

STEFFEN P. GRAETHER

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Department of Biochemistry
University of Alberta
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EDUCATION

Queen's University December 1999
Kingston, Ontario
Ph.D., Department of Biochemistry
Thesis: The Structure of Type III and Spruce Budworm Antifreeze Proteins: Globular versus β -Helix Folds

Queen's University December 1994
Kingston, Ontario
M.Sc., Department of Biochemistry
Thesis: Binding of Serum Amyloid A to Perlecan and the Early Detection of AA Amyloid

Queen's University May 1992
Kingston, Ontario
B.Sc.(Hon.), Biochemistry

RESEARCH EXPERIENCE

Research Associate July 2003 – Present
Department of Biochemistry
University of Alberta
Edmonton, Alberta

Principal Investigator: Brian D. Sykes

Nuclear magnetic resonance studies on β -helical and antifreeze proteins.

Examined the structure and dynamics of spruce budworm and *Tenebrio molitor* antifreeze proteins. Determined the structure and dynamics of type I antifreeze protein in both solution and ice.

STEFFEN P. GRAETHER

Post-Doctoral Fellow

February 2000 – June 2003

Department of Biochemistry
University of Alberta
Edmonton, Alberta

Principal Investigator: Brian D. Sykes

Nuclear magnetic resonance studies on type I and spruce budworm antifreeze proteins.

Determined the structure and dynamics of spruce budworm antifreeze protein at high and low temperatures. Examined the structure and dynamics of type I antifreeze protein in supercooled and normal water. Identified the formation of amyloid-like fibrils of type I antifreeze proteins after freezing and thawing.

Ph.D. Student

September 1996 – January 2000

Department of Biochemistry
Queen's University
Kingston, Ontario

Supervisor: Zongchao Jia

X-ray structure of type III antifreeze protein and NMR structure of spruce budworm antifreeze protein.

Determined the first insect antifreeze protein structure using NMR and demonstrated that it consists of a new β -helical fold. Predicted that ice-nucleation protein may also consist of a β -helical fold using modeling and molecular dynamics. Determined the structure of ten type III antifreeze protein point mutants by X-ray crystallography and analyzed the data by using visual methods and a neural network.

Ph.D. Student

January 1995 – August 1996

Department of Biochemistry
Queen's University
Kingston, Ontario

Supervisor: Alan S. Mak

Structure/function relationships of caldesmon in smooth muscle contraction.

Examined the interaction between wild-type and mutant caldesmon fragment with calmodulin. Purified several muscle proteins from natural and recombinant sources.

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M.Sc. Student

September 1992 – December 1994

Department of Biochemistry
Queen's University
Kingston, Ontario

Supervisor: Robert Kisilevsky

The role of perlecan in AA amyloidosis and the early detection of AA amyloid.

Detected the presence of AA amyloid earlier than previously known by using Thioflavin T fluorescence. Examined the potential interaction of serum amyloid A with perlecan using ELISA and other affinity methods.

HONOURS AND AWARDS

CIHR Fellowship	2000 – 2003
Alberta Heritage Fund for Medical Research Fellowship	2000 – 2003
Queen's Graduate Fellowship	1996 – 1997
Queen's Graduate Award	1992 – 1999
B.Sc.(Hon.) First Class Honours	1992

TEACHING EXPERIENCE

Teaching Assistant 1994 – 1999
Introductory Biochemistry Laboratory
Queen's University
Kingston, Ontario
Course Supervisor: E. Walters

Teaching Assistant 1997
Honours Biochemistry Project
Queen's University
Kingston, Ontario
Course Supervisor: J. S. Elce

LANGUAGE SKILLS

English	<i>Spoken: Native</i>	<i>Reading: Native</i>	<i>Writing: Native</i>
French	<i>Spoken: Intermediate</i>	<i>Reading: Intermediate</i>	<i>Writing: Basic</i>
German	<i>Spoken: Fluent</i>	<i>Reading: Intermediate</i>	<i>Writing: Basic</i>

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PUBLICATIONS

- 12) Daley, M.E., Graether, S.P. and Sykes, B.D. (2004) Hydrogen Bonding on the Ice-Binding Face of a β -Helical Antifreeze Protein Indicated by Amide Proton NMR Chemical Shifts. *Biochemistry* **43**:13012-13017
- 11) Graether, S.P. and Sykes, B.D. (2004) Cold survival in freeze-intolerant insects-the structure and function of β -helical antifreeze proteins. *Eur. J. Biochem.* **271**:3285-3296
- 10) Graether, S.P., Gagné, S.M., Spyropoulos, L., Jia, Z., Davies, P.L. and Sykes, B.D. (2003) Spruce budworm antifreeze protein: changes in structure and dynamics at low temperature. *J. Mol. Biol.* **327**:1155-1168
- 9) Graether, S.P., Slupsky, C.M. and Sykes, B.D. (2003) Freezing of a fish antifreeze protein results in amyloid fibril formation. *Biophys. J.* **84**:552-557
- 8) Graether, S.P., Slupsky, C.M., Davies, P.L. and Sykes, B.D. (2001) Structure of type I antifreeze protein and mutants in supercooled water. *Biophys. J.* **81**:1677-1683
- 7) Graether, S.P. and Jia, Z. (2001) Modeling *Pseudomonas syringae* ice-nucleation protein as a beta-helical protein. *Biophys. J.* **80**:1169-1173
- 6) Graether, S.P., Kuiper, M.J., Gagné, S.M., Walker, V.K., Jia, Z., Sykes, B.D. and Davies, P.L. (2000) Beta-helix structure and ice-binding properties of a hyperactive antifreeze protein from an insect. *Nature* **406**:325-328
- 5) Doucet D., Tyshenko, M.G., Kuiper, M.J., Graether, S.P., Sykes, B.D., Daugulis, A.J., Davies, P.L. and Walker, V.K. (2000) Structure-function relationships in spruce budworm antifreeze protein revealed by isoform diversity. *Eur. J. Biochem.* **267**:6082-6088
- 4) Graether, S.P., Ye, Q., Davies, P.L. and Jia, Z. (1999) Crystallization and Preliminary X-ray Analysis of Spruce Budworm Antifreeze Protein. *J. Struct. Biol.*, **126**:72-75
- 3) Graether, S.P., DeLuca, C.I., Baardsnes, J., Hill, G.A., Davies, P.L. and Jia, Z. (1999). Quantitative and qualitative analysis of type III antifreeze protein structure and function. *J. Biol. Chem.*, **274**:11842-11847
- 2) Graether, S.P., Heinonen, T.Y.K., Raharjo, W.H., Jin, J.-P. and Mak, A.S. (1997). Tryptophan Residues in Caldesmon are Major Determinants for Calmodulin-Binding. *Biochemistry*, **36**:364-369
- 1) Graether, S.P., Young, I.D. and Kisilevsky, R. (1995). Early detection of inflammation-associated amyloid in murine spleen thioflavin T fluorescence of spleen homogenates: Implications for amyloidogenesis. *Amyloid*, **3**:20-27

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BOOK CHAPTERS

1) Walker, V.K., Kuiper, M.J., Tyshenko, M.G., Doucet, D., Graether, S.P., Liou, Y.-C., Sykes, B.D., Jia, Z., Davies, P.L. and Graham, L.A. Surviving winter with antifreeze proteins: Studies on budworms and beetles. In *Insect Timing: Circadian Rhythmicity to Seasonality*, (D.L. Denlinger, J. Giebultowicz and D.S. Saunderson, Eds.), Elsevier Science, The Netherlands, Ch. 16, p. 199-212 (2001).

ABSTRACTS

10) Graether, S.P., Gagné, S.M., Spyropoulos, L., Jia, Z., Davies, P.L. and Sykes, B.D. Spruce budworm β -helical Protein: Structure and Dynamics at 5°C and 30°C. PENCE Annual General Meeting. Vancouver, British Columbia. May 2003.

9) Graether, S.P., Slupsky, C.M. and Sykes, B.D. Solid-State NMR Studies of the Structure of an Antifreeze Protein in Ice. International Conference on Magnetic Resonance in Biological Systems. Toronto, Ontario. September 2002.

8) Graether, S.P., Slupsky, C.M. and Sykes, B.D. NMR studies of Type I Antifreeze Protein at Supercooled Temperatures. Biophysical Society. Boston, Massachusetts. February 2001.

7) Graether, S.P., Gagné, S.M., Gauthier, S.Y., Walker, V.K., Jia, Z., Davies, P.L. and Sykes, B.D. Solution structure of the spruce budworm antifreeze protein. AFP workshop. Toronto, Ontario. June 1999.

6) Graether, S.P., DeLuca, C.I., Baardsnes, J., Hill, G.A., Wathen, B., Davies, P.L. and Jia, Z. Structural and quantitative analysis of mutant type III antifreeze protein. Biochemistry and Molecular Biology Meeting. San Francisco, California. May 1999.

5) Graether, S.P., Gauthier, S.Y., Jia, Z., Kay, C.M., Sykes, B.D., Walker, V.K. and Davies, P.L. The molecular structure of spruce budworm antifreeze protein. Canadian Federation of Biological Sciences Meeting. Edmonton, Alberta. June 1998.

4) Graether, S.P., DeLuca, C.I., Baardsnes, J., Davies, P.L. and Jia, Z. The contribution of the protein backbone to the interaction between ice and type III antifreeze protein. Canadian Federation of Biological Sciences Meeting. Québec City, Québec. June 1997.

3) Graether, S.P., Heinonen, T.Y.K., Raharjo, W.H., Jin, J.-P. and Mak, A.S. Tryptophan residues in caldesmon are major determinants for calmodulin-binding. Biophysical Meeting. New Orleans, Louisiana. March 1997.

2) Foster, D.B., Heinonen, T.Y.K., Tsuruda, T.S., Graether, S.P. and Mak, A.S. Characterization of caldesmon phosphorylated by mitogen-activated protein kinase. Canadian Federation of Biological Sciences Meeting. London, Ontario. June 1996.

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1) Graether, S.P. and Kisilevsky, R. Early detection of inflammation-associated amyloid in murine spleen using thioflavin T fluorescence. Canadian Federation of Biological Sciences Meeting. Montreal, Québec. June 1994.

PUBLIC PRESENTATIONS

5) Graether, S.P. *quoted in* “Big ideas on a tiny scale.” by Andy Ogle, Edmonton Journal page A2. October 2, 2004.

4) Graether, S.P. How do cold-blooded creatures survive the cold? University of Alberta Open House. Edmonton, Alberta. October 2, 2004.

3) Graether, S.P. How do antifreeze proteins bind to ice? Edmonton Chemistry Regional Presentations. Edmonton, Alberta. May 2001.

2) Graether, S.P. *interviewed by* Peter Watts, Alberta Weekend Morning Show, CHQR. Calgary, Alberta. July 21, 2000.

1) Graether, S.P. *quoted in* “The Prestone of Proteins: Researchers isolate natural antifreeze that keeps bugs alive in sub-zero weather.” by Allan Chambers, Edmonton Journal page A1. July 20, 2000.