



ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 JANUARY 2020

This ESD Newsletter is a monthly enterprise involving ALL members of ESD. ESD Members are encouraged to forward materials, authored papers for publishing on Environmental Engineering topics, and comments on newsletter topics or current events to the Editor. Your participation in submitting materials for the newsletter is greatly appreciated.

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1. ENVIRONMENTAL TECHNOLOGIES

Lab-Evolved E. coli Consume Carbon Dioxide

Researchers have engineered Escherichia coli (E. coli) bacteria to grow by taking in carbon dioxide, according to a paper published in Cell. E. coli are normally heterotrophs—organisms that ingest organic compounds such as glucose for food—but the new study shows that they can be turned into autotrophs that consume carbon dioxide from the atmosphere and turn it into biomass. This process of using inorganic carbon to make biomass, called carbon fixation, could be used to solve “some of the biggest challenges of humanity today.” For



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example, increasing carbon fixation in plants generates more biomass, which could increase the world's food supply.

E. coli doesn't normally have molecular mechanisms in place to use CO₂, so the researchers gave it genes for the ability to fix carbon that was based on the gene sequence of carbon-fixing Pseudomonas bacteria. These changes weren't enough to force the bacteria to switch to being autotrophic, so the team also disabled three genes involved in heterotrophic metabolism and put the bacteria into growth chambers with limited amounts of sugar, which starved them. In this environment, there was an advantage for bacteria that used CO₂ instead of the finite sugar supply, and the researchers wanted to see if the bacteria could evolve only to use CO₂. The E. coli were grown on sodium formate, a carbon molecule that donates the necessary electrons during the process of making energy but doesn't contribute to biomass. The air in the growth chambers was also enriched with carbon dioxide. (Ref. 1) [Back to Newsletter's Page 1](#)

Danish university researchers convert cooking oil into biofuel using rare algae enzyme

Researchers at Aarhus University in Denmark have discovered an unusual enzyme in microalgae that can be used to convert waste oils and fat into drop-in biofuels. Supported by a grant of DKK 3 million (€0.4 million) from the Novo Nordisk Foundation, the research project at Aarhus University's Department of Engineering aims to develop a system that converts organic waste into sustainable biofuels via natural processes. The special light-dependent enzyme, which was first discovered around two years ago, exists in microalgae. It has the particular characteristic that, with light as the only source of energy, it can decarboxylate fatty acids into alkanes, and thereby synthesize biofuel. "The project covers all stages of the process, from the selection of the best mutant of the enzyme to development of the flow system itself, which, via photobiocatalysis, will convert organic waste oils and fats into different biofuels in a continuous flow." The sustainable biofuel produced using this method can be used directly in existing engines, with petrol and diesel vehicles able to switch to run on the carbon-neutral green fuel. Production has to be in a single, continuous flow in which waste stream is added at one end and, via enzymatic photobiocatalysis with the algae enzymes, is converted into fuel at the other end. Numerous processes have to be linked together before the fuel is produced. Currently, the enzyme produces alkanes of different lengths; the goal is to develop variants of the enzyme through protein engineering, to adjust the individual production of alkanes to a kind of portfolio. (Ref. 2) [Back to Newsletter's Page 1](#)



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2. ENVIRONMENTAL REGULATIONS

Wrap-up of Federal and State chemical regulatory developments, November 2019

EPA Regulatory Science Transparency Rule: Transparency is one of the key elements of regulatory science, a term that was established in the 1970s shortly after the formation of the Environmental Protection Agency (EPA). Interestingly, the EPA has finally recognized the existence of the new discipline that covers natural sciences, engineering and other disciplines used in regulatory and other policy-making processes. William Ruckelshaus, the founding Administrator of the EPA, promoted transparency by popularizing the Jeffersonian Principle that implied that if people are enlightened enough to “exercise their control with a wholesome discretion,” then the remedy is to inform them. A proposed rule published by the EPA in the spring of 2018 required public accessibility to the information, including data used in studies to inform the regulatory process. In effect, the EPA implied that the public including the affected community, and communities of scientific and engineering professions, must have access to evaluate its results and conclusions for it to be used in the regulatory process. Note that section 30.9 indicated that the EPA Administrator might exempt specific studies.

At Georgetown University, three professors and 18 graduate students performed a study that evaluated the proposed rule. The study identified three categories of “confidential” data consisting of personal privacy, confidential business information, and sensitive national and homeland security data. The study also identified about 600,000 responses who overwhelmingly opposed the proposed rule. The opposition was based on the notion that neglecting confidential data would eliminate many studies notably epidemiological studies in the regulatory process. Although seldom mentioned, the respondents were concerned that the EPA Administrator might not provide exemptions to studies whose results may be inconsistent with his/her ideological vision. Using the example of epidemiological studies, the study provided a potential solution to the problem referred to as Controlled or Virtual Transparency. Many universities, including Georgetown, have processes that protect personal privacy data, including an Institutional Review Board (IRB). The studies that include personal privacy data should be made available to all universities and other organizations that have a functioning IRB. Such an approach would result in a reevaluation of conclusions of the initial study resulting in virtual transparency.

A. Alan Moghissi, PhD

ASME Fellow

President, Institute for Regulatory Science

Adjunct Professor, Georgetown University. (Ref. 3, 4) [Back to Newsletter's Page 1](#)



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3. ESD CHAIRMAN/DIVISION NEWS

Congressional fellowship 2020-2021: energy and manufacturing

Who: Applicants must be a U.S. citizen and member of ASME at the time of application.

Why: ASME Federal Government Fellows have served in the Executive and Legislative branches of the U.S. Government for the past 46 years applying their engineering expertise to complex issues.

Fellowships are a life-changing experience, resulting in new professional qualifications and providing Fellows with the satisfaction of having served the public good at the highest levels.

How: This program allows ASME Members to move to Washington, DC, to serve a one-year Fellowship in the Executive and/or Legislative Branches of Government, where they provide engineering and technical expertise to policymakers.

More details: <https://lyris.asme.org/t/511188/4615455/82054/0/>

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Dixy Lee Ray award announcement

Why: The Dixy Lee Ray Award, established in 1998 "for outstanding engineering achievement in environmental protection through improvements in technology, science, and policy," recognizes significant achievements and contributions in the broad field of environmental protection. Achievement in the following areas will be recognized: environmental engineering, including environmental technology and related topics; other environmental areas, including environmental health, environmental sciences, environmental management and policy, and related topics. The award was established in honor of Dixy Lee Ray's advocacy to the development of those technologies that serve humanity. She believed that the engineering profession was uniquely qualified to develop and implement environmentally acceptable technologies. The person winning this award will be presented with a \$1000 honorarium, a bronze medal, a certificate, and will also receive a travel grant (not to exceed \$750) to attend the presentation ceremony.

Submit Nominations: Send nominations to the Award Committee Chair, M.C. Edelson, at mcedelson@gmail.com

Deadline: Must be received by February 1, 2020.

More Information: Contact the Award Committee Chair.

List of Past Winners: Available at (<https://www.asme.org/about-asme/honors-awards/achievement-awards/dixy-lee-ray-award>). [Back to Newsletter Page 1](#)

ICEM 2021 ANNOUNCEMENT

ASME, the Nuclear Engineering and the Environmental Systems Divisions, are pleased to announce the return of the International Conference on Radioactive Waste Management and Environmental Remediation (ICEM). The Conference is set for Oct 10-13, 2021, in Stuttgart, Germany. As with past, ICEM's the Conference will feature Plenary and Luncheon speakers, breakout sessions and a large exhibit hall suitable for equipment displays for radioactive



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D/D&D tasks. The breakout sessions will feature panel discussions, invited speakers, articles, and presentations, as well as peer-reviewed papers.

The Tracks for ICEM 2021 include:

Track 1 Robotics and Remote Handling and Viewing Technologies

Track 2: Facility Decommissioning, Decontamination & Demolition (D/D&D) Overall (Plan, Decommissioning, Demolition, R&D)

Track 3: Major facilities experience in handling accidents and D/D&D

Track 4. Spent Fuel, Fissile Material, TRU, and HLW Management:

Track 5. L/ILW Radioactive Waste Management:

Track 6. Environmental Remediation (ER) including Activities at NORM/TENORM Sites

Track 7. Special Topics 1 - Public Involvement/ Crosscutting Issues/Global Partnering/Human Resource Development

Track 8. Special Topics 2 - New Facility Planning/ Environmental Management (EM)/ Health & Safety

Track 9. Student/Young Engineers Program

Track 10. D/D&D Research & Development Activities

If you are interested in being a Track Chair, a Session Chair, or helping to develop the conference, please do not hesitate to contact Arnie Feldman (jjdsenv@att.net) or Bob Stakenboroghs (bob@evisive.com). [Back to Newsletter's Page 1](#)

4. EDITORIAL BOARD SELECTIONS

Packaging Waste Recycling Market Expected to Secure Notable Revenue Share During 2018-2025

Recycling converts waste materials into useful materials and objects. It prevents the waste of potentially constructive materials and decreases the requirement of fresh raw materials leading to reduced energy usage, air pollution from incineration, and water pollution from landfills. Getting rid of packaging waste has become a major concern in today's world. Several countries are employing several rules and regulations to control and recycle huge waste generated from paper, metal, glass, and plastic packaging products. Packaging waste, if not recycled, may pollute the environment and create serious health problems. Amongst all, plastic packaging waste has significantly increased in the preceding decade owing to rising demand for packaged food and consumer goods in developed as well as developing countries of the world. A huge quantity of this waste gets collected in landfills or the ocean thus causing the natural resources to suffer. Furthermore, some authorities burn their packaged waste in giant incinerators adding to the toxic air pollution. Owing to increasing awareness of the environment, the government across the world is coming up with stringent regulations to address this concern aggressively. This is expected to be the key factor driving the packaging waste recycling market. E.g. In January 2018, the European Commission (EC) published a European Strategy for Plastics in a Circular Economy mandating all Member States to reuse and recycle 50% of all plastic packaging waste by 2025 and 55% by 2030. The



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packaging waste recycling market can be segmented on material type, technology, source industry, and geography. Based on material type, the packaging waste recycling market can be segmented into glass, plastic, paper, and metal. Based on technology, the packaging waste recycling market can be segmented into chemical recycling, mechanical recycling, and others. (Ref. 5) [Back to Newsletter's Page 1](#)

The sound of one hand clapping

There is a mounting sense of déjà vu, and no shortage of dismay, that bodies including the United Nations Environmental Programme (UNEP) are making pronouncements about solutions to Asia's plastics packaging 'crisis.' Asiaphile has been pointing out these solutions for more than 20 years. The latest solution proposed by UNEP is that governments in Southeast Asia impose tougher regulations on plastics packaging to curb leakage. The report is the first comprehensive look at government policies on packaging waste and standards in the ten-country ASEAN block (Indonesia, Singapore, Malaysia, Thailand, Brunei, Myanmar, Cambodia, Laos, Vietnam and Philippines) and draws comparison between Southeast Asian national policies and those of developed nations in the EU, in addition to Japan. The UN analysis suggests that in the developed world, packaging waste is managed more sustainably due to the presence of national targets, an overarching lifecycle approach to packaging, and adopting policies that emphasize solutions to address the root cause of the problem. The UN does not address the scandalous export of general mixed waste – household, medical and otherwise contaminated – from Europe, Australia and North America which, to meet these 'national targets,' is dumped in Southeast Asia. However, according to UNEP, Southeast Asia has limited or non-existent packaging-related policies and weak enforcement, which aggravates the plastics pollution problem. (Ref. 6) [Back to Newsletter's Page 1](#)

Confused about GMOs and pesticides? Here is a science-based handbook for combating anti-biotech fallacies

Junk science is everywhere these days. From scare stories about pesticides to allegations that genetic engineering threatens humanity's future, the internet teems with misinformation about food, farming, and biotechnology. A recent and very disappointing example comes from the usually reputable Scientific American. In August, the news outlet ran an opinion piece claiming that vegetables today are less nutritious and more toxic than they were in years past: *Why are nutrients in our food declining? Well, for one, we are killing the soil it grows in. Prodigious use of biocides (herbicides, insecticides, fungicides, as well as synthetic chemical fertilizers and antibiotics) kill or disrupt soil microorganisms that allow plants to absorb nutrients. In addition, increased atmospheric CO2 is accelerating photosynthesis; plants grow faster but contain fewer nutrients, which is expected to lead to worldwide nutrient deficiencies. Vegetables becoming more like sugary snacks. Not good.*

Experts quickly pounced on Scientific American for running an article filled with so many inaccuracies, which was later updated to address some of this criticism. This story was but one example of the mass of misinformation that proliferates online, poisoning discussions about important technologies and threatening to grind innovation in agriculture to a halt. With so much on the line, scientists are pushing back against the misinformation onslaught.



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William Kerr and Peter Phillips at the University of Saskatchewan and Stuart Smyth are aiding that effort with a new book that takes on a variety of common myths surrounding food production and crop biotechnology: *GM Agriculture and Food Security: Fears and Facts*. As academics, the three of them have researched and written about agriculture, biotechnology, food, and innovation for more than 20 years, with over 400 publications between them. The internet has put limitless amounts of information at our fingertips. Sadly, much of it is misinformation—junk science meant to skew our perception of important topics like food safety and biotechnology. The risk this poses cannot be overstated. (Ref. 7). [Back to Newsletter's Page 1](#)

The misbegotten promise of anaerobic digesters

Federal agencies and state governments are spending millions on anaerobic digesters to wring renewable energy from animal poop. However, critics say “cow power” from factory farms is neither clean nor green. At a glance, anaerobic digesters seem like the perfect solution to one of society’s many messes: They take the waste from cows, pigs, and chickens raised en masse for human consumption, and from literal shit generate energy to power our cars, homes, and electronics. What could be more renewable than manure? To that end, last year, the New York State Energy Research and Development Authority (NYSERDA) announced \$16 million in funding for new and existing on-farm anaerobic digesters, an additional windfall for a sector that has already received more than \$26 million from the agency. It is a big investment, but NYSERDA is just one government agency bankrolling the digester industry: A database of renewable energy policies and programs across the country lists 96 financial incentives for anaerobic digesters, including property tax reductions, corporate tax credits, loan programs, grant programs, and performance-based incentives. The thing is, digesters are expensive: expensive to build, expensive to maintain. They can sometimes generate enough energy to power an entire farm, reducing one big bill and offsetting the cost of the digester, but the excess energy is not usually so excessive that selling it back to the grid nets the farm significant profits. Without outside funding, it simply does not make financial sense for most farms to build or operate a digester. The question is, do the environmental benefits justify significant—and ongoing—public investment? Critics say absolutely not. While biogas from digesters may be renewable, it is hardly “clean” or “green” in the way most people understand those concepts. (Ref. 8) [Back to Newsletter's Page 1](#)

Farms of the future

Intensive agriculture may be nourishing most of the Earth’s inhabitants, but it is doing the opposite to earth itself. Its dependence on singular crops, heavy ploughing machinery, fossil-fuel-based fertilizers and pesticides is degrading our soil’s wildlife and nutrient cycles and contributing a quarter of the planet’s unwanted extra heat. Nevertheless, we are not powerless to change the future of food. Nature and technological innovation are tackling these problems head-on – and if the solutions they are offering are incorporated on a large scale and used together, a new agricultural revolution could be on its way. Here are three of the most exciting developments that can help farms not just feed the planet but heal it too. Several UN reports have highlighted agroecology – farming that mimics the interactions and



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cycles of plants, animals and nutrients in the natural world – as a path to sustainable food. The approach uses a wide variety of practices. For example, instead of artificial fertilizers, it improves soil quality by planting nutrient-fixing “cover crops” in-between harvest crops, rotating crops across fields each season and composting organic waste. It supports wildlife, stores carbon, and conserves water through the planting of trees and wildflower banks. It also integrates livestock with crops. This may seem counter-intuitive given their inefficient land use and high emissions. However, having a small number of animals grazing land does not have to accelerate global heating. Grassland captures carbon dioxide. Animals eat the grass and then return that carbon to the soil as excrement. The nutrients in the excrement and the continuous grazing of grass both help new grassroots to grow, increasing the capacity of the land to capture carbon. (Ref. 9) [Back to Newsletter’s Page 1](#)

Bio stimulants market overview, opportunity & growth analysis

Bio stimulants are applied to the soil, plants, seeds, and other substrates for stimulating the natural processes of plants, which are intended to improve the nutrient use efficiency of plants. Bio stimulants enhance the crop quality, crop vigor, and crop yield as well as crop tolerance to the abiotic stress. Bio stimulants contain various formulations of microorganisms, substances, and compounds, which are applied to plants or soils. Bio stimulants nurture the development of plants throughout their life cycle, right from seed germination to crop maturity. Bio stimulants differ from conventional agrochemical solutions such as pesticides and fertilizers, as they work for the vigor of plants, but they are not intended for use against pests or diseases. The global bio stimulants market is anticipated to expand at a substantial pace during the forecast period, owing to the rising demand for eco-friendly agro products across the world. Bio stimulants serve as an effective tool for the development of sustainable agricultural products. Factors such as increasing ecological concerns led by excessive usage of synthetic pesticides, reduction in the availability of arable land, rising demand for higher-value crops, and increasing adoption of eco-friendly agro products are estimated to promote the growth of the global bio stimulants market during the forecast period. The decrease in the availability of arable land has been triggering the usage of bio-based crop protection chemicals to increase crop yield over the last few years. There has been a significant decrease in the availability of arable land due to a surge in population and erosion of soil over the last 50 years. Frequent plowing of fields and a rise in the usage of chemical-based fertilizers have led to soil degradation. Bio stimulants serve as an eco-friendly solution that not only improves the quality and quantity of the crop yield but also enriches the structure and nutritive value of the soil. Thus, the decline in the availability of arable land is anticipated to present significant opportunities to the global bio stimulants market soon. (Ref. 10) [Back to Newsletter’s Page 1](#)

5. ESD NEWSLETTER READER COMMENTS

None received this week.

Expecting the reader's comments and views on the newsletter. [Back to Newsletter’s Page 1](#)



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ABOUT NEWSLETTER

ENVIRONMENTAL ENGINEERING features the application of environmental technologies to engineering systems to attain optimal performance according to established standards. The Newsletter of the Environmental Systems Division (ESD) will attempt to highlight a variety of environmental technology applications aimed at enhancing engineering systems performances in accordance with the latest standards by presenting excerpts of and links to selected articles from a variety of websites.

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