

# PROCEEDINGS OF THE NORTH DAKOTA ACADEMY OF SCIENCE

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NORTH DAKOTA ACADEMY OF SCIENCE  
*(Official State Academy; Founded: December 1908)*

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104<sup>th</sup> Annual Meeting

April 13, 2012

Bismarck, North Dakota



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## EDITOR'S NOTES

### HISTORY

The *Proceedings of the North Dakota Academy of Science* (NDAS) was first published in 1948, with Volume I reporting the business and scientific papers presented for the 40th annual meeting, May 2-3, 1947. Through Volume XXI, the single yearly issue of the *Proceedings* included both abstracts and full papers. Commencing with Volume XXII, the *Proceedings* was published in two parts: A, published prior to the annual meeting, contained an abstract of each paper to be presented at the meeting, and B, published later, contained full papers by some of the presenters.

In 1979 (Vol. 33) the *Proceedings* changed to an 8½ x 11-inch format. Produced from camera-ready copy submitted by authors, it was distributed at the annual meeting. As desktop computing became more prevalent vol. 51-vol. 64 of the *Proceedings* were assembled with desktop publishing software from submitted computer disks. The current volume was assembled from electronic submission of abstracts via email and the *Proceedings* archived online as pdfs.

### VOLUME 66 ORGANIZATION

In 2003 the NDAS council voted to accept all abstracts scheduled for presentation at the Annual Meeting. Thus, communications in volumes 58 to present haven't undergone a "typical" peer review. Rather, they provide an accurate reflection of the material presented before the NDAS membership at the Annual Meeting. The presentations in this year's *Proceedings* are presented in three major sections. The first contains the undergraduate communications presented as part of the A. Rodger Denison Student Research Competition. The second section comprises the graduate Denison Competition papers, and the final section comprises professional communications presented by faculty members of the Academy. Readers may locate communications by looking within the major sections of these *Proceedings* (*see table of contents*) or by referring to the author index on [page 91](#).

### IN APPRECIATION

The Academy wishes to acknowledge current and emeritus members of the Academy who continue to support the mission of the North Dakota Academy of Science Research Foundation through their special gifts. A listing of these supporters accompanies the Financial Report. The Academy also wishes to express its thanks to the presenters of papers at the Annual meeting, the session chairs, as well as all who have helped in organizing spaces and places, soliciting manuscripts, and compiling of this year's communications. The President of the Academy also wishes to sincerely thank North Dakota State Paleontologist John Hoganson who served as honored guest speaker at this year's meeting.



Mike A. Bingle-Davis, President



Paul Lepp, Secretary-Treasurer

## SCHEDULE

### Summary Schedule 2012

Time			
8:00 AM	8:30 AM	Breakfast, Registration	--
8:30 AM	8:40 AM	President's welcome	Mike Bingle-Davis
8:40 AM	9:00 AM	--	Wilson - undergraduate
9:00 AM	9:20 AM	--	Radi - undergraduate
9:20 AM	9:40 AM	--	Wu - graduate
9:40 AM	10:00 AM	--	Shipunov - professional
10:00 AM	10:20 AM	--	Marron Bingle-Davis - professional
10:20 AM	10:40 AM	Break	--
10:40 AM	11:00 AM	--	Fergel - undergraduate
11:00 AM	11:20 AM	--	Samanta - graduate
11:20 AM	11:40 AM	--	Bobilev - professional
11:40 AM	12:00 AM	--	Maskey - professional
12:00 PM	1:00 PM	Lunch	--
1:00 PM	1:20 PM	--	Heuser- undergraduate
1:20 PM	1:40 PM	--	Lynnes - graduate
1:40 PM	2:00 PM	--	Mugabi - graduate
2:00 PM	2:20 PM	--	Best - professional
2:20 PM	2:40 PM	--	Beachy- professional
2:40 PM	3:00 PM	break	--
3:00 PM	3:20 PM	--	Kraft - undergraduate
3:20 PM	3:40 PM	--	Kurada - graduate
3:40 PM	4:00 PM	--	Kaczor - graduate
4:00 PM	4:20 PM	--	Bilski - professional
4:20 PM	4:40 PM	--	Mike Bingle-Davis - professional
4:40 PM	5:00 PM	<b>NDAS business meeting and elections</b>	
5:00 PM	7:00 PM	Dinner and awards ceremony	
7:00 PM	8:00 PM	Guest Speaker – Dr. John Hoganson	
8:00 PM	9:00 PM	Social Hour	

All talks will take place in the Shyenne Cannonball room of the Ramkota Hotel, Bismarck.

## SCHEDULE OF PRESENTATIONS

### MORNING SESSION

- 8:40 AM CADMIUM LEVELS IN AMPHIBIANS AND NORTH DAKOTA WETLANDS. Markus Wilson\*, Amanda Kraft, Derek Diede, Ryan Winburn, and Christopher Beachy.
- 9:00 AM UNDER-ICE ACTIVITY PATTERNS IN WESTERN TIGER SALAMANDERS, *AMBYSTOMA MAVORTIUM*. Alexander Radi\*
- 9:20 AM ULTRASENSITIVE MERCURY IONS DETECTION BASED ON THE MOLECULAR BEACON. Steven Xu Wu\*, Julia Xiaojun Zhao
- 9:40 AM IN SEARCH OF HYBRIDITY: THE CASE OF KARELIAN SPRUCES. Alexey Shipunov , Ranelle Ivens, Polina Borisova, Polina Volkova
- 10:00 AM WATERFLOODING PETROLEUM RESERVOIRS IN THE NEWCASTLE/MUDDY FORMATION, POWDER RIVER BASIN, WYOMING. Marron Bingle-Davis
- 10:20 AM **Break**
- 10:40 AM BARLEY RESPONSE TO MINERAL STRESS CAUSED BY THE PRESENCE OF COAL FLY ASH (FA) IN PLANT GROWTH MEDIA. Audrey Fergel, Mardee Lander, Emma Nelson, Ashley Farnsworth, Candace Kraft, Erin McLean, Fakira Soumaila, Jerzy J. Bilski
- 11:00 AM TEMPORAL AND SPATIAL GENE EXPRESSION IN *ESCHERICHIA COLI* BIOFILMS. Priyankar Samanta\*, Shelley M. Horne, Pawel Borowicz, Birgit M. Prüß
- 11:20 AM ADDRESSING THE HAZARDS OF POST-FLOOD MOLD TO PUBLIC HEALTH.. Braden A. Burckhard, Luke W. Uran, Lioudmila I. Bobyleva, Mikhail M. Bobylev\*
- 11:40 AM ASPECTS OF MENINGEAL WORM (*PARELAPHOSTRONGYLUS TENUIS*) INFECTION IN WHITE-TAILED DEER FROM NORTH DAKOTA. James J. Maskey Jr.\* and Amber J. Vetter
- 12:00 AM **Lunch**

### AFTERNOON SESSION

- 1:00 PM BYPRODUCTS IN THE RAPID SYNTHESIS OF N-(4-CHLOROBENZYL)FORMAMIDE. Misty Huesers\*, Mikhail M. Bobylev
- 1:20 PM EFFECTS OF CARBON AND NITROGEN SOURCES ON *ESCHERICHIA COLI* O157:H7. Ty Lynnes\*, Shelley M. Horne, Birgit M. Pruess
- 1:40 PM ANALYSIS OF BIOFILM FORMATION IN *ESCHERICHIA COLI* K-12 *ldhA* MUTANT. Robert Mugabi\*, Shelley M. Horne, Birgit M. Pruess
- 2:00 PM ANOTHER VARIANT OF THE C-REACTIVE PROTEIN GENE (CRP) IS ASSOCIATED WITH IMMUNE RESPONSE AND RISK OF PRE-ECLAMPSIA IN AN AMERICAN INDIAN POPULATION. Lyle Best, Melanie Nadeau, Kylie Davis, Felicia Lamb, Shellee Bercier, Cindy M. Anderson, Brendan J. Keating
- 2:20 PM EFFECT OF TEMPERATURE ON POSTMATURATION METAMORPHOSIS IN THE WESTERN TIGER SALAMANDER, *AMBYSTOMA MAVORTIUM*. Christopher K. Beachy, Hyla O. Beachy
- 2:40 PM **BREAK**
- 3:00 PM HEAVY METALS ACCUMULATION IN PLANTS GROWN ON COAL FLY ASH AMELIORATED BY VARIOUS ADDITIVES. Candace Kraft\*, Erin McLean, Fakira Soumaila, Audrey Fergel, Emma Nelson, Ashley Farnsworth, Mardee Lander, Jerzy J. Bilski
- 3:20 PM SIGNAL TRANSDUCTION MECHANISMS INVOLVED IN CORTICOTROPIN RELEASING FACTOR-MEDIATED INCREASE IN NEURONAL EXCITABILITY IN THE ENTORHINAL CORTEX. Lalitha Kurada\*, Saobo Lei
- 3:40 PM PALEONTOLOGICAL HISTORIOGRAPHY OF THE LATE CRETACEOUS FRUITLAND AND KIRTLAND FORMATIONS OF THE SAN JUAN BASIN, NEW MEXICO. Joseph H. Hartman, Richard W. Kaczor,\* Lance D. Yarbrough
- 4:00 PM PILOT STUDY ON THE ENGINEERING OF COAL FLY ASH BASED GROWTH MEDIA FOR PLANTS. Jerzy J. Bilski, Erin McLean, Fakira Soumaila Candace Kraft, Audrey Fergel, Emma Nelson, Ashley Farnsworth, and Mardee Lander
- 4:20 PM URANIUM ROLL FRONT DEPOSITS OF WYOMING, THEIR DEFINITION, DEVELOPMENT AND POTENTIAL ORIGINS. Michael Bingle-Davis\*

**UNDERGRADUATE COMMUNICATIONS**  
**IN THE**  
**A. ROGER DENISON COMPETITION**

(communications are listed alphabetically by the last name of the presenting author)

BARLEY RESPONSE TO MINERAL STRESS CAUSED BY THE PRESENCE OF COAL FLY ASH  
(FA) IN PLANT GROWTH MEDIA

Audrey Fergel\*, Mardee Lander, Emma Nelson, Ashley Farnsworth, Candace Kraft, Erin McLean, Fakira Soumaila, and Jerzy J. Bilski

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The utilization of coal fly ash (FA) as a soil amendment is one of the most intensively studied FA reutilization option. Despite the presence of toxic metals, elevated salinity levels, and high pH, up to date research have shown that FA may be used to support plant growth as a component of plant growth media. We investigated barley response to two different types of FA, one obtained by burning semi-bituminous coal (NDSU FA, collected from NDSU power plant), and another obtained by burning lignite coal (VCSU FA, collected from VCSU power plant).

We examined plants germination, growth, and a wide variety of potentially toxic elements, such as As, B, Co, Cu, Cr, Hg, Li, Mn, Ni, Ti, V, Zn uptake by the plants. The growth media were composed of a soil as a control, and two mentioned above ashes in the following combinations: 90%FA + 10%Soil, 80%FA + 20%Soil, 70%FA + 30%Soil, 60%FA + 40%Soil, 50%FA + 50%Soil, 40%FA + 60%Soil, 30%FA + 70%Soil, 20%FA + 80%Soil, 10%FA + 90%Soil. Barley (*Hordeum vulgare*), ryegrass (*Lolium perenne*), Sudan grass (*Sorghum bicolor*), canola (*Brassica campestris*), rapeseed (*Brassica napus*), and alfalfa (*Medicago sativa*) were grown in Petri dishes for 14-21 days in listed above growth media.

Results indicated that plant growth was greater on media composed of soil and FA when compared to the FA alone. Plants did not grow on the VCSU FA media, and barley was the only plant species tested that established growth on NDSU FA alone. Concentration of the most elements in plants grown on the soil control was similar to levels in the growth media containing FA. Barley appeared to be very viable plant, able to tolerate both relatively high amounts of toxic metals and poor growth conditions, such as growth media containing FA. It also has a root system able to stabilize coal FA piles. We concluded that the mineral stress caused by the presences of FA in growth media was tolerated by barley at greater extend than other plants tested. There were noticeable differences in seedlings growth, depending on the type and source of coal FA used.

Large scale implementation of plant cover over coal FA landfills will require conducting in-depth and large scale research. Plants should be grown till reaching maturity and results of such experiments would provide data for large-scale application of “green technology” to establish the growth of selected plant species on coal FA. Our results clearly demonstrated that plants are able to grow in such adverse conditions, as on coal FA media. In addition, our results have shown that the transfer of heavy metals present in FA to plants is limited. Thus, heavy metals transmission to a food chain is unlikely, and therefore, application of FA to plant growth media would not be dangerous from environmental health perspective.

*This project was supported by grants from the National Center for Research Resources (5P20RR016471-12) and the National Institute of General Medical Sciences (8 P20 GM103442-12) from the National Institutes of Health.*



## BYPRODUCTS IN THE RAPID SYNTHESIS OF N-(4-CHLOROBENZYL)FORMAMIDE

Misty Huesers and Mikhail M. Bobylev

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**Background and Objective:** N-(4-chlorobenzyl)formamide is an important intermediate in the synthesis of medicinally active compounds. Recently, we developed an accelerated procedure for the synthesis of formamides and successfully used it for the synthesis N-(4-chlorobenzyl)-formamide. In this work, the newly developed reaction was investigated for the purpose of isolation and investigation of the reaction by-products.

**Methods:** The reaction was conducted on 10 mmol scale at 192-193°C. Column chromatography was used for the isolation of the products of the reaction. NMR-spectroscopy and elemental analysis were used to determine the structure of the products.

**Results:** The reaction was fully completed in 1 minute and produced N-(4-chlorobenzyl)-formamide in good yield. Three byproducts were isolated and their structures were determined.

**Conclusions:** The results will help to better understand the mechanism of the Leuckart reaction.

*The project is supported by NIH grant P20 RR016741 from the NCRR*

## HEAVY METALS ACCUMULATION IN PLANTS GROWN ON COAL FLY ASH AMELIORATED BY VARIOUS ADDITIVES.

Candace Kraft\*, Erin McLean, Fakira Soumaila, Audrey Fergel, Emma Nelson, Ashley Farnsworth, Mardee Lander, and Jerzy J. Bilski

Department of Biology, Valley City State University, Valley City, ND

Increasing quantities of coal combustion byproducts are accumulating in the environment due to the proliferation of coal-generated electricity. The use of coal fly ash (FA), particularly, as a soil amendment is one of the most intensively studied utilization options today. We investigated the response of plant seedlings to FA obtained from several coal-burning power plants in ND, including North Dakota State University FA (NDSU FA from semi-bituminous coal incineration) and Valley City State University FA (VCSU FA from lignite coal incineration). These FA's were separately mixed with various additives: sphagnum peat moss (PM), vermiculite (V), sand (S), corn stover (CS), fertilizer composed mainly of activated sewage sludge (SS), and/or soil (s). An extensive assortment of common crops and associated varieties, including Sudangrass (*Sorghum sudanese*), barley (*Hordeum vulgare*), canola (*Brassica campestris*), rapeseed (*Brassica napus*), alfalfa (*Medicago sativa*), perennial ryegrass (*Lolium perenne L.*) and switchgrass (*Panicum virgatum*) was planted in Petri dishes containing these media for 14-21 days. Then, plant germination, growth, and uptake of potentially toxic elements, such as As, B, Ba, Co, Cu, Cr, Hg, Li, Mn, Mo, Ni, Sr, Ti, Tl, V, and Zn were evaluated. Composition of growth media included a soil control, FA control, and mixtures of soil, FA and other additives. Results showed that growth and weight of seedlings was greater on media containing additives, notably PM, when compared to FA alone. Plants did not grow on pure VCSU FA, and barley was the only plant that established growth on the pure NDSU FA. The concentration of elements varied widely between growth media and tested plant species. However, barley grown in FA-based media consistently contained higher levels of many tested elements, including Cu, Mo, Na, Ni, and Zn. Detected concentration of elements indicated no environmental health endangerment based on EPA standards. Corn stover, V and S appear to be more practical and environmentally-friendly alternatives than PM as additives that can maintain plant growth on FA-based media. Sewage sludge also shows promise as an ameliorating agent because of the ability of plants to germinate on FA-based media amended with SS and SS capacity to neutralize FA's alkalinity. Experiments conducted on FA/SS-based media and FA/CS-based media currently await chemical analysis and data interpretation.

*This project was supported by grants from the National Center for Research Resources (5P20RR016471-12) and the National Institute of General Medical Sciences (8 P20 GM103442-12) from the National Institutes of Health.*

UNDER-ICE ACTIVITY PATTERNS IN WESTERN TIGER SALAMANDERS, *AMBYSTOMA MAVORTIUM*

Alexander Radi\*

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Paedomorphosis is the condition wherein an animal become sexually mature before metamorphosis, with the result being that many larval/juvenile features are retained in the adult stage of the life cycle. The ecological factors that influence paedomorphosis in salamanders is a rich research area (e.g., 1, 2) and larval density and pond drying have been implicated as significantly influencing the expression of facultative paedomorphosis (when the salamander is phenotypically plastic and can metamorphose or express paedomorphosis). Thermal variation has received little attention, although there is a general sense that salamander populations inhabiting cold climates are more likely to express paedomorphosis.

Many populations of the western tiger salamander, *Ambystoma mavortium*, express facultative paedomorphosis. Because all ponds freeze, this means that these larval salamanders (and possibly transformed salamander as well) must overwinter under the ice. I intended to assess the under-ice activity patterns of tiger salamanders by using an underwater camera system to discover salamanders and create a video. I hypothesized that these salamanders, because of low temperatures, would exhibit little movement.

During February-March 2012 I established three viewing sites at Swalls Lake in Ward Co., North Dakota. This population typically has a mixed population of metamorphs and paedomorphs (3). At each site, I drilled nine 17.9 cm diameter holes in a 3 X 3 grid. An underwater color camera was lowered to the bottom of the lake. I recorded maximal depth (0.76-1.38 m) and water temperatures (1.5-3.0°C). Each hole was visited for two minutes. If no salamanders were observed, I proceeded to the next hole. All discovered salamanders were individually observed for up to two minutes. I recorded movement (none or moving). I sampled each of the three sites three times, for a total of nine formal observation periods. If a salamander was observed, I recorded the encounter for the full two minutes (or until the salamander swam away).

Previous attempts to capture under-ice salamander have never succeeded, therefore I expected to find few (if any) salamanders. However, I observed hundreds of salamanders and nearly all were active. Salamanders often were seen in association with cattails. I used a sample of cattail stem widths as a scale in order to use ImageJ software to estimate salamander size. In addition, several images allowed a sufficient cloacal inspection to assess sexual maturation status and in some cases to determine the sex of a salamander. Thus, where possible, I determined size, developmental stage (larval or transformed), sex, and maturation status (juvenile or mature).

#### References

- 1) Denoel, M., and P. Joly. 2000. Neoteny and progenesis as two heterochronic processes involved in paedomorphosis in *Triturus alpestris* (Amphibia: Caudata). *Proceedings of the Royal Society, London B* 267:1481-1485.
- 2)Whiteman, H.H., S.A. Wissinger, and W.S. Brown. 1996. Growth and foraging consequences of facultative paedomorphosis in the tiger salamander, *Ambystoma tigrinum nebulosum*. *Evolutionary Ecology* 10:433-446.
- 3) Poitra, M., K.C. Cabarle, D. Blackhawk, F.D. Henry, J. Entzel, and C.K. Beachy. 2007. Life history of the tiger salamander, *Ambystoma tigrinum*, in northwest North Dakota. *Proceedings of the North Dakota Academy of Science*.

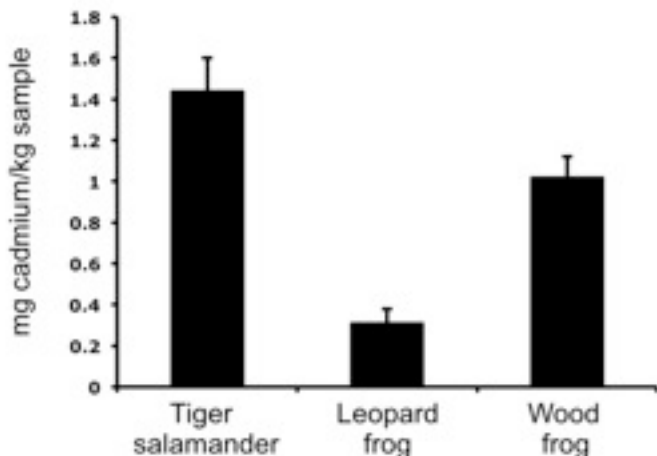
*This project was supported by grants from the National Center for Research Resources (5P20RR016471-12) and the National Institute of General Medical Sciences (8 P20 GM103442-12) from the National Institutes of Health. C.K. Beachy provided support and advice on this project.*

## CADMIUM LEVELS IN AMPHIBIANS AND NORTH DAKOTA WETLANDS

Markus Wilson\*<sup>1,2</sup>, Amanda Kraft<sup>1,2</sup>, Derek Diede<sup>1,2</sup>, Ryan Winburn<sup>2</sup>, and Christopher Beachy<sup>1</sup>.

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Amphibians occupy several trophic levels in North Dakota Wetlands and have permeable skin. They exhibit high sensitivity to very low levels of several heavy metals, e.g. cadmium, mercury, and arsenic. In previous studies we have determined the actuality of cadmium in accumulation in salamander tissues and



**Figure 1 - Tiger salamander have higher cadmium loads than frogs. This is likely due to their status as top predator in North Dakota wetlands. Interestingly, the frogs also vary in their cadmium loads. This suggests that even slight life history differences result in variation in liver cadmium content.**

therefore believe they may represent a useful vertebrate biomonitor for North Dakota wetlands. We tested the hypothesis that, because they have different life cycles, frogs and salamanders have different cadmium liver content. We also tested the hypothesis that amphibians have higher content of cadmium than local soil and water. Cadmium integration in amphibian tissues and soil and water samples was tested using standard chemical techniques as well as graphite furnace atomic absorption spectrophotometry. We collected one salamander species, *Ambystoma mavortium* (Tiger salamander), and two frog species, *Lithobates sylvaticata* (wood frog), and *L. pipiens* (leopard frog), at our three research site localities and harvested the livers to determine cadmium integration. We used the livers of salamanders, *A. mavortium* and the axolotl *A. mexicanum*, that were used in LC 50 laboratory studies to assess the relationship between exposure level

and cadmium integration. We concluded from the data that the tiger salamander to be the largest accumulator of cadmium of the three species. From our geographic cadmium studies it was determined that cadmium is at higher levels in soils than in water samples. Additionally, it was shown our three principal AGP sampling localities have varying cadmium levels.

*Supported by NIH Grant Number P20 RR016741 from the INBRE Program of the National Center for Research Resources.*

**GRADUATE COMMUNICATIONS  
IN THE  
A. ROGER DENISON COMPETITION**

(communications are listed alphabetically by the last name of the presenting author)

PALEONTOLOGICAL HISTORIOGRAPHY OF THE LATE CRETACEOUS FRUITLAND AND KIRTLAND FORMATIONS OF THE SAN JUAN BASIN, NEW MEXICO

Joseph H. Hartman, Richard W. Kaczor,\* and Lance D. Yarbrough

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**Introduction.** Integrating advancements in technology with previous studies is an adventure and a challenge for paleontologists. An important example is the chronostratigraphic reevaluation of the Late Cretaceous continental and brackish fossils discovered by C.M. Bauer and his crew in 1915 while they mapped the coal resources on Navajo Nation lands in northwestern New Mexico. The U.S. Geological Survey (USGS) was given the mandate to determine the economic resources of western states in 1906; mapping coal beds was a major part of this mission. Bauer (1) and Bauer and Reeside (2) reported in detail on the coal of San Juan County, New Mexico, while Stanton (3) identified their fossils.

**Overall Project Objective.** Stanton (3) described 12 new species from 19 fossil localities based on specimens returned by Bauer. By 1980 and earlier studies (4, unpublished), a few of these type localities were lost to strip mining; more have been lost since. The development of more rigorous species concepts and a biostratigraphic distribution of Stanton-identified species are major overall project objectives.

**Immediate Project Objective.** To interpret the stratigraphic horizon of destroyed and possibly still extant fossil localities requires specific and accurate knowledge of the geographic location of Bauer's fossil localities (F#s). Thus an immediate objective is to determine where type specimens were collected. There are three aspects to reevaluating location, all of which rely on knowing, as precisely as possible, where the Bauer found fossils: 1) determining how to access data associated with original fossil discoveries, 2) determining the quality of the original location data, and 3) assessing previous interpretations of Bauer location data.

**Geologic Context.** Bauer (1) named the Fruitland and Kirtland Formations as part of his study of San Juan Basin coal beds. Since 1963, Navajo Mine strip mine operations have provided coal to the Four Corners Steam Plant, which resulted in the loss of Stanton's type localities and other Bauer fossils.

**Methods. Working with Published Locality Data.** From publications, we have fossil locality descriptive information and locations marked on a very small scale map (1, 267,200) (1, pl. LXIV). Example: *Unio amarillensis* Stanton, n. sp.: "The type lot consists of three valves from Bauer's locality 14 [Hartman L3083], in Amarillo Canyon, 10 miles [16.1 km] south of Jewett, N. Mex. (locality 9270)" (3, p. 313). At best, this information provides only an approximate location.

**Working with Unpublished Data.** USGS field studies typically surveyed coal beds for accurate location. Bauer and crew mapped fossil localities on canvas-backed card stock or linen plane-table (p-t) sheets (USGS Field Records Collection; courtesy of C. Martin). Knowledge of the p-t sheets, plots of fossils, and field notes means that a published generalized location can be upgraded to a relatively specific point on a published large-scale map (e.g., Fruitland 1978 Quad., USGS 7.5-minute, 1:24,000).

**Working with Current Technology.** Various electronic tools are now available to more accurately evaluate the plotted p-t (1) and state plane coordinate locations previously presented (3). Locality placement error can be reduced through high-resolution scanning of p-t sheets, topographic maps, and registration of published maps, all integrated with geographic information system (GIS) technology, and available Navajo Mine maps (courtesy of O.J. Estrada).

**Results/Conclusions.** Field studies by Hartman (1980–1983) indicated that Bauer fossil localities might be reoccupied through techniques employed by Hartman (3). However, the correspondence between plotted and newly discovered fossils was not exact. Current GIS registration techniques indicate a method for determining the error likely in relocating historic fossil localities.

1) Bauer, C.M. (1916) US Geological Survey, Professional Paper 98-Q, p. 271–278.

2) Bauer, C.M., and Reeside, J.B. Jr. (1921) Bulletin 716, p. 155–248.

3) Stanton T.W. (1916) Professional Paper 98-R, p. 30–9326, pls. LXXIX–LXXXIII.

4) Hartman J.H. (1981) American Association of Petroleum Geologists Bulletin 65, no. 3, p. 560.

SIGNAL TRANSDUCTION MECHANISMS INVOLVED IN CORTICOTROPIN RELEASING  
FACTOR-MEDIATED INCREASE IN NEURONAL EXCITABILITY IN THE ENTORHINAL  
CORTEX

Lalitha Kurada\* and Saobo Lei.

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The entorhinal cortex (EC) is an essential component of the limbic system that is functionally found to be closely linked to emotional control, consolidation and recall of memories, Alzheimer's disease, schizophrenia and especially temporal lobe epilepsy. The EC serves as an interface to connect the hippocampus and other cortices. Corticotropin releasing factor (CRF), a neuropeptide, is known to be related to these physiological functions and neurological disorders. CRF is widely distributed in the brain including the limbic structures. Various studies suggest that the generation of epileptic seizures is related to the EC, hippocampus and amygdala. However, the signal transduction mechanisms involved in increase in the neuronal excitability leading to the epileptic seizures are not known. Here we studied the signaling mechanisms involved in CRF-mediated increase in neuronal excitability in the EC slices, using whole-cell recordings. Our results demonstrated that CRF increased the neuronal activity via activation of CRF<sub>2</sub> receptors. We further demonstrated that G proteins, adenylate cyclase and protein kinase A were required for the increased neuronal excitability. With whole-cell patch-clamp recordings, we also showed that CRF increased action potential firing frequency by generating membrane depolarization.

EFFECTS OF CARBON AND NITROGEN SOURCES ON *Escherichia coli* O157:H7

Ty Lynnes\*, Shelley M. Horne, and Birgit M. Pruess

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Because of its effects on human health, *Escherichia coli* O157:H7 is a major concern for food processing worldwide. The purpose of our research was to look for nutrient additives that would inhibit the growth, cell division rate and the ability to form biofilms of *E. coli* O157:H7. Ultimately, these additives could be used in food processing to limit the occurrence of outbreaks. A *flhC* mutant was also tested because prior research done by our lab demonstrated that FlhC was correlated to biofilm development, cell division, and virulence. Nutrients were looked at because they would have little selective pressure in comparison to bacterial static or bactericidal chemicals.

*E. coli* O157:H7 and *E. coli* O157:H7 *flhC* were plated on LB plates and incubated overnight at 37° C. Both strains were then added to sterile beef extract and standardized to 0.100 OD for inoculation. This inoculum was added to PM1 and PM3 Plates from Biolog. PM1 Plates are 96 well plates with 95 different carbon sources in each well along with a negative control well. PM3 Plates are 96 well plates that have trace amounts of 95 different nitrogen sources in each well along with a negative control well. Plates were incubated at 10 ° C for 1 week to simulate meet storage. Three separate assays were done to measure the nutrients effects. OD<sub>600</sub> was measured to determine growth. Wells were drained and biofilm was rinsed and measured using an ATP assay. Cell division was measured by counting colonies. Well liquid was serial diluted and plated on LB, then incubated overnight. CFUs were then calculated. Each data set that was characterized by one PM plate (PM1 or PM3) and one assay (biofilm, growth, or cell division) was analysed with the statistical package SAS 9.3 using PROC ANOVA to determine differences between the two bacterial strains and difference between the effects of different nutrients.

The ANOVAs for the PM1 plate showed that there were no interactions between effects of isolates vs effects of carbon sources, again for both, biofilm production (P-value=0.9704) and growth (P=1.0). This permits further statistical analysis, leading to the following conclusions. First, the mutants grew faster and produced more biofilm in the presence of most carbon sources, which is consistent with previous research [1]. Second, the entire pattern of nutrients differed between the mutant and its parent strain for growth (*p*-value < 0.0001) and biofilm amounts (*p*-value = 0.0033). Third, individual carbon sources significantly impacted biofilm amounts (*p* < 0.0001) and growth (*p* < 0.0001). As one example, acetoacetic acid had the greatest effect on both biofilm production and growth, reducing both by over half. The ANOVAs for the PM3 plate determined that the difference between the two strains with respect to biofilm production (*p* = 0.0941) and growth (*p* = 1.0) was not significant. As examples for individual nitrogen sources, hydroxylamine and D,L- $\alpha$ -amino-caprylic acid reduced biofilm amounts and growth significantly in both strains. Altogether, the study shows that nutrients may be used as a novel way control bacterial growth and biofilm formation.

Sule, P, SM Horne, CM Logue & BM Pruess. 2011. Appl. Environm. Microbiol. 77:3653-3662.

*This research was funded but the North Dakota Beef Commission and the ND State Board of Agricultural Research and Education (SBARE).*



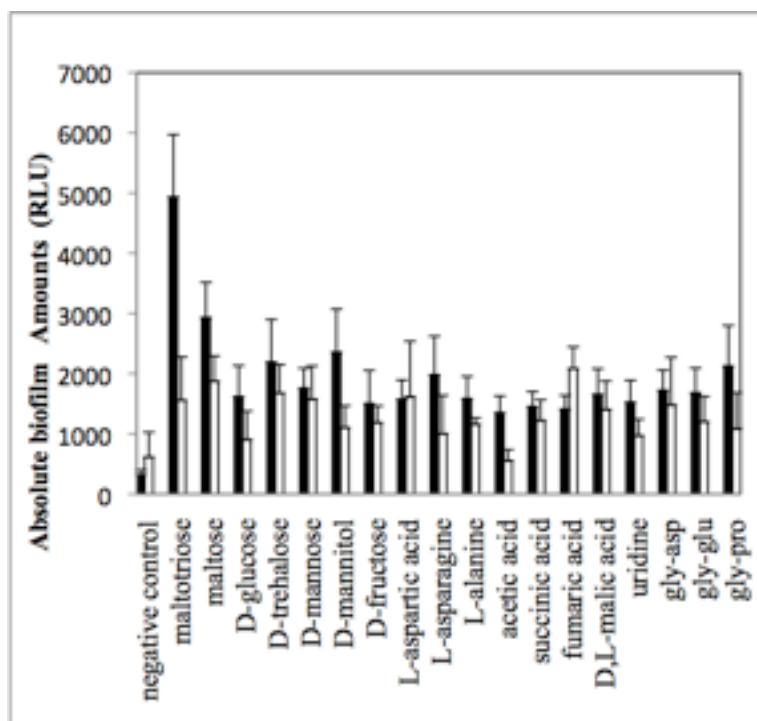
ANALYSIS OF BIOFILM FORMATION IN *ESCHERICHIA COLI* K-12 *ldhA* MUTANT

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**Background-** Biofilms are bacterial communities that form a slime layer on liquid/solid and air/ liquid interfaces. They are problematic in a variety of natural, clinical and bioindustrial settings because of their inability to be eradicated using conventional techniques. *ldhA* encodes fermentative lactate dehydrogenase an enzyme that breaks down pyruvate to D-lactate. Previous research in Dr. Pruess's lab showed biofilm formation by an *Escherichia coli* K-12 strain was high on carbon sources that are metabolized to acetyl-coenzyme A, acetyl phosphate or acetate. This suggests that acetate metabolism is critical in biofilm formation [1].

**Methods-** In order to elucidate the effect of *ldhA* in biofilm formation on different carbon sources, an *E. coli* K-12 *ldhA* mutant were analyzed using Phenotype MicroArrays (BioLog, Hayward CA), as previously explained [1]. The ATP content of the bacteria was measured with the luciferase reaction; biofilm amounts formed were reported as relative bioluminescence units (RLU). The experiment was done four times, averages and standard deviations were determined. Biofilm amounts formed by the mutant were compared with their previously measured parent strain.



**Results-** Previous carbon sources that favored biofilm with a bioluminescence of at least 1,300 RLU in the parent strain were compared with biofilm amounts formed by the mutant as shown in the graph to the left. The black bars represent the parent, whereas the white bars represent the *ldhA* mutant. Maltotriose, D-mannitol and acetic acid permitted decreased biofilm formation by the mutant. The remaining carbon sources permitted almost equal amounts of biofilm in both strains.

**Conclusion-** *ldhA* impacts biofilm amounts on a small number of carbon sources.

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*The work was funded by grant on Agrosecurity: Disease Surveillance and Public Health from the USDA/APHIS (09-9138-1184-CA).*

## TEMPORAL AND SPATIAL GENE EXPRESSION IN *ESCHERICHIA COLI* BIOFILMS

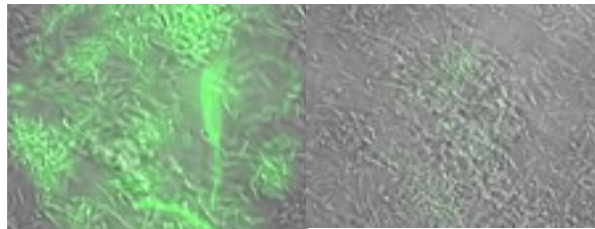
Priyankar Samanta\*, Shelley M. Horne, Pawel Borowicz, Birgit M. Pr   

Department of Veterinary and Microbiological Sciences, North Dakota State University, Fargo ND 58108

**Background**-Biofilms can be defined as a bacterial community that has almost 1,500 times stronger antibiotic resistance than planktonic bacteria. The formation of the biofilm is regulated by several two-component systems, global regulator *flhD* and numerous other regulators. In this study, we started to investigate the temporal and spatial expression from the promoters of selected biofilm associated genes, such as *flhD* and *ompR*.

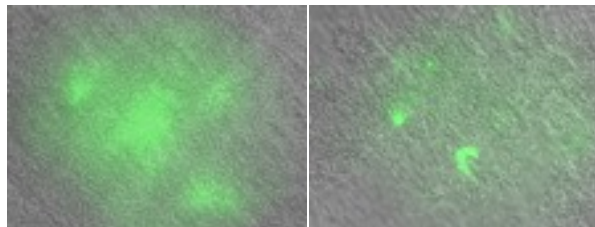
**Methods**-To study *flhD* gene expression, the *flhD* promoter region was cloned in front of the open reading frame (ORF) of pUA66, contains *gfpmut-2* as reporter gene. The promoter fusion plasmid for *ompR* was obtained from the Open Biosystems collection. The *Escherichia coli* K-12 strain AJW678 was transformed with these plasmids. To determine temporal expression from both promoters in biofilm-associated bacteria, a flow cell experiment was performed, biofilms were visualized with a Zeiss Axio Observer Z1 inverted fluorescence microscope. For this experiment, 1 ml of overnight culture of each *E. coli* strain (*flhD::gfp*, *ompR::gfp*, pUA66) was injected into one channel of the three chambers flow cell (STOVALL Life Science Inc., Greensboro NC). Images were taken at 0h, 4h, 9h, 24h, 30h, 48h, and 55h from the top and the bottom of the biofilms using 1,000 X magnification.

**Results and**  
first experiment we  
expression is high at two  
h) of biofilm formation  
and the late stage (55 h)  
(dispersal phase?).  
of *flhD* is almost limited  
biofilm. The images to the  
left image documents *flhD*



**Conclusions**-From the  
observed that *flhD*  
time points: early stage (9  
(reversible attachment?)  
of biofilm formation  
Spatially, the expression  
to the top layer of the  
right are taken at 9 h, the

The expression of  
at the middle stage (24  
formation (maturation  
the left show expression  
post-inoculation. The  
left was taken at the top  
right image at the bottom.  
stronger at the bottom of



*ompR* expression is high  
h-30 h) of biofilm  
phase?). The images to  
of *ompR* in biofilms 24 h  
image all the way to the  
layer of the biofilm, the  
Expression of *ompR* is  
the biofilm.

We conclude that *flhD* expression is high whenever *ompR* expression is low with respect to both, temporal and spatial expression. This could be attributed to the fact that phosphorylated OmpR is a repressor of *flhD* expression [1, 2].

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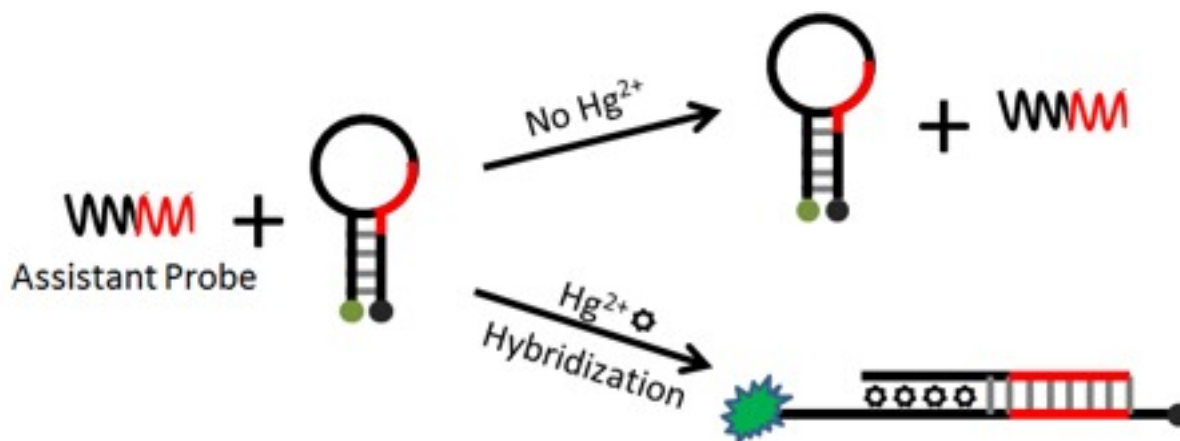
*The work is funded by NIH grant 1R15AI089403*

## ULTRASENSITIVE MERCURY IONS DETECTION BASED ON THE MOLECULAR BEACON

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A novel ultrasensitive, molecular beacon (MB) based sensing system for the mercury ion ( $\text{Hg}^{2+}$ ) was developed. In the design, the assistant probe is introduced into the hybridization buffer containing MB. In the absence of  $\text{Hg}^{2+}$  in the solution, the assistant probe can't hybridize with MB to open it. However, in the presence of the mercury ion, through the thymine- $\text{Hg}^{2+}$ -thymine (T- $\text{Hg}^{2+}$ -T) interaction, the assistant probe can hybridize with MB and open it to restore the fluorescence of the MB. The fluorescence intensity of the system is proportional to the concentration of the  $\text{Hg}^{2+}$ . The results showed that this MB based sensor system is high sensitive to  $\text{Hg}^{2+}$  with limit of detection (LOD) of 8.36 nM, and it also showed excellent selectivity against other metal ions even with higher concentration.



**Scheme 1.** Sensing strategy of the  $\text{Hg}^{2+}$  detection using the molecular beacon.

## **PROFESSIONAL COMMUNICATIONS**

(communications are listed alphabetically by the last name of the presenting author)

EFFECT OF TEMPERATURE ON POSTMATURATION METAMORPHOSIS IN THE WESTERN  
TIGER SALAMANDER, *AMBYSTOMA MAVORTIUM*

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Approximately 10% of all species of salamander exhibit paedomorphosis, i.e., a life cycle where the larval salamander does not metamorphose (Lannoo, 2005). Most of these paedomorphic species belong to the Family Ambystomatidae, and paedomorphic species are either obligatory paedomorphs or facultative paedomorphs. The latter form refers to species that exhibit phenotypic plasticity in expression of metamorphosis or paedomorphosis: environmental conditions, e.g., temperature and larval density, influence whether or not an individual will metamorphose. It is generally considered that once the paedomorphic condition is attained, i.e., sexual maturity in the larval stage, that metamorphosis is no longer possible (Gould, 1977). However, more recent field collections and experiments demonstrate that paedomorphs still are capable of metamorphosis (Winne and Ryan, 2001). We investigated the role that thermal variation plays in the postmaturation metamorphosis of a facultatively- paedomorphic salamander.

The western tiger salamander (*Ambystoma mavortium*) exhibits facultative paedomorphosis throughout many parts of its range (western North America). Like other western tiger salamander populations, growth is very rapid and individuals can attain large sizes (>100 mm SVL) in their first summer of life. In North Dakota, populations are completely metamorphic when ponds are ephemeral (and can reach high temperatures), completely paedomorphic in deep cattle ponds that always have water and do not freeze completely (and are always cool), and are mixed metamorphic/paedomorphic in larger shallow lakes that dry periodically (e.g., once every 10-20 years). We hypothesized that temperature variation among these types of habitats is a significant cause of life cycle variation. We collected 20 salamanders using minnow traps from the flooded Agsite Pond/Swells Lake in Ward County in northwestern North Dakota. This site is characterized by a mixed population of paedomorphic and metamorphic salamanders. We tested two hypotheses: (1) metamorphosis is temperature dependent and (2) metamorphosis is dependent on maturation status. We placed large (>85 mm SVL) larvae in individual boxes and placed 10 larvae in a cooler at 15 degrees C and 10 larvae in a cooler at 20 degrees C. The cool treatment was the water temperature at the site at the time of collection. At high temperature, 7 of 10 larvae metamorphosed, while only 1 larva metamorphosed. Subsequent dissection indicated that the propensity to metamorphose was contingent on maturation status: large larvae that were already sexually mature were less likely to metamorphose.

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*This project was supported by grants from the National Center for Research Resources (5P20RR016471-12) and the National Institute of General Medical Sciences (8 P20 GM103442-12) from the National Institutes of Health. Animals used in this project were kindly provided by Alex Radi.*

ANOTHER VARIANT OF THE C-REACTIVE PROTEIN GENE (*CRP*) IS ASSOCIATED WITH  
IMMUNE RESPONSE AND RISK OF PRE-ECLAMPSIA IN AN AMERICAN INDIAN  
POPULATION

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The etiology of pre-eclampsia (PE) is unknown; but it has been long acknowledged that normal pregnancy represents a distinctive challenge to the maternal immune system. Maladaptive responses to this challenge are frequently postulated as primary initiators of the multiple subsequent pathways leading to pre-eclampsia (1,2). C-reactive protein (CRP) is a prominent component of the innate immune system (3); and has been employed as a non-specific measure of inflammatory status in epidemiologic studies of cardiovascular disease (CVD) (4). The *CRP* single nucleotide polymorphism (SNP), rs876538, has not been shown to be an independent predictor of baseline, serum expression (5); but has been reported to influence the outcome of photodynamic therapy in age-related macular degeneration (6). Although much previous attention has been focused on *CRP* gene variants in relation to CVD, there were no studies investigating a possible role in pre-eclampsia until our report of an association between the rs1205 SNP and severe PE in this same cohort (7). The ITMAT/Broad/CARe (IBCv1) microarray (8) consists of nearly 50,000 SNPs in proximity to candidate genes and loci with potential pathophysiologic effects or other evidence of association with CVD.

**Objectives:** Since our previous data showed an association between the *CRP* variant, rs1205 and severe pre-eclampsia, our aim was to assess possible associations between other *CRP* variants and PE within this American Indian community.

**Methods:** This case-control study has enrolled 139 cases confirmed by chart review and 295 controls, matched on date of the index infant's birth. Genotyping was carried out at Children's Hospital of Philadelphia on the ITMAT/Broad/CARe (IBCv1) microarray; and a total of 24 SNPs associated with the *CRP* gene were identified. Descriptive statistical analysis and conditional logistic regression was conducted using SPSS (v10.1.0) or Egret (v2.0.31), respectively.

**Results:** Among the SNPs chosen for study, 13 were uninformative, either due to complete lack of variation at this locus (8) or of such low frequency (<1.1%) that a solution for the odds ratio could not be obtained. Hardy-Weinberg equilibrium is satisfied for all but one (rs2808634) of the 11 polymorphisms analyzed. Analysis of the 3', non-coding rs876538 SNP of *CRP* finds the distribution of CC/CT/TT genotypes to be 91/26/2 and 91/52/3 among cases and controls respectively. Analysis of these proportions yields an unpaired chi square value of 6.18 with 2 degrees of freedom and a p value of 0.046. The estimated population allele frequency of the risk allele (T) is 80.1% among controls. Conditional logistic regression analysis using an additive model showed an increased odds ratio (OR) of 1.93 (p=0.025, CI 1.08-3.43) for each additional T allele in unadjusted analysis. Using a recessive T model, the OR is 2.30 (p=0.010, CI 1.22-4.36). When the recessive model is adjusted for age, nulliparity and BMI the odds ratio is increased to 2.86 (p=0.013, CI 1.25 – 6.52).

**Conclusions:** The *CRP* variant rs876538 is associated with pre-eclampsia in this American Indian population. This SNP may not be the underlying causal factor; but may be associated due to linkage disequilibrium with other variants in proximity. These findings further support the influence of *CRP* genotype on immune function and resultant risk for pre-eclampsia.

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## PILOT STUDY ON THE ENGINEERING OF COAL FLY ASH BASED GROWTH MEDIA FOR PLANTS

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Coal fly ash (FA) is a major industrial by-product from electric power plants. Fly ash is produced in huge amounts reaching 120 million Mg in the US. Out of this amount only 22% is used for beneficial application such as cement concrete admixture, road-base stabilization or geotechnical fills, and 78% is used as landfills (2). Fly ash is composed of oxides of iron, silicon, aluminium, magnesium, calcium, sodium, potassium and other elements. In addition, FA contains traces of elements which are known to be harmful to health. These elements include: arsenic, barium, lead, mercury, nickel, radium, zinc, uranium, and others.

A vegetative cover is a remedial technique utilized on coal FA landfills for soil stabilization and for the physical and chemical immobilization of contaminants. There is a great concern, that plants planted or voluntarily growing on media with high content of FA may absorb toxic amounts of selenium (Se) and/or heavy metals. If such plants are ingested, it may result in toxicity to animals or humans. Despite these objections, the utilization of FA as a growth medium for plants is an attractive alternative for disposal of FA in landfills (1).

The principal objective of our research project is to study the potential use of FA as the medium for plants. The subordinate objectives of the proposed research are to determine the environmental safety of different growth media composed of FA and soil, and to study the influence of various FA content in soil media (from 0 to 100% of FA) on the germination, growth, heavy metals, boron (B), and Se uptake by the plants.

Plant species tested in our experiments showed significant growth adaptation to media based on FA. There were noticeable differences in seedlings growth, depending on the type and source of coal FA used. However, pre-plantation tests should be done before performing green cover over FA piles (3).

The results of chemical analysis of FA and harvested young plants implicate that plants do not accumulate toxic amounts of heavy metals even being grown on media containing 100% FA. These results indicate that coal FA might be used as a plant growth media supplement. However, additional studies should be undertaken to determine the effects of FA on plants grown till maturity (4).

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*This project was supported by grants from the National Center for Research Resources (5P20RR016471-12) and the National Institute of General Medical Sciences (8 P20 GM103442-12) from the National Institutes of Health.*

WATERFLOODING PETROLEUM RESERVOIRS IN THE NEWCASTLE/MUDDY FORMATION,  
POWDER RIVER BASIN, WYOMING

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Injecting water into an oil reservoir to improve recovery has been a practiced method for almost 100 years. Waterflooding a reservoir can increase secondary production from the primary 20-30% to 50% recovery. In the 1860s, it was noticed in some oil fields in Pennsylvania that ground water would seep into a well through bad casing and eventually ruin it making it produce only water. The operators also noticed a spike in oil production just prior to the well producing primarily water. In 1880, John F. Carll, a geologist and petroleum engineer, officially stated that if water was deliberately let into one well then it would push oil towards a nearby well because "all the oil cannot be withdrawn from a reservoir without the admission of something to take its place." Although the process was known to be successful, allowing the groundwater to seep into oil wells was potentially hazardous to the water supply. In 1921, the process was legalized and therefore regulated to assure no contamination of the groundwater. At this time it was customary to drill a line of injecting wells where they injected water down tubing to lessen the chance of seepage into the water supply. The injected water would then drive the oil towards a line of nearby producing wells. Despite the proven success of waterfloods, people were slow to adopt the method. This was due to higher costs involved, the presence of already naturally flooded fields that were automatically unsuccessful, or the lack of proper knowledge of reservoir geology that might make it initially unsuccessful. By the 1950s waterfloods were a common practice using the revised 5-spot pattern of four injection wells surrounding a producing well.

One of the major factors hindering the success of a waterflood is poorly understood heterogeneous rock. If the oil producing unit is uniform with suitable porosity and permeability then the injected water will uniformly flow and push a significant amount of oil towards the producing well. However, if the rock is heterogeneous with intervals of conversely high and low porosity/permeability then the injected water will immediately flow through the higher porosity/permeability layers. It sweeps these intervals of oil and leaves the remainder of the producing interval untouched. As injection continues, the water will maintain the flooding of the high porosity/permeability layers and will eventually cause the nearby well to produce only water. Even though the producing well has "watered out," there is still untouched oil that can potentially be extracted. This is common in the Newcastle/Muddy Formation, which was deposited during transitional marine conditions where the shoreline was continually advancing and retreating over a short period of time. The depositional environment caused the Newcastle/Muddy Formation to include several beds of intertongued sand, silt, and clay, which then caused smaller intervals of much higher porosity/permeability. Due to this heterogeneous nature of the Newcastle/Muddy Formation, the injected water must be chemically treated prior to injection to resolve these issues. The most common treatments are a KOH treatment to stabilize clays and a polymer treatment to seal the high porosity/permeability intervals. Only with water treatment are waterfloods truly successful in the Newcastle/Muddy Formation.



## URANIUM ROLL FRONT DEPOSITS OF WYOMING, THEIR DEFINITION, DEVELOPMENT AND POTENTIAL ORIGINS

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Uranium is estimated as being 40 times more common than silver, 500 times more common than gold (1). And while is relatively common, the difficulty is finding it in concentrations high enough to make mining economical. Uranium deposits are usually classified according to host rocks, structural setting, and mineralogy. A classification scheme developed by the International Atomic Energy Agency is most widely used; it subdivides deposits into 15 categories.

Uranium is a radioactive heavy metal, is extremely soluble, transported within groundwater, and is precipitated through oxidation-reduction. Within the 15 classifications, the sandstone type is most common in Wyoming. The sandstone category is subdivided into tabular, roll-front, basal paleochannel and structurally controlled deposits.

Uranium roll-fronts are found primarily in porous and permeable sandstones. The uranium is in dissolution and transported through the host unit. When this uranium comes into contact with carbon-rich organic matter the fluid changes redox state and the uranium in solution forms a “front.” This front will form characteristic zonation that makes it amendable to in situ leach recovery.

The source for the uranium within the host sands is debated, either being from overlying volcanic ash deposits or from exposed granitics found on the margins of Wyoming basins. This talk addresses the deposition, zonation, and potential source for the sandstone deposits seen in Wyoming.

“Cameco – Uranium 101”. [http://www.cameco.com/uranium\\_101](http://www.cameco.com/uranium_101). Retrieved February 28, 2012.

## ADDRESSING THE HAZARDS OF POST-FLOOD MOLD TO PUBLIC HEALTH

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**Background:** The devastation of the Souris River Flood of 2011 doesn't stop after the water recedes; dangerous molds grow and spread in structures that have been inundated with flood water. Recovery from the flood requires the recognition and proper treatment of mold infestation in damaged structures throughout the Souris River Basin. The goal of this project is to involve students and community members in research and service in order to elevate the awareness of the risk posed by mold in a post-flood environment. Mindful of the disaster in their community, students will be involved in lab research to evaluate novel fungicides that eventually could mitigate the hazard presented by mold infestation.

**Methods/Components:**

1. Collection and preservation of a variety of molds from structures inundated by flood-water.
2. Synthesis of a limited number of novel formamide fungicides. Novel formamide fungicides have an unknown and potentially new mode of anti-fungal action. They may become instrumental in overcoming resistance to the currently used fungicides.
3. Confirmation (verification) of the structures via spectroscopic methods (IR, NMR, MS) and elemental analysis.
4. Biological (antifungal) testing of the newly synthesized compounds in vitro against molds from structures inundated by flood-water.

**Results:** The results of the research will provide data for mapping structure-activity relationships among novel formamide fungicides. The results may also have some practical value if novel fungicides will be capable of providing a lasting and efficient control of dangerous molds.

*Supported by the Great Plains Center for Community Research and Service as funded by the US Department of Education Grant Award P1 16Z100151*

## ASPECTS OF MENINGEAL WORM (*PARELAPHOSTRONGYLUS TENUIS*) INFECTION IN WHITE-TAILED DEER FROM NORTH DAKOTA

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*Parelaphostrongylus tenuis*, the meningeal worm is a nematode parasite that of white-tailed deer (1). Where transmission conditions are favorable, *P. tenuis* infection prevalence is often high (>80%) and does not differ greatly among age classes of deer because most deer are infected at an early age (3, 4). Infection intensity is a function of the initial larval dose; deer tend to accumulate few additional worms over their lifetimes (4). Therefore, median intensity may be higher and the percentage of patent infections (requiring at least one worm of each sex) may be greater where transmission conditions are better. North Dakota (ND) represents the western limit of *P. tenuis*, with dry environmental conditions potentially limiting the survival of first-stage larvae and availability of terrestrial gastropod intermediate hosts (2). Thus, we predicted that *P. tenuis* prevalence here will be low, that prevalence should increase with deer age because most young deer are not infected, and that infection intensity should be low with high rates of single worm and unisexual infections.

We estimated the prevalence of *P. tenuis* in white-tailed deer throughout ND from 2002 to 2005 by examining hunter-killed deer. Deer heads were cut sagittally, and the cavernous, intercavernous, transverse, and sagittal blood sinuses; brain surface; and inner surface of dura mater of each head were examined for *P. tenuis* (5). Deer were aged from tooth wear and eruption. In 2002 and 2003, we collected all worms recovered from these deer and preserved them in 70% ethanol for later examination. We examined worms under a dissecting scope at 20x and determined infection intensity by counting the number of intact worms and caudal end fragments recovered from each deer. The sex of each worm was confirmed using a compound scope at 100x. We used Fisher's exact tests to compare infection prevalence among four age classes of deer (1.5, 2.5, 3.5, and 4.5-years-old and older) as well as the proportions of single worm and single sex infections. We used a Mood's median test to compare median intensity among age classes.

Overall infection prevalence was 16.6% (N= 3506). Prevalence was lower in younger deer ( $P < 0.001$ ). The number of worms recovered from deer ranged from 1 to 6, with a median intensity of 1 worm (N = 98 deer). Median intensity did not differ among age classes ( $P = 0.24$ ). Sixty four percent of deer had single-worm infections, while 73% had single-sex infections. Proportions of single-worm ( $P = 0.30$ ) and single-sex infections ( $P = 0.49$ ) were similar among age classes.

*P. tenuis* prevalence in North Dakota was low compared to levels reported in the more eastern portion of the parasite's range (50-90%; 2, 3, 4). Because transmission conditions allowed only a small proportion of deer to be infected each year, prevalence increased with deer age. This contrasts with the results of Slomke et al. (4) where, in an area of with high infection prevalence (>90%), nearly all deer acquired infection at an early age, and prevalence increased little thereafter. The low infection intensity and high percentage of single-sex infections we observed also differed from the results of other studies (3,4), and may have been the result of low numbers of infected gastropod intermediate hosts in North Dakota compared to these other areas. Other results may be accounted for by the immune response by deer to *P. tenuis* infection. For example, the low intensity found among all age classes may have resulted from concomitant immunity that prevents the accumulation of worms over time (2, 4). Low infection prevalence combined with the decreased parasite productivity that results from a high proportion of single-worm and single-sex infections may serve to limit the range expansion of this parasite.

1) Anderson, RC and AK Prestwood. (1981) Lungworms. In Diseases and parasites of white-tailed deer, Miscellaneous Publication No. 7, Tall Timbers Research Station, Tallahassee, FL, pp 266-317.

2) Lankester, MW. (2001) Extrapulmonary lungworms of cervids. In Parasitic diseases of wild mammals, 2<sup>nd</sup> edition. Iowa State University Press, Ames, Iowa, USA, pp 228-278.

3) Bogaczyk, BA, WB Krohn, and HC Gibbs. (1993) Factors affecting *Parelaphostrongylus tenuis* in white-tailed deer (*Odocoileus virginianus*) from Maine. J Wild.Dis 29:266-272.

4) Slomke, AM., MW Lankester, and WJ Peterson (1995). Infrapopulation dynamics of *Parelaphostrongylus tenuis* in white-tailed deer. J Wild Dis 31: 125-135.

5) Comer, JA., WR Davidson, AK Prestwood, and VF Nettles. (1991) An update on the distribution of *Parelaphostrongylus tenuis* in the southeastern United States. J Wild Dis 27: 348-354.

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In search of hybridity: the case of Karelian spruces

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Norwegian spruce (*Picea abies* (L.) Karst.) and Siberian spruce (*Picea obovata* Ledeb.) are conspicuous ornamental trees growing well in North Dakota. These two species are suitable for cultivation and may be used in restoration of our tree flora suffered from 2011 catastrophic flood. The native area of these spruces is the whole Northern Eurasia: Norwegian spruce occurs mostly in the West (Europe), and Siberian spruce to the East of Ural mountains. These species meet only in narrow zone in Finnish and Russian Arctic where putative hybrid, *Picea x fennica* (Regel) Kom. (Finnish spruce) has been described. Despite of sufficient morphological research, there were no investigations employed contemporary methods of hybridization study, e.g., geometric morphometry and molecular analysis of polymorphic markers.

For morphological analysis, we employed both classical and geometric morphometry approaches. Linear measurements of cones and seed scales unequivocally show that Karelian spruces should be treated as Siberian *Picea obovata*. However, geometric morphometry (studies of form) of seed scales showed that Karelian trees hold the intermediate position between two species. Therefore, morphology did not return a clear answer.

For molecular analysis, we are using three polymorphic fragments which are already known as producing good results in the studies of spruces phylogeny: non-coding regions of chloroplast DNA (trnT-trnL intergenic spacer and trnL (UAA) intron) and polymorphic fragment of the second intron of mitochondrial nad1 gene. DNA of 59 samples from eight populations was extracted, and after some tuning, we now have good results of trnT-trnL fragment amplification. Since this fragment should contain a G-insert characterising Siberian spruces, results of sequencing will probably shed a light to the origin of our Karelian samples. We are planning to sequence also two other fragments.

# CONSTITUTION OF THE NORTH DAKOTA ACADEMY OF SCIENCE

*Founded 1908, Official State Academy 1958*

## ARTICLE I - *Name and Purpose*

Section 1. This association shall be called the NORTH DAKOTA ACADEMY OF SCIENCE.

Section 2. The purpose of this association shall be to promote and conduct scientific research and to diffuse scientific knowledge.

## ARTICLE II - *Membership*

Membership in the Academy shall be composed of persons who share the stated purpose of the Academy and who are active or interested in some field of scientific endeavor.

## ARTICLE III - *Council*

The officers of the Academy shall be a President, a President-Elect, and a Secretary-Treasurer. The Council, consisting of the officers, the retiring President, and three elected Councilors, shall be responsible for the fulfillment of the scientific and business obligations of the Academy.

## ARTICLE V - *Dissolution and Limits of Action*

Section 1. In the event of dissolution of the Academy, any remaining assets shall be distributed to organizations organized and operated exclusively for education and scientific purposes as shall at the time qualify as exempt organizations under Section 501(c) (3) of the Internal Revenue Code of 1954.

Section 2. No substantial part of the activities of the Academy shall be the carrying on of propaganda, or otherwise attempting to influence legislation, and the Academy shall not participate in or intervene in, any political campaign on behalf of any candidate for public office.

Section 3. No part of any net earnings shall inure to the benefit of, or be distributable to, Academy members or officers, or other private persons, except that the Academy may authorize the payment of reasonable compensation for services rendered.

## ARTICLE VI - *Amendments*

Section 1. This Constitution may be amended at any annual Business Meeting of the Academy by a two-thirds vote. Proposed amendments shall be submitted in writing to the Secretary-Treasurer who shall send them to the members at least two weeks before the meeting at which such amendments are to be considered.

Section 2. Bylaws may be adopted or repealed at any regular business meeting by a two-thirds vote.

## BYLAWS

### BYLAW 1. *Meetings*

Section 1. *Scientific Meetings.* The Academy shall hold at least one annual scientific meeting each year at a time and place determined by the Council. Other scientific meetings, regional, state, or local, may be held at times and places determined by the Council. The Council shall establish regulations governing the presentation of papers at Academy sessions. Such regulations shall be made available to members at least three months before any meeting at which they are to apply.

Section 2. *Business Meetings.* A Business Meeting of the membership shall be scheduled at the regular, annual scientific meeting of the Academy. Ten percent of the active members shall constitute a quorum at the annual business meeting.

Section 3. *Special Meetings.* Special meetings shall be called by the President upon the request of ten percent of the active members and require twenty percent of the active members for a quorum. Notice of the time and place of such meetings shall be sent to all members of the Academy at least four weeks in advance of the meeting. Only matters specified in the call can be transacted at a special meeting.

Section 4. *Procedure.* Parliamentary procedures to be followed in all business meetings shall be those specified in "Standard Code of Parliamentary Procedure" by Alice F. Sturgis.

#### BYLAW 2. *Financial*

Section 1. *Fiscal year.* The fiscal year shall run concurrently with the calendar year from January 1 to December 31.

Section 2. *Dues and Assessments.* The annual dues and assessments may be changed from time to time by the Council, subject to approval by a two-thirds vote of the members at an annual Business Meeting. These dues are payable by January 31 for the current fiscal year or by the Annual North Dakota Academy of Science Meeting for those registering for the meeting

Section 3. *Supporting Members.* Council shall maintain a program to encourage members to voluntarily contribute funds over and above the regular dues and assessments for the support of activities of the Society.

Section 4. *Sustaining Members.* Any association, corporation, institution, or individual desiring to support the Society with funds or services valued at \$50 or greater may be invited by the President or designee to become a Sustaining Associate.

Section 5. *Audit and Reports.* The Nominating Committee shall appoint on a yearly basis one member who is not a member of Council to conduct at least one internal audit per year. The Secretary-Treasurer shall report on the financial affairs of the Society, including the results of an annual audit, as may be requested by the Council.

#### BYLAW 3. *Membership*

Section 1. *Membership Categories.* Classes of membership shall include the following: (a) Regular, (b) Student, (c) Emeritus, (d) Honorary, (e) Supporting, (f) Sustaining, and (g) Lifetime Members.

Section 2. *Eligibility and Procedure for Membership.* Candidates for membership, except Sustaining Member, may be proposed by any regular or emeritus member of the Academy by submitting the candidate's name to the chairman of the Membership Committee.

(a) *Regular Members.* Any person who is active or interested in some field of scientific endeavor shall be eligible for regular membership. A majority vote of Council shall elect to regular membership.

(b) *Student Members.* Any student who is an undergraduate or graduate student in some field of science shall be eligible for student membership. A majority vote of Council shall elect to regular membership.

(c) *Emeritus Members.* Any member in good standing upon formal retirement is eligible for emeritus membership. A majority vote of Council shall elect to emeritus membership.

(d) *Honorary Members.* The Academy may recognize, by awarding honorary membership, any person (nonmember or member) who has in any way made an outstanding contribution to science. It shall be the responsibility of the Membership Committee to be aware of individuals whom it would be fitting for the Academy to honor in this fashion. A two-thirds vote of members attending the annual business meeting shall elect to honorary membership.

(e) *Supporting Members.* Regular or student members may voluntarily contribute funds over and above the regular dues and assessments for the support of activities of the Society.

(f) *Sustaining Associates.* Any association, corporation, institution, or individual desiring to support the Society with funds or services valued at \$50 or greater may be invited by the President or designee to become a Sustaining Associate.

(g) *Lifetime Members.* Any regular member in current good standing for at least one year may become a Lifetime Member by paying an assessment equal to 18 times the current annual dues in one lump sum or in two equal payments over the current and following year.

Section 3. *Privileges of Membership.*

- (a) Voting at the annual business meeting is permitted of regular and emeritus members.
- (b) Members of all categories may attend business meetings of the Academy.
- (c) The Secretary-Treasurer and members of Council must be regular members in good standing.
- (d) Regular, student, and emeritus members may submit abstracts or communications for scientific meetings of the Academy.
- (e) Emeritus and Honorary Members shall be exempt from payment of dues.
- (f) A Sustaining Member is provided a display area at the annual scientific meeting of five linear feet per \$50 donation up to a maximum of 20 linear feet.
- (g) Every member in good standing shall receive a printed copy or an electronic copy (if available and of equal or lesser cost than the printed copy) of the annual *Proceedings of the North Dakota Academy of Science*, the form to be determined by the member.
- (h) Special offices such as Historian may be created by the unanimous vote of the regular members at the annual Business Meeting.
- (i) All student research participants shall receive a properly inscribed certificate.

Section 4. *Forfeiture of Membership.*

- (a) *Nonpayment of dues.* Members shall be dropped from the active list on 31 November following the nonpayment of dues during the membership year commencing the previous 1 December. A member may return to the active list by paying the current year dues.
- (b) *Expulsion for Cause.* Membership may be terminated for conduct injurious to the Academy or contrary to the best interests of the Academy. The accused member shall be given an opportunity for a hearing before the Council. If a majority of the Council votes to expel the member, the action must be ratified by at least two-thirds of the members present at the next annual business meeting of the Academy. An expelled member shall forfeit all paid dues and assessments.

BYLAW 4. *Duties and Responsibilities of the Council and Council Members*

Section 1. *Council.* The Council shall meet, at the call of the President, at least twice a year. The Council shall:

- (a) be the governing board of the Academy, responsible only to the membership.
- (b) arrange for programs, approve committee appointments, be responsible for the fiscal affairs of the Academy, and transact such business as necessary and desirable for function and growth of the Academy.
- (c) determine the location of the annual meeting three years in advance.
- (d) annually appoint an Academy representative to the National Association of Academies of Science and to Section X (General) of the American Association for the Advancement of Science.
- (e) shall appoint and may compensate a Secretary-Treasurer.
- (f) shall appoint and may compensate an Editor of the PROCEEDINGS and other publications.
- (g) shall be empowered to charge a publication fee of authors on a per page basis.
- (h) shall control all activities of the Academy including grant applications.

Section 2. *President.* The President shall preside at meetings of the Council and over the annual business meeting of the Academy at the close of the regular term office. The President shall vote only to break a tie. Unless otherwise specified, the President shall, with the approval of the Council, appoint members to serve on Standing Committees and *ad hoc* Committees, designate the chair of each Committee, and appoint representatives to other organizations. The President serves as Coordinator of the Local Arrangements Committee for the annual meeting that occurs at the end of the President's term.

Section 3. *President-Elect.* The President-elect shall be considered a vice president and shall serve as such in the absence of the President.

Section 4. *Past-President.* The retiring President shall serve as Past-President and chair of the Nominating Committee. The Past President shall serve ex officio on those committees designated by the President and shall serve in the absence of the President and President-elect.

Section 5. *Secretary-Treasurer*. The Secretary-Treasurer shall:

- (1) Assist Council in carrying on the functions of the Academy including the receipt and disbursement of funds under the direction of Council.
- (2) Manage the Academy Offices under Council's general supervision.
- (3) Serve as Managing Editor of the *Proceedings of the North Dakota Academy of Science*.
- (4) Prepare a summary of the most recent audit and a report of the Academy's current financial status. This information shall be shared with the membership at the annual business meeting and published in the PROCEEDINGS following the business meeting.
- (5) Perform all other duties of the Secretary-Treasurer listed in the Bylaws.
- (6) Serve as archivist and be responsible for all official records, archives, and historic material which shall be in deposit with the Secretary-Treasurer.

BYLAW 5. *Appointment, Nomination and Election of Members of Council*

Section 1. *Eligibility for Office*. All candidates for election or appointment to the Council must be regular members in good standing. Nominees for President-elect must be members who reside within easy commuting distance of the site of the annual meeting selected by the Council that occurs when the President-elect serves as President.

Section 2. *Nomination Procedures*. The Nominating Committee shall be responsible for all nominations to elective office, shall determine the eligibility of nominees, shall ascertain that nominees are willing to stand for office, and shall be required to advance to the Secretary-Treasurer at least two names for each open position as needed. Academy members shall have been encouraged to suggest nominees to the committee prior to the Committee submitting its report.

Section 3. *Election Procedures*. Election shall be by secret mail ballot. The Secretary-Treasurer shall prepare a printed ballot that bears all names submitted by the Nominating Committee, that contains a brief biography of each candidate, and that has space for write-in candidates for each office. This ballot is to be mailed to all members no later than 1 November. Each member wishing to vote must return the marked ballot in a sealed signed envelope to the Secretary-Treasurer postmarked not more than thirty days after the ballots were mailed out to members. The President shall appoint tellers, who shall count the ballots that have been received by the Secretary-Treasurer and the tellers shall present the results in writing to the President. A plurality of the votes cast shall be necessary to elect and in the case of a tie vote, the President shall cast the deciding vote. The results of the election shall be announced at the annual Business Meeting.

Section 4. *Term office*. A President-Elect shall be elected annually by the membership and the following years shall succeed automatically to President and Past President to constitute a three-year nonrenewable term. Three Councilors shall be elected by the membership to three-year, non-renewable terms on a rotating basis. All elected Council members shall take office at the end of the next annual Business Meeting following election and shall continue until relieved by their successors. Council is empowered to appoint and compensate a Secretary-Treasurer to successive three-year terms that commence with the beginning of the fiscal year.

Section 5. *Removal from office or position*. If for any reason any elected member of Council is unable to fulfill his/her duties, the Council member may be removed from office by two-thirds vote of Council. If for any reason the Secretary-Treasurer is unable to fulfill his/her duties, the Secretary-Treasurer may be relieved of all duties by a majority vote of Council.

Section 6. *Interim vacancies*. Should a vacancy occur in the Presidency, the Council by a majority vote shall appoint a member of the Academy able to coordinate the next annual meeting to fill the unexpired term. A retiring interim President shall succeed automatically to Past President. Should a vacancy occur in the Presidency-elect, the Council shall reassess and change the location of the coinciding annual meeting as necessary and then call for a special election by mail ballot. An interim vacancy in the Past-Presidency shall be filled by the most recently retired Past-President able to fill the duties of the Past-President. Persons appointed to fill the unexpired term of Secretary-Treasurer are expected to remain in the position for a minimum of three years. A vacancy in the office of Councilor shall be filled by a majority vote of Council until the following election at which time the interim Councilor may stand for a full three year nonrenewable term.

BYLAW 6. *Committees*



Section 1. *Standing Committees.* Standing committees shall include but not be limited to, the following: Editorial, Education, Denison Award, Necrology, Nominating, Resolution, Membership, and Audit Committees. The President shall appoint members of committees other than the Nominating and Audit Committees.

Section 2. *Editorial Committee.* The Editorial Committee shall consist of three regular members appointed to three year terms. The duties are explained in BYLAW 7 (Publications).

Section 3. *Education Committee.* The Education Committee shall consist of five regular members and two high school teachers appointed to five year terms. The Education Committee shall work with high school students and teachers in the state, in visitation programs, Science Talent Search programs, and other programs to stimulate an interest in science by the youth of the state. It shall operate the Junior Academy of Science program and administer the AAAS high school research program.

Section 4. *Denison Awards Committee.* The Denison Awards Committee shall consist of six regular members appointed to three year terms. The Denison Awards Committee shall have as its prime duty the judging of student research and paper competitions, both undergraduate and graduate, and any other similar competitions. The committee shall also maintain the criteria to be used in the judging and selection of papers, such criteria to be circulated to prospective competitors.

Section 5. *Necrology Committee.* The Necrology Committee shall consist of three regular members appointed to three year terms. The Necrology Committee shall report to the annual meeting on those deceased during the preceding year. Obituaries may be included in the minutes of the annual meeting and/or published in the Proceedings.

Section 6. *Nominating Committee.* The Nominating Committee shall consist of the five most recent past-presidents. The major duties of the Nominating Committee are listed in BYLAW 5 (*Appointment, Nomination and Election of Members of Council*). The Nominating Committee will also administer the selection process, develop a separate funding source for a monetary award, and develop, for Executive Committee approval, the criteria for the North Dakota Academy of Science Achievement Award.

Section 7. *Resolution Committee.* The Resolution Committee shall consist of three regular members appointed to three year terms. The Resolution Committee shall prepare such resolutions of recognition and thanks as appropriate for the annual meeting. Further, the Committee shall receive suggested resolutions for the membership and transmit such resolutions and the Committee recommendation to the membership.

Section 8. *Membership Committee.* The Membership Committee shall consist of unlimited numbers of regular members appointed annually.

Section 9. *Audit Committee.* The Nominating Committee shall appoint on a yearly basis one member who is not a member of Council to conduct at least one internal audit per year.

Section 10. *State Science Advisory Committee.* The State Science Advisory Committee (SSAC) shall consist of five regular or emeritus members appointed to four year terms. The SSAC shall serve to direct questions of a scientific nature to the appropriate expert as requested, shall inform regional granting agencies and state and national science policymakers of its expertise and availability and shall counsel those agencies and persons upon their request. The SSAC shall adhere in particular to the guidelines described in Article V, Section 2 of the Constitution.

Section 11. *Ad hoc Committees.* The President may appoint such additional committees as may be needed to carry out the functions of the Academy. Ad hoc committees serve only during the tenure of the president who appointed them. Reports of ad hoc committees shall be presented to Council or to the annual meeting.

#### BYLAW 7. *Publications*

Section 1. *Editorial Committee.* Three regular members are appointed to the Editorial Committee for renewable three year terms. The Editorial Committee shall develop and recommend the Academy publication program and policies to the Council. It will assist the Editors of each official publication in reviewing manuscripts for those publications that include the *Proceedings*. Chairs of symposia will review manuscripts written for relevant symposia.

Section 2. *Managing Editor*. The Secretary-Treasurer shall serve as the

Section 3. *Editor*. Editors shall serve three year terms. The Editors shall edit all official publications of the Academy including the *Proceedings*.

BYLAW 8. *Memorial Fund*

The Council of the Academy shall establish a J. Donald Henderson Memorial Fund and administer this fund so that the proceeds will be used to promote science in North Dakota.

BYLAW 9. *Fiscal Year*

The fiscal year of the North Dakota Academy of Science, for the purpose of financial business, shall be 1 January to 31 December.

BYLAW 10. *Achievement Award*

The Academy establishes the North Dakota Academy of Science Achievement Award to be given periodically to an Academy member in recognition of excellence in one or more of the following:

- a. Nationally recognized scientific research.
- b. Science education.
- c. Service to the Academy in advancing its goals.

The Nominating Committee will administer the selection process, will develop a separate funding source for a monetary award, and will develop, for Council approval, the criteria for the award.

BYLAW 11. *Research Foundation*

The **North Dakota Science Research Foundation** is established as an operating arm of the Academy. The purposes of the Foundation are:

(1) to receive funds from grants, gifts, bequests, and contributions from organizations and individuals, and (2) to use the income solely for the making of grants in support of scientific research in the State of North Dakota. Not less than 50% of the eligible monies received shall be placed in an endowment from which only the accrued interest shall be granted.

The foundation shall be responsible for soliciting the funds for the purposes described. The Foundation funds shall be in the custody of the Secretary-Treasurer of the Academy and shall be separately accounted for annually. The Foundation Board of Directors shall be comprised of five members of the Academy, representing different disciplines. Members shall be appointed by the President of staggered five year terms. The chairperson of the Board shall be appointed annually by the President. The Board shall be responsible for developing operating procedures, guidelines for proposals, evaluation criteria, granting policies, monitoring procedures, and reporting requirements, all of which shall be submitted to the Executive Committee for ratification before implementation.

The Foundation shall present a written and oral report to the membership of the Academy at each annual meeting, and the Secretary-Treasurer shall present an accompanying financial report.

BYLAW 12. *Affiliations*

The Academy may affiliate itself with other organizations which have purposes consistent with the purposes of the Academy. Such affiliations must be approved by the Council and by a majority of those attending a regularly scheduled business meeting of the membership.

BYLAW 13. *Indemnification*

Section 1. Every member of the Council or employee of the North Dakota Academy of Science shall be indemnified by the Academy against all expenses and liabilities, including counsel fees, reasonably incurred or imposed upon him/her in connection with any proceedings to which he or she may be made part, or in which he or she may become involved, by reason of being or having been a member of the Council, or employee at the time such expenses are incurred, except in such cases wherein the member of the Council or employee is adjudged guilty of willful misfeasance or malfeasance in the performance of his or her duties. Provided, however, that in the event of a

settlement of the indemnification herein shall apply only when the Council approves such settlement and reimbursement as being for the best interests of the Academy. The foregoing right of indemnification shall be in addition to and not exclusive of all other rights to which such members of the Council or employee may be entitled.

## ACADEMY OFFICERS AND COMMITTEES

### Executive Committee

#### Membership

President  
 Past-President  
 President-Elect  
 Secretary-Treasurer (three-year term)  
 Councilors (three-year terms)

### President

Michael A. Bingle-Davis  
 Cameco Inc.  
 Sheridan, WY  
 701-740-8425  
 Michael\_Bingle-Davis@cameco.com

### President-Elect

Jerzy Bilski  
 Math, Science and Technology  
 Rhoades Science Center 203  
 Valley City State University  
 Valley City, ND 58072  
 701-845-7453  
 jerzy.bilski@vcsu.edu

### Past-President

Lyle Best  
 Turtle Mountain Community  
 College  
 RR1, PO Box 88  
 Rolette, ND 58366  
 701-246-3884  
 sbest@utma.com

### Secretary-Treasurer

Paul Lepp (2010-2013)  
 Department of Biology  
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 Minot, ND  
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### Councilors

Christopher Beachy (2010-2013)  
 Department of Biology  
 Minot State University  
 500 University Avenue W  
 Minot, ND 58707  
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 christopher.beachy@minotstateu.edu

Ronald Jyring (2010-2013)  
 Bismarck State College  
 PO Box 5587  
 Bismarck, ND 58506  
 701-224-5459  
 Ronald.Jyring@bsc.nodak.edu

Vacant

## COMMITTEES OF THE NORTH DAKOTA ACADEMY OF SCIENCE

Executive Committee\*  
 Editorial Committee\*  
 Education Committee\*  
 Denison Awards Committee\*  
 Necrology Committee\*  
 Nominating Committee\*

Resolution Committee\*  
 Membership Committee\*  
 North Dakota Research Foundation Board of Directors\*  
 Historian\*

\*indicates available openings

**PAST PRESIDENTS AND THE LOCATIONS**  
OF THE ANNUAL MEETING OF THE NORTH DAKOTA ACADEMY OF SCIENCE

1909	M A Brannon	Grand Forks	1961	Vera Facey	Grand Forks
1910	M A Brannon	Fargo	1962	J F Cassel	Fargo
1911	C B Waldron	Grand Forks	1963	C A Wardner	Grand Forks
1912	L B McMullen	Fargo	1964	Fred H Sands	Fargo
1913	Louis VanEs	Grand Forks	1965	P B Kannowski	Grand Forks
1914	A G Leonard	Fargo	1966	Paul C Sandal	Fargo
1915	W B Bell	Grand Forks	1967	F D Holland, Jr	Grand Forks
1916	Lura Perrine	Fargo	1968	W E Dinusson	Fargo
1917	A H Taylor	Grand Forks	1969	Paul D Leiby	Minot
1918	R C Doneghue	Fargo	1970	Roland G Severson	Grand Forks
1919	H E French	Grand Forks	1971	Robert L Burgess	Fargo
1920	J W Ince	Fargo	1972	John C Thompson	Dickinson
1921	L R Waldron	Grand Forks	1973	John R Reid	Grand Forks
1922	Daniel Freeman	Fargo	1974	Richard L Kiesling	Fargo
1923	Norma Preifer	Grand Forks	1975	Arthur W DaFoe	Valley City
1924	O A Stevens	Fargo	1976	Donald R Scoby	Fargo
1925	David R Jenkins	Grand Forks	1977	Om P Madhok	Minot
1926	E S Reynolds	Fargo	1978	James A Stewart	Grand Forks
1927	Karl H Fussler	Grand Forks	1979	Jerome M Knoblich	Aberdeen, SD
1928	H L Walster	Fargo	1980	Duane O Erickson	Fargo
1929	G A Talbert	Grand Forks	1981	Robert G Todd	Dickinson
1930	R M Dolve	Fargo	1982	Eric N Clausen	Bismark
1931	H E Simpson	Grand Forks	1983	Virgil I Stenberg	Grand Forks
1932	A D Wheedon	Fargo	1984	Gary Clambey	Fargo
1933	G C Wheeler	Grand Forks	1985	Michael Thompson	Minot
1934	C I Nelson	Fargo	1986	Elliot Shubert	Grand Forks
1935	E A Baird	Grand Forks	1987	William Barker	Fargo
1936	LR Waldron	Fargo	1988	Bonnie Heidel	Bismark
1937	J L Hundley	Grand Forks	1989	Forrest Nielsen	Grand Forks
1938	P J Olson	Fargo	1990	David Davis	Fargo
1939	ED Coon	Grand Forks	1991	Clark Markell	Minot
1940	J R Dice	Fargo	1992	John Brauner	Grand Forks
1941	F C Foley	Grand Forks	1993	John Brauner	Jamestown
1942	F W Christensen	Fargo	1994	Glen Statler	Fargo
1943	Neal Weber	Grand Forks	1995	Carolyn Godfread	Bismark
1944	E A Helgeson	Fargo	1996	Eileen Starr	Valley City
1945	W H Moran	Grand Forks	1997	Curtiss Hunt	Grand Forks
1946	J A Longwell	Fargo	1998	Allen Kihm	Minot
1947	A M Cooley	Grand Forks	1999	Joseph Hartman	Grand Forks
1948	R H Harris	Fargo	2000	Mark Sheridan	Moorhead, MN
1949	R B Winner	Grand Forks	2001	Ron Jyring	Bismark
1950	R E Dunbar	Fargo	2002	Jody Rada	Grand Forks
1951	A K Saiki	Grand Forks	2003	Richard Barkosky	Minot
1952	Glenn Smith	Fargo	2004	Anna Grazul-Bilska	Fargo
1953	Wilson Laird	Grand Forks	2005	Holly Brown-Borg	Grand Forks
1954	C O Clagett	Fargo	2006	Andre Delorme	Valley City
1955	G A Abbott	Grand Forks	2007	Chris Keller	Minot
1956	H B Hart	Jamestown	2008	Van Doze	Grand Forks
1957	W E Comatzer	Grand Forks	2009	Birgit M Prüß,	Fargo
1958	W C Whitman	Fargo	2010	Paul W. Lepp	Minot
1959	Arthur W Koth	Minot	2011	Lyle Best	Belcourt
1960	H J Klosterman	Fargo	2012	Michael A. Bingle-Davis	Bismarck

## MINUTES OF THE NORTH DAKOTA ACADEMY OF SCIENCE

### ANNUAL BUSINESS MEETING 2012

President Best convened the annual business meeting at Turtle Mountain Community College in Belcourt, North Dakota on April 18, 2011 at 4:0 PM. President Best welcomed all and thanked them for their attendance.

Approval of the minutes from the 2010 annual meeting were unanimously approved.

There was no old business to complete.

Christopher Keller of Minot State University nominated Jerzy Bilski of Valley City State University for the position of President-Elect. Christopher Beachy seconded the motion. Jerzy Bilski accepted the nomination. The motion passed unanimously.

Secretary-Treasurer Paul Lepp reported that the Academy maintained a checking account balance of \$14,376.92, a scholarship Savings account of \$11,407.55, a research foundation savings account of \$4543.88 and investments totaling \$67,505.15. There was some discussion as to the nature and intended use of these funds, particularly the invested funds. Secretary-Treasurer Lepp was assigned the task of discovering what, if any, restrictions were placed on the funds.

Meeting statistics:      45   Registered attendees  
   15 Professionals  
   14 Graduate Students  
   16 Undergraduate Students

We had 3 professional talks, 10 Denison graduate student talks and 12 Denison undergraduate student talks. The Denison Awards were presented by President Best. The award winners were:

Denison Undergraduate Award			Denison Graduate Award		
2 <sup>nd</sup> runner-up	Adam Bommersbach	\$100	2 <sup>nd</sup> runner-up	Brian Nelson	\$100
1 <sup>st</sup> runner-up	Joseph Bruenjes	\$150	1 <sup>st</sup> runner-up	Brianna Goldenstein	\$150
Winner	Braden Buckhard	\$200	Winner	Jiao Chen	\$200

Lyle Best (Turtle Lake Community College) officially ended his duties as President.

The business meeting was adjourned at 4:28 PM

Respectfully submitted,



Paul Lepp, Secretary-Treasurer

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