Jayne Christine Boyer, Ph.D.

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Employment History:

Research Specialist (laboratory manager), November 30, 2009 – present; Department of Environmental Sciences and Engineering, University of North Carolina, Chapel Hill, NC

Research Assistant Professor, March 1, 2002 – June 30, 2009; Department of Pathology and Laboratory Medicine, University of North Carolina, Chapel Hill, NC.

Education:

Postdoctoral Research Associate
Dept. of Pathology and Laboratory Medicine, University of North Carolina, Chapel Hill, NC.
Staff Fellow, Laboratory of Molecular Genetics, The National Institute of Environmental Health Sciences, Research Triangle Park, NC.
Ph.D., University of North Carolina at Chapel Hill, NC, Toxicology.
M.S., Drexel University, Philadelphia, PA, Biological Sciences.
B.S. University of Pittsburgh, Pittsburgh, PA, Biochemistry.

Research Statement:

The focus of my research from 1995-2007 was to investigate mechanisms of microsatellite mutagenesis. My major efforts have been to analyze factors that affect spontaneous mutation rates in microsatellites. These factors include: microsatellite length, unit size, sequence composition and degree of sequence perfection. The effect of mismatch repair on these factors was studied using human cells in culture that are proficient or deficient in this repair process. I have also studied the effects of cadmium toxicity on mismatch repair in human fibroblasts and in collaboration with Dr. William Kaufmann, Department of Pathology and Laboratory Medicine, UNC, have extended these studies to cadmium's effect on DNA replication and cell cycle control.

Due to funding difficulties, I switched research interests in July 2007 and began working with Dr. Charles Jennette, Department of Pathology and Laboratory Medicine, UNC, on two projects in the Nephrology Division of the School of Medicine. The first was to design a method to detect and quantify heparanase in the blood of diabetic patients and to test the hypothesis that heparanase is involved in the pathogenesis of kidney disease in diabetes. Towards this effort I designed a sandwich-type ELISA to detect heparanase in plasma. The second project involved the use of several recombinant chimeric mouse/human myeloperoxidase (MPO) protein species to attempt epitope mapping in the autoimmune disease, ANCA (anti-neutrophil cytoplasmic auto-antibody). I expressed recombinant chimeric MPOs *in vitro* in HEK (human embryonic kidney) cells and purified the protein by FPLC. The chimeric MPOs will be injected into mice to stimulate an autoimmune response and kidney damage similar to that seen in ANCA renal vasculitis patients.

My current research interests in the laboratory of Leena Nylander-French include the use of a 3-dimensional human skin reconstruct model to study skin exposures to environmental and occupational chemicals. I was trained to isolate primary skin cells and to reconstruct them into *in vitro* dermal tissues in the laboratory of our collaborator Meenhard Herlyn, Wistar Institute (University of Pennsylvania), Philadelphia, PA and have developed the system in the Nylander-French laboratory to study mechanisms of dermal toxicity from environmental exposures. I have also

been involved in exposure and risk analysis of workers exposed to diisocyanates using analyses of bio-fluids for metabolites and SNP and DNA methylation analysis for genetic susceptibility.

Laboratory Skills

Nucleic acids: I have many years of experience with DNA/RNA molecular biology techniques: agarose gel electrophoresis, purification of nucleic acids, PCR, RT-PCR, qPCR (Roche Light Cycler 480), PAGE, capillary gel electrophoresis (ABI 310 Genetic Analyzer), Affymetrix Genome-Wide Human SNP 6.0 analysis, IlluminaHumanMethylation450 BeadChip arrays, DNA sequencing, UV/visible spectrophotometry, ultracentrifugation.

Cell culture techniques: bacterial and yeast cell culture, tissue culture (monoculture of primary human fibroblasts, melanocytes, keratinocytes, mouse fibroblasts, and human cancer lines), 3D human skin reconstruct tissue culture, electroporation and lipofection of DNA into cells in culture, safe mutagen/carcinogen handling techniques, mismatch repair assay, M13-based DNA polymerase mutation assay, and use of a fluctuation test in cultured mammalian cells to determine mutation rate as well as mutagen-induced cytotoxicity. Histological staining of 3D tissue reconstructs.

Proteins: 2 years of experience with the following protein techniques: ultra-filtration, ELISA, FPLC-purification of proteins (AKTA), Concanavalin A bead purification of glycoproteins, SDS-PAGE, Coomassie and silver-staining of poly-acylamide gels, Western Blots, transfection of protein-expression vectors into HEK293 cells in culture (including the FreeStyle suspension culture system), detection of fluorescently labeled proteins on Western blot using the GE Typhoon PhosphoImager, preparation of an antibody-based affinity column, use of an ELISA-based heparanase activity assay, use of the Exocell urine creatinine quantification assay, and design of a sandwich ELISA for human heparanase.

Professional Societies:

Environmental Mutagen Society
Genetics and Environmental Mutagenesis Society, Board of Councilors 2004-2007
Genetics and Environmental Mutagenesis Society, Nomination Committee Chair 2008
Genetics and Environmental Mutagenesis Society, Interim Treasurer Aug 2008- Jan 2009.
Genetics and Environmental Mutagenesis Society, Secretary 2007-2009; 2009-2011, 2011-2012.

Volunteerism
Marydell HOA President, 2011-present
Marydell HOA Beautification Chair, 2008-present
Marydell HOA Secretary, 2009-2011
Tree Keeper for City of Durham 2014

Research Funding:

University Research Council grant, University of North Carolina, $4000
"Suppression of expression of mismatch repair proteins in normal human fibroblasts using an siRNA expression vector". 11/02 - 12/04

University Research Council grant, University of North Carolina, $4000
"Effects of cadmium on microsatellite instability". 5/05 – 4/07

Center for Environmental Health Susceptibilities pilot project grant/ UNC, Chapel Hill, NC, $25,000
"Effects of cadmium on DNA synthesis, cell cycle control and microsatellite mutation rate in human cells in culture". 5/15/06 – 3/31/07

Publications:

Nylander-French LA, Wu MC, French JE, Boyer J, Smeester L, Sanders AP and Fry RC. DNA methylation modifies urine biomarker levels in 1,6-hexamethylene diisocyanate exposed workers: A pilot study. Toxicology Letters 231:217-226 (2014).

McDaid, J.R., Loughery, J., Dunne, P., Boyer, J.C., Downes, C.S., Farber, R.A., and Walsh, C.P. MLH1 mediates PARP-dependent cell death in response to the methylating agent N-methyl-N-nitrosourea. *British Journal of Cancer* 1-11 (2009).

Boyer, J.C., Hawk, J.D., Stefanovic, L. and Farber, R.A. Sequence-dependent effect of interruptions on microsatellite mutation rate in mismatch repair-deficient human cells. *Mutation Research* 640(1-2): 89-96 (2008).

Cao, F., Zhou, T., Simpson, D., Zhou, Y., Chen, B., Jin, T., Cordeiro-Stone, M., Boyer, J.C., and Kaufmann, W. p53-dependent but ATM-independent inhibition of DNA Synthesis and G2 arrest in cadmium-treated human fibroblasts. *Toxicology and Applied Pharmacology* 218:174-185 (2007).

Hawk, J.D., Stefanovic, L., Boyer, J.C., Petes, T.D., and Farber, R.A., Variation in efficiency of DNA mismatch repair at different sites in the yeast genome, *Proc. Natl. Acad. Sci. USA* 102:8639-8643 (2005).

Boyer, J.C., Yamada, N.A., Roques, C.N., Hatch, S.B., Riess, K., and Farber, R.A., Sequence dependent instability of mononucleotide microsatellites in cultured mismatch-repair-proficient and -deficient mammalian cells, *Hum. Molec. Genet*. 11:707-713 (2002).

Yamada, N.A., Smith, G.A., Castro, A., Roques, C.N., Boyer, J.C., and Farber, R.A., Relative rates of insertion and deletion mutations in dinucleotide repeats of various lengths in mismatch repair proficient mouse and mismatch repair deficient human cells, *Mutation Res*. 499:213-225 (2002).

Roques, C.N., Boyer, J.C., and Farber, R.A., Microsatellite mutation rates are equivalent in normal and telomerase-immortalized human fibroblasts, *Cancer Res.* 61:8405-8407 (2001).

Bebenek, K., Boyer, J.C., and Kunkel, T.A. The base substitution fidelity of HIV-1 reverse transcriptase on DNA and RNA templates probed with 8-oxo-deoxyguanosine. *Mutation Research/Fundamental and Molecular Mechanisms of Mutagenesis*. 429: 149-58 (1999).

Twerdi, C.D., Boyer, J.C., and Farber, R.A., Relative rates of insertion and deletion mutations in a microsatellite sequence in cultured cells, *Proc. Natl. Acad. Sci. USA* 96:2875-2879 (1999).

Boyer, J.C., and Farber, R.A., Mutation rate of a microsatellite sequence in normal human fibroblasts, *Cancer Res*. 58:3946-3949 (1998).

Boyer, J.C., Risinger, J.I., and Farber, R.A., Stability of microsatellites in myeloid neoplasias, *Cytogenet. Cell Genet*. 106:54-61 (1998).

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Boyer, J.C., Umar, A., Risinger, J.I., Lipford, R., Kane, M., Barrett, J.C., Kolodner, R.D., and Kunkel, T.A. Microsatellite instability, mismatch repair deficiency and genetic defects in human cancer cells. *Cancer Research*, 55: 6063-6070 (1995).

Risinger, J.I., Umar, A., Boyer, J.C., Evans, A.C., Berchuck, A., Kunkel, T.A., and Barrett, J.C. Microsatellite instability in gynecologic sarcomas and in hMSH2 mutant uterine sarcoma cell lines defective in mismatch repair activity. *Cancer Research*, 55: 5664-5669 (1995).

Umar, A., Boyer, J.C., Thomas, D.C., Nguyen, D., Risinger, J.I., Boyd, J., Ionov, Y., Perucho, M., and Kunkel, T.A. Defective mismatch repair in extracts of colorectal and endometrial cancer cells lines exhibiting microsatellite instability. *The Journal of Biological Chemistry*, 269: 14367-14370 (1994).

Boyer, J.C., Thomas, D.C., Maher, V.M., McCormick, J.J. and Kunkel, T.A.
Fidelity of DNA replication by extracts of normal and malignantly transformed human cells, *Cancer Research*, 53: 3270-3275 (1993).

Boyer, J.C., Bebenek, K., and Kunkel, T.A. Unequal HIV-1 reverse transcriptase error rates with RNA and DNA templates, *Proc. Natl. Acad. Sci,* USA, 89: 6919-6923 (1992).

Kaufmann, W.K., Boyer, J.C., Estabrook, L., and Wilson, S.R. Inhibition of replicon initiation in human cells following freezing of topoisomerase-DNA cleavable complexes. *Molecular and Cellular Biology*, 11: 3711-3718 (1991).

Boyer, J.C., Kaufmann, W.K., and Cordeiro-Stone, M. The role of postreplication repair in transformation of human fibroblasts to anchorage independence, *Cancer Research*, 51: 2960-2964 (1991).

Boyer, J.C., Kaufmann, W.K., Brylawski, B.P., and Cordeiro-Stone, M. Defective postreplication repair in xeroderma pigmentosum variant fibroblasts. *Cancer Research*, 50: 2593-2598 (1990).

Cordeiro-Stone, M., Boyer, J.C., Smith, B.A., and Kaufmann, W.K. Xeroderma pigmentosum variant and normal fibroblasts show the same response to the inhibition of DNA replication by benzo[a]pyrene-diol-epoxide-I. *Carcinogenesis*, 7: 1783-1786 (1986).

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Gealt, M.A., Chai, M.D., Alpert, K.B. and Boyer, J.C. Transfer of plasmids pBR322 and pBR325 in wastewater from laboratory strains of *Escherichia coli* to bacteria indigenous to the waste disposal system. *Applied and Environmental Microbiology*, 49: 836-841 (1985).

Thesis

Boyer, J.C. Electrophoretic analysis of the mobilization of nonconjugative cloning vector, Master of Science Thesis, Department of Biological Sciences, Drexel University, Philadelphia, PA.

Dissertation

Boyer, JC. The association between inhibition of DNA replication and induction of transformation by ultraviolet radiation or benzo[a]pyrene-diol-epoxide-I in human fibroblasts, Doctoral Dissertation, Curriculum in Toxicology, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599.

References:

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