**David L. Njus, Ph.D.**

**Professor of Biological Sciences**

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## Education

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| Massachusetts Institute of Technology, Cambridge, MA | B.S. in Physics | 1970 |
| Harvard University, Cambridge, MA | Ph.D. in Biophysics | 1975 |
| University of Oxford, Oxford, U.K. | Post-doctoral (Biochemistry) | 1975-78 |

## Professional Experience

Assistant Professor of Biological Sciences, Wayne State University, Detroit, MI, 1978-82
Associate Professor of Biological Sciences, Wayne State University, Detroit, MI, 1982-86
Professor of Biological Sciences, Wayne State University, Detroit, MI, 1986-present
Associate Dean, College of Liberal Arts, Wayne State University, Detroit, MI, 1991-1992
Associate Dean, College of Science, Wayne State University, Detroit, MI, 1992-1993, 1999-2004
Associate Dean, College of Liberal Arts and Sciences, Wayne State University, Detroit, MI, 2004-2010
Chair, Department of Biological Sciences, Wayne State University, Detroit, MI 2010-2018
Chair, Department of Geology, Wayne State University, Detroit, MI 2010-2018

## Honors and Awards

US Public Health Service Traineeship in Biophysics (1970-1975)
NATO Postdoctoral Fellowship in Science (1975-1976)
NIH National Research Service Award (1976-1978)
AAAS Fellow (1982)
American Heart Association Established Investigator (1983-1988)
National Academies Education Fellow in the Life Sciences (2005)

## Grants

Howard Hughes Medical Institute, $1,200,000 (7/1/89 - 12/30/94) Undergraduate Biological Sciences Education Initiative, Program Director
Howard Hughes Medical Institute, $1,100,000 (10/1/94 - 9/30/98) Undergraduate Biological Sciences Education Initiative, Program Director

NASA, $1,510,856 (8/1/01-9/30/14) Detroit Science, Engineering, Mathematics and Aerospace Academy (SEMAA), Principal Investigator

Principal Investigator on research grants from the National Institutes of Health, National Science Foundation, and American Heart Association totaling $1,426,755.

**Courses Taught**

Last 5 years

Bio 3200 – Human Physiology (Fall 2012, Fall 2016, Winter 2018, Fall 2019, Fall 2020)
Bio 3990 - Directed Study
Bio 5996 - Senior Research
Bio 6990 - Honors Directed Study in Biology
Bio 6994 - Technical Communication in Molecular Biotechnology (Winter 2014, Winter 2017)
Bio 6999 -Terminal Essay: Honors Program
Bio 7996 - Research Problems
Bio 8995 – Graduate Seminar (Winter 2020)
Bio 9996 - Lab Rotation
Bio 9999 - Doctoral Dissertation Research

Other courses since 1979

Biology 101/151 - Basic Biology I
Biology 1050 - Introduction to Life
Biology 1510 - Basic Life Mechanisms
Biology 340 - Principles of Physiology
Biology 341 - Principles of Physiology Laboratory
Biology 590/690 - Honors Research
Biology 595 - Senior Seminar
Biology 6160 - Biophysics and Molecular Biology
Biology 617 - General Physiology and Biophysics Laboratory
Biology 660 - Vertebrate Physiology Laboratory
Biology 666 - Neurophysiology
Biology 6690 - Neurobiology I
Biology 625 - Biology Instruction for Teachers
Biology 626 - Biology Laboratory for Teachers
Biology 766 - Neurophysiology
Biology 7660 – Neurobiology II
Biology 769 - Neurochemistry
Biology 800 - Special Topics
Biology 895 - Graduate Seminar
Biology 899 - Master's Thesis Research

**Ph.D. Dissertations Directed**

Jane Knoth, Energy-coupling in Chromaffin Vesicle Ghosts, 1984
Gordon J. Harnadek, Electron Transfer in Chromaffin-Vesicle Ghosts, 1990
Eric D. Özkan, Characterization of the catecholamine transport system in chromaffin vesicles from bovine adrenal medulla, 1993
David A. Turner, Modulation by adenosine of catecholamine secretion from bovine chromaffin cells, 1994
Victor G. Romanenko, Diffusion and transport of membrane-permeant molecules in vesicular monoamine uptake, 2000
Brian H. Kipp, A concerted electron/proton transfer mechanism for the oxidation of ascorbic acid, 2001
Joel P. Burgess, A model of histamine uptake by the type two vesicular monoamine transporter, 2002
Guoliang Li, Nonenzymatic mechanisms of oxidation/reduction reactions of biologically important organic compounds, 2007
Nihar J. Mehta, Understanding the mechanism of oxidative stress generation by dopamine oxidized metabolites: Implications in Parkinson's disease, 2017
Praneet Marwah, in progress

**Selected Education Initiatives**

Howard Hughes Programs**:** Between 1989 and 1997, I served as Program Director for two grants from the Howard Hughes Medical Institute through the Undergraduate Biological Sciences Education Program. These awards funded 1) curriculum development in molecular and cell biology in WSU's undergraduate Biological Sciences program, 2) equipment upgrades and renovations in teaching laboratories including a molecular biology laboratory and a computer facility, 3) summer research fellowships for undergraduates and 4) a series of summer courses for high school and community college science teachers.

Science, Engineering, Mathematics and Aerospace Academy (SEMAA)**:** SEMAA was developed by the National Aeronautics and Space Administration (NASA) to provide science enrichment for students in grades K-12. NASA developed an exciting curriculum for each grade level. I arranged the transfer of the Detroit SEMAA program to Wayne State University in Fall 2001 and served as the WSU Principal Investigator for 13 years. The Detroit SEMAA program served approximately 200 students in each session with three sessions during the academic year and a summer program.

National Academies Summer Institute on Undergraduate Education in Biology**:** Along with 40 other faculty members from 19 institutions, I attended a Summer Institute at the University of Wisconsin, Madison in August 2004 and a follow-up meeting at the Howard Hughes Medical Institute in January 2005. I also participated in the 2005 Summer Institute as a reviewer. The objective of the Summer Institute, sponsored by HHMI and the National Academies, was to develop assessment tools and active learning units for undergraduate biology.

**Selected Research Accomplishments**

Vesicular Monoamine Transport: Early in my career, I was a key figure in the discovery of what are now known as the vacuolar ATPase and the vesicular monoamine transporter (VMAT). Working with chromaffin vesicles isolated from bovine adrenal medulla, my colleagues and I showed that ATP-dependent catecholamine transport into the vesicles required two components, an ATPase that transported $H^+$ and a transporter that was inhibitable by reserpine. This work began during a 3-year postdoctoral period in the laboratory of Sir George Radda at Oxford University and continued in my own laboratory at Wayne State University beginning in 1978. This work became the model for transport of neurotransmitters into synaptic vesicles and for the transport of other substances across membranes of endoplasmic reticulum, Golgi, lysosomes and other components of the vacuolar system.

Ascorbate-Reducible Cytochromes: I was the first to show that the function of cytochrome b561, the paradigm for ascorbate-reducible cytochromes, is to transport electrons across the secretory vesicle membrane for the purpose of regenerating ascorbic acid within chromaffin vesicles. Ascorbic acid is used in secretory and synaptic vesicles by dopamine β-monooxygenase and peptidylglycine α-amidating monooxygenase to make dopamine and amidated peptides respectively. The ascorbic acid is oxidized to semidehydroascorbate and the cytochrome reduces the radical back to ascorbic acid. The cytochrome is in turn reduced by ascorbic acid in the cytosol at the outer surface of the vesicle. Similar cytochromes have now been discovered throughout the animal and plant kingdoms and function in some cases to reduce metals such as iron instead of semidehydroascorbate.

Free-radical Scavenging Mechanism of Ascorbic Acid (Vitamin C): The ascorbate radical is unique in that it reacts preferentially with other radicals resulting in elimination of both radicals rather than free radical chain propagation common when radicals simply pass their unpaired electrons on to another molecule. The ascorbate radical anion does not simply pass on its unpaired electron because that would result in the formation of a very high energy form of dehydroascorbic acid. Working with Professor H. Bernhard Schlegel in the Chemistry Department, we showed, using density functional methods to calculate energies, that the ascorbate radical instead forms an adduct with another radical (e.g., superoxide). Chemical rearrangement occurs within that adduct, and dissociation then yields dehydroascorbic acid directly in its low energy bicyclic form.

Chemistry of Catechol Oxidation: Recently, I have been working on the oxidation of catechols with a specific goal of identifying dopamine oxidation products that might be involved in Parkinson's Disease. We have found that treating cysteinyl-dopamine with hypochlorite yields a toxic substance which we call HOCD. HOCD appears to be synthesized in cells from cysteinyl-dopamine and this conversion is promoted by rotenone and inhibited by taurine. We have also discovered a related group of compounds that have a high affinity for manganese and increase their rate of two-equivalent redox cycling by an order of magnitude in the presence of manganese. We are pursuing these compounds for their possible role in manganism, a condition with symptoms similar to Parkinson's disease caused by chronic exposure to high concentrations of manganese.