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Asst Prof Zijuan Liu and Her Students Publish a Report on Arsenic Uptake

CBR member **Zijuan Liu** is one of an outstanding crop of promising young researchers in OU's **Department of Biological Sciences**. Liu, who arrived at OU in 2007, recently was awarded a grant from the **National Institutes of Health** to study **arsenic** uptake. While her work focuses on studies in an animal model--**zebrafish**--the work has important implications for human health. Recently, Liu published **Arsenic Transport by Zebrafish Aquaglyceroporins** in the open access journal **BMC Molecular Biology** (Volume 10, Article Number 104). First author on the study was **Mohamad Hamdi**, a graduate student in the Biomedical Sciences: Biological Communications PhD program, and a coauthor was **Lauren Beene**, a graduate student in the Master of Science in Biology program. The abstract of Liu's paper is reproduced below.

Background: Arsenic is one of the most ubiquitous toxins and endangers the health of tens of millions of humans worldwide. It is a mainly a water-borne contaminant. Inorganic trivalent arsenic (As-III) is one of the major species that exists environmentally. The transport of As-III has been studied in microbes, plants and mammals. Members of the aquaglyceroporin family have been shown to actively conduct As-III and its organic metabolite, monomethylarsenite (MAsIII). However, the transport of As-III and MAsIII in in any fish species has not been characterized.

Results: In this study, five members of the aquaglyceroporin family from zebrafish (Danio rerio) were cloned, and their ability to transport water, glycerol, and trivalent arsenicals (As-III and MAsIII) and antimonite (Sb-III) was investigated. Genes for at least seven aquaglyceroporins have been annotated in the zebrafish genome project. Here, five genes which are close homologues to human AQP3, AQP9 and AQP10 were cloned from a zebrafish cDNA preparation. These genes were named aqp3, aqp31, aqp9a, aqp9b and aqp10 according to their similarities to the corresponding human AQPs. Expression of aqp9a, aqp9b, aqp3, aqp31 and aqp10 in multiple zebrafish organs were examined by RT-PCR. Our results demonstrated that these aquaglyceroporins exhibited different tissue expression. They are all detected in more than one tissue. The ability of these five aquaglyceroporins to transport water, glycerol and the metalloids arsenic and antimony was examined following expression in oocytes from Xenopus leavis. Each of these channels showed substantial glycerol transport at equivalent rates. These aquaglyceroporins also facilitate uptake of inorganic As-III, MAsIII and Sb-III. Arsenic accumulation in fish larvae and in different tissues from adult zebrafish was studied following short-term arsenic exposure. The results showed that liver is the major organ of arsenic accumulation; other tissues such as gill, eye, heart, intestine muscle and skin also exhibited significant ability to accumulate arsenic. The zebrafish larvae also accumulate considerable amounts of arsenic.

Conclusion: This is the first molecular identification of fish arsenite transport systems and we propose that the extensive expression of the fish aquaglyceroporins and their ability to transport metalloids suggests that aquaglyceroporins are the major pathways for arsenic accumulation in a variety of zebrafish tissues. Uptake is one important step of arsenic metabolism. Our results will contribute to a new understanding of aquatic arsenic metabolism and will support the use of zebrafish as a new model system to study arsenic associated human diseases.

SUMMARY
CBR member Zijuan Liu publishes Arsenic Transport by Zebrafish Aquaglyceroporins in the open access journal BMC Molecular Biology.

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