UH-BCM Teaming Workshop

Thursday, May 23, 2019
**VISION**

- Build an infrastructure that develops and leverages UH intellectual capacity to advance innovative research

- Provide innovative, empirically-grounded, culturally informed and community-empowered solutions

- Become the international model for eliminating health disparities
DIRECTORS

Dr. Ezemenari M. Obasi
Founder & Director

HRI Focus:
Daily Operations
Research Infrastructure
Strategic and Financial Planning

Dr. Lorraine R. Reitzel
Co-Founder & Co-Director

HRI Focus:
Community Engagement
Dissemination and Implementation
Student/ESI Training/Relations
HRI staff offers support in the following domains:

**Biostatistician**
- Statistical Consultation
- Power Analysis
- Data Analytic Plans
- Data Management
- Advanced Statistical Analysis
- Grant & Manuscript Development

**Community Liaisons**
- Cultivate Community Partnerships & Engagement
- Recruitment & Retention
- Social Media
- Dissemination of Project Materials
- Health Screenings
- Spanish- and English-speaking Outreach

**Program Director**
- Lead Research Projects
- IRB Submission
- Progress Monitoring
- Grant Reporting
- Compliance
- Quality Control
RESEARCH INTERESTS & EXPERTISE

Behavioral Health
Biological Mechanisms
Built Environment
CANCER
Clinical Science
Culture
Diabetes
Discrimination
DISSEMINATION
Food Insecurity
GIS/GPS
IMPLEMENTATION SCIENCE
Mental Health
Obesity
Physical Activity
Prevention
Psychological Interventions
Public Policy
Social Determinants
STRESS
SUBSTANCE USE/ABUSE
Translation
MEMBERSHIP

**Fellow:** Faculty with a $1M grant – or a sustained record of $3M – as the principal investigator.

**Mentee:** New investigators seeking supervised career development experience leading to research independence.

**Affiliate:** Faculty interested in being included in HRI programming and activities.

- Biomedical Engineering
- Graduate College of Social Work
- Health & Human Performance
- Hispanic Studies
- Law School
- Psychological, Health, & Learning Sciences
- Psychology
COMMUNITY ADVISORY BOARD: AFFILIATIONS
IMPACTFUL SPONSORED PROJECTS
Ezemenari M Obasi
Professor and Associate Dean for Research, College of Education

• B.S. Physics
• Ph.D. Psychology, Counseling
  • Minor is Quantitative Psychology
• Research Interests / Expertise:
  • Neurobiology of stress and addictions
  • Health disparities
  • Social determinants of health
  • Cultural predictors of health behaviors
  • www.ezemenariobasi.com

Director, Hwemudua Addictions and Health Disparities Laboratory
# Neurobiology of Stress and Drug Use Vulnerability, Health Disparities, Social Determinants of Health

## Objective
- Investigate trajectories of stress and immunological dysregulation as predictors of drug use vulnerability, severity, and susceptibility to chronic diseases.
- Investigate social determinants of health and chronic diseases
- Investigate barriers to accessing and receiving culturally-competent healthcare
- Culturally-informed health education and information dissemination

## Impact
- Director/Founder of UH’s HEALTH Research Institute
- One of the first longitudinal studies to investigate stress dysregulation and addictions in emerging African American adults
- Community-based obesity and Type 2 diabetes prevention in Third Ward and East End: [https://touch.healthuh.com/](https://touch.healthuh.com/)
- Development of early-stage investigators into a pathway of research independence

## Representative Funding as PI
- A community collaborative for preventing and treating obesity in underserved communities in Houston, United Health Foundation, MPI. 2016 – 2019. Awarded: $2,000,000.
Lorraine R Reitzel, Associate Professor, Department of Psychological, Health, & Learning Sciences, College of Education

- **Background**
  - Licensed Clinical Psychologist in Texas
  - Research Foci: Health disparities; cancer disparities; social determinants of health; cancer-related risk behaviors; tobacco control interventions; dissemination and implementation science; built environment effects on behaviors; training grants to diversify scientific pipeline
- **Expertise in Motivational Interviewing**
- **Chair, IRB1 at the University of Houston**
- **132 peer-reviewed publications; h-index = 33**
- [www.lorrainereitzel.com](http://www.lorrainereitzel.com)

Director, Social Determinants / Health Disparities Laboratory
Determinants and Mechanisms for Health / Health Risk Behaviors Among Vulnerable, Underserved and Low Socioeconomic Groups

Impact
Our work has had real-world impact on healthcare policies and practices; cited by CDC, SAMHSA, National Council. Example:
• Since 2013, changed the landscape of how tobacco use is addressed in behavioral health centers across Texas through dissemination and implementation of evidence-based multi-level systems intervention that included policy changes: [www.TakingTexasTobaccoFree.com](http://www.TakingTexasTobaccoFree.com)

Objective
- Influence of neighborhood and built environment on health behaviors/health risks/access to care and facilitators of healthy living
- Working in partnership with community agencies to implement evidence-based policy and practice changes
- Knowledge dissemination through tele-mentoring
- Understanding mechanisms of behavior change
- Health education and information dissemination
- Ethical considerations in research with vulnerable pops

Related Accomplishments/Research Efforts/Contracts
- **Training/Research in cancer prevention**: NIH/National Cancer Institute (P20 CA221697); Role: PI; 9/22/17 – 8/31/21; $1,271,195 and supplement (P20 CA221697-S1) 6/01/18 – 5/31/20; $286,549
- Systems intervention for tobacco control: Cancer Prevention & Research Institute of Texas (PP170070); Role: PI; 9/01/17 – 8/31/20; $1,348,851; Prior funding PP130032 and PP160081 (~$1,800,000); Role: MPI/PI
- **Breast cancer disparities**: UH/UH-D Synergy Grants; Role: MPI; 7/01/18 – 7/01/20; $59,117

Results from joinpoint regression models on thyroid cancer incidence trends in Texas, 1995-2008 by socioeconomic status for A) whole study pop; B) NH White; C) NH Black; and D) Hispanic survivors
For more information on the HEALTH Research Institute and its current initiatives:

Web: http://www.uh.edu/healthuh/
Email: hri@central.uh.edu
Twitter: @HEALTHuh
Facebook: @HEALTHuh

Dr. Ezemenari M. Obasi
Founder & Director
emobasi@uh.edu

Dr. Lorraine Reitzel
Co-Founder & Co-Director
lrreitzel@uh.edu
Bill Elder, PhD
Chair and Clinical Professor of the Department of Behavioral and Social Sciences

Kendra Smith, PhD
Director of Community Engagement

David S Buck, MD, MPH
Associate Dean for Community Health and Clinical Professor

University of Houston
College of Medicine
Population health, values (asset)-based care with underserved

Gaps / opportunities
• Improving point of care processes and Tx & counseling re: SDoH, behavioral health and teamwork
• If social determinants are 80% of healthcare impact, how can it be actionable?
• Engaging communities to improve health

Research Objectives
I. Improving access to and quality of care
II. Asset Vs problem based approach for difficult to engage populations
III. Community-engaged/based participatory research
IV. Care coordination to reduce re-admit/arrest
V. Actionable social determinants of health
VI. Community engagement in health interventions
VII. Changing clinical process for care transformation
VIII. Physician – Patient interactions
IX. Decision making at the point of care

Areas of collaboration with Baylor College of Medicine (BCM)
• Innovate, test & refine new care models
• Engage difficult to reach populations
• Enhance primary care access
• Improve physician and patient activation and satisfaction
• Community Engagement Core for CTSA
• Peer support through navigation and counseling
• Maternal and infant health disparities

Related Accomplishments/Research Efforts/Contracts
• Development of NGOs addressing workforce, training shortages and care for underserved populations
• Development of EHR integrating SDoH into care coordination
• Creating IPE for Med students (HRSA)
• Develop educational models for transformed care (HRSA)
• Pragmatic studies on LBP (NIH) and BH integration
• Opioid prescribing practices (Pfizer)
Ioannis A. Kakadiaris
Hugh Roy and Lillie Cranz Cullen Distinguished University Professor
Computer Science

Competencies: Kakadiaris
• AI / Deep Learning / Machine Learning
• Image / Video Analysis

Competencies: CS@UH
• Natural Language Processing
• Distributed Ledger (Blockchain)
• Data Mining / Visualization
• Physical and Cybersecurity
• Human Computer Interaction
Selected Accomplishments & Value

1. **Pioneered** the combined use of machine learning and game theory for the **prediction of adverse cardiovascular events**.
   - Machine-learning driven guidelines about who should take statin.

2. **Invented** an imaging protocol using microbubbles and developed the **image analysis** tools for detecting inflammation in atherosclerotic plaques from Intravascular Ultrasound images.
   - Allows surgeons (for the first time) to evaluate plaque inflammation and activity (to decide if a stent is warranted) **using an existing catheter design**.

3. **Designed, implemented** and tested **deep learning algorithms** that work on 2D facial images that include, non-frontal poses, facial expressions, Occlusions, outdoor illumination & age variation
   - Allows robust identity management using **one’s face as a password** or a **passport** with the advantage of **convenience** and **speed**.
Potential Collaborations: AI-Powered Computing

1. Decision Support for Diagnosis
   • Refined staging system
2. Understanding of rare diseases
   • Text, imaging data, genomics
3. Generating insights into Population
   • Smart sensors and analytics
4. Risk Screening / Prediction
   • During Hospitalization
     - Surgical Outcome
     - Medication effectiveness / interactions
   • Before Discharge
     - Risk of Fall (patient profile & environment)
     - Facial Analysis to Identify Rare Conditions
5. Decentralized Digital Identity
6. AI for Low Resource Areas
7. Improving Operations
Nuri INCE, Associate Professor, BME

**Background**
- Clinical Neural Engineering Laboratory
- Discover Neurobiomarkers for the Diagnosis and Treatment of Neurological Disorders
- Parkinson’s Disease, Epilepsy
- Neural Signal Processing and Interfacing
- Record Neural Data in Clinical Setting/Intraoperatively
Clinical Neural Engineering

Objective: Neurobiomarker Discovery
- Identify electrophysiological signatures to distinguish PD subtypes
- Investigation of large scale neural recordings with computational intelligence in Epilepsy.

Description of Efforts
- Together with neurosurgeons and neurologist at BCM, we recorded local field potentials during awake brain surgeries.

Impact
- Development of novel neuromodulation techniques for PD subtypes
- Technology for real-time intraoperative brain signal analysis
- Detection of seizure generating brain regions through brief invasive monitoring

Related Accomplishments/Research Efforts/Contracts
- UH + BCM funded by Medtronic in 2017
- UH + BCM funded by Abbott/St.Jude in 2018
Karolos Grigoriadis
Moores Professor, Mechanical Engineering
Dynamic Systems Control Laboratory

Areas of Expertise:

• Systems Modelling and Simulation
• System Estimation and Identification
• Model Reduction and Simplification
• System Monitoring and Diagnostics/Prognostics
• Fault Detection
• System Optimization
• Feedback Control and Automation
• System Adaptation
Computerized Decision Support and Automation of Treatment

**Objective** Optimize administration of vasopressors/fluids for critical patient resuscitation to achieve hemodynamic stability
- Trauma/Hemorrhage, TBI, Burn, Sepsis
- Regulate physiological response to target levels
- Address inter/intra-patient variability
- Avoid under/over-resuscitation
- Computerized decision support for treatment
- Adaptive automated closed-loop administration of drugs/fluids

**Future Efforts**
- Response modelling for various treatments
- Dynamic drug dosing optimization
- Personalized response-based dose/regimen selection
- Virtual patient response models
- Applications:
  - Cancer
  - Anesthesia
  - HIV
  - Infectious diseases

**Research Efforts & Collaborations**
- Validation of animal experiments
- Computer vs MD comparisons
- GUI/Virtual patient models

Virtual Patient GUI

- Assessment and statistical analysis of open-loop and closed-loop drug/fluid administration strategies on varying simulated scenarios
- Virtual patient for MD training
- Bed-side decision support to assist treatment
Elena L. Grigorenko, Professor
UH (Psychology/TX Institute for Measurement, Evaluation, and Statistics)
BCM (Molecular and Human Genetics/Pediatrics)
# Developmental, Cognitive, and Behavior Neuroscience /Clinical Psychology (Forensic Specialization)

## Objectives
- Early brain injury as a predictor of subsequent development (conduct disorder and learning disorders)
- Genomic lesions and developmental (language and cognition) outcomes
- (Behavioral) intervention effectiveness

## Impact
- Quantifying, qualifying, and predicting child (cognitive) development
  - The ‘Developmental Origins of Health and Disease (DOHaD)’ hypothesis
  - The transmission of diffused (risk and protective) phenotype hypothesis

## Description of Efforts
- Large-scale datasets
- Utilization of genetic information

## Related Accomplishments/Research Efforts/Contracts
- Current partners
  - HCJPD
  - HISD
  - Independent schools for children with learning difficulties
  - **Linking to the TX Children’s databases?**
- Current funding sources
  - NIH
  - DOE
  - Private Foundations
Preethi Gunaratne, Ph.D.
Moores Professor, Biology & Biochemistry
Director, UH-Sequencing & Gene Editing Core, Natural Science & Mathematics

• **Background – Education & Training**
  • Ph.D. Genetics, Cornell University, Ithaca, NY
  • Post Doc. Hematology/Oncology, Lurie Cancer Center, Northwestern University, Chicago, IL
  • Post Doc., Department of Human & Molecular Genetics, Baylor College of Medicine
  • Board Certification – Clinical Molecular Genetics & Medical Genetics (1999)
    • Fellow of the American College of Medical Genetics (F.A.C.M.G.)

• **Positions Held - Department of Biology & Biochemistry, UH**
  • Director, UH-Sequencing & Gene Editing Core (2015-Present)

• **Positions Held – Baylor College of Medicine (BCM)**
  • 1998-1999  Assistant Director, Baylor DNA Diagnostic Lab
  • 1999-2005  Baylor Human Genome Sequencing Center (Baylor-HGSC)
    Director, cDNA Sequencing Team; Member, Dan L. Duncan Cancer Center
  • 2005-Present  Adjunct, Baylor HGSC, Departments of Molecular & Cell Biology & Pathology, BCM

• **Leadership Roles in National Consortia**
  • Leader Long non-coding RNA (LncRNA) Analysis Working Group
    NCI – TCGA PanCancer Consortium (2016-2018)
  • Leader microRNA Analysis Working Group
    NHGRI – Marmoset Genome Consortium (2010-2013)
    NHGRI – Zebrafinch Genome Consortium 2009
  • Leader Baylor Human Genome Sequencing Center – cDNA Sequencing Team
    NHGRI – The International Human Genome Project Consortium 1999-2003
Data Analytics Platform 1 (Est. 2008)
New Druggable Target and Biomarker Discovery Pipeline

Objective
- Discovery of novel disease gene networks from the microRNA & LncRNA-Regulated Transcriptome
- Extract Blood-based microRNA biomarkers for Predicting Suicide Events in Patients with Depression
- (Thomas Kosten-BCM) - 2019

Description of Efforts
- Established Non-Coding RNA Integration Pipeline Designed to Mine The Cancer Genome Atlas (TCGA) and other Disease Genome Projects

Impact
- Assembled a Multi-institutional Multi-disciplinary Consortium
  - UH – Gunaratne
  - BCM – Matzuk, O’Malley, Goodell, Donehower, Corry, Kheramand, Gibbs, Creighton, Coarfa, Sumazin, Anderson, Hawkins
  - Texas Children’s Hospital – Yustein, Sumazin, Lopez-Terrada, Shohet
  - MDACC – Sood, Bedrosian, Akbani
  - Texas Methodist Hospital – Chang, El-Zein

Related Accomplishments/Research Efforts/Contracts
- Contracts: 22 Grants
  - NIH - NCI, NHLBI, NIGMS, NIDDK, NIAID, NICHD, NIMH, SBIR
  - CPRIT
  - Ovarian Cancer Research Fund, Cullen Foundation, McNair Foundation, Multiple Myeloma Foundation

- Publications: 72 Total (2008-Present)

- Patents: 3 Published, 3 Pending
## Remote Sensing Disease Onset and Progression via Single Cell Sequencing

### Objective
- Establish functional genomics & data analytics platform to integrate Single Cell Sequencing & Whole Exome Sequencing Datasets

### Description of Efforts
- Mapping the Immune Repertoire and Neoantigen landscape underlying the Evolution of Precancerous Lesions
- Single Cell Sequencing of Natural Killer Cell Population in Chronic Disease and Cancer Samples
- Monitoring Astronauts’ Exposure to Radiation under Microgravity

### Impact
- Designing Tumor Vaccines to Neoantigen for Cancer Prevention
  (UH-BCM-MDACC-TMH)
- Harnessing the Potential of Natural Killer Cells in Treatment of Chronic Diseases and Cancer
  (UH-Columbia)
- Monitoring the Immune System to Capture Early Responses to Pre-Cancerous Lesions
  (UH-BCM-NASA)

### Related Accomplishments/Research Efforts/Contracts

#### Contracts
- NIH-1R01AI137275-01A1
- NASA
- NCI-Pre Cancer Genome Atlas (Gunaratne et al. In Preparation)

#### Publications
- Chen et al. *Immunity*, 2018
- Moreno-Villanueva et al. *Int. J. Mol. Sci.* 2019
Objective

- Establish functional genomics & data analytics platform to integrate Single Cell Sequencing & Whole Exome Sequencing Datasets

Description of Efforts

- Led TCGA Non-Coding RNA Analysis Working Group to Define Biomarkers for Pan Gynecologic and Pan Squamous Cancers

Impact

- Developing the First Single Cell Biopsy for Early Detection of Gynecologic Cancers from Pap Smears
  - (UH-BCM-TXCCC-MDACC)

Related Accomplishments/Research Efforts/Contracts

- **Contracts**
  - CPRIT - $2M Grant – New Faculty Recruitment (Rohit Reddy – Electrical & Computer Engineering)
  - NCI-Pre Cancer Genome Atlas (Gunaratne et al. -In Preparation)

- **Publications**
  - Berger et al. Cancer Cell 2018
  - Chiu et al. Cell Rep 2018
  - Campbell et al. Cell Rep 2018
Funding Request to Support Data Analytics Platform 2

TEAM

Next Gen Sequencing & Data Analytics
- Preethi Gunaratne (UH)
  - Mitchell Rao
    (Chad Shaw-BCM -> UH)
- Cristian Coarfa (BCM)
  - Kimal Rajapakshe
    (John Miller-UH -> BCM)
- Pavel Sumazin (BCM-TXCCC)
  - H. S. Chiu
- Rehan Akbani (MDACC)
  - Rupa Kanchi

Blood & Tissue Procurement
- Thomas Kosten (BCM)
- David Neilson (BCM)
- Jason Yustein (BCM)
- Isabelle Bedrosian (MDACC)
- Randa El-Zein (Texas Methodist Hospital)
- Hong Lu Wu (NASA)

Animal Models/In Vitro Analysis
- Therese Kosten (UH)

CURRENT FUNDING
NCI-R01CA218036; NIAID-1R01AI137275-01A1
CPRIT-RP180674-C2; NASA, KOSTEN

FUNDS NEEDED
$35K (50% EFFORT – MITCHELL RAO)
Rep. Sheila Jackson Lee, Houston residents push for study on rail yard contamination

Erin Douglas | April 24, 2019 | Updated April 24, 2019 10:02 p.m.

The view of a Union Pacific train going east from Lavender Street on Thursday, March 21, 2019, in Houston.

Photo: Yi-Chin Lee, Staff / Staff photographer

The Texas Commission on Environmental Quality said Wednesday that it would ask state health officials to conduct a cancer-cluster study in a northeast Houston neighborhood where residents have lived for decades with toxic chemicals and contamination from a nearby railroad yard.
Intersection of geography, machine learning, and electronic health records (EHRs)

<table>
<thead>
<tr>
<th>Gaps / Opportunities</th>
<th>Hypotheses</th>
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<tbody>
<tr>
<td>• Neighborhood data are not integrated into EHRs</td>
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<tr>
<td>• Geography is not routinely included in prediction tools</td>
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<tr>
<td>• Prediction tools that use geography and neural networks will outperform those that do not</td>
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<tr>
<td>• Prospectively, prediction tools will outperform clinician predictions</td>
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<tr>
<td>• Patients randomized to risk-stratified interventions will achieve better health compared to usual care</td>
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<thead>
<tr>
<th>Areas of collaboration with Baylor College of Medicine (BCM)</th>
<th>Related Accomplishments/Research Efforts/Contracts</th>
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<tbody>
<tr>
<td>• Use the BCM Clinical Data Warehouses to develop the tools</td>
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<tr>
<td>• Integrate clinical decision support systems into BCM electronic health records</td>
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<tr>
<td>• Connect patients at high risk for poor health outcomes with BCM interventions (e.g. Elizabeth Vaughan’s community health worker intervention)</td>
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<tr>
<td>• Collaborate with BCM researchers to select outcomes to predict</td>
<td></td>
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<tr>
<td>• Social Deprivation Index. <em>Health Serv Res.</em> 48(2 Pt 1).</td>
<td></td>
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<tr>
<td>• Living in deprived communities is associated with poor diabetic control. <em>J Am Board Fam Med.</em> 31(3).</td>
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<table>
<thead>
<tr>
<th>Future Directions</th>
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<tbody>
<tr>
<td>• Incorporating EHR free text into prediction models</td>
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<td>• Additional types of data, including wearables and social services</td>
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<tr>
<td>• Humana Integrated Health System Sciences Institute Humana Healthcare Research Database: 26 million members</td>
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</tbody>
</table>
Background

- Our group has expertise in multispectral and multi-modality cell and tissue imaging instrumentation, development of nanomaterials for imaging, and computational quantitative analysis of images using deep learning methods.
Objective Comprehensive quantitative profiling of brain cellular alterations due to primary and secondary injury, combination drug treatments, healing processes, infections, tumors...
Microscopy at the Macro Scale

Knife-Edge Scanning Microscopy

Array Tomography

radius (μm)

3.33 10.0 70.0 74.0

30.0 20.0 10.0

100μm

1mm

0.5mm

100μm
In-vivo OCT and Label-free Molecular Diagnostics
AI for Medical Image Analysis

Figure 1: Prediction of gene knock-down effects on cell shapes using deep networks

Figure 2: Modeling uncertainty in deep learning

Figure 3: Immune cell apoptosis classification with dynamically voting deep networks
Single Cell Imaging and Analysis

Heterogeneity of Metabolic Activities of HeLa

Drug Responses

STF-31 (metabolic inhibitor) added to HeLa cells

3D Membrane Map of Single Cells
Pablo Guillen-Rondon, Research Assistant Professor/Faculty, Hewlett Packard Enterprise Data Science Institute

Pablo Guillen-Rondon is a Research Assistant Professor/Faculty at the HPE Data Science Institute, University of Houston, Houston, TX, USA. He holds a B. Sc. Degree in Mathematics and a M. Sc. Degree in Applied Mathematics, a PhD in Biomedical Engineering, and a Postdoc in Computational Science from University of Texas at El Paso, El Paso, TX, USA. During the last 20 years he has been working on Research and Development projects related to Oil, Gas, and Biomedical Sciences. These projects have been in different areas such as: Artificial Intelligence, Machine Learning, Data Mining, Data Reconciliation and Fault Diagnosis, Reservoir Simulation, Geophysics, Geothermal, Gas, Processing of Signals, Images, and Visualization. Universities and Companies funded these projects. He has been a keynote speaker in several Conferences, and he has over 115 papers published in Journals and Conferences.
USES OF MACHINE LEARNING FOR BIOMEDICAL RESEARCH

Convergence of various disciplines

Engineering

Translational Medicine

Medicine

Artificial Intelligence

Health Economics

Physical Science

Emergence of translational medicine

DNA sequence, Epigenomic states, Single cell gen expression activity, Proteomics, functional and phenotypic measures, Lifestyle properties, etc

Big data

Precision Medicine Platforms

Artificial Intelligence

Building Models

Machine Learning

Cognitive Computing

Deep Learning

Supervised Learning

Reinforcement Learning

Unsupervised Learning

Translational medicine is the science that bridges biomedical research, clinical practice and improved health, characterized by:

- Therapeutic and preventive solutions tailored to individual patient’s needs
- Innovative tools based on emerging technologies and artificial intelligence
- Data-intensive approaches
- Novel health systems and economic model
**Objective** Machine learning for integrating data in medicine and biology.

- No single data type can capture the complexity of all the factors relevant to understanding a phenomenon such as a disease.
- Integrative methods that combine data from multiple technologies have thus emerged as critical statistical and computational approaches.
- The key in developing such approaches is the identification of effective models using machine learning algorithms to provide and identifying important features and predicting outcomes, by harnessing heterogeneous data across several dimensions of biological variation.

**Data integration:** *the process by which different types of biomedical data are combined as predictor variables to allow for more thorough and comprehensive modeling of biomedically relevant outcomes.*
USES OF MACHINE LEARNING FOR BIOMEDICAL RESEARCH

Computational methods for the analysis of single-cell analysis:
- Integrative single-cell
- Cell type discovery and exploration
- Single-cell multi-omics
- Large-scale single cell bioinformatics
- Clustering
- Classification
- Visualization
- Multi-GPU technology

Deep Learning to Classify Single-Cell RNA Sequencing in Primary Glioblastoma

<table>
<thead>
<tr>
<th>Variable</th>
<th>Relative Importance</th>
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<tbody>
<tr>
<td>AQP4</td>
<td>1.00</td>
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<tr>
<td>CADPS</td>
<td>0.98</td>
</tr>
<tr>
<td>SGK1</td>
<td>0.97</td>
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<tr>
<td>AXL</td>
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<tr>
<td>DPP6</td>
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<tr>
<td>NUDT4</td>
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<tr>
<td>CRBI</td>
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<tr>
<td>IGHCC4</td>
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<tr>
<td>JAG1</td>
<td>0.95</td>
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<tr>
<td>ARHGP26</td>
<td>0.94</td>
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</tbody>
</table>
USES OF MACHINE LEARNING FOR BIOMEDICAL RESEARCH

Impact
• to provide researchers a precision genomics platform to support the discovery, development, and delivery of precision medicine.
• combining precision engineering with cutting-edge biochemistry, we see the opportunity to greatly impact the economics and success of the development and clinical use of precision therapies.
• machine learning can help to better understanding precision therapy selection at diagnosis as well as disease monitoring and subsequent treatment strategy.

Research/Experiences
• Machine learning applied to deep brain stimulation (DBS) for Parkinson disease
• Machine learning to characterize epileptic patients using EEG data
• Data mining and machine learning to characterize HRV
• Data mining applied to EEG signal for monitoring anaesthetic depth during propofol infusion
• Sparse Representation via l1-minimization for Underdetermined Systems in Classification of Tumors with Gene Expression Data
• Machine learning to Classify Single-Cell RNA Sequencing in Primary Glioblastoma
• Breast Cancer Classification: A deep learning approach for digital pathology
• Convolutional Neural Networks for Breast Cancer Histopathological Image Classification