



## **Narendra P. Singh, Research Associate Professor**

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### **Education**

MS, King George's Medical College, India, 1976

MBBS (medicine & surgery), King George's Medical College, India, 1972

BS, Meerut University, India, 1967

### **Research Interests**

- DNA damage/repair
- Apoptosis
- Aging and cancer

### **Research Description**

Life style, diet, and environment influence our physical and mental abilities. These factors influence our longevity and incidence of various diseases including cancer. In many of these diseases, DNA is thought to be adversely affected. To monitor the adverse effects on DNA, our research focuses on DNA damage and its repair and modulation of these by various nutrients. Experiments involve analysis of cell death, DNA breaks, and oxidative lesions in DNA using a sensitive microgel electrophoresis technique developed in our laboratory. Some studies involve the effects of ionizing and non ionizing radiation (EMF, electromagnetic field and radiofrequency radiations) on cellular DNA. An integral part of my research goals is the application and relevance of investigations in DNA damage and apoptosis to aging, cancer and other diseases. The ultimate goal of my research is the elucidation of the mechanisms responsible for the aging process and application of these findings to ameliorate or prevent aging and age-related diseases.

We are also measuring DNA double-strand break levels and apoptosis in human sperm cells. Such studies are useful in assessment of risk by chemical and physical agents to future generations. We have an ongoing collaboration with Dr. Russ Hauser of Harvard School of Public Health to investigate the effects of various environmental toxins on DNA damage and apoptosis in human sperm. We are working with Dr. Charles Muller of the University of Washington's Male Fertility Laboratory to study sperm DNA damage and apoptosis and its relationship to aging. We are also developing modalities in our laboratory for treatment and prevention of cancers using chemical and physical means. We have several ongoing in vivo and in vitro studies on the anticancer properties of the compound **artemisinin** and its **analogs**. One of our interests is in the mechanism of drug resistance in cancer cells.

### Honors, Awards and Professional Activities

- 2000: Colgate-Palmolive Visiting Professor Award, Department of Epidemiology and Public Health, Yale University
- Member, Editorial Boards of *Biogerontology*, *Environmental Mutagens and Carcinogens*, and *Mutation Research*

### Selected Publications

- Singh NP, McCoy M, Tice RR, and Schneider E. A simple technique for quantitation of low levels of DNA damage in single cells. *Experimental Cell Research*, 175:184–191, 1988.
- Singh NP, Graham MM, Singh V, and Khan A. Induction of DNA single strand breaks in human lymphocytes by low doses of gamma rays. *International Journal of Radiation Biology*, 68: 563–570, 1995.
- Singh NP and Stephens RE. Microgel electrophoresis: sensitivity, mechanisms, and DNA electrostretching. *Mutation Research*, 383:167–75, 1997.
- Singh NP. Sodium ascorbate induces DNA single-strand breaks in human cells in vitro. *Mutation Research*, 375:195–203, 1997.
- Singh NP, Stephens RE. X-ray induced DNA double-strand breaks in human sperm. *Mutagenesis*, 13:75–9, 1998.
- Singh NP, Stephens RE, Singh H and Lai H. Visual quantification of DNA double-strand breaks in bacteria. *Mutation Research*, 429:159–168, 1999.
- Singh NP. A simple method for accurate estimation of apoptotic cells. *Experimental Cell Research*, 256: 328–337, 2000.
- Singh NP. Microgels for estimation of DNA strand breaks, DNA protein crosslinks and apoptosis. *Mutation Research*, 455:111–127, 2000.
- Singh, NP and Lai, H. Selective toxicity of dihydroartemisinin and holotransferrin toward human breast cancer cells. *Life Sciences*, 70:49–56, 2001.
- Singh NP, Ogburn CE, Wolf NS, van Belle G and Martin MG. DNA double-strand breaks in mouse kidney cells with age. *Biogerontology*, 2:261–270, 2001.
- Singh NP and Lai H. Selective toxicity of dihydroartemisinin and holotransferrin toward human breast cancer cells. *Life Sciences*, 70:49–56, 2001.
- Duty SM, Singh NP, Ryan L, Chen Z, Lewis C, Huang T and Hauser R. Reliability of the comet assay in cryopreserved human sperm. *Human Reproduction*, 17:1274–1280, 2002.
- Singh NP, Penn PE, Pendergrass WR and Wolf NS. White light-mediated DNA strand breaks in lens epithelial cells. *Experimental Eye Research*, 75:555–560, 2002.

- Singh NP and Verma KB. Case Report of a Laryngeal Squamous Cell Carcinoma treated with artesunate. *Archives of Oncology*, 10:279–280, 2002.
- Duty SM, Singh NP, Silva MJ, Barr DB, Brock JW, Ryan L, Herrick RF, Christiani DC and Hauser R. The relationship between environmental exposure to phthalates and DNA damage in human sperm using the neutral comet assay. *Environmental Health Perspectives*, 111:1164–9, 2003.
- Singh NP, Muller CH and Berger RE. Effects of age on DNA double strand breaks and apoptosis in human sperm. *Fertility and Sterility*, 18:1420–1430, 2003.
- Singh NP and Lai H (2004) Artemisinin Induces Apoptosis in Human Cancer Cells. *AntiCancer Research* 24: 2277–2280.
- Singh NP and Lai H (2005) Synergistic Cytotoxicity of Artemisinin and Sodium Butyrate on Human Cancer Cells. *Anticancer Res* 25: 4325–4321.
- Singh NP, Panwar VK. (2006) Case Report of a Pituitary Macroadenoma Treated With Artemether. *Integrative Cancer Therapies* 5: 391–394.
- Lai H. and Singh N.P. (2006) Oral artemisinin prevents and delays the development of 7,12-dimethylbenz[a]anthracene (DMBA)-induced breast cancer in the rat. *Cancer Letters* 231: 43-48.
- Toraason M., Lynch D.W., DeBord D.G., Singh N., Krieg E., Butler M.A., Toennis C.A. and Nemhauser J.B. (2006) DNA damage in leukocytes of workers occupationally exposed to 1-bromopropane. *Mutation Research* 603: 1-14.
- Shi S., Hudson F.N., Botta D., McGrath M.B., White C.C., Neff-LaFord H.D., Dabrowski M.J., Singh N.P. and Kavanagh T.J. (2007) Over Expression of Glutamate Cysteine Ligase Increases Cellular Resistance to H<sub>2</sub>O<sub>2</sub>-induced DNA Single-Strand Breaks. *Cytometry* 71:686-692.
- Meeker J.D., Singh N.P. and Hauser R. (2008) Serum Concentrations of Estradiol and Free T<sub>4</sub> Are Inversely Correlated with Sperm DNA Damage in Men from an Infertility Clinic. *Journal of Andrology*. 29(4):379-88.
- Nakase I., Lai H., Singh N.P. and Sasaki T. (2008) Anticancer properties of artemisinin derivatives and their targeted delivery by transferrin conjugation. *International Journal of Pharmaceutics*. 354(1-2):28-33.
- Wolf N, Pendergrass W, Singh N, Swisshelm K, Schwartz J. (2008) Radiation cataracts: mechanisms involved in their long delayed occurrence but then rapid progression. *Molecular Vision* 14: 274-85.
- Oh S., Kim B.J., Singh N.P., Lai H. and Sasaki T. (2009) Synthesis and anti-cancer activity of covalent conjugates of artemisinin and a transferrin-receptor targeting peptide. *Cancer Letters*, 274(1), 33-39.
- Lai H., Nakase I., Lacoste E., Singh N.P., and Sasaki T. (2009) Artemisinin-transferrin conjugate retards growth of breast tumors in the rat. *Anticancer Res* 29:3807-3810.
- Marty M.S., Singh N.P., Stebbins K.E., Linscombe V.A., Passage J. and Gollapudi B.B. (2010) Initial Insights Regarding the Role of p53 in Maintaining Sperm DNA Integrity Following Treatment of Mice with Ethylnitrosourea or Cyclophosphamide *Toxicologic Pathology* 38: 244-251
- Singh N.P., Ferreira, J.F.S., Park, J.S. and Lai, H.C. Cytotoxicity of Ethanolic Extracts of *Artemisia annua* to Molt-4 Human Leukemia Cells. *Planta Medica* (EPublication Ahead of Print).  
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