

Center for Computational Systems Biology

2021-04-30

Seungchan Kim, Ph.D.

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<https://ccsb.pvamu.edu>

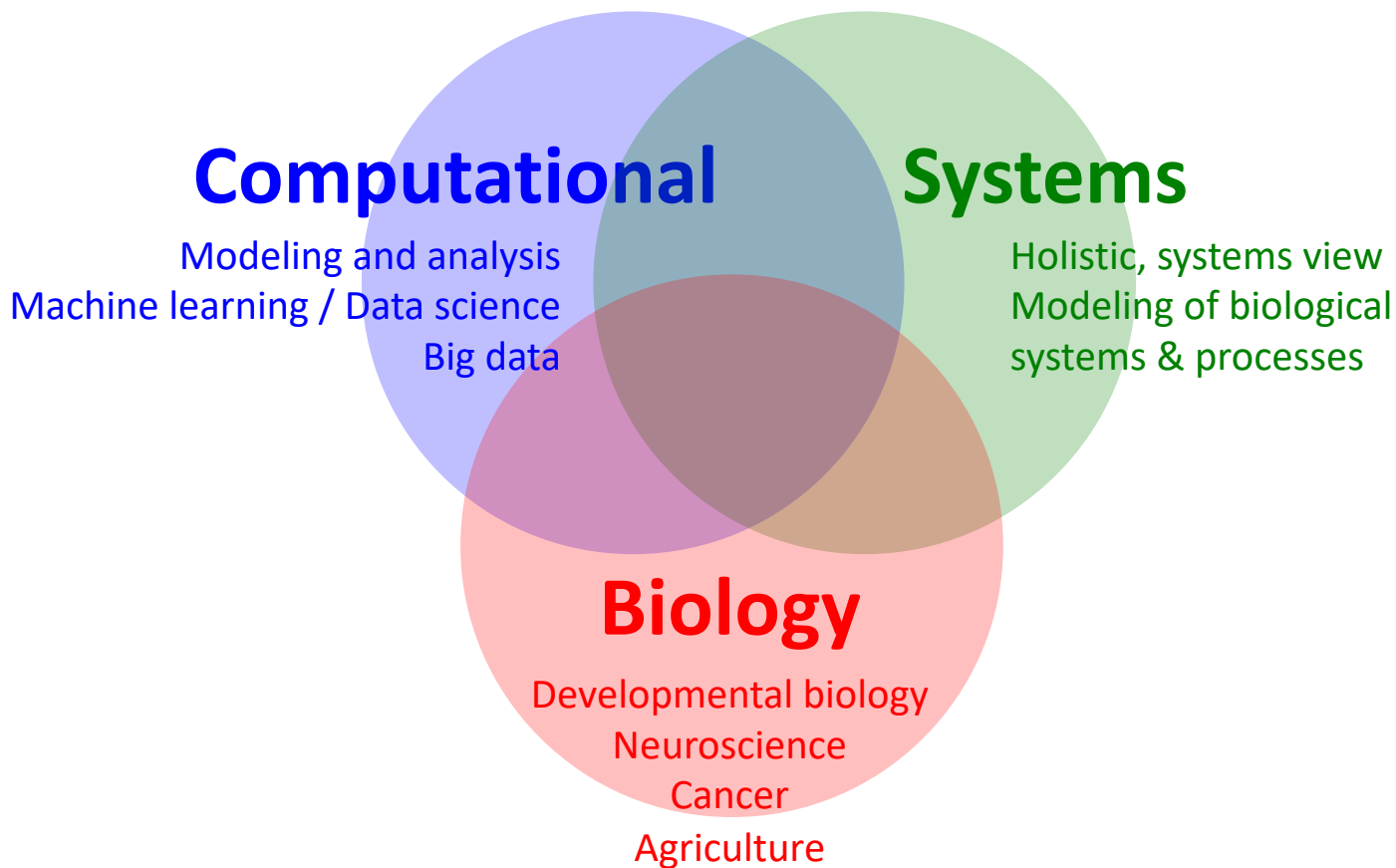


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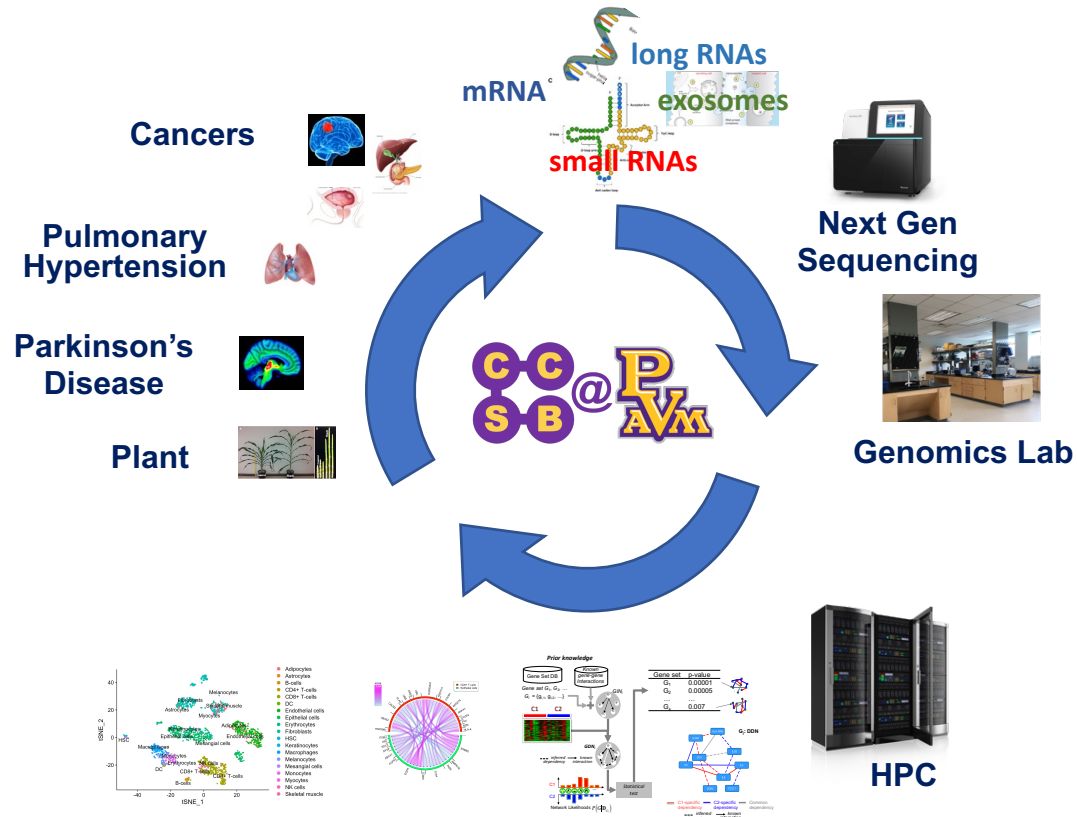
Center for Computational Systems Biology

- Established in 2017, funded by Texas A&M University Systems Chancellor's Research Initiative (CRI)
 - 2 Tenured/Tenure-track faculty (core members)
 - 3 Research faculty
 - 1 research associate
 - 1 graduate student, 2-3 additional students in consideration
 - 2 undergraduate students, 2-3 additional students in consideration
- New courses for students
 - 1 undergraduate course – under consideration with the University committee
 - 3 graduate courses – approved

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Xishuang Dong, Ph.D., Assistant Professor

Center for Computational Systems Biology | Machine Intelligence Biology Lab
Department of Electrical and Computer Engineering
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- **Research Areas:** Machine learning based computational systems biology, Biomedical information processing, Deep learning for big data analysis, Natural language processing,
- **Deep Learning Theory and Application:** Semi-supervised Deep Learning, Deep Transfer Learning, Ensemble Deep Learning
- **COVID-19 Data Analysis:** COVID-19 Classification of Chest Radiography Image and Image Segmentation with Deep Learning
- **Fake News Detection on Social Media:** Detecting Fake News on Social Media Data with Semi-supervised Learning

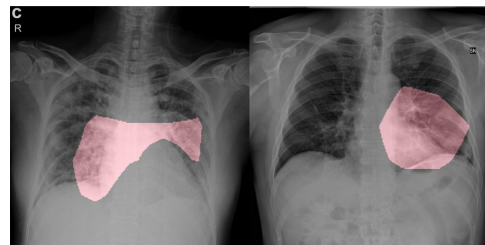


Figure 1. Chest radiography images of COVID-19 cases from 2 different patients

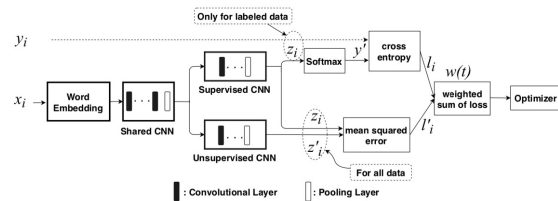


Figure 2. Semi-supervised deep learning



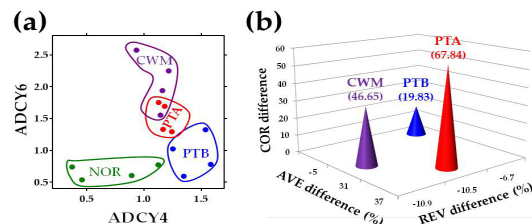
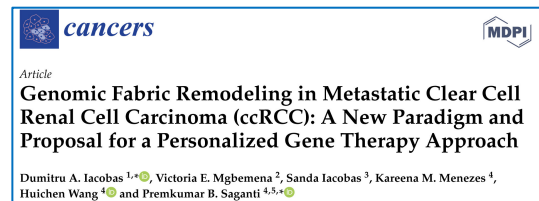
Dumitru Iacobas, Ph.D., Research Associate Professor

Center for Computational Systems Biology | Personal Genomics Lab

Department of Electrical and Computer Engineering

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- **Research Areas:** Experimental and Computational Genomics, Systems Biology, Biophysics
- **Research Focus:** Remodeling of functional genomic fabrics in cancer, neurodegenerative and cardiovascular diseases
- **Objectives:**
 - Comprehensive characterization of gene networks alterations in disease and recovery following a treatment;
 - Develop personalized genomics procedures and analytical tools for cancer diagnostic and gene therapy.
- **Research Methods:**
 - Optimized wetlab protocols, experimental designs and normalization and filtration algorithms;
 - Genomic Fabric Paradigm that considers the transcriptome as a multi-dimensional mathematical object constraint by selective control of transcripts' abundances and expression correlations among genes;



Transcriptomic differences among 3 equally graded cancer nodules (PTA, PTB, CWM) and the normal tissue (NOR) from a surgically removed metastatic kidney cancer.



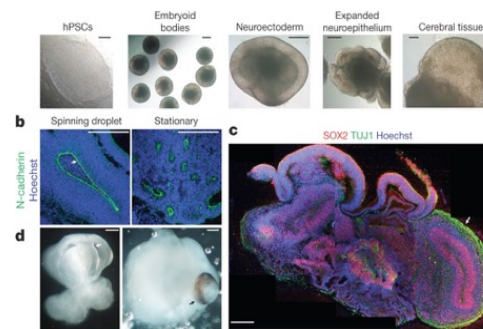
Anna Joy, Ph.D., Research Associate Professor

Center for Computational Systems Biology | Genomics Lab

Department of Electrical and Computer Engineering

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- **Research Areas:** Biomarker and therapy development for primary and metastatic brain tumors, Genomics, Brain organoid tumor models.
- **Brain organoid tumor models**
 - Develop 3D in vitro model of Glioblastoma brain tumors and Breast Cancer Brain Metastasis using brain organoids.
 - Use for discovering and testing new therapeutics, molecular mechanistic studies.
 - Discover targetable tumor-microenvironment interactions.
- **Immune Subtypes to improve immunotherapy in brain tumors**
 - Find Glioblastoma brain tumor immune subtypes.
 - Determine subtype-specific response to therapy.
 - Investigates mechanisms of Immune suppression.



Lancaster, Renner, M, Martin, C, Wenzel, L, et al. (2013). *Cerebral organoids model human brain development and microcephaly*. Nature. 501. 10.1038/nature12517.

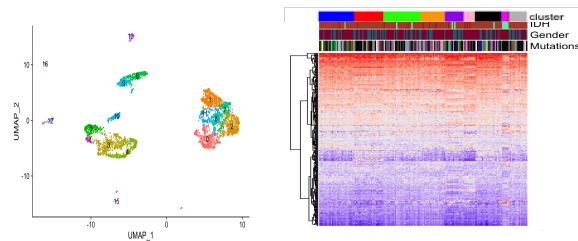


Figure 1. UMAP plot of Glioblastoma single cells from GSE 84465 used to derive immune-specific genes (a). Heatmap of immune subtypes in GBM (b).



Tesfamichael Kebrom, Ph.D., Research Scientist

Center for Computational Systems Biology | Plant Systems Biology Lab

Department of Electrical and Computer Engineering

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- **Research Areas:** Plant Physiology, Plant Systems Biology, and Crop Yield Improvement
- **Research Focus:** Investigating the physiological and molecular basis of shoot branching (Fig. 1) and stem growth (Fig. 2) in plants.
- **Objectives:** Identifying molecular pathways and genes that control shoot branching, stem growth and biomass accumulation and alter the function of the genes to increase the yield of crops grown for food (grain), feed and biofuels (stem).
- **Research Methods:** Growing plants under controlled environmental conditions that increase or decrease shoot branching or stem growth and identify molecular pathways and genes that control changes in branching or stem growth using computational tools developed at CCSB.



Figure 1. Excessive branching in WT wheat reduces yield, and limited branching in *tin* increased yield

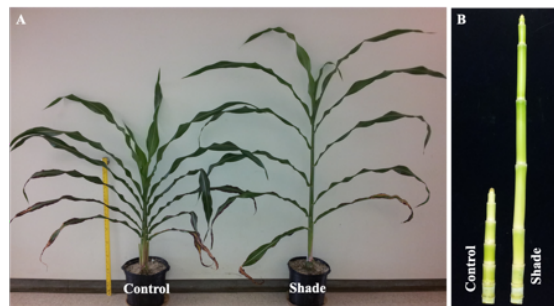
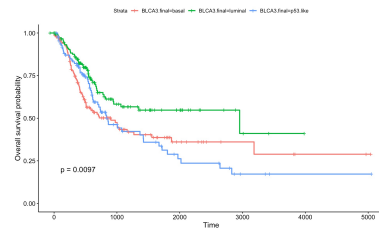
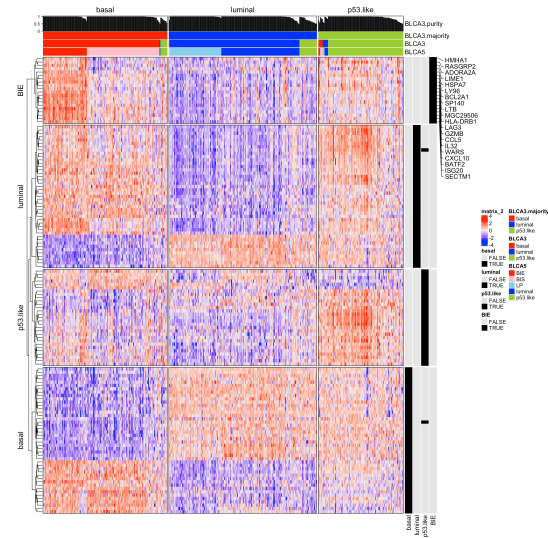


Figure 2. Far-red light (shade signal) treatment for two weeks increased stem growth and biomass accumulation in sorghum



Seungchan Kim, Ph.D., Chief Scientist, Executive Professor
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- **Research Areas:** Computational Systems Biology, Bioinformatics, Machine Learning, Cancer Genomics
- **Research Focus:**
 - computational modeling of molecular networks
 - development of computational methods to analyze high throughput multi-omics data to identify disease biomarkers
 - computational models to diagnose patients or predict patient outcomes, for example, disease subtypes or drug response
- **Highlight:**
 - Discovery of exosome biomarkers for early detection of pancreatic cancer (NCI sponsored, in collaboration with City of Hope, Duarte, CA)
 - Biomarker discovery of bladder cancer subtypes (DoD CDMRP sponsored, in collaboration with Johns Hopkins Medical School, Baltimore, MD)



Research Publications

Year	2018	2019	2020	2021*
Journal	12	10	11	5
Conference	3	6	2	0
Book chapters	1	0	0	0

*** In progress**

Summary

- Overall proposal activities keeps improving significantly
 - 30 proposals (>\$18M) submitted in 2020
 - Also, all CCSB members submitted at least 2 or more proposals as a PI
- Overall funding improved (CCSB primary + CCSB participating)
 - >\$850K (2020) and ~\$740k (2019) secured
 - Almost all CCSB members have at least an externally funded project
- CCSB members continue to publish research in peer-reviewed journals and conferences
- Joint US provisional patent was filed with University of Pittsburgh, based on 3+ years of collaboration on pulmonary hypertension and drug repurpose.

Acknowledgement

- CCSB Members: Sumithra Weerasooriya (Research Associate), Lucy Nwosu (Ph.D student), Nneka Ede (former undergraduate student), Lijun Qian (CREDIT), Xianfang Li (CREDIT)
- Collaborators: CREDIT@PVAMU, JHMI, City of Hope, TGen, UPMC, Channing Lab@Harvard, NYMC, Albert Einstein College of Medicine, M.D. Anderson Cancer Center, Texas A&M University.
- Funding:



Chancellor
THE TEXAS A&M
UNIVERSITY SYSTEM



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Early Detection Research Network



THE MICHAEL J. FOX FOUNDATION
FOR PARKINSON'S RESEARCH

