

The global spread, pathogenesis and control measures for hypervirulent *Aeromonas hydrophila* in warm water fish species

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A clonal population of hypervirulent *Aeromonas hydrophila* (vAh) has caused the loss of over 10 million kilograms of farmed catfish across the southeastern United States since 2009. Phylogenomic analyses suggest that U.S. catfish isolates emerged from the importation of Asian carp, with outbreaks of *A. hydrophila* in carp species documented in China since 1989. An ongoing worldwide survey of *A. hydrophila* isolates revealed that vAh strains have disseminated to multiple countries and can infect diverse fish hosts. We developed two strategies for vAh control, using either probiotic bacteria or an attenuated vaccine.

Probiotic studies: We identified *Bacillus* spp. strains that have the ability to reduce fish mortality due to multiple bacterial pathogens, including vAh. The effect of probiotic-amended feed ($10^6 - 10^7$ CFU spores/g feed) over 10 or more weeks on catfish growth performance indicated that *B. velezensis* AP193 induced a mean 9-14% increase in growth compared to control fish and significantly reduced mortality (3%) when challenged with vAh compared to control fish (60% mortality).

Vaccine studies: Comparative genomic analysis of vAh strains from the US and China identified many genetic loci that are uniquely present in vAh strains, including a novel O-antigen biosynthesis gene cluster. Genetic knockouts in the *gfc* operon responsible for O antigen capsule assembly were found to attenuate vAh virulence, reduce biofilm formation and affect protein secretion. Furthermore, a *gfcD* mutant was observed to induce an adaptive immune

Response that protected catfish from challenge with wild-type vAh in aquaria and pond studies.



Biography:

Prof. Mark Liles is microbiologist in the Department of Biological Sciences, Auburn University. He has a B.S. in Biology from Tulane University, a Ph.D. in Microbiology from Northwestern University (1998), and conducted postdoctoral research at the University of Wisconsin-Madison in the labs of Prof. Jo Handelsman and Prof. Bob Goodman. Over the past 30+ years in science, he has developed methods for community genomic (“metagenomic”) analysis of complex microbial communities and developed treatments for the control of disease in agriculture, aquaculture and human medicine. He has published over 100 peer-reviewed journal articles, over 150 published abstracts and is an inventor on five awarded patents with other patents pending. He co-Founded the biotechnology company [Varigen Biosciences](#) and serves as President of the company.

Speaker Publications:

Thurlow, C.M., Hossain, M.J., Heiss, C., Sun, D., Foshee, L., Wang, Z., Azadi, P., Newton, J.C., Terhune, J.S., Saper, M.A., and Liles, M.R. (2019) The gfc operon is involved in the formation of the O antigen capsule in *Aeromonas hydrophila* and contributes to virulence in channel catfish. *Aquaculture*, <https://doi.org/10.1016/j.aquaculture.2019.734334>

Hassan, M.K., McInroy, J.A., Jones, J., Shantharaj, D., Liles, M.R. and Kloepper, J.W. (2019) Pectin-rich amendment enhances soybean growth and nodulation mediated by *Bacillus velezensis* strains. *Plants*, 8(5).

Thurlow, C.M., Williams, M.A., Carrias, A., Ran, C., Newman, M., Tweedie, J., Allison, E., Jescovitch, L.N., Terhune, J.S. and Liles, M.R. (2019) *Bacillus velezensis* AP193 exerts probiotic effects in channel catfish (*Ictalurus punctatus*) and reduces aquaculture pond eutrophication. *Aquaculture*, 503:347-356.

Wang, E., Yuan, Z., Wang, K., Gao, D., Liu, Z. and Liles, M.R. (2019) Consumption of florfenicol-medicated feed alters the composition of the channel catfish intestinal microbiota including enriching the relative abundance of opportunistic pathogens. *Aquaculture*, 501:111-118.

Li, Y., Liles, M.R. and Halanych, K. (2018) Endosymbiont genomes yield clues of tubeworm success. *ISME Journal*, 12: 2785–2795.

Nasrin, S., Ganji, S., Kakirde, K.S., Jacob, M.R., Wang, M., Rao, R.R., Cobine, P.A., Khan, I.A., Wu, C.C., Mead, D.A., Li, X.-C. and Liles, M.R. (2018) Chloramphenicol derivatives with antibacterial activity identified by functional metagenomics. *Journal of Natural Products*, 81(6):1321-1332.

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