INTERCHANGE

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From the Regional Math & Science Center at Grand Valley State University

Our Vision: *Math and Science: Excitement in Learning for Success in Living*

Our Mission: *Provide and coordinate leadership, programs and services to achieve excellence for all in the teaching, learning and application of mathematics and science.*

In this Issue...

RMSC Welcomes Kelly Heid

Kelly Heid has joined the Regional Math and Science Center as a science consultant and program coordinator. She brings thirteen years of middle and high school earth science teaching to the Center and has experience with students of different backgrounds and abilities. Working with honor students to those with various special needs both in urban and suburban settings is part of her background. She has experience directing student research projects, acting as coach for a Science Olympiad team, and leading a World Challenge Expedition team.

Kelly has a Baccalaureate Degree from the University of Missouri–Kansas City and a Masters Degree from Cambridge College in Massachusetts. In addition to her position at the RMSC, Kelly continues to teach as adjunct faculty in the Grand Valley Geology Department.

Kelly replaces Linda Decker who retired in June. She will assume responsibilities for several of the RMSC major projects. Kelly will manage the electronic network for science teachers, *Building a Presence for Science*. She will provide a monthly electronic update for key leaders and points of contacts in over 80% of the school buildings in our region. She will also be our liaison for National Energy Education Development (NEED) projects and will be part of the organizing teams for the GVSU Science Olympiad Regional Tournament and the Michigan Environmental Education Curriculum Support Project. Kelly will also coordinate the Summer Science Adventure Camps.

The staff at the Center will miss Linda's creativity, hard work, and good cheer and wish her a happy retirement. We welcome Kelly and look forward to a productive and happy working relationship. Kelly can be reached at (616) 331-3031 or heidke@gvsu.edu.

Kelly Heid teaching geology students at GVSU.

Learn the Language of Mathematics

Do your students act like mathematics is a foreign language? If so, then this course is for you! In this course, you will engage in the study of mathematics as language including the technical aspects of vocabulary and symbols, and strategies for learning vocabulary and reading technical language. Consideration of issues related to the communication of mathematics, including reading and writing mathematics and solving verbal problems, will be included.

Reading the Language of Mathematics (MTH 380 / 699) will be taught by Dr. Charlene Beckmann, professor of mathematics at GVSU. Offered for two credits, this course may assist teachers in meeting No Child Left Behind Highly Qualified Teachers requirements and is appropriate for all secondary teachers, middle through high school. Upper elementary (grade 5) will also benefit. Students enrolling for graduate credit will complete a year-long plan for using communication strategies, including reading, writing, vocabulary, assessment, and questioning in one of the mathematics classes they teach.

This course is being offered Winter Semester 2006 on Monday evenings from 6:00 – 7:50 pm on the Allendale Campus of GVSU. The course may be taken for undergraduate (MTH 380) or graduate (MTH 699) credit. Current GVSU students can register for graduate credit online at www.gvsu.edu/registrar or by phone at (616) 331-3327. Non-GVSU students must complete an application and be admitted. The Graduate Non-degree Application form is available online at www.gvsu.edu/forms/registrar/forms/.

Questions concerning the course may be directed to Dr. Charlene Beckmann at beckmannc21@aol.com.

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These materials were developed under a grant awarded by the Michigan State Board of Education.

Calling Science Olympiad Coaches!

Science Olympiad is a national nonprofit organization dedicated to the goals of improving the quality of science education, creating renewed interest in learning science, and providing recognition for exemplary achievement in science education by students and teachers. These goals are pursued through classroom activities, research, professional development workshops, and tournaments at levels ranging from district to international.

If you are a Science Olympiad Coach in Region 12, the Regional Math and Science Center at GVSU is pleased to invite you to join us for the annual *Michigan Science Olympiad Region 12 Coaches Meeting* to be held on Wednesday, December 7, 2005 from 4:15- 6:00 p.m., 204 Pere Marquette Room in the Kirkhof Center on GVSU's Allendale campus. Cost is $7.00 per person.

We will discuss the new 2006 Science Olympiad events, any major changes to old events, and preview the first draft of the 2006 Region 12 competition schedule. This meeting will include information gathered at the *National Science Olympiad Coaches Meeting* in Hammond, Indiana on October 7 and 8 and the *State MSO Coaches Workshop* at Michigan State University on December 3. We strive to provide the most accurate and up-to-date information for all the Region 12 schools in our area.

GVSU has been the site of a Science Olympiad regional tournament for the past 22 years. The 2005 regional tournament at GVSU drew 53 middle school and 25 high school teams from Ottawa and Kent County. Top scorers from the Region 12 tournament typically do very well at the state and national levels. Each year, more schools and more students join in the excitement of learning through competition.

This year's event will be held on Saturday, March 25 at the Fieldhouse/ Arena on the Allendale campus of GVSU. If your school is involved or interested in sponsoring a team, you are invited to volunteer your time and come to watch the fun! For further information, you may contact Sandi Bacon at 896-3172 or bacons@gvsu.edu, or Margo Dill at 895-2272 or dillm@gvsu.edu.

SPARKLE Models Energy Efficiency

SPARKLE (Spinning Physical and Renewable Kinetic Living Energy) is using human motion on a bicycle to enhance health and fitness while at the same time producing usable electric energy. A healthy citizenry and innovative renewable energy are critical to the present and future of the United Sates. With America's well documented health crisis and concerns about energy, any efforts that promote health and fitness while at the same time producing renewable energy are advantageous.

SPARKLE is an education program developed by Grand Valley State University's Department of Movement Science and The Michigan Alternative and Renewable Energy Center (MAREC). MAREC is a multidisciplinary research and education center dedicated to alternative and renewable energy technology and innovation. Students from west Michigan and beyond are invited to tour MAREC. During the tour students will be introduced to energy efficient design, as well as alternative sources for energy. These include pressed wheat board walls, waterless toilets, and bamboo wood and recycled tire flooring. Students will also experience fuel cell, micro turbine, and photovoltaic solar energy generation systems. The culmination of the student's tour is watching a wide-screen, DVD recording about health/fitness and renewable energy. While watching the production, students will be in the audience spinning electricity on bicycle generators that have been engineered by MAREC. In addition to producing electricity that will be used to power the DVD production, the bicycle generators create light and recharge useable batteries.

Tours are available on Tuesdays or Thursdays between 8:30 a.m. and 1:30 p.m. Each tour is approximately fifty minutes. There is no cost. To arrange for a tour or to inquire about how you can purchase a SPARKLE health/fitness, renewable energy generator, please contact us at: (616) 331-6913 or sparkle@gvsu.edu. For additional information visit our website at www.gvsu.edu/marec/.

"Dig" this Summer Science Camp

"Can You Dig It?" was the question last summer at Sherwood Park School as students in grades 4-8 explored the science of archaeology. The one-week science camp, sponsored by the Van Andel Education Institute in collaboration with Sherwood Park School administration and faculty, provided the students the opportunity to participate in a simulated archaeological dig and learn about the processes and tools of archaeology. In preparation, the students visited the *Petra: Lost City of Stone Exhibit* at Calvin College and spoke with Dr. Neil Bierling, one of the archaeologists of the Petra excavation site in Jordan. By week's end, the students had prepared a digital documentary of the week's work and discoveries. A more detailed description of the summer camp will be presented at the Fall Update Science Seminar at GVSU.

Students enjoy "the digs" at the 2005 Archaeology Summer Science Camp

SCIENCE AND MATH UPDATE

The Einstein Paradox

Sheldon J. Kopperl, Department of Biomedical Sciences

As the world of physics celebrates the centennial of Albert Einstein's special theory of relativity and as humanity marks the 60th anniversary of the atom bomb, it is ironic that Einstein, who sat out World War I as a conscientious objector, played a significant initial role in America's development of the atomic bomb itself. Another irony in this situation is the fact that Einstein's famous 1905 equation, $E = mc^2$, was only found relevant to a physical situation in explaining the large amount of energy predicted to be produced in a fission chain reaction.

Einstein, a secular Jew, renounced his pacifist stance once he foresaw what Hitler's government would do to European Jewry (and civilization in general) if it were not stopped by armed force. When in 1938-9 he became aware of the discovery of uranium fission by Otto Hahn and his coworkers in Berlin, he was implored by three fellow refugee physicists, Leo Szilard, Edward Teller (later to become the pioneer of the American hydrogen bomb effort) and Eugene Wigner, to write a personal letter to President Franklin D. Roosevelt, emphasizing the necessity for the United States to begin urgent research to catch up with the expected German lead on developing a fission weapon. Einstein, his colleagues felt, was the only scientist with the prestige to attract the attention of FDR.

As a result of the letter (as well as other indications of the seriousness of the situation), the government appropriated $1500 for the purchase of uranium from Belgium (which had access to rich deposits in the then Belgian Congo). Einstein was again helpful since he had personally met Belgian Queen Elizabeth previously. Following this initial intervention, he had no further role in or knowledge of the development of the Manhattan Project, the massive American effort to build and test the atomic bomb.

“Einstein, his colleagues felt, was the only scientist with the prestige to attract the attention of FDR”

With Germany out of the war by the time the first bomb was tested on July 16, 1945, Einstein was opposed to its use on Japanese military or civilian targets. He became quite active in post-war anti-nuclear weapons efforts. In 1952 he was offered (and declined) the presidency of Israel upon the death of its founding president Chaim Weizmann (himself a leading scientist).

In the year of his death, 1955, he joined with ten other scientists including Bertrand Russell and future Nobel Peace Prize laureates Linus Pauling and Joseph Rotblat to lend his name to a manifesto in London declaring that researchers must take full moral responsibility for their discoveries. Ironically by the time the manifesto was formally issued on July 9, 1955, Einstein had died. This group became the Pugwash Conferences on Science and World Affairs, which was to win the Nobel Peace Prize in 1995.

In 1980 the first Einstein Peace Prize (of $50,000) was awarded to Alva Myrdal, who received the Nobel Peace Prize two years later. Thus we see that Einstein, a man devoted to the promotion of peace, when convinced that there is a greater evil than war, used his enormous reputation to save Western civilization from one foe and unwittingly saw humanity unleash the capacity to self-destruct upon the world.

The Sky is Falling!

By Geoff Lenters, Department of Physics

In 2004, astronomers detected yet another asteroid creatively named, 2004 MN4, (or 99942 Apophis) which will have a close encounter with Earth. The date is set for 13 April 2029 and the minimum approach distance will be around a mere 18,000 miles. Does this sound like a close approach to you? Maybe not, but in astronomical terms this is within a gnat's eyelash. For comparison the moon's orbital radius is at 384,000 miles and a geosynchronous satellite, a satellite that remains in orbit above the same place on earth's surface, (weather, communications) resides at a comfortable 22,000 miles.

This asteroid measures 320 meters in diameter, about 1/30 the size of the rock purported to have extinguished the dinosaurs 65 million years ago. The asteroid will pass through the night skies of

Africa, Europe, and Asia, shining as bright as a 3rd magnitude star — as bright as the stars that make Orion's head. The Near Earth Object Program (neo.jpl.nasa.gov/orbits/) continually monitors and searches for such objects; objects whose orbit around the sun carries them into the path of Earth's orbit (NEOs). One of the many problems associated with NEOs is that a close encounter with one of the planets in our solar system significantly changes their orbit. Continual monitoring is crucial to our determination of the orbital characteristics of NEOs (in fact, the date of potential impact for 99942 Apophis has changed to 13 April 2036, since this was written).

The Near Earth Object Program currently maintains a list of Potentially Hazardous Asteroids (PHAs). These are asteroids that have the potential of a close encounter with Earth such as Asteroid 2004 MN4. The list is continually changing as the orbital characteristics of the asteroids change. How likely is it that Earth will have a serious collision with an asteroid? Estimates strongly depend upon the population of near earth objects out there; an entity that is not well-known, since some of the near earth objects have orbits that take them well outside our solar system (about 60 times the Earth-Sun distance and twice the Pluto-Sun distance) for a couple hundred years before they show up again near us. It is difficult to pick out dark stadium-sized objects at such a distance. That is why NEO continues their search of the heavens. Perhaps our fate is more strongly tied to the stars than we think; however, it is rather unpredictable.

Algal Blooms and Bacterial Interactions

Bopi Biddanda, Annis Water Resources Institute

Interactions between plants (producers) and animals (consumers, including bacteria) are a central consideration in ecology. In the vast deep-water environments of both freshwater and marine ecosystems, the principal producers of organic matter are tiny phytoplankton (1-100 µm

"How likely is it that Earth will have a serious collision with an asteroid?"

plants in suspension), and the principal consumers are even tinier bacterioplankton (0.5-2 µm planktonic bacteria; 1 mm = 1000 µm). Thus, microscopic organisms (microorganisms) are still running the largest ecosystems on our planet! Once phytoplankton fix carbon into organic matter in the sunlit surface waters, consumers within the food web dominated by bacteria, process carbon and associated elements until it either becomes stored in the sediments or is released to the atmosphere. In temperate latitudes, the annual occurrence of massive spring blooms of phytoplankton (abundant phytoplankton often coloring the water green over large areas that are observable from satellites) are a phenomena of major importance to fisheries as well as for the seasonal drawdown of atmospheric carbon dioxide.

Working together with several colleagues, I examined various scenarios of how phytoplankton and bacteria interact in natural waters. In the pelagic environment, bacteria primarily depend on phytoplankton for organic matter, and microbial mineralization of organic matter supplies limiting nutrients to phytoplankton for growth. Consequently, both bacterial abundance and activity are usually linked closely to phytoplankton abundance and production, as seen during spring blooms of phytoplankton in most coastal and open water ecosystems. Exceptions to this rule occur when the exudates (dissolved products released from the cell) of phytoplankton inhibit bacterial growth (presumably by releasing bactericides – substances inhibitory to bacteria), as observed in high-energy surf-zone environments where diatoms (silica-clad phytoplankton) bloom periodically causing sharp decreases in bacterial growth rates. On the other hand, bacteria may produce algicides (anti-phytoplankton exudates) or compete with phytoplankton for limiting nutrients, potentially affecting phytoplankton growth, succession (the dominance of one species over another in time), and even the emergence/regulation of harmful algal blooms. One thing is certain: the critically important relationship between phytoplankton and bacteria in nature, is much more complex than presumed hitherto.

References available on request.

These pages are produced by faculty from GVSU.

Prepare for the Knowledge Revolution

On November 21, from 3 to 5:30 p.m., the Grand Rapids Education Reform Initiative and the Van Andel Institute will host an engaging forum to advance a "get ahead" strategy for math and science education in Grand Rapids. *The Knowledge Revolution: Whose side are we on?*, will feature a distinguished panel of business and education leaders who will discuss the critical situation in U.S. science, technology, engineering and math.

Best-selling author, founder of the Harvard Business School Life Science Project, and CEO of Biotechonomy - Juan Enriquez will lead this interactive discussion. Mr. Enriquez's book, *As the Future Catches You: How Genomics & Other Forces are Changing Your Life, Work, Health & Wealth,* was selected by Amazon as one of the best business books of the year.

"Growth and wealth will be distributed unevenly as long as a few communities pay more attention to their children's science education and disproportionately attract the world's best brains," writes Enriquez. "In a borderless world, those who do not educate and keep their citizens will lose most intellectual wars."

ERI and VAI leaders hope to use the forum as a community wake-up call, drawing attention to these kinds of issues:

- By 2010, if current trends continue, more than 90 percent of all scientists and engineers in the world will be living in Asia. *
- Although U.S. 4th graders score well against international competition, our students fall near the bottom in mathematics and dead last in science by 12th grade. *

VAI and ERI anticipate that this will be the first in a series of local discussions used to create a regional model for building the intellectual capital that will keep greater Grand Rapids on the map of innovation.

*From "Tapping America's Potential: The Education for Innovation Initiative," available at www.businessroundtable.org.

NASA Images Displayed

Two of the largest and sharpest images ever taken by the NASA Hubble Space Telescope are now on permanent display on the second floor of the Padnos Hall of Science, Allendale Campus, Grand Valley State University. The mural-sized images include a 4-foot-by-6-foot image of the well-known spiral Whirlpool Galaxy M51 image that reveals striking details of how clusters of stars are born in the galaxy's long, curving spiral arms. The new 3-foot-by-6-foot photograph of the eerie looking tower of gas in the Eagle Nebula M16 shows a gaseous landscape sculpted by ultraviolet light from a group of massive, hot, young stars.

NASA released the images to a select group of institutions in celebration of the Hubble's 15th anniversary. *"We are honored to have been selected to receive these prints"* said Karen Meyers, Assistant Director of the Regional Math & Science Center at GVSU. *"They are a mesmerizing combination of science, technology, and art that reveal the beauty and vastness of space. We welcome their addition to the GVSU science-related art collection showcased in the Padnos Hall of Science. It is our hope that they will inspire the next generation of astronomers."*

The Earth-orbiting observatory was deployed in space on April 25, 1990. Hubble orbits above the Earth's murky atmosphere, which distorts light from celestial objects. During its 15 years of viewing the universe, the Hubble telescope has taken more than 700,000 images of celestial objects such as galaxies, dying stars, and giant gas clouds, the birthplace of stars. The telescope gave the world a front-row seat to watch the chunks of a comet slam into the giant planet Jupiter. Hubble also photographed galaxies that existed billions of years ago, when the universe was a youngster. More information about the Hubble Space telescope is available at hubblesite.org/.

A happy and successful STEPS camper with her radio-controlled glider airplane. 2005 was the fourth summer of Science, Technology, and Engineering Preview Summer Camps (STEPS) at GVSU.

Track Spring's Journey North

Teachers and students in K-12 classrooms are invited to participate this February through May in one of the Journey North project's free online global studies of wildlife migration and seasonal change. One of the nation's premier Internet-based "citizen science" projects, Journey North enables students in 11,000 schools to watch spring sweep across the northern hemisphere by following the migration patterns of monarch butterflies, bald eagles, whooping cranes, and other animals; the budding of plants; changing sunlight in "mystery class" locations; and other natural events. Students share field observations with classmates across North America and analyze live maps and data from other classroom and professional scientists.

Each Journey North study features standards-based lessons and challenges, stunning photos and video clips, weekly migration updates, interactive maps, reading selections, connections with field scientists, and compelling migration "stories." They also provide guidance for helping students conduct local inquiries and fit them into a global context. "This is the best program I have seen in 26 years of teaching for integrating math, science, reading, and even social studies," writes a Journey North classroom teacher. "It motivates students and gives them a chance to develop and use skills in a real-world situation." Journey North also offers professional development workshops to schools and districts across the U.S.

Thanks to a grant from Annenberg/CPB, Journey North participation is free. For more information and inspiration, visit the Journey North web site: www.learner.org/jnorth. You'll find an overview of all Journey North projects here: www.learner.org/jnorth/orientation/Overview.html. Plan now; spring projects begin February 1st!

Visit an Online Math Magazine

Convergence is the Mathematical Association of America's new online magazine about the history of mathematics and its use in teaching. It is both a resource and forum for mathematics teachers of high school classes who want to use the history of mathematics to engage and motivate their students and help them better understand the mathematical ideas. The editor, Victor J. Katz, from the University of the District of Columbia, and Frank Swetz, from Penn State University, Harrisburg, welcome all mathematics teachers to log in to the Convergence website (convergence.mathdl.org) and see what the magazine has to offer. The magazine is currently free to all, although registration is required. We encourage you to log on, to use the material in your classes, to participate in the discussion groups, and to contribute new articles based on your own experiences.

Sharing Math and Science Research

The 2006 Michigan High School Math and Science Symposium is open to any high school researcher in Michigan. Students typically share their research findings as a PowerPoint or poster board presentation. A 10-15 minute presentation is followed by questions from fellow student presenters, faculty, and the public. Student abstracts are published and students are recognized with a certificate and medallion. The Symposium web site may be found at www.moisd.org/Gen_Ed/MSTC/MHSMSS/michigan_high_school_math_scienc.htm

The 2006 Symposium will be held on April 28 at the GVSU Eberhard Center.

Participants in the Michigan High School Math and Science Symposium

CALENDAR OF EVENTS

NOVEMBER

5 Saturday

Project WET (Water Education for Teachers) training for K-12 teachers. 9:00 am - 3:00 pm. at the Pierce Cedar Creek Institute in Hastings. $35 (includes lunch). Contact Jen at (269) 721-4473 or howellj@cedarcreekinstitute.org. If you are interested in becoming a Project WET facilitator, contact Janet Vail at (616) 331-3048 or vailj@gvsu.edu.

8 Tuesday

Exploring Einstein's Universe, part of the World Year of Physics 2005 – Workshop Series. 4:30 – 8:00 p.m. Designed for middle and high school teachers. Presented by GVSU's Brad Ambrose and Keith Oliver in 303 Henry Hall on the Allendale campus. $45 (includes a light dinner and materials). Sessions continue November 29 and December 13. To register or more information contact Karen Meyers at (616) 331-2515 or meyersk@gvsu.edu.

12 Saturday

Five Year Anniversary Celebration for the Wittenbach Agriscience And Environmental Center in Lowell, MI . Nature and agri-science showcase and family fun. Contact Steve Mueller at Smueller@lowellschools.com or call (616) 987-1002.

16 Wednesday

GVSU RMSC's **Fall Science Update Seminar**. 4:00 - 9:00 p.m. on GVSU's Allendale campus. Visit www.gvsu.edu/rmsc or call (616) 331-2267 for additional information.

17 Thursday

AWRI seminar titled ***"Cyanobacterial When does diversity matter? Microbial species and ecosystem function in northern peatlands"*** *from* 3:00 - 4:00 p.m. *by* Dr. Stephen C. Nold of Assistant Professor of Biology at University of Wisconsin – Stout. Lake Michigan Center, 740 W. Shoreline Drive, Muskegon, MI. For more information call (231) 728-3601.

DECEMBER

7 Wednesday

Region 12 MSO Coaches Workshop 4:15 - 6:00 pm. Receive first draft of schedule and 2006 rule clarifications. For more information contact Sandi Bacon (616) 331-3172, bacons@gvsu.edu; Margo Dill (616) 331-2272, dillm@gvsu.edu; or visit www.gvsu.edu/mso-r12.

31 Saturday

Kent County Christmas Bird Count. 7:30 am - 5:00 pm. Meet tentatively at Kent County Conservation League on Conservation Ave near Ada, MI or possibly Wittenbach Agriscience And Environmental Center in Lowell, MI. Pre-register by calling WWC at (616) 987-1002. $5.00 for 17 and older, youth free.

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