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Education:

- Postdoc., 1962-1964, Harvard University
- Ph.D., 1962, University of Illinois
- B.S., 1956, Brooklyn College

Research Interest:

- **Environmentally Regulated Genes in *M. aeruginosa*, a Fresh Water**

Our long term goal is to understand how environmentally regulated genes are expressed in the toxin-producing cyanobacterium *Microcystis aeruginosa* UV027, a fresh water organism reported to be a health hazard to animals and humans. We are presently examining regulation of the synthesis of the cyclic heptapeptide toxin, microcystin-RR (MCYST-RR) in *Microcystis aeruginosa* UV027. This toxin is produced non-ribosomally. It inhibits PP1 and PP2A-type eukaryotic protein phosphatases resulting in impairment of signal transduction and cell-cycle regulation.

Using a lambda ZAP II *M. aeruginosa* UV027 genomic library and PCR, we cloned both

the peptide synthetase operon and the second operon, found upstream and transcribed in the opposite direction, which encodes a polyketide synthase and other genes for the synthesis of MCYST-RR. These putative operons are similar to those reported for MCYST-LR in *M. aeruginosa* K-139 and PCC 7806 except for one region in the peptide synthetase operon which encodes arginine in MCYST-RR rather than lysine.

We isolated the 726 bp promoters for the two operons and have ligated them to the reporter gene *gfp* replacing the *mcuD* gene and the reporter gene *luxAB* replacing *mcuA*. This construct has been cloned into the shuttle vector, pMaL-D7 (constructed by us from a plasmid isolated from *M. aer.*UV025), to enable us to examine regulation of toxin production by light. Suspected regulatory sequences in the promoter region in the plasmid have been mutated in order to examine their role in regulation.

We are also searching for regulatory genes, starting with phytochromes, found in other cyanobacteria, that might be involved in regulating toxin synthesis. A

phytochrome gene from strain UV027 has been cloned, and its role, if any, in MCYST regulation will be analyzed.

Studies have been initiated with *M. aeruginosa* UTEX 2063 which does not synthesize MCYSTs. Our data indicates that it lacks the MCYST operons. This strain will be used for examining regulation by reconstituting genes into this natural "knock-out" strain.

Selected Publications:

- Zhong, S, Qiu, W., and Raps, S, 2008. Phytochrome sequence from *Microcystis aeruginosa* UV027. GenBank accession number EU723511.
- Raps, S. 2007. Plant Pigment, Photosynthetic Pigments. McGraw-Hill Encyclopedia of Science & Technology, 10th Edition, vol 13, 755-760. AccessScience@McGraw-Hill (on-line version)
- Raps, S. 2002 "Photosynthetic Pigments" in The Encyclopedia of Science and Technology. 9th ed. McGraw-Hill Publishing Co. Miller, David and Raps, Shirley, 2001. Synthesis of the toxin microcystin-RR in *M. aeruginosa*UV027, The VIIth Cyanobacterial Workshop, Asilomar Conference Center, Pacific Grove, CA. July 27- 31.*
- Raps, S., Miller, D. and Ratner, S. 2002. Nucleotide sequence of microcystin RR peptide synthetase operon, Genbank accession number AF458094.
- Wallace, M., Miller, D. and Raps, S. 2002 Characterization of pMa025, a plasmid isolated from the cyanobacterium *Microcystis aeruginosa* UV025. Arch. Microbiol., 177:332-338
- Raps, S. 2002 "Photosynthetic Pigments" in The Encyclopedia of Science and Technology. 9th ed. McGraw-Hill Publishing Co. Miller, David and Raps, Shirley, 2001. Synthesis of the toxin microcystin-RR in *M. aeruginosa*UV027, The VIIth Cyanobacterial Workshop, Asilomar Conference Center, Pacific Grove, CA. July 27- 31.*
- Wallace, M. and Raps, S. 2000 Characterization of pMa025, a plasmid isolated from the cyanobacterium *Microcystis aeruginosa* UV025. Submitted
- Miller, David, Arora, Shalini** and Raps, Shirley, 1998. Construction of a Shuttle Vector and Its Use in Gene Transfer in *Microcystis*. The VIth Cyanobacterial Workshop Exploiting the

Cyanobacterial Genome, Asilomar Conference Center, Pacific Grove, CA. B26 July24-27.

- Wallace, M., Miller, D. and Raps, S. 1997. Construction of a Shuttle Vector for *Microcystis aeruginosa*. A. S. M., 97th General Meeting, Miami Beach, Fl, May 4-8, H-34, p.290 (Abstract)