

## Veena Prahlad

Northwestern University  
Department of Molecular Biosciences  
Hogan 2-100, 2205 Tech Drive  
Evanston, IL 60208

Lab Phone: (847) 491-3714  
Cell Phone: (847) 498-1918  
Lab Fax: (847)-491-4461  
E-mail: [v-prahlad@northwestern.edu](mailto:v-prahlad@northwestern.edu)

## Research Interests

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- Systemic response of organisms to environmental change: how the response of individual cells to proteotoxic stress is coordinated and integrated within metazoans to deliver an adaptive response at the organismal level
- Protein folding homeostasis
- Neuronal signaling and cell-cell communication
- Resource allocation between cells and tissues upon stress and its impact on disease phenotypes

## Education and Training

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Northwestern University, Evanston, IL

**Postdoctoral Fellow with Dr. Richard I. Morimoto**

Department of Molecular Biosciences, 2004-present

Project: Neuronal regulation of stress responses and protein folding homeostasis in *C. elegans*

University of Madison, Wisconsin, WI

**Postdoctoral Fellow with Dr. Elizabeth B. Goodwin**

Department of Genetics, 2000- 2004

Project: Sex determination in *C. elegans*

Northwestern University, Chicago, IL

**Graduate student with Dr. R.D. Goldman**

Integrated Program in Life Sciences, 1992–1999

Thesis: The assembly of Intermediate Filaments

Jawaharlal Nehru University, New Delhi, India

Masters of Science (M.Sc.)

Life Sciences, 1990-1992

St. Joseph's College, Bangalore, India

Bachelor of Science (B.Sc.)

Chemistry, Botany, Zoology. Honors in Microbiology, 1987-1990

Thesis: Identification and characterization of carriers of nosocomial diseases in Bangalore

## Research Experience

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### Postdoctoral Fellow with Dr. Richard I. Morimoto

Northwestern University, Evanston, IL

My current work focuses on the systemic response of organisms to stress.

- Provided the first evidence that the heat shock response, previously thought to be a cell autonomous function, is regulated in a cell non-autonomous manner within an organism by neuronal signaling.
- Showed that the misfolding of disease related proteins such as polyQ containing peptides and mutant forms of SOD is also controlled cell non-autonomously by the nervous system.

The use of *C. elegans* for these studies offers an exciting opportunity to dissect the hierarchical levels of regulation of the stress and investigate of the strategies of resource allocation between cells and tissues of an organism under stress conditions.

### Postdoctoral Fellow with Dr. Elizabeth B. Goodwin

University of Madison, Wisconsin, WI

I explored the presence of environmental sex determination in *C. elegans*.

- Discovered a novel plasticity in the sexual phenotype and genotype of *C. elegans*, such that larvae born with an XX genotype could lose their paternal X chromosome and develop into XO males upon exposure to specific bacterial metabolites.
- Studies were the first to demonstrate sexual plasticity, and X chromosome instability in *C. elegans* in response to environmental factors and provided the first hint that the male X chromosome must be distinct from the hermaphrodite X chromosome in *C. elegans*.
- Studies suggested that sexual reproduction may confer an advantage to progeny by allowing greater developmental plasticity in changing environments.

### Graduate student with Dr. R.D. Goldman

Northwestern University, Chicago, IL

I worked on the assembly of the cytoplasmic intermediate filament network.

- Showed that the intermediate filament (IF) proteins were dynamic, constantly transported as particulate complexes along microtubules by kinesin-dependent fast transport to polymerize locally. One of the first reports of intracellular trafficking of non-membranous cargo along microtubules using kinesin.
- Showed that microtubule-based fast transport of neurofilament protein also occurs in neurons, during two summers at the Marine Biological laboratories at Woods Hole. Demonstrated fast axonal transport of cytoskeletal proteins.
- Isolated the transported particles and found that they contain numerous other proteins including those that regulated the regional polymerization of IF particles.

The work was done in cultured mammalian cells and the axoplasm of the squid giant axon. To study the axonal transport of endogenous neurofilament protein particles, I developed a method to rapidly fix them *in situ* after visualizing and recording the movements in preparations of extruded squid axoplasm, combining Video Enhanced Differential Interference microscopy (AVEC-DIC) with immunolocalization.

## Publications

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**Prahlad, V.** and Morimoto, R.I. (2011). Neuronal circuitry regulates the response of *C. elegans* to misfolded proteins. *Proc. Natl. Acad. Sci.*;doi:10.1073/pnas.1106557108.

Commentary on this article:

Highlighted by: E. M. Adler, (2011) A Different Response to Acute and Chronic Stress, *Sci. Signal.* **4**, ec238, National Institute of General Medical Sciences, (2011), Genetic Switch in Neurons Inhibits Protective Cell Stress Response, <http://www.nigms.nih.gov/>, ScienceDaily, (2011) Protecting Cells: Evidence Found for a Neuronal Switch to Prevent Neurodegenerative Diseases.

\*Gidalevitz T., \***Prahlad, V.**, and Morimoto R. I. (2011) The Stress of Protein Misfolding: From Single Cells to Multicellular Organisms. Cold Spring Harb. Perspect Biol doi: 10.1101/cshperspect.a009704

\* equal contribution

**Prahlad, V.** and Morimoto, R.I. (2009). Integrating the stress response: lessons for neurodegenerative diseases from *C. elegans*. *Trends Cell Biol.* **19**: 52-61.

**Prahlad, V.**, Cornelius, T., Morimoto, R.I. (2008). Regulation of the cellular heat shock response in *Caenorhabditis elegans* by thermosensory neurons. *Science* **320**:811-814.

Commentary on this article:

Faculty of 1000 evaluation: Must Read, Podrabsky, J.E., (2008) "Neuronal control of cellular heat shock response in nematodes", *J. Exp. Biol.* **211**. Highlighted by: Ray, B.L., (2008) "Wholesale Heat Shock", Editor's Choice, *Sci Signal* **1**, ec180., Flight, M.H. (2008) "Sensory Systems: Beating the Heat", *Nat. Rev. Neurosci.* **9**, 500.

**Prahlad, V.**, Pilgrim, D., Goodwin, E.B. (2003). Roles for mating and environment in *C.elegans* Sex Determination. *Science* **302**:1046-1049.

Commentary on this article:

Faculty of 1000 evaluation: Must Read, "Sex in the Soil" (2003) ScienceDaily. Highlighted by: Editor's Choice (2003) "Flexible Sex and Suspended Animation in Nematodes" *Sci STKE* (2003) tw438.

**Prahlad, V.**, Helfand B., Langford, G.M., Vale, R.D. and R.D. Goldman (2000). Fast transport of neurofilament protein along axonal microtubules. *J. Cell Sci.* **113**: 3939-3946.

Goldman, R.D., Chou, Y.-H., **Prahlad, V.** and M. Yoon (1999). Intermediate filaments: dynamic processes regulating their assembly, motility, and interactions with other cytoskeletal systems. Supplement 2 to the *FASEB Journal.* **13**: S261-S265.

Steinert, P.M., Chou, Y.-H., **Prahlad, V.**, Parry, D.A.D., Marekov, L., Wu, K., Jang, S.-I., and R.D. Goldman (1999). A high molecular weight intermediate filament-associated protein in BHK-21 cells is nestin, a Type VI intermediate filament protein. *J. Biol. Chem.* **274**: 9881-9890.

**Prahlad, V.**, Yoon, M., Moir, R.D., Vale, R.D. and R.D. Goldman (1998). Rapid movements of vimentin on microtubule tracks: kinesin-dependent assembly of intermediate filament networks. *J. Cell Biol.* 143-159-170.

Commentary on this article:

Highlighted in: Clarke, E.J. and Allan, V. (2002) “Intermediate Filaments: Vimentin moves in.” *Curr. Biol.* 12 R596-R598.

Yoon, M., Moir, R.D., **Prahlad, V.** and R.D. Goldman (1998). Motile properties of vimentin intermediate filament networks in living cells. *J. Cell Biol.* 143: 147-157.

## Patents

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**Method of Regulating the Heat Shock Response.** United States Patent 2011/0123512 A1

## Presentations

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### Academic Talks

**“Neuronal control of stress and protein folding homeostasis”**

Department of Cell and Molecular Biology Seminar Series  
Northwestern University, Feinberg School of Medicine, October 2011

**“Neuronal regulation of protein misfolding and stress responses in *C. elegans*”**

Neuromuscular medicine program/neurogenetics laboratory.  
Northwestern University, Feinberg School of Medicine, February 2011

**“Neuronal regulation of the heat shock response in *C. elegans*”**

Stadtman Symposium: Frontiers in Cell Biology and Cell Signaling  
National Institutes of Health, December 2010

**“Neuronal regulation of cellular stress responses”**

Department of Biology,  
Portland State University, March 2009

**“Neuronal regulation of cellular stress responses in *C. elegans*”**

ZMBH & Network Aging Research Symposium  
Zentrum für Molekulare Biologie der Universität Heidelberg, March 2009

**“How food makes males: the case of *C. elegans*”**

Keynote speaker “Graduate Student Research Days”,  
Department of Biological Sciences,  
University of Alberta, Edmonton, Canada, February 2006

**“Biological Strategies: What Biology Can Teach Engineers”**

Keynote speaker  
Department of Smart Materials and Material Sciences,  
National Aeronautics Laboratories, Bangalore, India, June 2000:

**“The formation of IF networks”**  
Department of Cell and Molecular Biology,  
University of Cincinnati, USA, April 2000:

### **Oral presentations at meetings:**

**“Cell non-autonomous regulation of stress responses in *Caenorhabditis elegans*.”**  
Chicago-area worm club  
University of Illinois, Chicago. June 2010.

**“Cell non-autonomous regulation of heat-shock response in *Caenorhabditis elegans* by the thermosensory neuronal network.”**  
2008 Midwest Stress Response and Molecular Chaperones  
Northwestern University, Evanston, Illinois, January 2008.

**“Identification of a bacterial component that induces postembryonic sexual transformation and genomic instability in *C. elegans*.”**  
15th International *C. elegans* Conference  
Los Angeles, USA, June 2005.

**“Developmental plasticity in the sex determination mechanism of *C. elegans* requires mating.”**  
14th International *C. elegans* Conference  
Los Angeles, USA, June-July 2003.

**“Regulating the Polymers of the Cytoskeleton”.**  
American Society for Cell Biology, Minisymposium  
Washington D.C, USA, December 1997.

### **Teaching Experience**

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#### **Laboratory:**

##### **Masters/Ph.D. students:**

Laetitia Chauve. Masters of Science (M.Sc) student, Ecole Normale Superieuer, Paris, 2007-2008. Masters project: Signaling pathways that regulate *C. elegans* heat shock response at the organismal level.

Current affiliation: Ph. D. student, Dr. Richard I. Morimoto’s laboratory.

Eric Huang, Masters of Science (M.Sc.) Biotechnology Program, Northwestern University, Evanston, 2004-2005. Project: “Biolistic microparticle transformation of *C. elegans*”

Current affiliation: Process Development Engineer. Cell Genesys Inc.

Brain Helfand. Northwestern MD/Ph.D student, 1999-2000. Ph.D. Thesis: Motile properties of Intermediate Filament Proteins.

Current affiliation: Feinberg School of Medicine, Department of Urology, Housestaff and Research Assistant Professor, Laboratory of Dr. Robert Goldman, Northwestern University.

### **Undergraduate students:**

Ravi Chopra, Northwestern undergraduate, 2009-2011. Senior Honors Thesis: "Chemosensory neurons regulate the stress response of *Caenorhabditis elegans* non-neuronal cells".

- Recipient URG (Undergraduate Research Grant).scholarship
- Best poster in Eighth Annual Undergraduate Research Symposium (in conjunction with Chicago Public High School students and teachers participating in the Meaningful Science Consortium).

Current affiliation: MD/Ph.D program, University of Michigan.

Tyler Cornelius, Northwestern undergraduate, 2007-2008.

- Authorship on 2008 Science paper.

Current affiliation: MD Program, Rush University, Medical School.

### **High school students:**

Becca Krock. IMSA high school student (Illinois Math Science Academy), 2006.

Current affiliation: Ph.D. student, Stanford.

### **Classroom:**

Teaching Assistant for Histology Laboratory, 1994.

Teaching Assistant for the Science Writers Fellowship Program at Marine Biological Laboratory, Woodshole, 1999.

### **Participation in minority education:**

Mentored Shaleeka Cornelius, Howard College undergraduate, summer of 2011, SROP (Summer Research Opportunities Program). Project: Exploring the role of neuronal signaling in proteostasis and proteotoxicity.

Mentor: Chicago Academy of Sciences program to mentor underprivileged teens, 1998-1999.

### **Other professional experience**

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Member: Chicago Center for Systems Biology, 2009-present.

Member: Chicago-area worm club, 2009-present.

Postdoctoral representative for organizing the Life Sciences Seminar series for the Department of Molecular Biosciences, 2011.

Assisted in the review of manuscripts for journals including *Science*, *Nature*, *PNAS*, *Nature Cell Biology*, and *Genes and Development*.

Served on organizing committee for Morimoto laboratory scientific retreat. 2011.

Volunteered to be a mentor for students for underprivileged high school children at the Illinois Academy of Science, Minority Program, 2002.

Organized a three-day workshop on " Smart Materials: Engineering Principles in Biology" at the Department of Smart Materials and Material Sciences, National Aeronautics Laboratories, Bangalore, India, 2000.

## Referees

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### **Dr. Richard I. Morimoto**

Bill and Gayle Cook Professor of Biology  
Director, Rice Institute for Biomedical Research  
Department of Biochemistry, Molecular Biology, and Cell Biology  
Northwestern University  
2205 Tech Drive, Hogan 2-100  
Evanston, IL 60208-3500  
Tel: (847)491-3340  
Fax: (847)491-4461  
email: [r-morimoto@northwestern.edu](mailto:r-morimoto@northwestern.edu)

### **Dr. Bernd Bukau**

Director of the ZMBH and Co-Director of the DKFZ-ZMBH Alliance  
ZMBH, Im Neuenheimer Feld 282  
69120 Heidelberg,  
Germany  
Tel.: + 49-6221 54 6795  
Fax.: +49-6221 54 5894  
E. mail: [bukau@zmbh.uni-heidelberg.de](mailto:bukau@zmbh.uni-heidelberg.de)

### **Dr. Yair Argon**

Chief, Division of Cell Pathology  
Dept. Pathology and Lab Medicine  
The Children's Hospital of Philadelphia and  
The University of Pennsylvania  
816B ARC, 3615 Civic Center Blvd.,  
Philadelphia, PA 19104  
Tel: (267) 426-5131

Fax: (267) 426-5165  
Administrator: (267) 426-5346  
Email: [yargon@mail.med.upenn.edu](mailto:yargon@mail.med.upenn.edu)

**Dr. Robert D. Goldman**

Stephen Walter Ranson Professor  
Chairman of the Department of Cell and Mol. Biology  
Feinberg School of Medicine  
Northwestern University  
Department of Cell and Molecular Biology  
Ward Building 11-145  
303 E. Chicago Ave.  
Chicago, IL 60611-3008  
Tel: 312.503.4215  
Fax: 312.503.0954  
E-mail: [r-goldman@northwestern.edu](mailto:r-goldman@northwestern.edu)