Mark Dry

Mark Dry was born in the Cape Province of South Africa where his father taught English, leaving Mark to always wonder why he was such a bad speller. He did his undergraduate studies at Rhodes University, as his father and his three older brothers had before him. He then received his Ph.D. at Bristol University in the United Kingdom, working under catalysis expert, Prof. Frank Stone, graduating in 1956. After graduation he became a postdoctoral researcher with Professor Ralph A. Beebe at Amherst College, working on the nickel-catalyzed oxidation of cobalt. Following his stay in the U.S., he joined Sasol in Sasolburg, South Africa in 1958. His brother, Len, was already at Sasol and assigned Mark to develop a catalysis research program for the new, small company.

His initial work at Sasol involved the high temperature Fischer-Tropsch reaction. His team also used the fixed bed, low temperature process as its catalyst did not present as many problems as did the high temperature process. Dry soon learned that there were two major issues with the catalyst: it would form carbon whiskers which caused the catalyst particles to disintegrate so small that they would not remain in the reactor and; the wax that was formed could cause the catalyst to

Record Breaking Catalysis Conference Organized by CAER Researchers

The record-breaking 23rd Meeting of the North American Catalysis Society got off on a fast track at an opening reception at Churchill Downs earlier this summer. A large portion of the successful conference was organized by University of Kentucky Center for Applied Energy catalysis researchers.

This biennial meeting, with its large international participation, is the premier scientific event in the field of catalysis. The Tri-State Technical Conference

33rd Biennial Technical Conference
November 3-6, 2013, San Francisco, CA
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Catalysis Conference...continued

Catalysis Society hosted the 23rd North American Meeting (NAM) in Louisville with the event surpassing all previous NAMs with 1,300 attendees, 54 exhibitors, 400 oral presentations, 600 posters, $278K in general sponsorship from 38 sponsors, and $75K in Kokes awards to enable students to participate in the meeting.

CAER researcher Uschi Graham was the meeting co-chair, along with Umit Ozkan (The Ohio State) and Madan Bhasin (MATRIC). CAER Associate Director Burt Davis was the honorary chair; and CAER researcher Gary Jacobs chaired the Kokes Student Award Committee. In addition, several researchers presented papers and posters.

NAM23 logo in one of the meeting rooms at the Galt House (Uschi Graham introducing session).

Burt Davis receiving the NACS award for “Near Perfect Attendance of all NAM Meetings”.

Great Hall showing the slide show with the history of the Kentucky Derby.

Record attendance ~ 1000 attendees at the opening reception.
particles to adhere together to form large clumps, forming blockages in the reactor system. Ignoring the advice of their U.S. consultant "Stay away from catalysis – it is a dark hole that you will never get out of," Mark forged ahead. Eventually the two problems were reduced to manageable levels. Prof. Dry summarized his Sasol career as, "I was in R&D all the time, in charge of all catalytic processes. We were the only people in the world doing this new process. We couldn’t run to some other company if we had a problem. If there was a problem with a catalyst we were expected to solve it. So that made it interesting."

Mark worked at Sasol for more than 35 years and retired in 1993. Retirement in his case meant moving to Cape Town where he became a professor. He still gives courses in catalysis and carries out his own catalysis research. Mark has been described as having a superior, rather mocking style that keeps his students on their toes. However, he is very personable and respects hard work, especially when it includes scientific rigor.

"We were the only people in the world doing this new process. We couldn’t run to some other company."

Together with Andre Steynberg, he edited and wrote sections of an authoritative volume on the Fischer-Tropsch synthesis. In addition, Prof. Dry has written many excellent reviews of various aspects of the Fischer-Tropsch synthesis. He is, without question, the leading expert on the Fischer-Tropsch synthesis, spanning both academic and industrial worlds. He is still providing training for young students at Cape Town University.

Herman Pines was born in Lodz, Poland in 1902. He excelled during elementary and high school, but feared that he would not be admitted to a college in Poland due to being Jewish. This led him to a more tolerant France where he completed his undergraduate work at the École Supérieure de Chimie in Lyon. Upon graduation he made his way to the U.S. where he worked at various jobs until 1930 when he joined the Universal Oil Products Company. At that time, UOP was recruiting in Europe and several talented scientists and engineers were hired; this included the Russian emigrant Vladimir Ipatieff. Pines became an assistant to Ipatieff and the two made great progress in catalysis. Neither could speak English so they conversed in a mixture of French and Russian.

Pines and Ipatieff made discoveries that enabled the production of high octane aviation fuel, which was supplied to England and helped decide the Battle of Britain in the air. Pines made a significant observation as he performed what was then a standard test for fuels. He would shake the petroleum fraction with concentrated sulfuric acid in a calibrated cylinder to see how much dissolved; this could be related to the fraction of the sample that was alkenes. Pines observed that after a few hours, the fraction of insoluble (alkanes) increased. This led to the alkylation process where the light alkanes and alkenes can be combined to form very high octane fuels.

They also identified a reaction as ‘conjunct polymerization.’ "On a hunch we thought that paraffins might even react with olefins in the presence of acids; we introduced a stream of ethylene and hydrogen chloride to a stirred mixture of the pentanes and aluminum chloride. We observed that the ethylene was absorbed and that the hydrocarbons recovered from the reaction consisted of saturated hydrocarbons only, an indication that ethylene must have reacted with the pentanes.” Pines continued to study this reaction for many years at Northwestern, where he became a professor, and developed a reasonable mechanism to account for the reaction.


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I’ve spent the majority of my career working to promote and administer a National Science Foundation (NSF) program in Kentucky. The program, the Experimental Program to Stimulate Competitive Research (EPSCoR), began as an NSF idea in the late 1970s and expanded in the 80s when it started to receive meaningful budgets. Over time, it was judged to be an effective program and other federal agencies took note and started their own EPSCoR and EPSCoR-like programs.

But what does the program do? My guess is, at best, readers may have heard of EPSCoR but even if they have, they think of it as often as they think about Medicare, which is to say that general awareness probably doesn’t translate into caring about the details unless you are eligible for the benefits. I’ll give you the CliffsNotes® version and promise to keep it brief.

EPSCoR has the distinction of being the NSF’s only state-based program, which means simply by residing in certain states, scientific researchers are eligible to participate. (Technically, it’s the only “jurisdictionally” based program because a few US territories are also eligible, but I’ll use “state” for simplicity.) There is a single number that determines a state’s eligibility—its percentage of NSF’s annual research budget. If this percentage is less than 0.75%, a state is eligible. The NSF recognized in the late 1970s that it had a problem on its hands. A wildly disproportionate amount (even by per capita standards) of its research awards were going to a very few select states (the usual suspects: California, New York, Massachusetts). So while research life was relatively good on the west coast and in New England within concentrated pockets, the scientific research equivalent of the modern day Occupy Wall Street/99% Percent movement was brewing in the rest of the country. People began pointing out that to have such high levels of research funding going to very concentrated geographic regions was probably not the best thing for the country’s overall intellectual health. So, in gist, for the same reason your doctor would encourage balanced exercise over, say, “left arm bicep curls” as a better way to improve your health, EPSCoR was born. Its guiding principle is very simple—build research infrastructure in the states with historically lower levels of research distributions. By doing this, you’re improving research in those states but also strengthening the nation—creating jobs, transforming economies and improving quality of life.

Given the nature of the program, EPSCoR runs into its fair share of stigmas. It’s sometimes mischaracterized as a research welfare program that funds subpar or lesser deserving work. Not the case. EPSCoR proposals go through the same evaluation processes at NSF and must be recommended for funding as a result of their intellectual merit and broader impacts, just like other NSF programs. On occasion, I’ve heard grumblings from people (understandably, almost always from folks in non-eligible states) who have questioned the outcomes and effectiveness of the program. Fair enough. Let’s explore that a little further.

For starters, let’s discuss the aforementioned criterion that determines eligibility, 0.75%. It’s important to note that this is measuring “real growth.” Just measuring nominal dollars might lead one to believe that a state was doing better simply because their dollar numbers increased over time, but that could be reflecting simple inflationary growth of budgets. Measuring as a percentage of total solves that problem for us. So what story does the data tell us? The figure below reflects those EPSCoR state percentages over time as measured by cohort. All of the cohorts dating back to the start of the program reflect “real growth” with the exception of the cohort of states that have joined most recently (after 2000). But that would seem to only substantiate the argument that the program is effective; it just takes sufficient time to work properly, which is understandable given the nature of the task at hand. Transforming state economies, after all, certainly doesn’t happen overnight.
Why EPSCoR Matters...continued

The pace of statewide culture change brings me to my final point, which relates to the misconception that, "no one ever ‘graduates’ from EPSCoR.” Not true. Iowa, Tennessee, and Utah just lost their EPSCoR eligibility this year. Don’t feel badly for them. By definition, that means they are leveraging additional NSF research dollars through direct agency submissions and have built their state's research portfolios to self-sustainable levels.

We like our sports in Kentucky so I’ll conclude with a sports analogy. The NBA's Boston Celtics won the NBA championship eight years in a row in the 1960s. The league has expanded and added new teams over the years (30 exist today), so one might expect that this would result in a diverse group of new faces emerging as league champion. In fact, however, in the last 30 years only eight teams have won the championship. The “good” want to stay “good.” To join them requires creativity and innovative thinking. Sometimes the rules favor the “good” and situations give them a competitive advantage. In six of the last nine years, for example, the NBA champion was from either Florida or Texas—two states with no state income tax, so NBA superstars with multimillion dollar salaries tend to gravitate to those places during free agency because they get to keep more of those millions for themselves instead of paying them in taxes. But there is a silver lining to this analogy. Change can and does happen over time if you plan well and commit to improvement. The Dallas (2011) and Miami (2012-2013) teams have won the championship the last three years—these being two teams that weren’t even formed until the 1980s. So diverse, new faces can and do emerge on top. EPSCoR provides some of the important mechanisms and programs Kentucky needs to help us get there.

Additional information about KY NSF EPSCoR programs focused on energy and environmental research within the Commonwealth can be found at [www.kynsfepscor.org](http://www.kynsfepscor.org).

CAER selected for National Energy Technology Laboratory $3 million project

The National Energy Technology Laboratory, part of the DOE Office of Fossil Energy, has selected the UK Center for Applied Energy Research for a three-year, $3 million project.

The CAER project will advance the DOE’s goal of having technology available by 2020 that can achieve a 90-percent carbon dioxide capture rate, at a cost of $40 per metric ton of carbon dioxide captured.

A major cost associated with commercial carbon dioxide capture is the size of the “scrubber” needed to handle the volume of flue gas produced by a power plant. CAER has developed a catalyst to speed up the absorption rate of the solvent used, so the scrubber can be much smaller. Overall, the CAER technology could reduce the cost of carbon dioxide capture by 56 percent, compared to the current DOE reference case.

DOE's investment is $2,966,957, in addition to cost share of $242,615 from UK and $499,675 from the Carbon Management Research Group, an industry-based research consortium with membership consisting of AEP, Duke, EPRI, LGE-KU and the state's Department of Energy Development and Independence. Kunlei Liu, CAER associate director for research, will serve as the university's principal investigator.
The parents of Milton Orchin migrated from Russia to the U.S. where he was born in Barnesboro, PA on June 4, 1914, the youngest of four children. The family later moved to Youngstown, Ohio where his father became a milkman. He delivered milk, starting at 4:30AM with his children accompanying him. His father joined the International Workers of the World (IWW) which was associated with the communist party. The U.S. government deported many of these immigrants who were part of the IWW. One night police officers broke into his house, took his father and kept him for 2-3 days. When his father returned, he had been severely beaten. Prof. Orchin was five years old at the time. About the same time, his mother died. Although his father tried to care for the children, they were taken to the Jewish Orphan Home in Cleveland, Ohio. Prof. Orchin graduated at age 16 in 1930, just at the beginning of the depression.

The Jewish home helped him to obtain a job in a pawn shop, working 80 hours per week for $10. He was saving his money to attend college and took a night class in chemistry. When he was 18 he received a scholarship to attend The Ohio State University. He graduated with a B.S. and then was refused a teaching assistantship because he was Jewish. However, his undergraduate record was so good that he was offered a scholarship that did not involve teaching, and a lower stipend. He did his Ph.D. under Prof. Melvin Newman, developer of Newman Projections in organic chemistry. This was fortunate since Prof. Newman was a hands-on chemist and he taught his first student, Orchin, exceptionally well in laboratory techniques. After receiving his M.S. in 1937, the Department Chair predicted that he would never get a job as a Ph.D. at the school because he was Jewish, so for better career opportunities, he should leave. But the Chair offered that if Orchin stayed he could keep scholarship. Angered, Orchin did not accept but finding no job during the summer he returned to find there was no longer a scholarship. However, Newman golfed nearly every day so Orchin supported himself for the first semester by being Newman's caddy. A fellowship followed so he was able to complete his Ph.D. in 1939.

In 1943 he joined the U.S. Bureau of Mines lab in Bruceton, PA. At that time it was difficult for a Jewish chemist to obtain an industrial position, so many gravitated to government employment. Starting with a one-person group, he developed a 26-person staff by the time he left ten years later. During his stay at Bruceton, he performed pioneering research in metal carbonyl catalysis and the organic chemistry of coal conversion. McCarthyism was approaching its apex and Orchin was required to testify about one of his employees. Besides his aversion to the McCarthy concept, he was concerned that his father’s past associations would cause problems; thus, he decided to avoid the situation and seek a teaching position. The only position he could obtain was in a graduate department that offered degrees in chemistry and physics at the University of Cincinnati. This was an unusual appointment as he was expected to obtain most of his salary, and those of his students, from industry. Among the companies he consulted for was the Houdry Process Corp. Orchin obtained a patent, assigned to Houdry, that was for the DABCO catalyst used to make urathanes. The use of this plastic foam expanded rapidly; the DABCO catalyst offered many advantages such as being 10 times more active than the industry standard and offering superior operating and product quality. The catalyst revolutionized Houdry’s business and was for many years one of its biggest money makers. The catalyst is still going strong today, having been acquired by Air Products in 1962 and recently celebrating 60 years of success.

Prof. Orchin was the co-author of seven books. He started with books on spectroscopy and then moved to various application of symmetry and molecular bonding books.

Orchin married Ruth Wilner on June 4, 1941, proposing after four dates and after knowing each other for only two months. Unable to have children, they adopted two and were foster parents as well. In this way, Prof. Orchin was honoring his Jewish faith and his days at their orphan home. Prof. Orchin died on February 14, 2013 in Cincinnati, Ohio.
Irving Wender was born in New York City June 19, 1915. His father died before he was two years old and he was placed in the Hebrew National Orphans Home in the Bronx. His mother remarried when he was 11 years old and he left the Home for home. Tragically, later Wender’s stepfather, the owner of a dry cleaning business, was murdered during a robbery there. Irving worked nights at the post office and attended City College, NY during the day. He received his B.S. and M.S. from Columbia University. He continued studies at Columbia but with WW II was reclassified by the Draft Board and sent as a chemical engineer to VPI and then to the University of Chicago for special assignment. The assignment was to work on the Manhattan Project and he spent four years making enriched plutonium and ruthenium, studying their toxic effects, and making the first radioactive iodine. Following the war, Wender received an offer to join the U.S. Bureau of Mines in Pittsburgh. He attended the University of Pittsburgh during the evenings and earned a Ph.D. in 1950.

When Wender joined, the Bureau was becoming a leading research organization and his endeavors helped further this leadership. He conducted basic research on direct coal liquefaction to produce fuels. This was an opportune time for this research as the Bureau was to receive about 80 million dollars for coal research during a decade of intense effort. Metal carbynlys were becoming a hot research area and Wender was at the forefront. He helped define the reaction mechanism for hydroformylation and the structure of the homogeneous catalyst. During his tenure he became a leader in the science of homogeneous and heterogeneous catalysis in the energy area.

Dr. Wender was ahead of his time in terms of renewable energy by recycling organic trash. In the 1970s he recognized a need to improve a means of disposing of household waste and developed a process to convert organic garbage into a liquid fuel. This concept was developed so that a town in western Pennsylvania was selected where the organic fraction of household waste would be separately collected and then subjected to conversion in a pilot plant that had been built for this purpose. The concept was a technical success but, did not prove to be an economic success and was shut down.

He was a leader in establishing a consortium of five universities to conduct research on the conversion of coal to liquids. During the existence of this consortium, Dr. Wender was the leader by personality, if not by title, both in the research activities and in the politics of funding procurement.

As he advanced in his research accomplishments, he was directed to positions of increasing management responsibilities. He rose to become director of the Bureau of Mines’ Pittsburgh lab. As the role of energy became more important and was recognized as a major factor in the nation’s economy, the Bureau was expanded in function and name, eventually becoming the Department of Energy. Dr. Wender was promoted to the position of Director of Advanced Research and Technology at the Bureau of Mines headquarters in Washington, DC.

In recognition of his major research accomplishments, Dr. Wender has received many awards. He was the first to receive the distinguished American Chemical Society Storch Award, named for the director of the Bureau when Wender joined. He received the U.S. Department of Energy Lowry Award for his outstanding scientific and technological achievements in coal, petroleum or natural gas.

Prof. Wender describes himself as “low key” and those who know him would agree with his assessment. However, he is very forceful in spite of being low key as well as being ingenious in applying this force. For example, when his children were small, he would add a note with a new word to learn every day to his children’s lunch.

Burt Davis has been with the Center for Applied Energy Research since its inception and has published over 700 refereed articles. Dr. Davis may be reached at: burtron.davis@uky.edu. His research group’s web site is: www.caer.uky.edu/catalysis/home.shtml.
Institute for Briquetting and Agglomeration (IBA) 33rd Biennial Technical Conference

November 3-6, 2013
The Argonaut Hotel
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For over 50 years, the IBA has sponsored the premier conference on state-of-the-art agglomeration technology. The papers presented will include details of actual operations, as well as theoretical approaches to agglomeration. This year’s conference will be preceded by a half-day hands-on workshop, “Particle Size Enlargement through Agglomeration – Methods and Practices”.

For more information and to register to go: http://agglomeration.org/

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