at a local conference | Complete 100% of course work | Write F31 fellowship proposal | Receive Support from R2ST
Co-author a paper | Present at group meeting every week | Present two posters at a local or national conferences | Prethesis Exam - final revision of thesis plan | Assist in writing a grant proposal | Present at journal club 12 times
Receive Support from fellowship or research grant | Receive Support from fellowship or research grant | Receive Support from fellowship or research grant | Receive Support from fellowship or research grant | Receive Support from fellowship or research grant
Defend Thesis | Receive Support from fellowship or research grant | Receive Support from fellowship or research grant | Receive Support from fellowship or research grant | Receive Support from fellowship or research grant
Apply for postdoctoral fellowships | Receive Support from fellowship or research grant | Receive Support from fellowship or research grant | Receive Support from fellowship or research grant | Receive Support from fellowship or research grant
Apply for postdoctoral positions

Program Evaluation by Grad Students

Year 1 | Year 2 | Year 3 | Year 4 | Year 5
--- | --- | --- | --- | ---
Develop training plan | Knowledge gained at journal club | Feedback at group meeting | Ability to work in top choice research lab | Quality of course work | Assistance with F31 proposal
Financial support from home department | Assistance in developing thesis outline | Identifying relevant conference for poster presentations | Financial Support from R2ST
Assistance in co-authoring a paper | Assistance in writing grant writing | Advising in writing 1st author paper | Assistance is writing thesis
Receive Support from fellowship or research grant | Assistance in writing postdoctoral fellowship proposals | Assistance in identifying postdoctoral fellowships positions

Evaluation of the Program by the Trainees.

Postdoc Evaluation by Faculty

Year 1 | Year 2 | Year 3 | Year 4
--- | --- | --- | ---
Develop training plan | Present at journal club 12 times | Present at group meeting each week | Complete 80% of course work
Present a poster at a local conference | Co-author a paper | Receive support from R2ST
Complete 100% of course work | Assist in writing a grant proposal | Write a paper as primary author
Write proposal and apply for faculty positions

Program Evaluation by Postdocs

Year 1 | Year 2 | Year 3 | Year 4
--- | --- | --- | ---
Develop training plan | Knowledge gained at journal club | Feedback at group meeting | Ability to work in top choice research lab | Quality of course work | Identifying relevant conference for poster presentations | Assistance fellowship proposals | Assistance in co-authoring a paper | Financial Support from R2ST
Assistance in writing grant proposals | Assistance in writing 1st author paper | Financial support from fellowship or research grant | Assistance in developing proposals for faculty positions

UCSD Research Reputation

- Sixth in federal funding for R&D ($798 million)
- Top 10 for graduate program by NRC
- 11th for best undergraduate education value by Kiplinger's
- 7th in quality for public universities by US News
- Faculty rank 1st in science productivity by JHU study
- UCSD OPTIMAL LOCATION FOR R25T on Translational NanoTech
- 60 NAS members, 8 Nobel prize winners
- 4th in PhDs awarded to URM in the Biological & Biomedical Sciences
- UCSD Center members have funding of $197 mil. yr
- Cancer Center has 63,000 sq. ft. of lab and 18,000 sq. ft. of vivarium space

Yellow – Science
Pink – Diversity
Green – Cancer Research
Compressing the Time Element of Contrast Enhanced Ultrasound into a Single Image for Tumor Diagnosis

Casey Ta, Andrew Kummel, Christoph Dietrich, Yuko Kono, Robert Mattrey

- Two types of liver lesions – focal nodular hyperplasia (FNH) and hepatocellular adenoma (HCA) – can be distinguished by their characteristic perfusion patterns in contrast enhanced ultrasound (CEUS), but it requires an expert radiologist for accurate diagnoses.

- Software has been developed by a CRIN student to analyze CEUS videos and encode the perfusion information into a single color image.

- Application designed for use by radiologists with any level of experience and is being tested for accuracy, inter- and intraobserver reliability.

- CEUS videos were collected for analysis from UCSD (Dr. Kono) and Caritas Hospital Bad Mergentheim in Uhlandstr, Germany (Dr. Dietrich).
Ultrasound imaging of nonpalpable tumors for surgical excision could decrease the need for repeat surgery due to incomplete tumor removal.

Current methods that use inserted wires are painful and lack 3D localization.

Current ultrasound imaging agents that use soft shell micro-bubbles are short-lived and cannot be imaged hours and/or days later, but our gas-filled silica shells can.

The localization has been validated in tissue samples and in live rabbit animal models.

Nanoshells allow imaging of small particles which can be transported to lymph nodes!!!

Martinez, Sandoval – ET CURE graduate students.
Nanoparticle Assisted Dual Drug Delivery  
Santosh Aryal, Che-Ming Hu, Sadik Esener, Steve Howell, Liangfang Zhang

Figure 1. (A) Schematic illustration of a PTXL-GEM conjugates loaded nanoparticle. (B) Representative SEM image of PTXL-GEM conjugates loaded nanoparticles. (C) Diameter and surface zeta-potential of PTXL-GEM conjugates loaded nanoparticles and empty nanoparticles measured by dynamic light scattering (DLS).

Figure 2. (A) PTXL-GEM conjugates loading yield. (B) Cellular cytotoxicity of PTXL-GEM conjugates loaded nanoparticles and free PTXL-GEM conjugates against XPA3 human pancreatic cancer cell line.
PLGA-Lipid Hybrid NPs: With & Without Folate Results

Sergio Sandoval, Alex Liberman, Jian Yang, Sharraya Aschemeyer, Jesus G. Alfaro, Liangfang Zhang, Steve Howell, Andrew C. Kummel, William C. Trogler

• Careful studies of effect of targeting on nanoparticle-cell adhesion vs nanoparticle-cell endocytosis
• Majority of Folate targeted NPs tend to be endocytosed within HeLa Cells. Timing with drug release from nanoparticle is critical
• Sandoval – ET CURE student winner Siebel Award Prize; Liberman, Aschemeyer, Alfaro- former ET CURE undergrad and 2 now in graduate school
20-40% of breast cancer surgeries require a second operation due to positive margin. Automated analysis was developed so that touch prep could be employed without a skilled cytopathologist.

H&E stained touch preps known to be positive or close by permanent section analysis were automatically outlined and manually processed to identify lymphocytes, junk/debris and cancer cells followed by machine learning classifier training with cellular and local environment descriptors.

Testing was performed on an 8 case dataset (46 touch preps) unknown to the classifier. Positive margin status and thus secondary surgeries may have been avoided 50% of the time by allowing intraoperative reexcision.
DEP for Cancer Cell, DNA BioMarkers and Nanoparticle Isolation in Whole Blood

1. Blood sample with high molecular weight DNA is applied to the DEP Device
2. The DEP Field is Applied
3. Fluidic Wash is Applied to Remove Cells
4. Add Fluorescent DNA Stain and Wash

Isolation of cfc-DNA in CLL Patient Whole Blood

- ID and verify nature of cfc-DNA/RNA from CLL and other blood samples
- cfc-DNA/RNA isolation from pancreatic ovarian cancer patient blood samples
- ID other cellular nanoparticles (nuclei, mitochondria, endoplasmic reticulum, lysosomes, vesicles, etc.)
- In-situ RT-PCR and fluorescent antibody (seamless sample to answer)
- Other Application: MI and cardiac disease, stem cell separation and isolation work, Infectious disease (bacteria/virus) applications
Personalized Wireless Physiological Monitoring of Brain Tumor Patients
Santosh Kesari, M.D., Ph.D., Dennis Carson MD, Joe Wang PhD (Sensors), Manny Ruidiaz (Sensor Array Software)

Physiological Parameters to be Monitored in Brain Tumor Patients (and Neurosurgery patients in general) via a Sensor Array
- EKG monitoring, pulse oximetry, plasma chemistry (kidney, liver function), temperature, pulse rate, blood glucose, markers of inflammation.

Importance of Continuous Monitoring
• Acquire early indications of infections or untoward effects of surgery or radio/chemotherapy.
• Facilitate early intervention to prevent potentially serious complications (infections/bleeding diathesis on new drugs-angiogenesis inhibitors).
• Real-time monitoring at home; patients have greater sense of security.

• The research program aims at enhanced electrochemical biosensors for discharge patient monitoring
• (left) Wang group helped develop wearable non-invasive GlucoWatch – clinically validated, commercially available
• (right) Microneedle array sample blood glucose levels by measuring the glucose concentration in the interstitial fluid
Local TV News for Public Outreach

Use clinical faculty to talk
Have lots of students on camera
The TV crew does all the work and we get the video for our web site

Example clip1.m4v