**Protein Crystallography**

**JBB2025S**

**Departments of Biochemistry, Molecular Genetics and Medical Biophysics**

**January 2018**

**Instructors:**

1) J.M. Rini (course coordinator)

MaRS West Tower, Room 1614  
416-978-0557

[james.rini@utoronto.ca](mailto:james.rini@utoronto.ca)  
  
2) P.L. Howell  
Peter Gilgan Centre for Research & Learning, Room 20-9-715

416-813-5378

[howell@sickkids.ca](mailto:howell@sickkids.ca) 

3) G. Privé

MaRS Toronto Medical Discovery Tower Room 4-302   
416-581-7541

[prive@uhnres.utoronto.ca](mailto:prive@uhnres.utoronto.ca)   
  
4) T. Moraes

MaRS West Tower, Room 1613

416-946-3048

[trevor.moraes@utoronto.ca](file:///D:\rini\txt\5teaching_reports_theses\lecture\jbb\2025\xtal2025.14\trevor.moraes@utoronto.ca)

**Time:** 10:00 am - 12:00 noon

**Location:** Medical Sciences Building, Rm. 3278

**Lecture Dates:** Friday January 5, 2018 to Friday April 6, 2018

**Course Evaluation:**

Problem Set 1 (15%) - Re. Lectures 1-3 - due Friday Feb 2

Problem Set 2 (35%) - Re. Lectures 4-7 - due Friday Mar 2

Problem Set 3 (35%) - Re. Lectures 8-11 - due Friday Apr 6

Problem Set 4 (15%) - Re. Lectures 12-13 - due Friday Apr 20

**Course Outline:**

**Lecture 1 - Lynne Howell - Jan 5**

**Lecture 2 - Lynne Howell - Jan 12**

**Lecture 3 - Lynne Howell - Jan 19**

*Rupp Chapters 5.1, 5.2, 5.4, 6, 9.1, (overview of 9.2 and 9.3 )*

* Crystals, lattices (real and reciprocal) and planes
* Diffraction basics: Scattering of X-rays, Ewald sphere, X-ray absorption
* Reconstruction of electron density: Fourier transforms, convolution and factors that affect electron density map calculation

**Lecture 4 - Gil Privé - Jan 26**

**Lecture 5 - Gil Privé - Feb 2**

**Lecture 6 - Gil Privé - Feb 9**

**Lecture 7 - Gil Privé - Feb 16**

*Rupp Chapters 3, 4, 5.2, 5.3, 8, 9.2, 9.3 and part of 10.3*

* Space groups and symmetry
* Crystallization
* Instrumentation and generation of X-rays
* Data collection and reduction

**Lecture 8 - James Rini - Feb 23**

**Lecture 9- James Rini - Mar 2**

**Lecture 10 - James Rini - Mar 9**

**Lecture 11 - James Rini - Mar 16**

*Rupp Chapters 9.4, 10 and 11*

* Patterson and molecular replacement
* Heavy atom methods: MIR and MAD
* Phase improvement: symmetry averaging and solvent flattening

**Lecture 12 - Trevor Moraes - Mar 23**

**Lecture 13 - Trevor Moraes - Apr 6**

*Rupp Chapters 12 and 13*

* Model building
* Refinement
* Validation

**Required Text Book:**

1)*Biomolecular crystallography: principles, practice and applications to structural biology.*Rupp, B. New York: Garland Science, Taylor and Francis Group, 2010.

**Highly Recommended Text Books:**

1) International Tables for Crystallography (2012). Volume F, *Crystallography of Biological Macromolecules*. International Union of Crystallography 2012.

2) *Crystal Structure Analysis: a Primer.* Glusker, P, and Trueblood, K.N. Oxford University Press, New York, 1985

3) *Principles of Protein X-ray Crystallography*,Drenth, J., Springer-Verlag New York Inc., 2nd Edition, 1999.

**Recommended Text Books:**

1) *Crystallography Made Crystal Clear*. Rhodes, G. Academic Press, San Diego, 3rd Edition, 2006

2) *Crystallization of Nucleic Acids and Proteins: A practical Approach.*,Edited by A. Ducruix and R. Giege, 2nd Edition, 1999.

3) *Protein Crystallography: A Concise Guide*. E.E. Lattman and P.J. Loll, Johns Hopkins University Press (2008).

4) *Fundamentals of Crystallography*.Giacovazzo, C., Monaco, H.L. Artioloi, G. Viterbo, D., Ferraris, G. Gilli, G., Zanotti, G, and Catti, M., Oxford University Press, Oxford, 2nd Edition, 2002.

5) *Introduction to Macromolecular Crystallography*,McPherson A., John Wiley and Sons, New York, 2002.

6) *Protein Crystallography*,Blundell, T.L, and Johnson, L.N., Academic Press, London, 1990.