

Fairbanks AIM-UP!
All Hands Meeting 20-22 February 2012

Participants:

Joe Cook – (PI), Director and Curator, Museum of Southwestern Biology, Univ. of New Mexico
Steffi Ickert-Bond – (PI), Curator of the Herbarium, University of Alaska Museum of the North
Eileen Lacey – (PI), Curator of Mammals, Museum of Vertebrate Zoology, University of California, Berkeley

Kayce Bell, Graduate Asst, Museum of Southwestern Biology, Univ. of New Mexico
Meg Daly, Asst. Curator of Marine Invertebrates and Assoc. Professor, Ohio State Univ.
Maria Paz Echevariarrza, Director & Science Educator, UNESCO-Montevideo
Rob Guralnick, Professor & Curator of Invertebrate Zoology, University of Colorado
Szu-Han Ho, Assistant Professor, Art and Ecology Program, UNM
Miriam Langer, Professor of Media Arts, Highlands University,
Enrique Lessa, Director, PEDICIBA and Professor, Univ. de la Republica-Uruguay
Phil Myers, Professor and Curator, Museum of Zoology, University of Michigan
Tomislav Urban, Senior Software Developer, Data Management & Collections, Texas Advanced Computing Center, University of Texas, Austin
Corey Welch, Assistant Director, Biology Scholar Program, UC Berkeley
John Wieczorek, Programmer/Analyst, Museum of Vertebrate Zoology, University of California, Berkeley

Alaska (Regional) Participation:

Kitty LeBounty (University of Alaska Southeast -Sitka)
Sandra Talbot, USGS Molecular Ecology Laboratory and UA Anchorage

Fairbanks Participation

Falk Huettman University of Alaska Fairbanks, Biology and wildlife Department and Institute of Arctic Biology

Ute Kaden (UA Fairbanks Education, STEM)
Derek Sikes, Curator of Invertebrates, University of Alaska Museum of the North
David Klein, Emeritus Professor of Wildlife, UAF
Kevin McCracken, Professor of Biology, University of Alaska Fairbanks
Melanie Flamme, National Park Service Biologist, Fairbanks

UA Museum of the North Reception:

Link Olson, Curator of Mammals
Kevin Winker, Curator of Birds (Museum Reception)
Andres Lopez, Curator of Fishes (Museum Reception)

Sunday Arrival (most arrived on 12:23 am flight Monday)

Hotel Accommodations: Pikes Landing
Daily Meetings Held in the International Arctic Research Consortium Building, UAF

Monday, 20 February 2012 (-5°F, Sunny)

1. Pre-Evaluation

2. Welcome and introductions (Steffi, FBKS1)

3. Update RCN (Steffi, Joe FBKS2, Eileen),

4. Discussion of Goals for meeting

We discussed how to overcome institutional indifference or lack of administrative support for efforts related to education reform, including lack of incentives for faculty in tenure track positions because research productivity is the primary metric for promotion. Administrators (especially at Research 1 institutions) need to be convinced that improving undergraduate education is worth doing and faculty need to get credit for spending time on curriculum development. Faculty should be encouraged to think outside the box and find new ways to engage students. The challenge is to identify new ways to approach “old” problems. There is growing national dialog (recognition) about how STEM education is failing. Museums provide many opportunities for cross-disciplinary training (e.g. new web resources) so there are reasons to be optimistic. Museums should work on encouraging these integrative and experiential teaching efforts.

Goals for the meeting include:

a. Module development:

Peer-reviewed and allow authorship.

Evaluation: student evaluations, measuring performance on lecture exams, and evaluating students' performance and knowledge of topics before and after a module.

Modules based in peer-learning are effective ways to gain knowledge.

Focus on improving introductory biology courses,

Implement recommendations in Vision and Change

Lab exercises provide museums an opportunity to develop inquiry driven modules.

b. Challenges:

- Encouraging students to find value in the process of science,
 - Increasing enthusiasm for inquiry-based learning (vs. grades).
 - Linking meaningful lab experiences to museums,
 - Increasing visibility and value of collections to biology students.
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- Additional venues/resources: Bioquest, Merlot? There are already some modules available at these and other sites. Do any use museum resources?
 - Dissemination, use and follow-up (evaluation) important.
 - Standardize materials and include things such as time needed to complete a module, possible subunits, pre-requisites.
 - Research what types of modules are actually needed by those who teach evolution, ecology, etc.

- Interact with faculty in charge of introductory biology to see what they need.
- Check online materials associated with textbooks.
- Develop a module in which students work in groups and generate their own questions, rather than just having a well-scripted exercise.
- Intermediate approach: question already identified, but methods open and problem sufficiently challenging.

5. Lunch

6. Discussion of AIM-UP! And AAAS Vision and Change (V&C)

We discussed Vision and Change, which lists the five core concepts for biological literacy as well as several core competencies and abilities for biology. NSF wants to see that the recommendations from Vision and Change are implemented; this should give our efforts some weight with administrators and departments. Modules should directly address and include elements from Vision and Change.

Modules should develop structured inquiry-based activities to teach students about museums and tools. Development of modules should include student input and participation. We need a standardized format for modules and guidelines regarding what should be incorporated, using Vision and Change framework. AIM-UP! now has topics for 9 initial modules and working groups appointed to each. Modules should include: specific information about time requirements and implementation, necessary background, specific needs for local people (which can be identified by actively canvassing communities for needs). Development of modules should involve instructors/lab coordinators that are currently re-working curricula (e.g. UC, UNM, UAF). In addition to modules being developed and available, they need to be promoted. Modules should have enough content to stimulate students to ask their own questions. For now, the overall intent for modules is to lead students through a short, relatively scripted exercise to learn how to use the databases, then leave it open ended so that students can formulate their own questions. It is also possible to create an intermediate step, by presenting students with a series of questions without specific instructions on how to get the answers, let them explore it on their own and figure out how to address them. Begin by providing students with a previously identified interesting questions. Then students develop sampling design and hypothesis testing.

Miscellaneous comments related to modules:

- Another RCN (Ethnobiology UBE) is developing their curricula around the V&C document.
- Target a journal (e.g., *Evolution: Education and Outreach*) that might publish a collection of modules. NABT might be another venue for publishing modules.
- V&C suggests developing the curriculum from a different, student-centered perspective. Not just a cosmetic view.
- We can try to view the modules from the perspective of V&C main points (both in terms of concepts and abilities). We can also check for things that are missing but could be developed as part of these modules, or in future modules.

7. An Example of Digitization--VertNet (John FBKS3, Rob)

John presented an overview of VertNet, the culmination of several independent vertebrate networks (birds, herps, mammals, fish). There currently are 187 active collections and 81 participating institutions. Museums are now sharing data and providing many benefits. VertNet is sponsoring a Biodiversity Informatics Training Workshop – June 2012. The scope of VertNet is: vertebrates, specimens & observations, global, Darwin Core (a set of standard fields for information about biological entities, a who, what, where, and when of biological entities in the real world).

Rob presented *Map of Life*, an interactive database that integrates distributional data and knowledge. It collates range maps and point locality records of specimens. Students can be presented with both and explore discrepancies and provide possible explanations.

8. New Initiatives at Texas Advanced Computing Center (TACC-Tomislav FBKS4)

Tomislav presented on several initiatives at TACC. These include Odonata, a citizen science project to document dragonflies and migrations and a project for non-vertebrate paleogeographic mapping, based on the PLATES project.

9. Museums and the Web (Miriam Langer FBKS5)

Miriam presented on Museums and the Web. She presented an example of students working with scientists to create a public museum exhibit on the emergence of life; with both on-line (<http://nmnaturalhistory.org/emergence>) and an installed permanent exhibit at the NM Museum of Natural History (Albuquerque), which is updatable, scalable, and interactive. Miriam also suggested we consider attending other conferences focused on museums and the web. Many museums are re-designing exhibits so that the public can have interactive, open-ended experiences. For museums that have science collections, but not exhibits, empowering students to have access to collections will improve visibility and student involvement in projects.

Q&A on Emergence:

- Respect from scientists and the importance of conveying the material are key to gaining strong student involvement.
- Particularly effective aspects: mobile app to provide an image from database of something you are pointing to with your phone; could be applied to museum specimens.
- Datasharing: not easy, but developed over years with pressure from funding agencies.
- Students can come up with interesting ideas about how to provide access to collections that will never make the day of light directly.

Wrap up:

- Develop plan for presenting program at conferences.

- Need to close the gap between large scale databases and hands-on research, or actual use of databases and resources for students and teachers.

10. Evening

Reception at University of Alaska Museum of the North with
Interactive Tours of Collections, Prep Labs, and Exhibits

Summary of Day 1:

Introduction to AIM-UP! and overview of the goals of the RCN. We discussed how to get modules out and available, what kind of background/history is needed to put the lesson into context. We need to communicate that many university museums are primarily research collections with minimal public face or public access. Corey and Meg began developing a new idea for a module on geographic variation that incorporates a local or “place-based” perspective. Investigate the use of mobile apps (iPhones) for understanding local diversity (some used in Bio Blitzes). Implement citizen science projects (georeferenced) to document diversity on local scales through local projects. VertNet may provide an entry point for such projects.

Tuesday 21 February 2012 (7°F overcast)

Attendees:

Miriam, (Szu-Han, Sandy, Joe, Enrique, Falk, Kitty, Tomislav, Rob, Corey, Steffi, John, Eileen, Maria Paz, Meg, Phil, Kayce, Ute Kaden)

1. More Discussion of Modules

Provide case and context for the students. Remember there is an **overarching narrative** for all of the individual modules including:

- History of ideas
- Context
- Identify why museums are relevant. Remember we are talking about specimen collections.
- Use of a publication for NABT or introduce the project via NY Times and/or Bioscience articles
- Distinction between research collections vs public (exhibit) natural history museums.
 - goals are quite different
 - different models for dissemination

Potential outputs (from Eileen):

1. The modules (published online, elsewhere)
2. Peer reviewed publication (NABT, Bioscience others?) that provides overarching perspective

3. Modules need instructor overview, material to inform instructors
4. Revised sample intro biology lab exercises (used initially at our institutions?)
5. Modules should build on each other and have opportunities for others to create their own pieces.

2. Module Development: Working Groups

We broke into groups to work on the different modules. We began with initial thoughts and directions for each project. Later work will integrate the Vision and Change basic areas and core concepts and abilities. Should the framework for modules have a step-wise progression within each of the topics? In the future we will develop a network associating the different modules. Each module can be a discrete activity that can lead to another module. For example, a one hour in-class discussion/activity, proceed to a three hour lab/outside class activity, then a semester project. Set them up so they can be interconnected, but also have the ability to stand along with appropriate background knowledge or course level. For each activity/module/lesson plan provide the connections to other activities, need to set them up with suggested courses, course levels, necessary background, etc. Maybe provide “text-book” examples of taxa for activities suggested as an initial exercise in exploring the activity/module. Then allowing it to be explored with user-generated questions. Keep in mind the common themes and aspects that can go with all the modules.

a. Biodiversity: Assessing Module (BAM)

Local biodiversity is presented. This modules touches on topics related to introductory biology, conservation, sampling and scale, endemism, and skills such as working with data sets, diversity indices, basic classifications,

- local vs regional
- provide clear context with examples
- species of concern,
- point occurrence records...introductory data,

MAP of Life-Rob

- latitudinal scale, macroecological problems
- range maps, bird species as a measure for diversity across space
- list of rank abundance possible,

Provide students with an outline to get started. For example, do national parks actually preserve biodiversity? Compare parks to adjacent un-protected areas, compare species compositions, evenness, richness, identify species of conservation concern. At the introductory level there is limited awareness of the tools and data available. Explore possibilities with Map of Life in a higher level course or once students have been introduced to basic concepts. One tool available with Map of Life allows students to draw a polygon and see what is present. Scalable so that students can draw comparisons across different areas.

b. Climate Change Module

Two lines of reasoning were developed, latitudinal gradient and elevational gradients. Similar data need to be accumulated, also need to use caution about what data you use. Ability to discuss typical challenges that arise in scientific research, data quality, outliers, etc. Start by providing a pre-determined set of questions and taxa. Then also provide a list of potential groups to explore. Can also ask different kinds of questions, such as phenology and body size change. Can incorporate citizen science projects and activities.

Framework....emphasize the concept of time (temporal scale)

- one hour discussion, 3 hour lab, and climate change (3 hour), semester long project.
- What are the extensions to related activities
- Understanding evolution website at Berkeley
- Taxon choices for each module provided
- constrain early work, then allow for explorations
modules are lot of work....flexibility for the future...re-using the module for other taxa without enough knowledge may fail.
- Semester long or year long....initial analysis, data set incomplete...and then use this as a target for citizen science to identify what we NEED to know

- Two Focus areas examples:
 - Latitudinal gradient (Great Lakes project?)
 - Elevational gradient (Grinnell project)
- Obstacles: data acquisition, statistical outliers, searching and visualizing taxa over time.
- What hypotheses can be provided for existing data?
- Reuse the module or hypotheses for a new set of taxa.
- Phenology, citizen science scenario (described above)
- Basic outcomes are known for latitudinal/elevation foci.

c. Virtual Herbaria: Assembling a Flora

Works well with the island modules that is already up on the website. Include material that will reflect the history of the area and current physical conditions. Work on making it scale to other areas, as long as you can find the right data. Need GIS help to build the background, reference material (Tomislav and Falk will work on this). Make it scalable for advanced high school students, undergraduates. Pick taxa that will lead students to ask questions. Next step would be looking at genetic diversity (Use Phylota <http://phylota.net/> for getting an idea on what data is available in GenBank for taxa of interest in a quick way). Good for discussing suitability of data.

- jumped into existing island biogeography module example
- history of the area
- glacial history maps with current distributions

- Alaska centric
- GIS for the maps (not necessarily)
- scale up...how flora are assembled, colonization
- Taxa...plants...Phylota program-gives you a subset of taxa that are suitable
- ARCTOS has this ability. NCBI can tie to voucher (required with BarCodes as well).
- Island system....founder effect, extinction, MacArthur/Wilson etc...
- Invasive species component

d. Tree Thinking Module

A module that will identify sources of information, e.g., Barcode of Life, museum vouchers, GenBank. Start by building a phylogeny from sequences in GenBank, determining if specimens are vouchered, discuss repeatability in science, negative aspects, controversies in science. Possibly extend to a phylogeography project, incorporating georeferencing. Discussion points: vouchers/repeatability, homology (OMA browser), bioinformatics. Provide some options and examples for instructors.

bar coding, tissues, GenBank NCBI

- genetic variation in terms of phylogeny
- records are vouchered (repeatability...issue)-missing data problems
- relevance of having a specimen
- phylogeography (example would be good), but later
- homologous genes,
- didn't consider the core concepts at this point
- Instructor information...chipmunks...mtDNA trees vs nuclear trees
- link to other modules and being self-contained
- Enrique presentation later will be an example for the module
- morphological variation could be used as well
- Gene trees vs species trees
- Distinguishing this module from environmental genomic module

3. International Perspective: Evolution via the web-(Enrique FBKS6)

Enrique spoke about his workshops for teachers and projects for his undergraduate evolution course. The workshop on phylogenetics for teachers is an outreach project, that covers phylogeny reconstruction, morphological and DNA data, materials available online. The activities are put in the context of evolution, Darwin. (evolucion.fcien.edu.uy/evolucion-cultura/popularizacion/index.php). The exercise provides outcomes, so participants can explore where/why things may have gone wrong. The term paper for undergraduate evolution course assigns some topics for the semester that the students have to explore and address in groups.

<http://evolucion.fcien.edu.uy/inicio.htm>, <http://evolucion.fcien.edu.uy/evolucion/diapositivas-2010.htm>. Unexplored or underutilized opportunities: implications of alternative hypotheses for

character evolution, more generally - incorporation of additional data (morphological, behavioral).

4. International Perspective II: Partnerships with Science Teachers (MP FBKS7)

Maria Paz presented on linking teachers and researchers in physics, chemistry, and biology. This was done through teacher professional development. The program “Acortando Distancias” (shortening distances) connects teachers with innovative programs. Teachers spend a month in a research lab. This model builds a relationship between researcher and teachers and ends with final workshop, teachers present posters. The other project she presented is “Docentes Aprendiendo en Red” (teachers learning in networks). DAR is collaborative work between researcher, writing specialist, and group of teachers. The teachers work to write something targeted for fellow teachers over 8 month period. These programs provide content for professional learning and personal experiences for teachers, people teach the way they have been taught. The emphasis is to work on fewer topics, better quality. Teachers enjoy collaboration when perceived as pertinent and challenging. Participating teachers appreciated opportunities to improve skills and courses, were willing to work hard. The programs emphasize experiencing the culture of science, being in a university, learning from mistakes.

5. Lunch and Field Trip to Morris Thompson Center downtown Fairbanks

6. Designing Evaluation Plans (Phil FBKS8, with Tricia via Skype)

Phil discussed his experience with evaluations and assessment related to Animal Diversity Web. We had an open discussion, including Tricia via Skype, about AIM-UP!’s goals and plans for assessment. Phil and Tricia suggested that we should assess content learning, usability, student attitudes, and student confidence in doing science. The best way to assess the students’ experience is to do pre- and post-experience questionnaires. We can use the Student Assessment of Learning Gains (SALG), which allows students to assess learning and target particular aspects of the course or activity. We need to develop a standard instrument to assess faculty experience. It is possible to associate assessment with social media (such as Facebook) that would allow us to push for feedback.

7. Student Surveys (Eileen FBKS9)

Eileen presented on the AIM-UP! surveys that have been distributed to introductory biology courses at University of California, Berkeley, University of New Mexico, University of Alaska, Fairbanks, and Texas A & M over the last year. Not all of these have been tabulated due to technical issues. The survey is a series of demographic-style questions, followed by questions about the on-campus museum or collection. The outcomes vary by institution, semester, and class, but preliminary numbers indicate that about half of the students do not know their

institution has an on-campus collection, and that less than a quarter of those who knew about the museum had actually visited the collections. Students do not understand what natural history collections are or their value to different biology disciplines. We are also planning to use the survey in upper division courses that currently use collections in their labs. Eileen is working to get IRB approval for possible publication of surveys results. We will work with Phil and Tricia to revise the questions.

Wednesday 22 February 2012 (10°F, light snow)

Attendees: Miriam, Szu-Han, Sandy, Melanie, Joe, Enrique, John, Kitty, Tomislav, Rob, Steffi, Maria Paz, Meg, Corey, Eileen, Phil, Kayce, Falk

1. Brainstorming session on new directions for modules

Taxon specific: e.g., Deer Mice (model with lots of specimen-based research completed)

Classic Cases

 Diagnostics

 Bird strikes on aircraft

 West Nile Virus - crows

 Avian Influenza

 Stable isotopes - trophic cascades, isoscapes,

Emerging Human Issues

 Climate change, including paleoclimates

 Emerging pathogens

 Invasive species

 Contaminants

 Biodiversity

 Human conflict, encroachment, land use change

Informatics, Information science

Engineering, robotics

Archaeology

Natural Resource Management

Ethnology

Geography

Art and Ecology

Environmental History

Chemistry

Medicine, Ethnobiology

2. STE(A)M: Intro to ART & BIOLOGY Workshops—(Szu-Han FBNKS10)

Szu-Han introduced us to the interface between Art and Biology by showing us art that challenges us to view processes and change in nature. Her talk covered the following topics:

- Art, Ecology and Environmental History workshop held in December 2011 at the Sevilleta LTER
- UNM Arts and Ecology Department is a unique academic program that uses art-based learning objectives and incorporates social issues, environmental issues, and arts through collaborative efforts. Land Arts – is one course that us project and field-based, providing hands-on experience for students in addition to studio practice.
- Models for Teaching in Art and Science
- Enroll arts students in introductory biology
- Science, whose knowledge?—Need to democratize science and build capacity for being interpreters through efforts like science zines.
- Surrealistic evolution and systematics
- Intro course introduces collections
- AIM-UP at UNM –Spring 2012 efforts.

Szu-Han ended by introducing this semester’s seminar course entitled *Co-Evolution*. Held at UNM, the course is teleconferenced to faculty and students at UAF, Harvard and UC Berkeley. The course includes advanced art and biology students with the central theme focused on geographic variation, morphology - form and place. 6 groups of students (one each at Berkeley and Fairbanks) have to create educational modules (see <http://unm-coev.blogspot.com/>). In addition to the weekly seminar, three 2-day workshops in Albuquerque, each directed by a renowned artist working in natural history will also be held this semester.

Questions:

Intervention - political resonance, creating change, calling attention to issues.
 In science, social concept, how do we change perceptions?
 Amazing that there is an art field class, why not in biology?
 Started with vision, now endowed.

3. Brandon Balengeé conference via Skype (FBKS11)

Brandon Ballangée (via SKYPE) presented his work *Praeter Naturam*. Brandon is an artist and a scientist (currently completing PhD) that uses art to focus on biological research and environmental problems. His primary focus of scientific research and ecological art is amphibians as bio-indicator species. Substantial work has been done with anurans with super-numeric and missing limbs. He has heavily involved the general public in collecting data.

Ecosystems, bio-indicators, environmental stress
 Research -> art -> Environmental programs & activism
 Examples of increasing awareness related to decline & extinction. He has installed insect “Love Motels” with ultraviolet light attractors in Europe and India. scaling up forms, backdrops for local activities
 Amphibian malformation research. Causes include pesticides, trematode infestation, dragonfly nymphs predation causing missing and malformed limbs.
 Field research involves volunteers

Still, environmental quality is correlated with malformations
Use of museum specimens for historical perspective
Good way to involve people to generate new information from preserved specimens

Art and Ecological Activism - Eco-Action

Public wants to be involved, but don't know how

Preliminary field research & experiential field trips, local

Public Bio-Art Laboratories

Cleared and stained specimens as fine art - 12k dpi scans of specimens 3'x4', Styx sculpture, videos

Questions:

Aha moments from involvement in this integrative and broad approach?

Promote openness, museum time, lab time, field time mix.

Monitor impact of art with video surveys

Do people leaving these programs translate impact on awareness and activism?

See transfers between majors. See evidence in surveys.

4. Lunch

5. Module Working Groups

Common themes: Prerequisite modules (data, tools, technical resources). Multiple entry and exit points for Module with prepared data options, limited or full investigations

Four groups (Climate Change, BAM, Phylo, Assembling the Alaska Flora) worked on independent modules. Each group addressed the components of Vision and Change and addressed the format, background, target class, objectives and skills of their module. The Tree Thinking Module is based on Enrique's semester project that he uses in his evolution course. It incorporates phylogenies and real evolutionary questions. The Climate Change Module uses known datasets, from the Grinnell Resurvey Project and the Changes in Small Mammal Distributions in the Great Lakes Area Project. The students are presented with the question, are distributions changing? The Biodiversity Assessing Module can work with bioblitzes and how to incorporate different -ology classes. It can be set up as a timed exercise that the students generate a sampling design for. The Niche Modeling Module addresses simple concepts, such as: what is a species distribution map? Why are distributions important? What is an occurrence? It incorporates expert maps and environmental data. The Range and Distribution Module will produce a set of tools that can be used with any organism to explore and discuss the roles of refugia and climate driven changes. It can also incorporate genetic and isotope aspects.

AIM-UP! should form links among the different modules, create the modules with different entry and exit points. The modules should be flexible, provide background resources, and have different levels of capacity and resources. AIM-UP! needs to develop recommendations for infrastructure and tool resources.

6. Post Meeting Evaluation