

## Applied Bioinformatics

### Course Description

This course provides an introductory survey for the interdisciplinary field of bioinformatics. Bioinformatics applies computing and information technology tools to gain insight into genomic and proteomic data. The central focus of the field was on using large datasets and computational and statistical methods to answer biological questions. Students will use existing tools and learn the underlying algorithms. Major topics in bioinformatics will be explored. Hands-on lab sessions will provide an opportunity to use and experiment on bioinformatics software and databases in current genomic and bioinformatic-based research.

The target audience of this course is students majoring in medical informatics or computing science. A background in biology is beneficial but not required.

### Topics

- Overview of history and future of bioinformatics
- Biological data models and bioinformatics databases
- Sequence alignments and searching
- Gene identification
- Comparative genomics and phylogenetic analysis
- RNA folding and visualization
- Protein analysis
- Genome analysis
- Systems biology
- Current topics in bioinformatics - student presentations

### Propose time

Winter semester (Oct 2024 – Feb 2025), over 2 weeks onsite sessions + other online components.

### Assessment:

Items	%	Description
Team project assignments	48%	A substantial semester-long team project
	7%	Peer evaluation
Participation and individual assignments	25%	Participation of various in-class activities and individual assignments
Presentation of a research paper	10%	Student will present a research paper to the class
Quiz	10%	A comprehensive closed-book assessment
<b>Total</b>	<b>100%</b>	

## References

Arthur Lesk, *Introduction to Bioinformatics*, 5th edition, Oxford University Press, 2019.

Phillip Compeau and Pavel Pevzner, *Bioinformatics Algorithms: An Active Learning Approach*, 3<sup>rd</sup> edition, 2018.

Jeremy J. Ramsden, *Bioinformatics: An Introduction*, 3rd edition, Springer London Ltd., 2016.

Greg Gibson and Spencer V. Muse, *A Primer of Genome Science*, Third Edition, Sinauer Associates Inc, 2009.

James Tisdall, *Beginning Perl for Bioinformatics: An Introduction to Perl for Biologists*, O'Reilly Media, 2001.

James Tisdall, *Mastering Perl for Bioinformatics*, O'Reilly Media, 2003.

Sandro Skansi, *Introduction to Deep Learning: From Logical Calculus to Artificial Intelligence*, Cham, Switzerland: Springer International Publishing AG, 2018.

## Instructor



Herbert H. Tsang is Professor of Computing Science & Mathematics and Director of the Applied Research Lab at Trinity Western University, BC, Canada. His research applies computational technologies to solve real-world problems that benefit humankind. His ongoing research interests include computational intelligence, bioinformatics, optimization, mobile computing, and scientific visualization. He is also an Adjunct Professor at the School of Interactive Arts and Technology at Simon Fraser University (SFU). At SFU, he taught in the Schools of Computing Science, Engineering Science, Interactive Arts & Technology, and Mechatronic Systems Engineering.

Professor Tsang worked as a postdoctoral researcher at the University of Calgary from 2009-2011 with support from the Natural Sciences and Engineering Research Council of Canada (NSERC) Postdoctoral Fellowship. Previously, he was a scientific and engineering staff at MacDonald Dewtttiler and Associates, where he worked on various remote sensing, space and defense projects with the Canadian Space Agency and Canadian Navy.

Dr. Tsang received grants from all three Canadian Government research funding agencies: the Natural Sciences and Engineering Research Council of Canada (NSERC), the Social Sciences and Humanities Research Council of Canada (SSHRC), and the Canadian Institutes of Health Research (CIHR). Also, Professor Tsang received support from M.J. Murdock Charitable Trust

and Mitacs. In recognition of his outstanding work as an innovative scholar in mobile learning, Dr. Tsang received the International E-Learning Association's Mobile Learning Award in 2018 and the Canadian Network for Innovation in Education's Excellent and Innovation - Partnership & Collaboration Award in 2019.

Professor Tsang is a Senior Member of the Institute of Electrical and Electronics Engineers (IEEE), the Association for Computing Machinery (ACM), and the IEEE Computational Intelligence Society. Prof. Tsang is licensed as a Professional Engineer (P.Eng.) in British Columbia and he served as a mentor for engineer-in-training at the Engineers and Geoscientists of BC. Tsang served as a guest editor for the Security Informatics journal and reviewer for numerous publications (IEEE/ACM Transactions on Computational Biology and Bioinformatics, and OUP Bioinformatics) and granting agencies (Natural Sciences and Engineering Research Council of Canada and Estonian Research Council).

Prof. Tsang received a M.S. in Electrical Engineering from Washington University in St. Louis, MO, USA and Ph.D. in Computing Science from Simon Fraser University, Burnaby, BC, Canada. He also holds master's degree in music from Boston University, Boston, MA, USA.

To see Dr. Tsang's research projects, go to this link or visit his website at <http://www.HerbertTsang.org>

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