THE VORTEX

AMERICAN CHEMICAL SOCIETY **CALIFORNIA SECTION**
VOLUME LXXXI NUMBER 10 **DECEMBER 2019**

Photos from some of the Section's out reach programs like National Science Week Co-ordinated by Alex Madonik. See page 10 for a brief summary of the year's events

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Planning Your Legacy by Sandi Tillin

At the November Executive Committee meeting, Mary Bet Dobson, the ACS Assistant Director of Development, gave a short presentation of the various scholarships provided by ACS. These include, but are not limited to, Project SEED and the various scholarships available to Project SEED students, The ACS Scholars Program for under represented minority students in the chemical sciences, the Science Coaches Program to provide funds to science teachers to buy science supplies, and named scholarships (the scholarship is totally endowed by the person giving the money).

You can leave money to these or other programs in specific areas of interest in your will or trust. Also, ACS can be named the beneficiary of your IRAs, retirement plans, life insurance policies and commercial annuities.

You can also make yearly or end of year donations to any of these programs.

If you have a Traditional IRA and are 70 years or older, you need to take your Required Minimum Distribution (RMD). If you don't need the money and therefore don't want to pay the taxes on it, you can donate all or part of it to an ACS program of your choice. You won't have to pay taxes on what you donate, but you also can't take it as a charitable contribution on Schedule A of your 1040. If you have stock that has greatly appreciated, you can give shares of the stock to an ACS program of your choice. This you can take as a charitable contribution on Schedule A of your 1040.

Since I am a great believer in Project SEED (it is amazing how the kids grow over their summer job in a lab), I have given both appreciated stock and part of my RMD to both the national Project SEED and to our local California Section Project SEED.

If you are interested in donating to ACS both during your lifetime and as a legacy, please contact Mary Bet Dobson at m_dobson@acs.org, 202-872-4094.

Vacancy in the California Section Board of Trustees

The California Section has a five member Board of Trustees (Trustees) who manage the financial investments of the Section. The Trustees report to the Section Board of Directors (Directors) who appoint the individual trustees. The Section is looking for a person who must be a member of the Section familiar with evaluating financial items like stocks, bonds, and funds, investing, and managing money for a two year term on the Trustees running from January, 2020, through December, 2021.The person selected and appointed by the Directors would be eligible for reappointment to a subsequent four year term.

If you are interested in applying for the position, please send a short statement of your qualifications to the Section office at office@calacs.org. If you have any questions about the position, please contact Paul Vartanian, Section Treasurer, at pfvartanian@gmail.com.

THE VORTEX

Published monthly except July & August by the California Section, American Chemical Society. Opinions expressed by the editors or contributors to THE VORTEX do not necessarily reflect the official position of the Section. The publisher reserves the right to reject copy submitted. Subscription included in $15 annual dues payment. Nonmember subscription $15.

MAGAZINE OF THE CALIFORNIA SECTION, AMERICAN CHEMICAL SOCIETY

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Chair's Message

Dear members of the California Section of ACS,

I write to you this month as the Chair for the last time this year. December is a month for celebration and reflection. As we wrap up 2019, the California section celebrates the start of what we hope to be a series of events tailored to interests of a variety of our members. We collaborated with the Silicon Valley ACS section to host an ACS presidential dinner where our section members had the opportunity to interact with the 2019 ACS president, Bonnie Chapentier. We also started a series of Chemistry & AI panel discussions, led by Alicia Taylor (Chair-elect for 2020) to leverage the "tech" and "biotech" hubs located in our section. We also co-hosted a very successful Bay Area Chemistry Symposium in close collaboration with local universities, local biotechs, as well as the Silicon Valley section, to celebrate science and provide an opportunity for those interested in entering this sector to network and hear about the application of chemistry in this field. There is a clear need for an event like this and based on the success from this inaugural event, keep your eye out for Bay Area Chemistry Symposium 2020.

As we reflect on 2019, we should also be proud of the continued success in events like Project SEED and Chemistry Olympiad, hosting booths during the chemistry week, Bay Area Science Festivals and Solano Stroll, and visits to elementary/middle schools for science fairs and demonstrations. Our WCC section and YCC section continue to organize exciting events to celebrate the important contribution by women and young scientists to chemistry.

All of these events would not have been possible without all the volunteers and the entire executive committee. Our office manager, Julie Mason, deserves special recognition here since all of the events would not be possible without her help behind the scenes.

It was truly an honor to serve as the California ACS section chair in 2019 and I look forward to the year ahead with Jim Postma at the helm in 2020 and Alicia Taylor as the chair-elect. We will close the year with a Holiday Social at Scott's Seafood in Walnut Creek.

Sincerely,
Patrick S. Lee Ph.D.

A Brief summary of the year's Community out reach events coordinated by Alex Madonik

As NCW coordinator, Alex was asked by ACS national to respond to an online questionnaire about our NCW activities. Here is a summary of his responses. Note: BASF = Bay Area Science Festival, FSN = Family Science Night

Date	volunteers	public	Event Description
08 Sept	10	300	Solano Stroll
25 Sept	12	100	FSN - United for Success Academy (Oakland USD)
26 Oct	20	600	BASF - East Bay Science Discovery Day (Hayward)
27 Oct	12	200	East Bay Mini Maker Faire (Oakland)
02 Nov	8	300	BASF - Discovery Day at Oracle Park (San Francisco)
14 Nov	8	300	FSN - Bancroft Middle School (San Leandro)
Total	72	1800	

The estimate of "public" is pretty arbitrary. The Solano Stroll, the Mini Maker Faire, and the BASF Science Discovery Days are all-day events that attract thousands (or tens of thousands) of visitors, so the question is, how many did we interact with? The true numbers are probably significantly higher than the estimates reported. Our total expenses for these events (including registration fees, materials, etc.) was about $1800.

There were also activities carried out by our Student Affiliate groups and colleagues at CSU Chico, CSU Stanislaus, and UC Merced. Also omitted was the dramatic presentation, "Manya, the Living History of Marie Curie" by Susan Marie Frontczyk on October 19th at Laney College. While this performance delighted an audience of about 90, Ms. Frontczyk also performed at Korematsu Middle School in El Cerrito (on October 18th) for a combined audience of 700 students. The photos shown in this report were submitted for possible publication in C&E News.

On Sunday, September 8th, Cal ACS volunteers were back at the Solano Avenue Stroll in Berkeley, CA, displaying the ACS – Chemistry for Life logo as well as our poster from the San Diego meeting for thousands of visitors. Scientists of all ages tried out the NISEnet Build-a-Battery activity, or made their own UV-detecting bracelets with color-changing beads.

A few weeks later, we took these activities and more to Family Science Night

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It ís Elementary (Part 4)

by

Bill Motzer

In Part 3 (November 2019 Vortex), I discussed the discovery, mostly by British and Scottish physicists and chemists, of Group 18 elements known as the noble gases. By 1902, these discoveries had extended Dmitri Mendeleev's original periodic table. In 1904, for their noble gas discoveries, John William Stratt (Lord Rayleigh) (1842-1919) and Scottish scientist Sir William Ramsay (1852-1916) received the Nobel Prizes in Physics and in Chemistry, respectively, During the late 1800s and early 1900s such discoveries and awards were common to established chemists and physicists, famous in their time, almost all of which were men. However, we should not forget other element discoveries by scientists who had to overcome adversity and prejudice in nineteenth and early twentieth century male-dominated society. Principal among these were women chemists and physicists such as the discoverer of polonium (Po; Z=84) and radium (Ra; Z=88) ñ Maria Salomea Sklodowska Curie (1867-1934). In 1898, Marie Curie, along with her husband French physicist Pierre Curie (1859-1906), investigated the nature of radioactivity in pitchblende, a uranium (U)- and thorium (Th)-containing ore (largely UO2, but because of oxidation typically contains variable proportions of U3O8). Their studies suggested the existence of an element more radioactive than the uranium and thorium in their pitchblende. In his periodic table, Mendeleev had indicated an unknown element following bismuth (Bi; Z=83) and predicted that it would have an atomic mass of ~212. Polonium occurs in uranium ores in only trace quantities, about 0.1 mg per tonne (t). What the Curies had to do was first extract all of the uranium and thorium from ~10 t of ore. In July 1898, they succeeded by extracting Po-209 with a half-life (tΩ) of 125.2 years. Marie Curie named the new element after her native homeland of Poland (Latin: Polonia). (Note: for more information about polonium see January 2007 Vortex: The Perils of Polonium.) Five months later, on December 21, 1898, the Curies extracted and discovered radium, again isolating about 1.0 mg from the 10 t of ore. Based on new spectral lines, they determined that this was a new element. Because of its intense radioactivity it glowed with a faint blue light thus naming the new element radium from the Latin word for radius meaning ray. After Pierre's tragic death in 1906 (he slipped on wet pavement and was run over by a horse-drawn cart resulting in a fractured skull), Marie teamed with Pierre's former student French chemist Andre Debriene (1874-1949) to isolate radium metal by electrolysis of radium chloride ($RaCl_2$). To accomplish this, they used a mercury cathode, producing a radium mercury amalgam, that was then heated in a hydrogen atmosphere, which removed the mercury, leaving behind metallic radium. On July 4, 1934, Marie Curie died from aplastic anemia from her years of radiation exposure. She was the first woman to have won a Nobel Prize and the only person to have won a Nobel twice in two separate scientific fields: physics in 1903 and chemistry in 1911. The Curies have been further honored with the naming of element 96 curium (Cm; Z=96) discovered in 1944 by Glen Seaborg, Ralph James, and Albert Ghioroso of the University of California, Berkeley. A not as well-known woman chemist is the discoverer of francium (Fr; Z=87). Mendeleev had predicted that there would be an element similar to cesium (Cs; Z=55), which he named eka-cesium (eka is the Sanskrit word for one; see The Grammar of the Elements by A. Ghosh and P. Kiparsky, November-December 2019 American Scientist magazine). Beginning in 1870, several research teams alluded to the isolation and discovery of eka-cesium; there were at least four false claims based on possible new X-ray spectral lines. On January 7, 1939, Marguerite Catherine Perey (1909-1975), a French physicist/nuclear chemist and Marie Curie's student, isolated a sample of actinium (Ac; Z=89) at

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the Curie Institute in Paris, by purifying a sample of actinium-containing lanthanum (La; Z=57) that was supposedly free of all known other radioactive impurities. However, its radioactivity suggested the presence of another radioactive element and she determined that this was the missing element-87, which she first named actinium-K. But her discovery could not be confirmed until after WWII and in 1946 she proposed the name catium (Cm) because it had the most electropositive cation of the elements. Still, one of Perey's supervisors, Irene Joliot-Curie (daughter of Marie and Pierre Curie), opposed this name because of the use of the term catium rather than cation. Perey next proposed francium after France and this name was officially adopted by the IUPAC in 1949 becoming the second element to be named after that country gallium (Ga; Z=31) from the Latin Gallia for France being the first. On May 13, 1975, Marguerite Perey died from bone cancer believed to have developed from her exposure to radiation. Francium only occurs in very trace amounts in uranium and thorium minerals in the Earth's crust resulting from the natural radioactive decay of those elements (actinium and neptunium series). At any one time only 20 to 30 g is believed to exist. There are additional women discovers of the elements and in the next article, I will discuss their achievements.

Election Results

We are happy to report the results of our local section election. Here is a list of the positions that were filled effective January 1st, 2020 and listed in the order of votes received.

Chair-elect: Alicia Taylor
Treasurer: Paul Vartanian
Director: Attila Pavlath
Member-at-Large: Dan Calef, Charles Gluchowski
Councilors: Bryan Balazs (see note below), Jenelle Ball, Alex Madonik, and Patrick S. Lee
Alternate Councilors: Son Nguyen, Atefeh Taheri

Note regarding Bryan Balazs: Bryan Balazs was reelected as a Councilor for the California Local Section, but he is withdrawing from this role because he is automatically an Ex Officio Councilor by virtue of his being elected to the ACS Board of Directors for the three year term starting January 1, 2020.

Patrick S. Lee

Editor's notes

As is the custom, there are no scheduled meetings in December. I take this opportunity to wish all the best for the Holidays and the coming year.

I am sure you noticed that we often have articles regarding GMO issues While this is of great interest to me, it is also an easily available and legal filler when contributed content is light. Consider that as an invitation to submit content that is of interest to you.

Lou Rigali, Editor

Why regulation of gene editing will not hurt small and medium size companies

A common myth that's used to argue for de-regulation of gene editing is debunked. Report: Claire Robinson, GM Watch

An article for Euractiv, "MEPs slam gene-editing court ruling as damaging for SMEs [small and medium size enterprises]", is typical of the messages put out by the pro-GMO lobby in support of de-regulating gene editing in agriculture.

The article quotes the chair of the European Parliament's agriculture (AGRI) committee Norbert Lins MEP, as saying that it is relatively easy for larger companies to comply with the EU's GMO regulations, but the smaller ones are badly affected by the ruling of the European Court of Justice that gene-edited crops and foods fall under the EU's GMO regulation and thus must be safety checked and labelled.

The message, as stated by another MEP in the Euractiv article, is that de-regulation of gene editing will enable market access for SMEs that want to develop gene-edited crops and foods to save us all from climate change. Variations on this message elsewhere claim that opening the market to SMEs will democratise GM and help end the monopolistic domination of much-despised big Ag companies like Monsanto/Bayer.

Gene editing won't save us from climate change

The climate change argument is not supported by evidence, as there are no gene-edited crops that could help humanity face this challenge. Nor are there likely to be, as such traits are complex, controlled by multiple genes. These are not amenable to manipulation via the crude tools of gene editing. It is a scandal that journalists have become advocates for the GMO lobby and repeat their hyped promises of climate-ready gene-edited crops on the basis of no evidence at all.

DowDupont has a patent cartel on CRISPR

As for the SMEs argument, Testbiotech has strongly challenged it in an analysis that found that the agribiz giant DowDupont controls large parts of the seed market through a patent cartel on the most popular gene-editing technology, CRISPR. Testbiotech says, "The US corporation (with its agribiotech sector renamed Corteva) has allegedly signed contracts with all the important owners of basic patents on CRISPR/Cas technology. Data presented in a meeting with the EU Commission at end of 2018 show that DowDuPont has successfully managed to combine 48 patents on the most basic tools in one patent pool. According to DowDupont, access to such a high number of patents is necessary in order to apply the technology in plant breeding to its full extent."

As well as the patents, there are also the licensing agreements that grant formal permission to use gene-editing technologies. Testbiotech says, "DowDuPont is now in the unprecedented position in plant breeding of being able to allow other companies access to the patent pool and demand licence contracts: what on the one hand is promoted as the 'democratisation' of patent law, is on closer scrutiny emerging as nothing less than a way of controlling competitors and securing a dominant market position. DowDuPont is fast becoming the gatekeeper of an international patent cartel."

On their own, SMEs will never be able to afford the patents and commercial licensing agreements that govern gene editing.

Large corporations hold most gene-editing patents

Jan Plagge, president of EU organic farmers (IFOAM EU), told Euractiv that large corporations hold the majority of patents for gene-editing techniques. This, he said, makes it "hard for small and medium enterprises to use this technology" and therefore the argument that "regulation is preventing SMEs from strengthening their innovation and product development is not

really valid".

What, then, do we make of the GMO industry lobby group EuropaBio's claim in the Euractiv article that SMEs hold the "biggest share of genome-edited organisms ready to offer to the market"? If it's so hard for SMEs to use the technology, how is it that they have already accumulated a stockpile of products?

Three levels of licence

The molecular geneticist Dr Michael Antoniou has many years' of experience of developing biotech products (in the area of medical research), with both SMEs and larger companies, and patenting them. He says that both Plagge and EuropaBio's statements are correct thus far. But he takes issue with EuropaBio's subsequent claim in the Euractiv article that the Court of Justice ruling is an "insurmountable hurdle" for smaller companies and public researchers active in agricultural biotechnology.

Dr Antoniou explains that there can be three different types of licence for technologies like CRISPR, which industry-based researchers (including those in SMEs) have to take out at different stages of product development. These are evaluation, research, and commercial licences. Evaluation licenses are granted to researchers by the owners of the technology – typically large companies – to allow the researchers to do preliminary work to see if the technology could be useful to them. If the researchers find that the technology is of interest and want to pursue a particular application, the technology owner can grant them research licenses.

According to Dr Antoniou, evaluation and research licences are often granted quite cheaply, since the (mostly) large companies that own the technology want it to be used in the development of a product that can in due course be commercialised. A typical SME could afford evaluation and research licence fees. So it's perfectly possible that SMEs are indeed sitting on a large share of gene-edited organisms "ready to offer to the market".

But it's at the commercialisation stage that things can quickly get very expensive, with large companies demanding high payments, in the form of commercial licence fees and royalty payments on product sales, for the use of their technology. In addition, patenting fees can easily accumulate to six-figure sums, since patents must be applied for – and patent lawyers engaged – in each territory where intellectual property rights are sought. The patenting process can drag on for years, with lawyers' fees rising all the while.

Regulatory costs relatively low

Compared with these product development costs, regulatory costs to get a GM plant trait approved for marketing are relatively low. For first-generation GM crop traits, regulatory costs have been calculated by the industry consultancy firm Phillips McDougall as around 25% of the total research and development costs for the trait.

Thus regulatory costs are not the limiting factor when it comes to SMEs breaking into the GMO market. Rather, the business model (some might say "greed") of the large companies that own and control the technology could be said to be the factor that sets the bar higher than an SME can reach by itself.

Thus the system in the biotech market is, and will remain, that researchers based in small companies or universities, often with industry funding, "invent" a GMO and partner with investors and/or a large company to patent the product and bring it to market. That process includes the investors or large partner company paying the costs of obtaining regulatory approval. The inventors and their institutions enjoy a profit-sharing arrangement with the investors or large partner company. Often in this process, the SME is bought up by larger companies.

Business model not a cause for lamentation

This business model is not considered a

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cause for lamentation! On the contrary, it is celebrated as a path to success for all involved, including the individuals and the SME responsible for inventing the product. The world of biotech-dependent SMEs is marked by an extremely fast turnover. Many startups emerge but only 10%, at most, will make it. It is a Darwinian process of the survival of the fittest. But no one who has developed a promising product needs to fear that it will be "orphaned" without resources to bring it to market. If an SME has such a product, it will either attract venture capital investment to develop it by itself (in which case, the SME grows into a large company) or the SME will partner with, or be taken over by, a larger company and the product rolled out on a wide scale.

The bigger prospect of being taken over is not something that SMEs fear. On the contrary, SMEs actively desire to be bought out. Selling up means that the "small" business people who run them can find themselves in the fortunate position of being able to take a well-funded early retirement or use the sale money to set up another startup company that develops a new product. Universities are alert to the profits that can be made from such arrangements, which is why they have entire departments whose sole interest it is to transfer "inventions" generated by their academic staff to industry.

Based on the above, it is evident that whether an SME and its GMO product fails or not has nothing to do with the regulatory burden and everything to do with whether it comes up with a product that the market actually wants.

Why do companies want de-regulation?
These insights beg a further question. If de-regulating gene editing won't allow SMEs to gain a larger share of a market dominated by a few large agribiz corporations, what do companies (large and small) stand to gain by such a move? The answer: An unrestricted permit to release potentially dangerous and unproven GMOs into the market without safety testing or labelling – without even having to prove that the product does what it is claimed to do. They will also save the 25% of the R&D costs of getting their products through the regulatory system. In other words, it would make the lives and careers of agbiotech developers and companies easier (in terms of less accountable on efficacy as well as health and environmental safety) – and relatively less expensive.

What would de-regulation mean for the public?
Some may argue that on this basis alone – greater ease and relatively reduced expense for companies – gene editing should be de-regulated. After all, what's to lose? A good example of what the price of de-regulation would be for the public is provided by the gene-edited cattle of Recombinetics, Inc., whose animals were declared by the Minnesota-based company to be "free of off-target effects", but which were found by US FDA researchers to contain off-target effects that the company had failed to find. The off-target effects happened to be that they unexpectedly contained antibiotic resistance genes. If these genes transferred to pathogenic bacteria, they could make them antibiotic resistant, adding to an antibiotic resistance problem that threatens human and animal health.

The gene-edited cattle were repeatedly used by pro-GMO lobbyists – including the CEO of Recombinetics and Alison Van Eenennaam, the scientist who helped develop them – as an example of a product that was so nature-identical and obtained with such a "precise" technology that it required little or no regulation.

The case of the Recombinetics cattle is just the first in what promises to be a long line of gene-editing "surprises". It is a crystal-clear sign that it's time for Europe's politicians to respect the aim of the GMO regulations, which is to protect human health and the environment – not to enable corporations to make a quick and easy profit at our expense.

at United For Success Academy, a public middle school in Oakland, CA.

After a brief lull, we celebrated the official opening of National Chemistry Week with "Manya, a Living History of Marie Curie" at Laney College in Oakland on October 19th.

NCW continued with lots more hands-on chemistry at the Bay Area Science Festival's East Bay Science Discovery Day in Hayward, CA on October 26th, followed by the East Bay Mini Maker Faire on October 27th in Oakland, with the finale on Saturday, November 2nd at BASF's Science Discovery Day at Oracle Park in San Francisco.

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