BIOGRAPHICAL SKETCH

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NAME: Blum, Paul H.

eRA COMMONS USER NAME (credential, e.g., agency login): pblum1

POSITION TITLE: Chief Executive Officer

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of California-Berkeley	B.A.	06/1976	Bacteriology/Immunol.
University of California-Davis	Ph.D.	06/1984	Microbiology
University of California-Berkeley	Postdoctoral	06/1986	Biochemistry
Stanford University, School of Medicine	Postdoctoral	06/1989	Microbiology

A. Personal Statement.

My current academic research program emphasizes the function of diverse proteins combining *in vivo* and *in vitro* approaches. My most recent effort concerns the development of a repurposed protein toxin that is a candidate therapeutic to treat human pain. My academic laboratory has studied many proteins but the common theme is to integrate data to achieve a mechanistic understanding of protein function. As PI or co-I on numerous federal grants funded by NIH, NSF, DOE, DOD and other agencies, my academic laboratory has made fundamental contributions about cell biology from archaea to bacteria to eukaryotes.

To commercialize the technology related to my research on repurposed toxins leading to N-001, I co-founded Neurocarrus Inc., and am currently serving as its Chief Executive Officer. As CEO, I work closely with my co-founder and CSO, Ben Pavlik at Neurocarrus on the commercial development of N-001 a promising new pain therapeutic. My academic positions at the University of Nebraska Lincoln and the University of California Santa Cruz enable me to coordinate early stage startup activities of Neurocarrus with the institutional technology transfer divisions of both universities. I operate in strict compliance with conflict of interest regulations and this process is actively managed by both institutions. SBIR support for Neurocarrus will enable it to secure wet laboratory space for independent research activities. Currently, the Nebraska Department of Economic Development supports N-001 manufacturing at the University of Nebraska through its technology transfer division operating on the U. Nebraska's Innovation Campus. N-001 produced at that location will be used for the proposed studies described in this SBIR project. Support for these studies is indicated here:

R43NS120337
Blum (PI)
9/30/20-8/31/22

Citations:

1. Retargeting the Clostridium botulinum C2 toxin to the neuronal cytosol. 2016 Pavlik, B.J., E.J. Hruska, K.E. Van Cott and P.H. Blum. Sci Rep. 6:23707. PMID: 27025362.
2. Pavlik, B. J., K. E. Van Cott and P. H.. Blum. 2017. Repurposed bacterial toxins for human therapeutics. Curr. Topics Peptide and Prot. Res. 185; 18, 1-15.
3. Allen, D., Zhou, Y., Wilhelm, A. and P. Blum. 2020. Intracellular G-actin targeting of peripheral sensory neurons by the multifunctional engineered protein C2C confers relief from inflammatory pain. Sci Rep 10, 12789. DOI: 10.1038/s41598-020-69612-9 PMID: 32732905

4. Allen, D., Hanumantharao, S.N., McDonell, R. Irvine, K-A., Sahbaie, P., Clark, D., and Blum, P. Preclinical characterization of the efficacy and safety of biologic N-001 as a novel pain analgesic for post-operative acute pain treatment. 2023. Sci Rep 13:11778. PMID: 37479740.

B. Positions and Honors.

Positions and Employment

1977-1979	Research Technician, School of Optometry, University of California-Berkeley
1984-1986	Fellow National Institutes of Environmental Health Sciences (NIEHS)
1990-1996	Assistant Professor, School of Biological Sciences, University of Nebraska-Lincoln (UNL)
1997-2005	Associate Professor, School of Biological Sciences, UNL
2005-	Professor, School of Biological Sciences, UNL
2009-	Adjunct Professor, Department of Chemical and Biomolecular Engineering, UNL
2009-	Charles Bessey Professor in Biological Sciences, UNL
2014-2017	Associate Director, Nebraska Center for Energy Sciences Research
2017-	Adjunct Professor, Department of Microbiology and Environmental Toxicology, University of California-Santa Cruz
2017-	Chief Executive Officer, Neurocarrus Inc.
2023	Emeritus Bessey Professor, UNL

Other Experience and Professional Memberships

1985-	Member, American Society for Microbiology
1990-	Member, American Association for Advancement of Science
2004-	Member, American Chemical Society
2013,14,17	NIAID Peer Review Committee SEP: ad hoc reviewer
2013-18,22	NSF Panelist and ad hoc reviewer
2023	NIH Reach Panel Review Committee

Honors

1985-1987	National Research Service Award, National Institutes of Environmental Sciences
1992	Recognition Award for Contributions to Students, University of Nebraska
2003	Advisor of the Year Award, UNL
2004	Award of Excellence, BSGA-UNL
2006	Outstanding Research and Creative Achievement (ORCA) Award, CA&S, UNL
2010	Charles Bessey Professorship

C. Contribution to Science

1. In my early work using various bacteria, I studied aspects of tRNA and translation consistently emhasizing a genetic approach. Using *Salmonella typhimurium*, the contribution of the tRNA base modification pseudouracil was determined. Its role in translation elongation rate and on translational suppression efficiency of amber codons was determined. I then examined the role of a second tRNA base modification called cis-2-methylthioribosylzeatin (ms2io6A) again in enteric bacteria. Using mutant cell lines lacking the genes for base modification, I identified a regulatory role for the modified base in the synthesis of leucine likely through translational attenuation. As this modified tRNA base was evident in cell extracts of mutants lacking the tRNA-based synthetic pathway, alternate routes for its synthesis are present in bacteria.

a. Palmer, D. T., Blum, P. H. and Artz, S. W. 1983. Effects of the hisT mutation of S. typhimurium on translation elongation rate. J. Bacteriol. 153:357-363.
b. Blum, P. H. 1988. Reduced leu operon expression in a miaA mutant of Salmonella typhimurium. J. Bacteriol. 170:5125-5133.
c. Blum, P. H. and B. N. Ames. 1989. Imunnochemical identification of a tRNA independent cytokinin like compound in Salmonella typhimurium. Biochim. Biophys. Acta 1007:196-202.

2. As an assistant professor, I continued studies on protein synthesis in bacteria in this case on the function of

protein chaperones in the stationary phase and their role in regulation of synthesis of stress proteins that mediated resistance to heat and oxidation.

a. Blum, P., J. Bauernfiend, J. Ory, and J. Krska. 1992. Physiological consequences of DnaK and DnaJ overproduction in *Escherichia coli*. J. Bacteriol. 174:7436-7444.

b. Krska, J., T. Elthon, and P. Blum. 1993. Monclonal antibody recognition and function of a DnaK (HSP70) epitope found in gram negative bacteria. J. Bacteriol. 175:6433-6440.

c. Rockabrand, D., T. Arthur, G. Korinek, K. Livers, and P. Blum. 1995. An essential role for the *Escherichia coli* DnaK protein in starvation-induced thermotolerance, H_2O_2 resistance and reductive division. J. Bacteriol. 177:3695-3703.

d. Rockabrand, D., K. Livers, T. Austin, R. Kaiser, D. Jensen, R. Burgess and P. Blum. 1998. Roles of DnaK and RpoS in starvation-induced thermotolerance of *Escherichia coli*. J. Bacteriol. 180:846-854.

3. During my transition from assistant to associate professor I initiated studies on archaea (not bacteria) and developed the first genetic system for the thermoacidophile *Sulfolobus solfataricus*. This system was based on homologous recombination allowing directed efforts to reconstruct genes and flanking regions. The resulting methods were then refined to employ double stranded linear DNA and multiple homologous recombination products to create new cell lines.

a. Worthington, P., V. Hoang, P. Perez-Pomares, and P. Blum. 2003. Targeted disruption of the alpha-amylase gene in the hyperthermophilic archaeon *Sulfolobus solfataricus*. J. Bacteriol. 185:482-488.

b. Schelert, J., V. Dixit, V. Hoang, J. Simbahan, M. Drozda and P. Blum. 2004. Occurrence and characterization of mercury resistance in the hyperthermophilic archaeon *Sulfolobus solfataricus* using gene disruption. J. Bacteriology 186:427-437.

c. Korencic, D., I., Ahel, J., Schelert, M., Sacher, B., Ruana, C., Stathopoulosa, P., Blum, M., Ibba, and D. Söll. 2004. A freestanding proofreading domain is required for protein synthesis quality control in Archaea. Proc. Natl. Acad. Sci. USA 101:10260-10265.

d. Maezato, Y., K. Dana and P. Blum. 2011. Engineering Thermoacidophilic Archaea Using Linear DNA Recombination. Methods Mol Biol. 765:435-45.

List of Published Work in MyBibliography:

http://www.ncbi.nlm.nih.gov/sites/myncbi/paul%20helmuth.blum.1/bibliography/40346399/public/?sort=date&direction=ascending