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EDUCATION:

- Ph.D., Biochemistry and Biophysics, Oregon State University, Corvallis, OR
- B.S. Chemistry, B.S. Microbiology, University Scholar, University of Montana, Missoula, MT

Project Management Skills: Managed alcohol/*Listeria* (PI: Nancy Ray) and ATP8b1/cardiolipin (PI: Rama Mallampalli) research projects, which involved obtaining results from different project members then analyzing and communicating results in oral and written presentations including research conferences, progress reports, grant applications, and peer-reviewed research publications. Projects involving skin therapy and wound healing product presentation and promotion.

EXPERIENCE:

Director of Quality and Scientific Affairs/Science Officer, McCord Research, Coralville, IA (*July 2013-present*) Scientific literature research, writing, and editing. Scientific oral presentation, poster preparation and presentation, skin therapy and wound healing educational training, skin therapy and wound healing and health product promotion. Serve as McCord Research Faculty, oversee quality and maintenance of scientific accuracy. Develop programs for training healthcare professionals and programs for senior health. Preparation and editing of marketing materials.

Research Specialist/Assistant, Internal Medicine, University of Iowa (UI), Iowa City, IA (*June 2012-June 2013*) Temporary research and volunteer position to set up a Microsoft Access database and conduct studies of protein-DNA interactions involving bacterial protein and mammalian DNA using electrophoretic mobility shift assays (EMSA), immunoprecipitation, Western blotting, chromatin immunoprecipitation (ChIP) sequence analysis, DNA PCR and sequencing.

Assistant Research Scientist, Holden Comprehensive Cancer Center, UI, Iowa City, IA (*November 2009-June 2012*) Function studies on B cell-derived Granzyme B. Elevated granzyme B expression was found by ELISA and ELISPOT analysis following CpG DNA and CD40L treatment of murine B lymphocytes in contrast to control B lymphocytes from Granzyme B knockout mice. Granzyme B function did not correlate with killing of murine tumor cells tested. Tested newly modified CpG oligonucleotides for Pfizer Inc. study of efficacy with lymphoma cells. Studies on CpG and telomere homolog (T-oligo) oligonucleotide-induced proliferation, activation, and apoptosis of B of lymphoma cells using surface marker staining and flow cytometry as well as colorimetry spectrophotometric analysis. Apoptosis, S phase arrest, and calreticulin expression were induced by T-oligos. T-oligo treatment was combined with ionizing radiation treatment to test for additive or synergistic effects on calreticulin expression and immunogenic apoptosis.

Assistant Research Scientist, Department of Internal Medicine, Division of Pulmonary Medicine, UI, Iowa City, IA (June 2006 - November 2009)

Studies on protein pumps involved in the uptake of lipids comprising lung surfactant. A specific pump, ATP8b1 (FIC1) was discovered to internalize cardiolipin into lung epithelial cells ameliorating lung injury found to result from cardiolipin (CL) exposure in lungs. Elevated CL levels were detected in patients with pneumonia and in mice exposed to bacteria resulting in inflammation and pneumonia. The binding site of CL and ATP8b1 was mapped to a 40 amino acid region using PCR truncation and site-directed mutagenesis. Lentivirus overexpression of ATP8b1 in lung epithelial cells resulted in greater uptake of fluorescently labeled CL. Adenovirus overexpression of ATP8b1 in mice and instillation of a peptide comprising the CL binding site in ATP8b1 protected mice from lung injury. ATP8b1 knockdown in lung epithelial cells resulted in decreased uptake of cardiolipin and ATP8b1 mutant ("knockout") mice had elevated levels of cardiolipin in lung lavage and increased susceptibility to lung injury following infection with pathogenic *E. coli*.

Assistant Research Scientist, Department of Pathology, UI, Iowa City, IA (January 2002 - June 2006)

Studies on alcohol and water-exposed mouse susceptibility to infection with *Listeria monocytogenes* and immune responses of these mice to innate immune stimulation with CpG DNA. Increased sensitivity to low dose CpG stimulation found in alcohol-exposed mice. Th1-related, inflammatory cytokine and nitric oxide (NO) response studies in macrophage-like RAW cells and spleen cells from ethanol and water exposed mice following stimulation with CpG DNA and LPS. Intracellular bacterial killing response studies of RAW cells and spleen cells following exposure to ethanol or water. Studies involving chronic alcohol-induced immunodeficiency and potential reversal following innate immune stimulation with toll-like receptor ligands (TLR) ligands including CpG DNA, LTA and PGN. DNA vaccine studies with plasmid DNA encoding gene for Listeriolysin O (*hly*). Murine RNA isolation and differential gene expression (genechip/microarray) studies following chronic alcohol exposure compared to normal water exposure.

Postdoctoral Fellow, Department of Internal Medicine, Division of Rheumatology, UI, Iowa City, IA (August 1998 - January 2002)

Funded in part by NIH Immunology and Parasitism Postdoctoral Training Grants: Studies on human parvovirus B19 pathogenesis, induction of primary human synovial cell invasiveness by B19 and potential involvement in rheumatoid arthritis. DNA vaccination studies of mice using plasmid DNA encoding B19 capsid proteins, and baculovirus expression studies of B19 capsid proteins. Reconstitution studies of severe combined immunodeficiency disease (SCID) mice with human bone marrow as a model for B19 infection. CpG DNA induced NFkB activation studies and studies of systemic and mucosal immune responses in mice following immunostimulatory CpG DNA pretreatment and challenge with the intracellular bacteria, *Listeria monocytogenes* (LM). Decreased susceptibility to LM was found following oral CpG DNA pretreatment, intraperitoneal (IP), or oral challenge of normal and knockout mice with LM.

Postdoctoral Fellow, Department of Cancer Immunology and AIDS, Dana-Farber Cancer Institute and Harvard Medical School, Boston, MA (Sept. 1996 - Aug 1998)

Studies on infectious molecular SIV DNA and HIV-2-viral infection of neonatal primates, SIV vaccination studies involving attenuated SIV in neonatal and adult primates, and DNA vaccination against Rauscher murine leukemia virus (RLV) with recombinant plasmids encoding env and gag proteins. Expression studies of env and gag proteins in monkey-derived COS cells. HIV nef deletion studies and studies involving the production of infectious HIV-2 from lambda DNA clones, viral titers in PBMCs, and determination of antibody levels by Western blotting and ELISA in sera from SIV and HIV-2 inoculated macaques and RLV-inoculated mice.

IRTA Postdoctoral Fellow, NIAID Laboratory of Persistent Viral Diseases, NIH Rocky Mountain Laboratories, Hamilton, MT (Aug. 1992 - Aug. 1996) Rabies virus replication studies in macrophages, macrophage-like cells, microglial cells and astrocytes. Rabies virus persistence studies in macrophage-like cell lines using fluorescent microscopy, viral assays, and DNA PCR. Rabies virus DNA vaccination studies with plasmid DNA encoding rabies virus glycoprotein, *in vitro* glycoprotein expression studies in monkey-derived COS cells, and gene-gun, intramuscular (IM), and intradermal (ID) DNA vaccine inoculation of mice and primates resulting in significant protection against rabies virus infection.

Graduate Research Assistant, Department of Biochemistry and Biophysics, Oregon State University, Corvallis, OR (Sept. 1986 - June 1992)

T4 bacteriophage and *E. coli* nucleotide metabolism protein-protein interaction studies. Virology and nucleotide metabolism enzymology studies. *E. coli* nucleotide diphosphokinase gene (*ndk*) identification studies, gene cloning and sequencing, and NDPK protein purification and overexpression studies for protein-protein interaction (affinity chromatography and antiidiotypic antibody immunoprecipitation) assays, Western blotting, and 2D gel electrophoresis analysis.

Graduate Teaching Assistant, Department of Biochemistry and Biophysics Oregon State University, Corvallis, OR (Sept. 1985 - June 1986)

Graded biochemistry exams, taught biochemistry exam preparation, and tutored biochemistry students.

Undergraduate Assistant, University of Montana, Missoula, MT (Sept. 1982 - June 1985)

Research Assistant, Environmental Science Center. Studied affects of acid rain on ponderosa pines.

Watkins Researcher, Department of Chemistry. Watkins scholarship research project.

Teaching Assistant, Departments of Chemistry, Physics, and Mathematics. Graded general physics and analytical chemistry exams and tutored physics and mathematics students.

HONORS AND AWARDS:

- 2008 University of Iowa, Pulmonary Division, Performance Award
- 2006 Research Society on Alcoholism, Travel Award
- 2004 Society for Leukocyte Biology (AIRIG) Travel Award
- 2002 Walter Reed Army Institute of Research Basic Aspects of Vaccines Scholarship
- 2001 American Society for Virology Travel Award; Coley Pharmaceutical Group (CpG) Travel Award
- 2000 Walter Reed Army Institute of Research Basic Aspects of Vaccines Scholarship
- 2000 NIH Parasitism Postdoctoral Training Grant
- 1999 Midwest Trainee Investigator Award, Central Society for Clinical Research
- 1998 NIH Immunology Postdoctoral Training Grant
- 1987 Tartar Graduate Fellowship, Oregon State University
- 1985 Graduated University Scholar in fulfillment of Honors Program requirements, University of Montana
- 1982 Watkins Honors Research Scholarship, University of Montana

PUBLICATIONS:

1. **Ray, N.B.** and C.K. Mathews. 1992. Nucleoside diphosphokinase: a functional link between intermediary metabolism and nucleic acid synthesis. *Curr. Top. Cell Regul.* 33:343-357.
2. Mathews, C.K., L.J. Wheeler, C. Ungermann, J.P. Young, and **N.B. Ray**. 1993. Enzyme interactions involving T4 phage-coded thymidylate synthase and deoxycytidylate hydroxymethylase. *Adv. Exp. Med. Biol.* 338:563-570.

3. **Ray, N.B.**, L.C. Ewalt, and D.L. Lodmell. 1995. Rabies virus replication in primary murine bone marrow macrophages and in human and murine macrophage-like cell lines: implications for viral persistence. *J. Virol.* 69:764-772.
4. Wheeler, L.J., **N.B. Ray**, C. Ungermann, S.P. Hendricks, M.A. Bernard, E.S. Hanson, and C.K. Mathews. 1996. T4 phage gene 32 protein as a candidate organizing factor for the deoxyribonucleoside triphosphate synthetase complex. *J. Biol. Chem.* 271:11156-11162.
5. **Ray, N.B.**, C. Power, W.P. Lynch, L.C. Ewalt, and D.L. Lodmell. 1997. Rabies viruses infect primary cultures of murine, feline, and human microglia and astrocytes. *Arch. Virol.* 142:1011-1019.
6. **Ray, N.B.**, L.C. Ewalt, and D.L. Lodmell. 1997. Nanogram quantities of plasmid DNA encoding the rabies virus glycoprotein protect mice against lethal rabies virus infection. *Vaccine* 15:892-895.
7. Lodmell, D.L., **N.B. Ray**, and L.C. Ewalt. 1998. Gene gun particle-mediated vaccination with plasmid DNA confers protective immunity against rabies virus infection. *Vaccine* 16:115-118.
8. Lodmell, D.L., **N.B. Ray**, M.J. Parnell, L.C. Ewalt, C.A Hanlon, J.H. Shaddock, D.S. Sanderlin, and C.E. Rupprecht. 1998. DNA immunization protects nonhuman primates against rabies virus. *Nat. Med.* 4:949-952.
9. Baba, T.W., V. Liska, A.H. Khimani, **N.B. Ray**, P.J. Dailey, D. Penninck, R. Bronson, M.F. Greene, H.M. McClure, L.N. Martin, and R.M. Ruprecht. 1999. Live attenuated, multiply deleted simian immunodeficiency virus causes AIDS in infant and adult macaques. *Nat. Med.* 5:194-203.
10. Ruprecht, R.M., T.W. Baba, V. Liska, **N.B. Ray**, L.N. Martin, M. Murphey-Corb, T.A. Rizvi, B.J. Bernacky, M.E. Keeling, H.M. McClure, and J. Andersen. 1999. Oral transmission of primate lentiviruses. *J. Infect. Dis.* 179 Suppl 3:S408-S412.
11. von Gegerfelt, A.S., V. Liska, **N.B. Ray**, H.M. McClure, R.M. Ruprecht, and B.K. Felber. 1999. Persistent infection of rhesus macaques by the rev-independent Nef(-) simian immunodeficiency virus SIMmac239: replication kinetics and genomic stability. *J. Virol.* 73:6159-6165.
12. Lodmell, D.L., **N.B. Ray**, and L.C. Ewalt. 1999. DNA Immunization in combination with the immunostimulant monophosphoryl lipid A. IN: DB Lowrie and R.G. Whalen (eds.): *Methods in Molecular Medicine: Vaccine Protocols*, Totowa, NJ: Humana Press Inc. 261-266.
13. Bernard, M.A., **N.B. Ray**, M.C. Olcott, S.P. Hendricks, and C.K. Mathews. 2000. Metabolic functions of microbial nucleoside diphosphate kinases. *J. Bioenerg. Biomembr.* 32:259-267.
14. Yi, A.-K., T.W. Redford, **N. Ray**, and A.M. Krieg. 2000. LPS and CpG synergize for TNF-alpha production through a synergetic activation of NF-kappa B but not MAPK. *FASEB J.* 14:A1164.
15. Lodmell, D.L., **N.B. Ray**, J.T. Ulrich, and L.C. Ewalt. 2000. DNA vaccination of mice against rabies virus: effects of the route of vaccination and the adjuvant monophosphoryl lipid A (MPL). *Vaccine* 18:1059-1066.
16. **Ray, N.B.**, D.R. Nieva, E.A. Seftor, Z. Khalkhali-Ellis, and S.J. Naides. 2001. Induction of an invasive phenotype by human parvovirus B19 in normal human synovial fibroblasts. *Arthritis Rheum.* 44:1582-1586.
17. **Ray, N.B.**, Z. Khalkhali-Ellis, D.R.C. Nieva, E.A. Seftor, and S.J. Naides 2002. Reply to comment on article by Ray et al (Letter). *Arthritis Rheum.* 46: 2263-2264.
18. **Ray, N.B.** and A.M. Krieg. 2003. Oral pretreatment of mice with CpG DNA reduces susceptibility to oral or intraperitoneal challenge with virulent *Listeria monocytogenes*. *Infect. Immun.* 71:4398-4404.
19. Zhu, X., R.A. Coleman, C. Alber, Z.K. Ballas, T.J. Waldschmidt, **N.B. Ray**, A.M. Krieg, and R.T. Cook. 2004. Chronic ethanol ingestion by mice increases expression of CD80 and CD86 by activated macrophages. *Alcohol* 32:91-100.
20. Cook, R.T., X. Zhu, R.A. coleman, Z.K. Ballas, T.J. Waldschmidt, **N.B. Ray**, D.R. LaBrecque, and B.L. Cook. 2004. T-cell activation after chronic ethanol ingestion in mice. *Alcohol* 33:175-181.
21. Hoek, J., G.M. Thiele, L.W. Klassen, P. Mandrekar, S. Zakhari, R.T. Cook, **N.B. Ray**, K.I. Happel, J.K. Kolls, E.J. Kovacs, and G. Szab. 2005. RSA 2004: combined basic research satellite symposium-mechanisms of alcohol-mediated organ and tissue damage: inflammation and immunity and alcohol and mitochondrial metabolism: at the crossroads of life and death session one: alcohol, cellular and organ damage. *Alcohol Clin. Exp. Res.* 29:1735-1743.
22. Cook, R.T., A.J. Schlueter, R.A. Coleman, L. Tygrett, Z.K. Ballas, T.R. Jerrells, M.B. Nashelsky, **N.B. Ray**, T.H. Haugen, and T.J. Waldschmidt. 2007. Thymocytes, pre-B cells, and organ changes in a mouse model of chronic ethanol ingestion--absence of subset-specific glucocorticoid-induced immune cell loss. *Alcohol Clin. Exp. Res.* 31:1746-1758.

23. Gurung, P., B.M. Young, R.A. Coleman, S. Wiechert, L.E. Turner, **N.B. Ray**, T.J. Waldschmidt, K.L. Legge, and R.T. Cook. 2009. Chronic ethanol induces inhibition of antigen-specific CD8⁺ but not CD4⁺ immunodominant T cell responses following *Listeria monocytogenes* inoculation. *J. Leukoc. Biol.* 85:34-43.
24. **Ray, N.B.**, S.C. Wiechert, R.A. Coleman, B.M. Young, A.M. Krieg, and R.T. Cook. 2009. Chronic alcohol exposure and CpG DNA-induced stimulation of mice; resistance to infection with *Listeria monocytogenes*. Submitted.
25. **Ray, N.B.**, L. Durairaj, B.B. Chen, B.J. McVerry, A.J. Ryan, M. Donahoe, A.K. Waltenbaugh, C.P. O'Donnell, F.C. Henderson, C.A. Etscheidt, D. McCoy, M. Agassandian, E.C. Hayes-Rowan, T.A. Coon, P.L. Butler, L. Gakhar, S.N. Mathur, J.C. Sieren, Y.T. Tyurina, V. E. Kagan, G. McLennan, and R.K. Mallampalli. 2010. Dynamic regulation of cardiolipin by the lipid pump Atp8b1 determines the severity of lung injury in experimental pneumonia. *Nat. Med.* 16: 1120-1127.
26. Chen, B.B., J.J. Jiang, **N.B. Ray**, V.E. Kagan, and R.K. Mallampalli. 2011. Reply to "The Flip side of cardiolipin import". *Nat. Med.* 17: 413-414.
27. Bonvino N.P., **N. B Ray**, V.T. Luu, J. Liang, A. Hung, and T.C. Karagiannis. 2015. Exploration of mechanisms in nutriepigenomics: Identification of chromatin-modifying compounds from Olea Europaea. *Hell J Nucl Med. Suppl*1: 51-62.