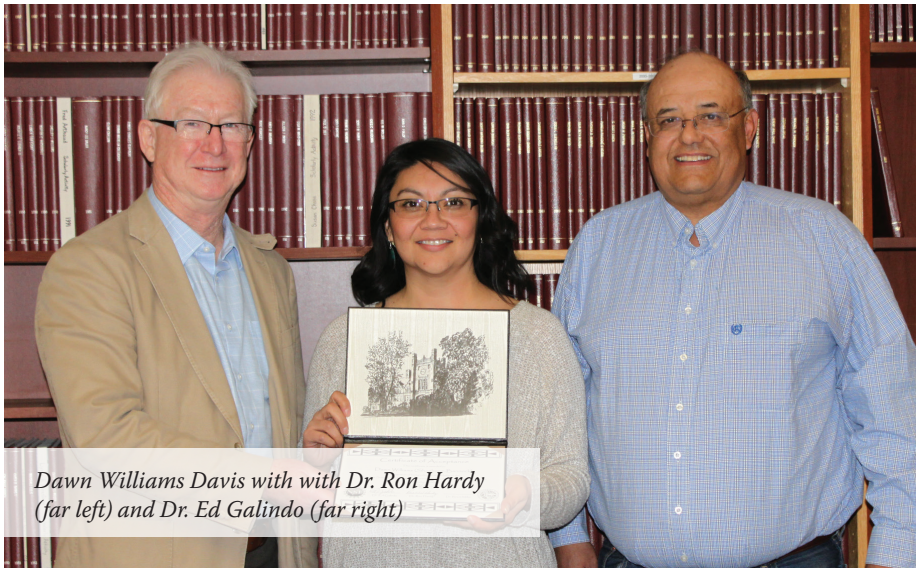
University of Idaho
Aquaculture Research Institute
SPRING 2015

ISTEM at ARI

submitted by Dr. Ron Hardy



Dawn Williams Davis with with Dr. Ron Hardy (far left) and Dr. Ed Galindo (far right)

The Indigenous Program for STEM Research and a Regional Native Network of Graduate Education (ISTEM for short) is a novel program funded by the National Science Foundation. It is intended to increase the number of American Indians receiving graduate degrees in STEM (science, technology, engineering and math) fields. Now reaching the end of year 1 of the five-year, $750,000 program, ISTEM has enrolled eight Native American scholars at four universities, providing mentoring and financial support as they navigate their advanced degree studies. ISTEM takes a unique approach to the topic, engaging students and providing support at several levels. ISTEM was the brainchild of Drs. Ed Galindo and Ron Hardy; they now oversee the program along with Dr. Brant Miller (Education) and external advisor Dr. Kim Winkleman, former president of Comanche Nation College.

ISTEM was developed to address a troubling statistic, namely that Native Americans are severely under-represented in the pool of students earning graduate degrees in the USA every year. For example, in 2012, according to The Chronical of Higher Education, only 102 American Indian students earned PhD degrees, about 0.3% of doctorates awarded to US citizens and permanent residents, despite the fact that they represent 1.2% of the population. Even worse, they were the only minority group whose shares of doctorates actually declined over the past 20 years; in 1992, there were 149 doctorates awarded to American Indians. Many reasons are given for this depressing situation but most are connected to poverty, family and community commitments that make residence at universities a struggle, lack of role models and lack of a supporting environment at universities that takes into account the social needs of students.

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INSIDE

Aquaculture Research Institute

The ARI newsletter will be produced semi-annually and available online in Adobe Acrobat format through **www.uidaho.edu/aquaculture**. If you would like to be notified via email when the latest edition is available on our web page, please notify the editor at **aqua@uidaho.edu.**

We would be happy to include appropriate contributions from those of you working in the field. Feedback and suggestions on how to improve this newsletter would also be appreciated.

This issue of the newsletter highlights various projects being conducted on the Moscow campus, the Hagerman Fish Culture Experiment Station and includes various extension activities.

The Aquaculture Research Institute Newsletter provides information about aquaculture-related activities at the University of Idaho. It is intended to complement rather than duplicate the Idaho Aquaculture Association Newsletter, although some articles may overlap. Articles in this newsletter may be reproduced without permission, provided they are properly cited. Please feel free to submit comments or material you would like us to consider for publication to:

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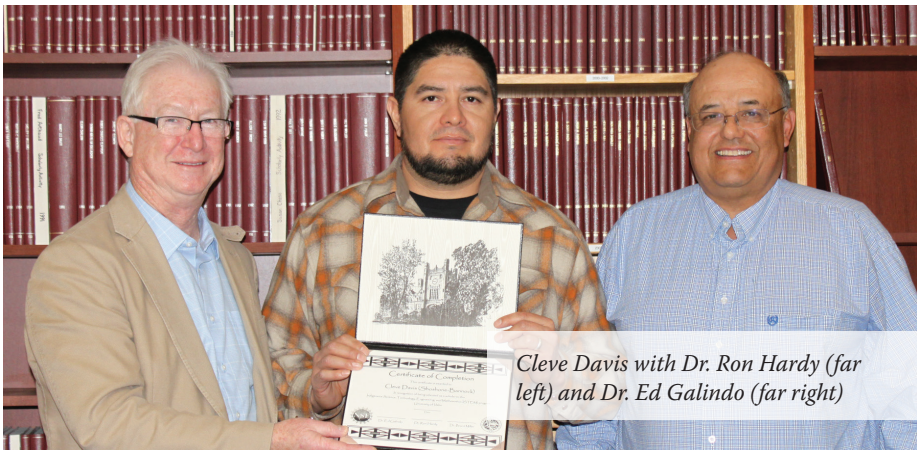
Programs have been developed to address each of these issues separately, but ISTEM is the first program designed to address these issues simultaneously. First, ISTEM provides financial support to students, contingent on successful progress following a study plan approved by ISTEM in collaboration with the faculty advisor of the student. Second, ISTEM is designed to deliver education to students for whom relocation to a university offering PhDs in their chosen field is difficult. This is accomplished by arranging for course work to be taken at nearby universities and/or by delivering coursework using video conferencing or other on-line methods. Role models are provided by project investigators and collaborators, who also foster engagement and mentoring by maintaining regular contact, including site visits, with students and their faculty advisors.



Cleve Davis with Dr. Ron Hardy (far left) and Dr. Ed Galindo (far right)

In the first year of the project, the primary goal was to identify and enroll three or four students in the ISTEM program as the first cohort group. However, after extensive searching eight candidates were ultimately enrolled. Two were near the end of their PhD programs and needed little or no financial support. Two others were in their final year of study and required support to allow them to finish. The remaining students are just starting their graduate studies or in their first year. ISTEM student demographics differ somewhat from the graduate student population in that their average age is in the mid-thirties. They come from several different reservations/nations and have a high interest in serving their communities after they complete their studies.

A second goal of the project was to institute an on-line course for ISTEM students called "Methods of Native Inquiry." The course, taught by Dr. Winkelman, introduces Indian-STEM students to concepts of inquiry on the engagement and execution of their professions. Specifically, the course is designed to provide students with conceptual frameworks in the application of their STEM profession that brings cultural considerations into scientific research, technology application, engineering design and mathematical models. The course is based on a fundamental premise that ancient cultural values can be integrated into modern STEM professions, providing students with a bridge to link their STEM studies with traditional learning and experiences. The course is also based on the fundamental idea that individuals can shift the current paradigm in organizations, institutions, and communities through growth, positive change, and an understanding of their cultural roots. The course was taught during fall 2014.

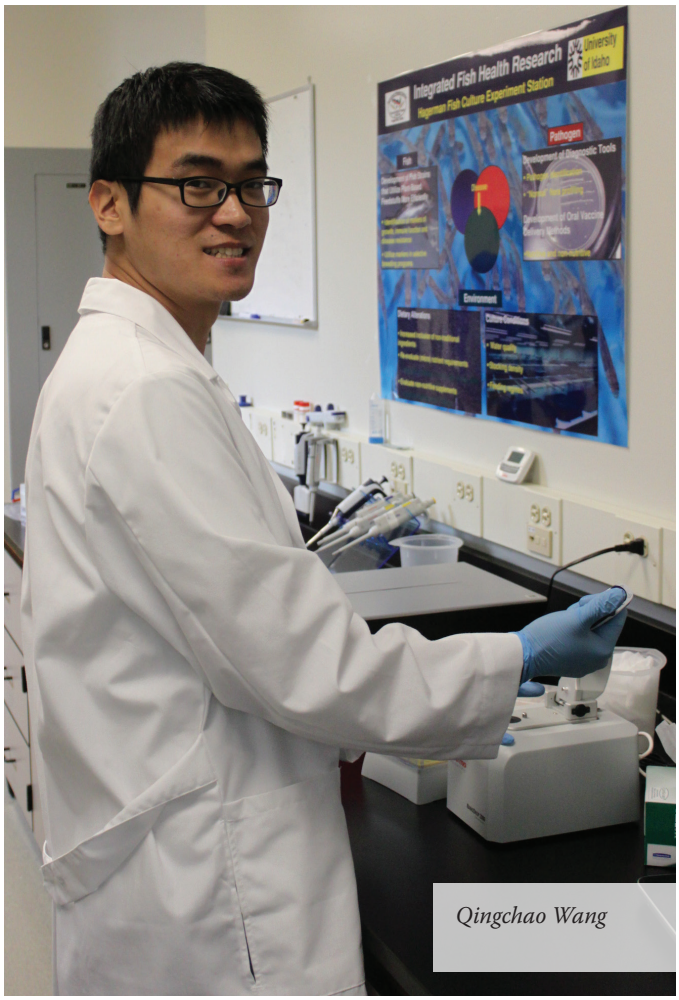
A final goal of the project is to engage in active mentoring of ISTEM students by project co-PIs in partnership with their faculty advisors. The concept is to link ISTEM financial support with accountability by meeting periodically with students who are expected to make an oral presentation on their specific research project. The two purposes of the oral presentation are to make students 'self-assess' their progress in order to present it to their mentors, and to gain experience in organizing and presenting their work to better prepare them for making scientific presentations. Students at Idaho State University, University of Montana and North Arizona University will be visited during spring 2015.

Foreign Scholars Come to Hagerman to Study

submitted by Dr. Ron Hardy

The Aquaculture Research Institute (ARI) continues to receive many requests each year from foreign graduate students to host them for short-term or long-term research experience at the Hagerman Fish Culture Experiment Station (HFCES). Such visits are an important facet of graduate education, exposing students to new techniques, approaches and, for many, a new species of fish, the rainbow trout.

Requests from students are first screened to determine if their research focus at their home university matches research projects underway at HFCES. If so, then the question arises as to their financial support. Finally, students are chosen based on whether or not their visit will be mutually beneficial, i.e., do they have skills that can contribute to research at HFCES and are there aspects of research that will enhance their education? In the past year four foreign graduate students were selected to be visiting scholars at HFCES. They were Qingchao Wang, Visiting Scholar, PhD candidate, Ocean University of China (June 2014 to May, 2015); Nattanan Tiengtam, Visiting Scholar, PhD candidate, Suranaree University of Technology, Thailand (October-December, 2014); Christos Giatsis, Ph.D. student, Wageningen University, The Netherlands (August - October 2014); and Caroline Nebo, PhD candidate, Sao Paulo State University, Brazil (September 2013 to May 2014). The first three students studied aspects of fish nutrition and were supervised by Dr. Ron Hardy. Caroline Nebo's studies involved muscle fiber development in fish and she was supervised by Dr. Ken Overturf.



Qingchao Wang

Qingchao Wang's research involved assessing sampling protocols in fish nutrition studies to optimize sampling for gene expression, using juvenile rainbow trout. Researchers around the world employ several different protocols regarding the period of time after a feeding to sample tissues to measure expression levels of genes associated with energy metabolism, nutrient transporters and muscle growth. Some sample fish after an overnight fast, while others withhold feed for one or two days followed by a single feeding, after which genes are sampled sometime during the next 12-24 hours. Surprisingly, the effects of these feeding-starvation experimental designs on gene expression have never been compared.

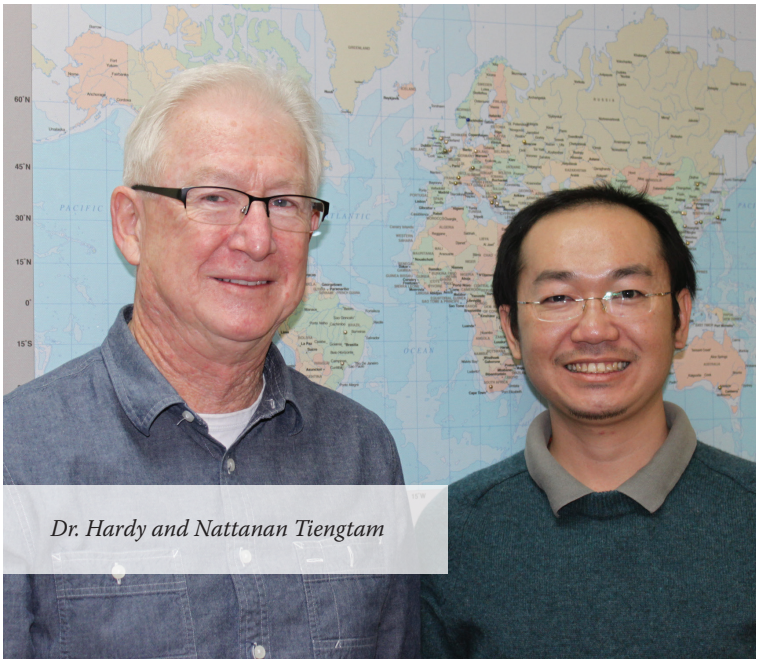
continued

Christos Giatsis

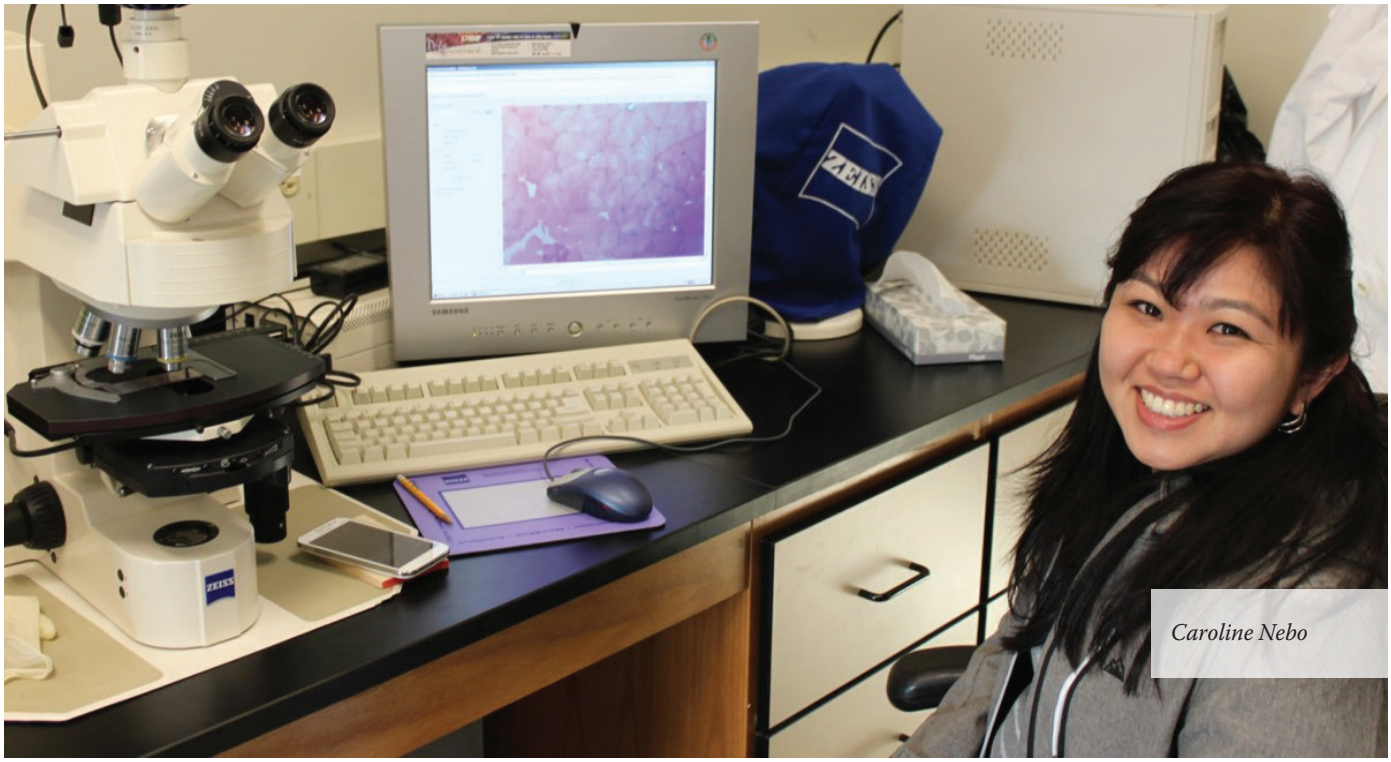
Nattanan Tiengtam had been studying the effects of probiotics on tilapia growth performance and health at Suranaree University of Technology in Thailand. During his stay he worked for the first time with rainbow trout, assisting with spawning and egg incubation. He also made experimental feeds and conducted a study on apparent digestibility of nutrients in feed ingredients using trout. The techniques he learned will be applied to his studies with tilapia in Thailand.

Christos Giatsis was a Greek student at Wageningen University, the main agriculture university in the Netherlands. His research also focused on the use of probiotics for fish but contrasting the results of probiotics on fish reared in recirculating aquaculture systems or traditional flow-through water systems. In Hagerman, he worked on a project to assess the effects of diet on the composition of the microbial community in the intestine of rainbow trout.

He will continue to collaborate with UI researchers by using novel statistical tools he developed for his research in the Netherlands to assess data produced in Idaho.



Dr. Hardy and Nattanan Tiengtam



Caroline Nebo

Finally, Caroline Nebo used histological and molecular techniques to assess muscle development in tilapia under different planes of nutrition. Tilapia are a major aquaculture species in Brazil. She contrasted and compared expression levels of genes associated with muscle development in rainbow trout used by Dr. Overturf with those of tilapia.

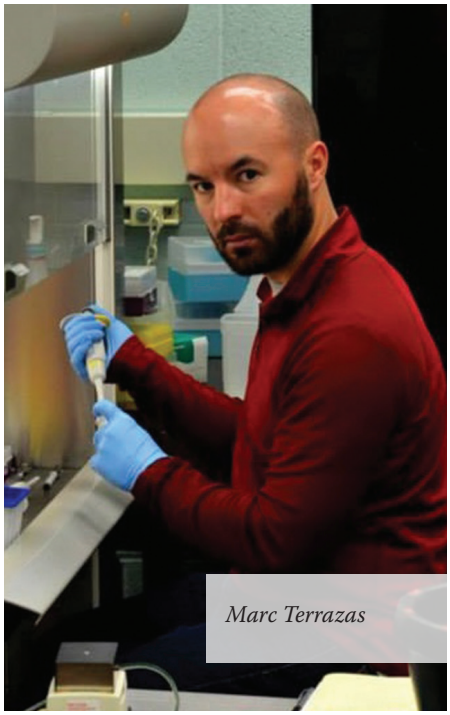
Hosting foreign graduate students, even for short periods, is an enriching experience for ARI scientists and staff, exposing them to new cultures and enhancing their understanding of challenges facing the aquaculture industry beyond the borders of Idaho. For the visiting students, the experience is also enriching as they see firsthand the top level research capabilities at ARI and also the American life style.

Featured Student

Marc Terrazas is originally from Missoula, Montana. He received a bachelor's degree in biology with an emphasis in ecology from the University of Montana. After graduation Marc worked for Montana Fish, Wildlife & Parks for five years as a fish health biologist. Understanding the opportunities an advanced degree brings he decided to pursue a graduate degree in natural resources with Dr. Ken Cain serving as his advisor. Marc's graduate work has focused on the problems associated with stress-mediated disease in the culture of burbot.

Marc's first task was to determine causative agents of previous epizootics. Previous students had isolated and preserved bacteria from these epizootics and they needed to be indentified and then the most pathogenic bacteria needed to be identified. Through much lab work and a series of experiments he was able to identify two of the previously isolated bacteria as the most pathogenic from the group of bacteria isolated and preserved. Marc is currently working on finishing up the susceptibility work by finding the LD-50 of the two pathogenic bacteria. He is also working on linking stress in burbot to carrier status and potential stress-mediated epizootics. This will benefit burbot culture moving forward and identify pathogens of concern for this species in captive rearing.

Marc will be graduating at the end of fall term 2015 with hopes of finding a job in the Intermountain West upon completion.



Marc Terrazas

Twin Rivers Hatchery Update

submitted by Shawn Young

Training session

Early construction

During mid-February 2015, British Columbia Ministry of Forests, Lands and Natural Resource Operations (BC), Kootenai Tribe of Idaho (KTOI), and Idaho Department of Fish and Game (IDFG) completed annual Burbot gamete collections on Moyie Lake, British Columbia. The Moyie Lake Burbot population serves as the donor stock for restoring the Kootenay River/Lake population. Angling, trammel nets, and cod traps were used to capture spawning adults in order to meet fertilized egg targets for both hatchery production at KTOI's new Twin Rivers Hatchery and for research needs through the University of Idaho Aquaculture Research Institute (UI-ARI).

In total, approximately 300 burbot were captured over a six-day sampling period. The pre-established egg collection and genetic management targets of up to 6 million viable eggs, from up to 60 families, for Twin Rivers; and 1 million viable eggs for ARI was met. At time of collection, the total egg count from these families was roughly approximated at 9 million eggs. The viable egg count after 10 days of incubation was estimated at 5.4 million eggs at Twin Rivers and 1.14 million eggs at ARI, for a total of 6.95 million viable eggs from 60 families. Burbot production has transferred to the new KTOI Twin Rivers Hatchery after several years of burbot aquaculture development at UI-ARI. The new facility anticipates scaling up production of releasable juveniles from the 5,000 – 20,000 annually produced at UI-ARI to approximately 100,000 per year class. To date, egg development has proceeded as anticipated, and the first hatch should be around April 1.

Incubating burbot eggs

Collaborative Waltham Foundation Research

submitted by Matt Powell

For the past two years visiting students and scholars at the Hagerman Fish Culture Experiment Station (HFCES) have been participating with Hagerman faculty and staff on a research project for the Waltham Foundation.

"The Waltham Foundation is a non-charitable organization dedicated to expanding the frontiers of humane scientific research into the nutrition and healthy longevity of companion animals around the world."

The project is using both tilapia and koi to develop rapid and humane means of determining stress in fish under a variety of water quality conditions.

As it turns out, a small amount of blood from a fish can reveal a lot about how the fish is handling stress and reacting to changes in its external environment. For instance, as fish digest their food, they excrete ammonia through their gills into the surrounding water. Typically ammonia dissipates into a large lake or stream but, if the fish swim in an aquarium where the amount of water is limited, ammonia levels can rise and fish can become stressed if the ammonia is not converted by bacteria or removed with a change of water. The collaborative team in Hagerman used several 30-gallon aquaria containing varying amounts of ammonia to simulate different ammonia concentrations stressful to the tilapia and koi but not permanently harmful. When sampled and analyzed, the blood of the fish reveal not only chemical changes but also the expression of several different kinds of genes located in the red blood cells which are nucleated. These changes in blood chemistry and gene expression can then be used as "biomarkers" for stress.

So far the team in Hagerman has tested high and low water temperatures, ammonia, pH, nitrate, nitrite, and chlorine to see how tilapia and koi react – all without having to sacrifice any fish. Analyzing the results comparatively, common methods fish use to adapt to stress are revealed as well as species specific differences.

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SCHEDULE OF EVENTS

May 26-30, 2015 | World Aquaculture Society Meeting
Jeju Island, South Korea

June 6, 2015 | Idaho Aquaculture Association Annual Meeting
Twin Falls, College of Southern Idaho campus, Evergreen Building, Room A5
Contact: Linda Lemmon, Executive Secretary of IAA at iaa@northrim.net

July 13-15, 2015 | American Fisheries Society, Fish Health Section, Annual Meeting
Ithaca, NY For more information: facebook.com/afs.fhs.2015.meeting

July 20-22, 2015 | International Conference on Aquaculture and Fishes
Brisbane, Queensland, Australia

August 16-20, 2015 | American Fisheries Society, Annual Meeting
Portland, Oregon Convention

August 26-28, 2015 | International Conference on Fishes and Aquaculture (ICFA)
Columbo, Sri Lanka
Theme: Aquaculture in a Global Age