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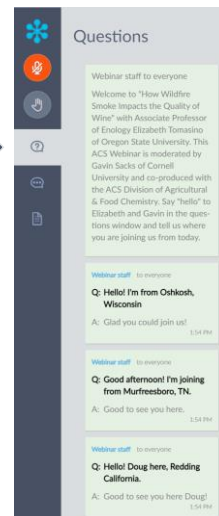
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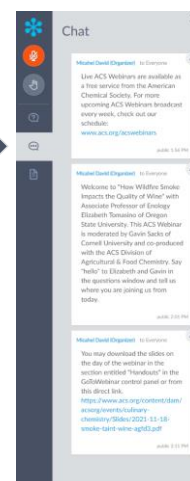


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**Chat**

Announcements and hyperlinks from our team



2

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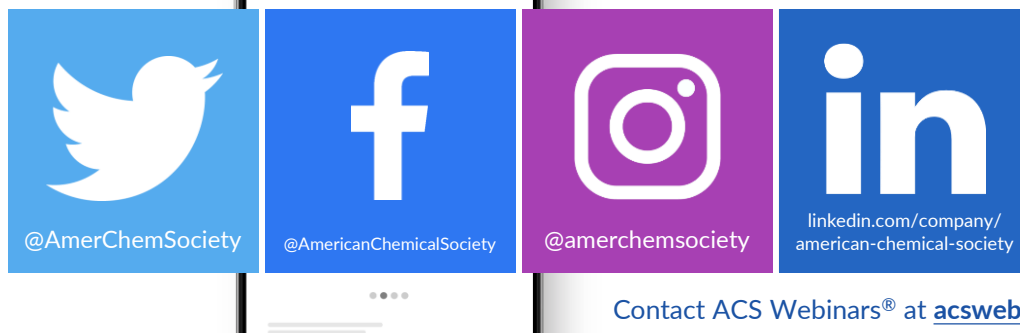


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3



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4

4

## A Career Planning Tool For Chemical Scientists



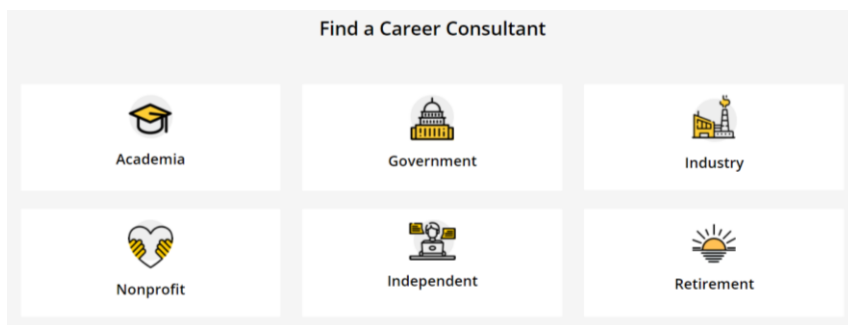
**ChemIDP** is an Individual Development Plan designed specifically for graduate students and postdoctoral scholars in the chemical sciences. Through immersive, self-paced activities, users explore potential careers, determine specific skills needed for success, and develop plans to achieve professional goals. **ChemIDP** tracks user progress and input, providing tips and strategies to complete goals and guide career exploration.

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5

5

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6

6

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7

7

### ACS Scholar Adunoluwa Obisesan

BS, Massachusetts Institute of Technology, June 2021  
(Chemical-biological Engineering, Computer Science & Molecular Biology)

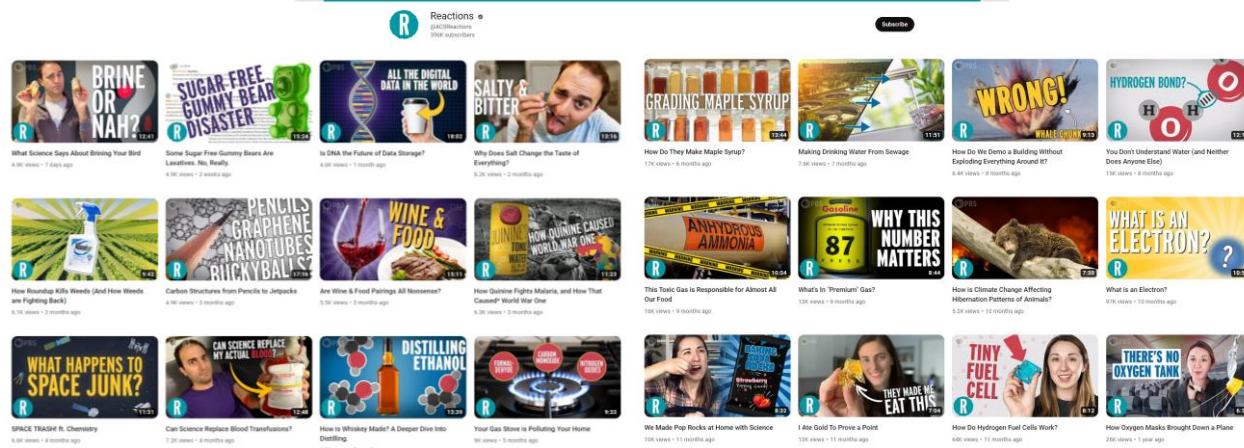
*"The ACS Scholars Program provided me with monetary support as well as a valuable network of peers and mentors who have transformed my life and will help me in my future endeavors. The program enabled me to achieve more than I could have ever dreamed. Thank you so much!"*

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8

8



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9

9



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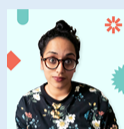
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10

10

## c&en's STEREO CHEMISTRY



**Bonus Episode**  
Carolyn Bertozzi and K. Barry Sharpless chat about sharing the 2022 Nobel Prize in Chemistry  
December 6, 2022



**Bonus Episode**  
Bioorthogonal, click chemistry clinch the Nobel Prize  
October 5, 2022



**Episode #40**  
Lithium mining's water use sparks bitter conflicts and novel chemistry  
September 13, 2022



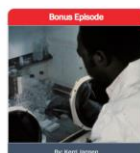
**Bonus Episode**  
Happy 100th birthday, John Goodenough! Stereo Chemistry revisits a fan-favorite interview with the renowned scientist  
July 25, 2022



**Bonus Episode**  
Jess Wade on Wikipedia and work-life balance  
June 21, 2022



**Bonus Episode**  
The sticky science of why we eat so much sugar  
May 31, 2022



**Bonus Episode**  
There's more to James Harris's story  
April 27, 2022



**Bonus Episode**  
The helium shortage that wasn't supposed to be  
March 24, 2022

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11

11

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12

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### Personal Career Consultations

**Jim Tung**  
Business Development Manager  
Lacamas Laboratories

Ph.D., Organic Chemistry, University of Notre Dame

Jim Tung works at Lacamas Laboratories in Portland, OR, currently as a business development manager. He has been with Lacamas for 10 years, working on developing new chemical manufacturing projects. Before that, he was a senior research chemist at Orlite Research in Champaign, IL, performing kilo-scale organic chemistry.

An Oregon native, Jim got his B.S. in biochemistry from the University of Oregon, his Ph.D. in organic chemistry from the University of Notre Dame, with postdoctoral experience at Pfizer's laboratories in La Jolla, CA. He is past chair of the Portland Section of the American Chemical Society and was 2019 general co-chair of NORM 2019. He has interests in process chemistry, labor economics, social media outreach and encouraging career exploration and development for younger chemists.

Ask me about:  
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Contact with Jim

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13

13



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14

14

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### Resources

<b>Inclusivity Style Guide</b> Designed to help staff and members use language and images that respect diversity in all its forms. →	<b>ACS Webinars on Diversity</b> Covering diversity and inclusion at the workplace →
<b>ACS Publications DEIR Hub</b> See what ACS Publications is doing for fostering inclusivity in scholarly publishing →	<b>ACS Volunteer and ACS Meetings Code of Conduct</b> Fostering a positive and welcoming environment for attendees, volunteers and staff. →
<b>C&amp;EN Trailblazers</b> C&EN highlights scientists from different backgrounds who are making an impact in chemistry. →	<b>NEW! Download DEIR Educational Resources</b> Download this educational guide for additional recommendations on videos, articles, books, podcasts, and more on diversity, inclusion, and related topics. →
<b>Quick Guide: Inclusion Moments</b> Learn more about what Inclusion Moments are and see ideas to host them during your meetings. →	<b>Quick Guide: How to host inclusive in-person events</b> Recommendations and best practices to ensure that your events can accommodate everyone. →

### Diversity, Equity, Inclusion, and Respect

\*\*Adapted from definitions from the Ford Foundation Center for Social Justice:

#### Equity\*\*

Seeks to ensure fair treatment, equality of opportunity, and fairness in access to information and resources for all. We believe this is only possible in an environment built on respect and dignity. Equity requires the identification and elimination of barriers that have prevented the full participation of some groups.

#### Diversity\*\*

The representation of varied identities and differences (race, ethnicity, gender, disability, sexual orientation, gender identity, national origin, tribe, caste, socioeconomic status, thinking and communication styles, etc.) collectively and as individuals. ACS seeks to proactively engage, understand, and draw on a variety of perspectives.

#### Inclusion\*\*

Builds a culture of belonging by actively inviting the contribution and participation of all people. Every person's voice adds value, and ACS strives to create balance in the face of power differences. In addition, no one person can or should be called upon to represent an entire community.

#### Respect

Ensures that each person is treated with professionalism, integrity, and ethics underpinning all interpersonal interactions.

<https://www.acs.org/diversity>

15

15



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16

16



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17



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Wednesday, October 4, 2023 | 2-3pm ET

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18

18



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👋 Say hello in the  
questions window!



19

19

## Who Will Win the #ChemNobel? Predicting the Next Nobel Laureate(s) in Chemistry

Share your comments in the chat window or tweet at us using **#ChemNobel**



Laura Howes  
C&EN



Robert Root-Bernstein  
Michigan State University



Michelle Muzzio  
iScience



Joaquín Barroso  
National Autonomous University of Mexico



Michael Booth  
University College London

Some of the slides are not available today (that would give the picks away!)...edited recording will be made available on [cen.org](http://cen.org)



20

20

## The Nobel Prize in Chemistry, the #ChemNobel

- Every year since 1901 (with a few exceptions)
- Nobel stipulated in his will that most of his estate should be converted into a fund and invested to provide income for five prizes, including one prize for... *“the person who shall have made the **most important chemical discovery or improvement...**”*  
– Alfred Nobel’s will



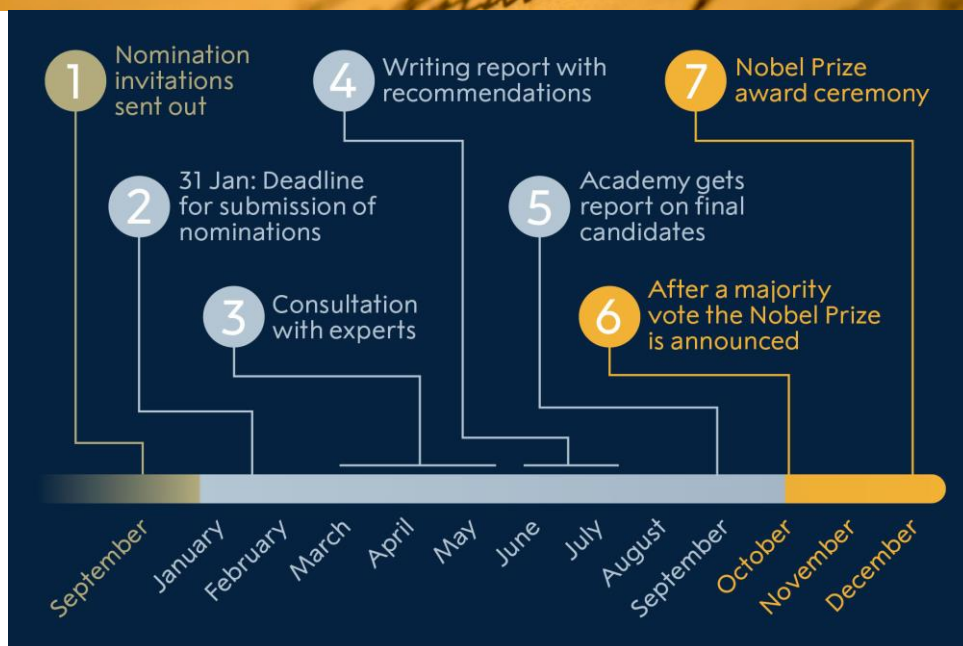
### Nobel Laureates receive:

- Nobel diploma
- Nobel medal
- Prize money

THE NOBEL PRIZE  
ANNOUNCEMENTS  
2-9 OCTOBER 2023

21

## #ChemNobel Timeline



Source: NobelPrize.org

22

22



# Polymathy Among Nobel Laureates

**Robert Root-Bernstein, Ph.D.**

Professor of Physiology  
Michigan State University,  
East Lansing, MI 48824 USA

[rootbern@msu.edu](mailto:rootbern@msu.edu)

24

24

## OUTLINE

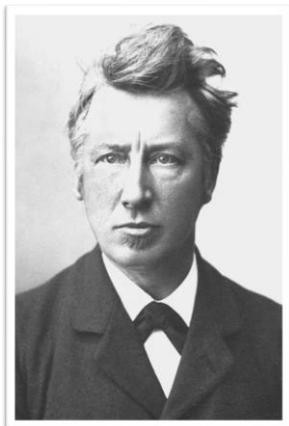
**I will argue that polymathy underlies scientific creativity:**

- 1) Nobel laureates are unusually trained, both in depth and breadth
- 2) One key to their success is integrating their diverse skills and knowledge to produce broadly applicable results
- 3) A second key is frequently changing research topics

25

25

## J. H. van't Hoff, first Nobel Laureate in Chemistry (1901) on “Imagination in Science” 1878



“ *Imagination plays a role both in the ability to do scientific research as well as in the urge to exploit this capability.... I have been prompted to investigate whether or not this [imaginative] ability also manifests itself in famous scientists in ways other than their researches. A study of more than two hundred biographies showed that this was indeed the case, and in large measure.* ”

van't Hoff, J.H. (1878/1967). *Imagination in Science*. G. F. Springer, trans. *Molecular Biology, Biochemistry, and Biophysics*, 1:1-18.

26

26

### van't Hoff was describing himself!

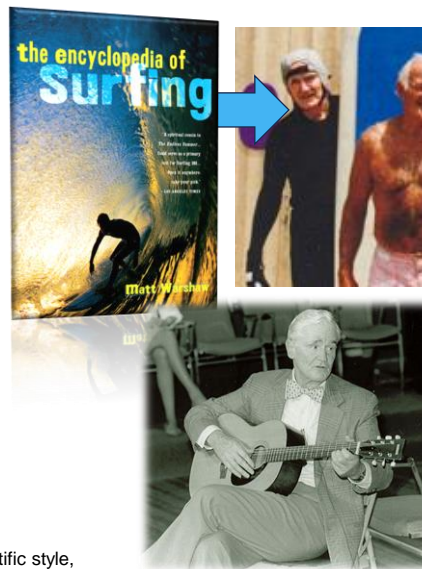


27

27

## Donald Cram, NP Chemistry, 1987

“ My concept of the ideal [scientist], is that you do one thing real well, and its a very specialized thing, and then you do a lot of other things, but not too many, maybe 5 or 6 or 10 different other things, which you do well enough to give yourself and possibly others pleasure. This should be distributed quite widely among sports and artistic things and carpentry and things that involve using your hands and a little music perhaps and things of that sort. ”



R. S. Root-Bernstein, M. Bernstein, H. Garnier. (1995). Correlations between avocations, scientific style, work habits and professional impact of scientists. *Creativity Research Journal*, 8: 115-137.

\* Encyclopedia of Surfing <https://eos.surf/entries/cram-donald/>

28

28

## Dorothy Crowfoot Hodgkin, NP Chemistry, 1964: Painting Prepared Her for X-Ray Crystallography

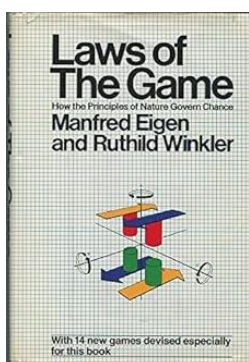
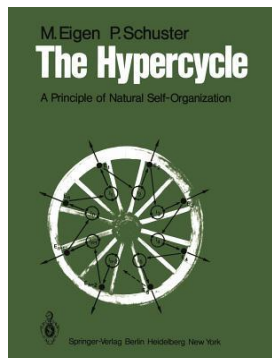


[Painting: D. M. Crowfoot.  
(b) MOSAIC IN DIACONIA IN PROPYLAEA CHURCH.

President of the Pugwash Conference  
on Science and World Affairs, 1976-1988

29

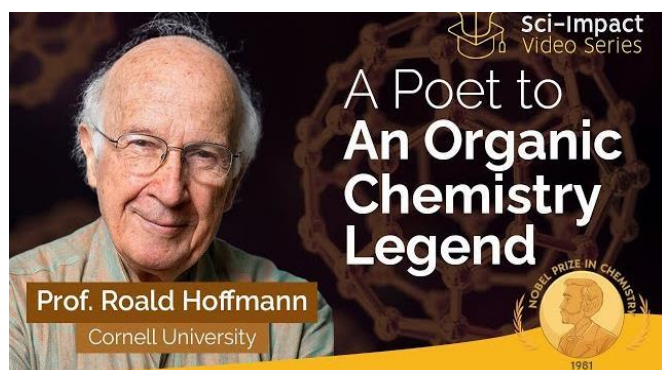
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## Manfred Eigen NP 1967



30



**Casual CHEMISTRY**

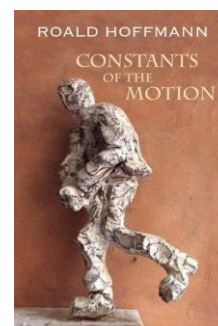
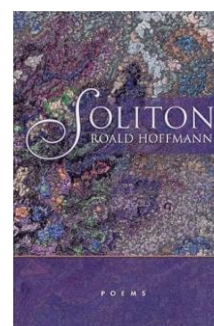
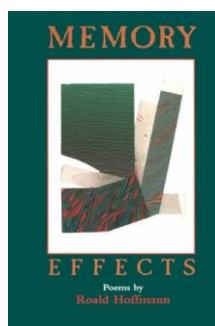
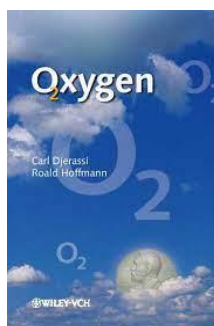
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USING  
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RULES**

**Cycloadditions**

$\pi^4_s + \pi^2_s$

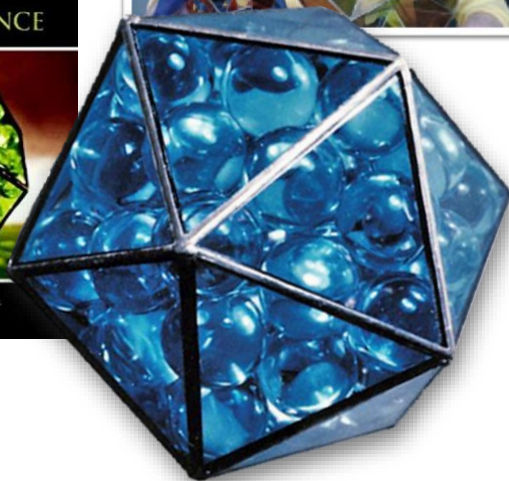
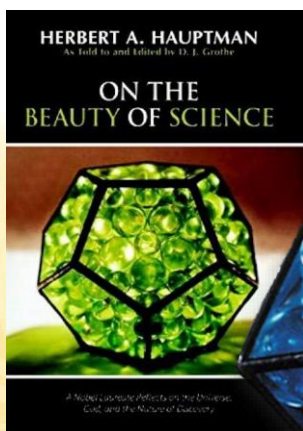
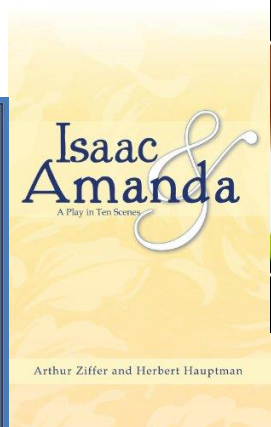
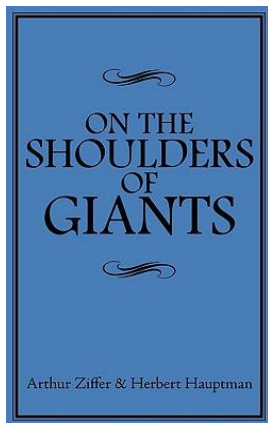
## Roald Hoffmann, NP 1981



31

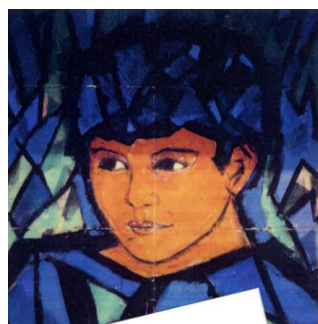
31

# Herbert Hauptman, NP 1985

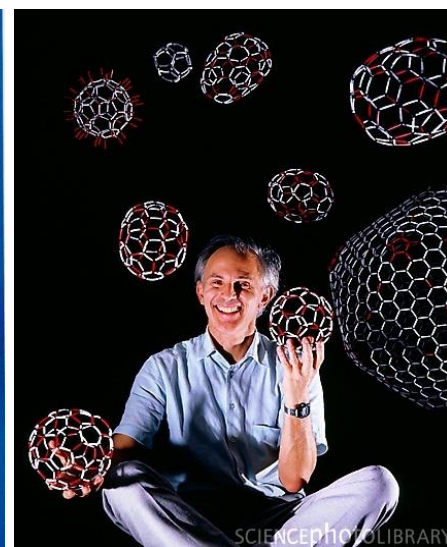
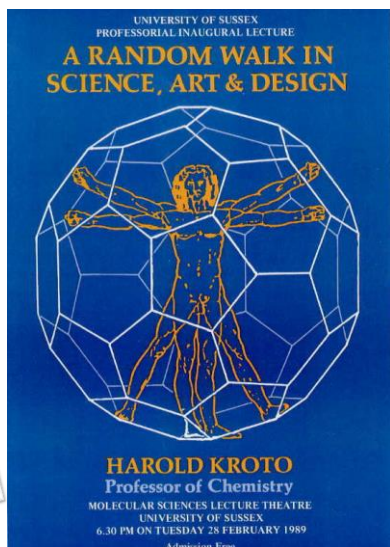


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32



# Harold Kroto, NP Chemistry, 1996 Was an Artist & Designer



33

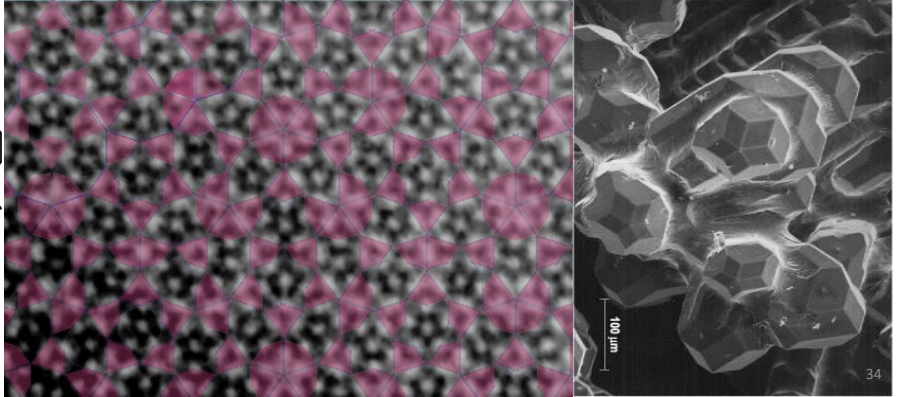
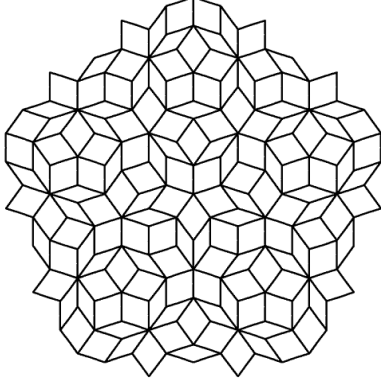
33





## Dan Schechtman, NP Chemistry, 2011

Drew upon Roger Penrose's (NP, Physics 2020) aperiodic tilings to understand anomalous crystal



34

## Creative Polymathy: The Integration of Multiple Interests and (A)Vocations



- Polymathy refers to development of vocational, avocational and autodidactic skills in two or more disciplines
- Polymathy is highly correlated with professional success in all disciplines
- Polymathic skills interrelate within a "network of enterprise"

35

35

# Integrated Networks of Enterprise

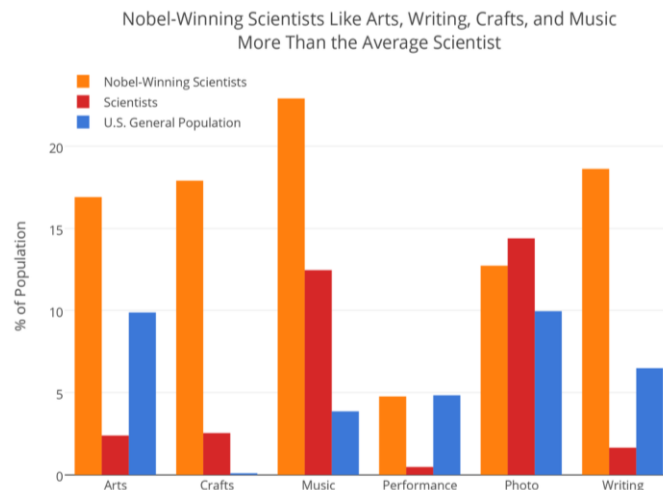
- John Dewey, *Art as Experience*, 1934 (“Integrative activity sets”)
- Gerald Holton, *On Trying to Understand Scientific Genius*, 1972 (“Becoming a piece of nature”)
- Howard Gruber, *Darwin on Man: A Psychological study of Scientific Creativity*, 1984 (“Networks of enterprise”)
- Robert Root-Bernstein, *Discovering*, 1989 (“Correlative talents”)



36

36

## Nobel Prizewinners 15 to 25 Times More Likely Than Average Scientist to Be Crafty & Artistic as Adults



Root-Bernstein, et al., *Arts Foster Scientific Success: Avocations of Nobel, National Academy, Royal Society, and Sigma Xi Members*. J. Psychol. Sci. Tech. 1(2):51-63 · October 2008 DOI: 10.1891/1939-7054.1.2.51

37

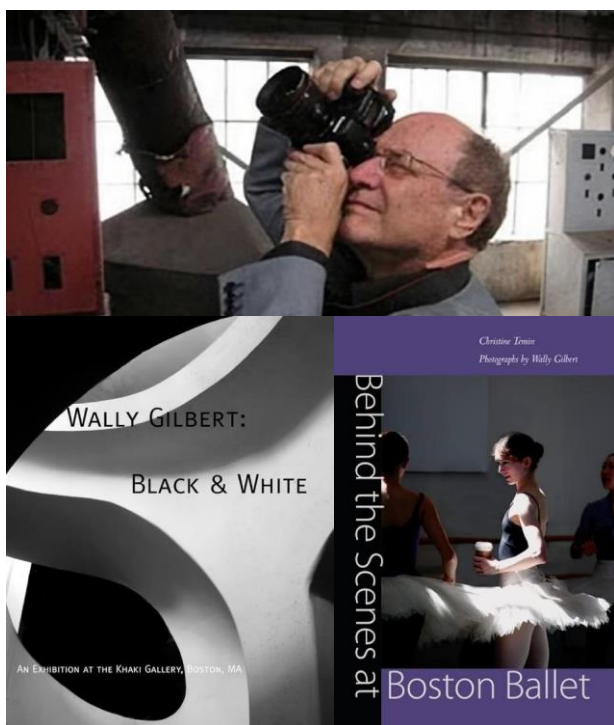
37

# Interdisciplinary and Intradisciplinary Polymathy

- People I've just highlighted displayed INTERdisciplinary polymathy (sciences, arts, literature, music, business, law, etc.)
- Many Nobel laureates also display INTRAdisciplinary polymathy (combining different aspects of STEM subjects)

38

38



## Walter Gilbert, NP Chemistry, 1980

- Physicist
- Biophysicist
- Biochemist
- Molecular Biologist
- Businessman / Entrepreneur
- Artist / Photographer

39

39

## Frances H. Arnold NP, Chemistry 2018

- Mechanical and aerospace engineer
- Chemical engineer
- Molecular biology and directed enzyme evolution
- Entrepreneur (biotech companies)



40

40

## INTRAdisciplinary (Within Science) Polymathy of Science Nobel Laureates

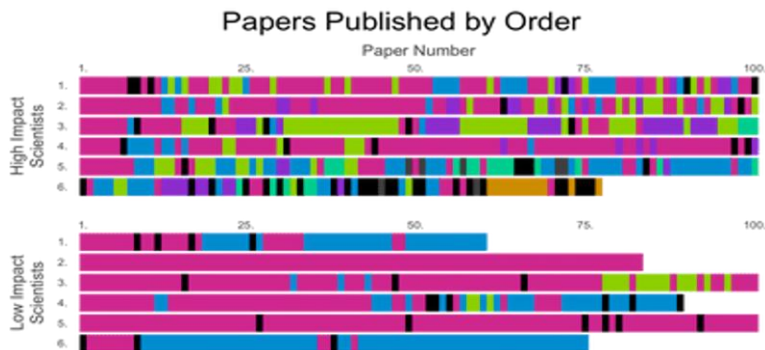
	Psych	Med	Biol	Chem	Phys	Math	Engin	Astro	Other
<b>Physics (177)</b>	0% (0)	4% (8)	4% (8)	<b>25%</b> <b>(49)</b>	<b>100%</b> <b>(177)</b>	<b>33%</b> <b>(65)</b>	<b>26%</b> <b>(53)</b>	8% (15)	19% (37)
<b>Chemistry (149)</b>	0.7% (2)	15% (23)	<b>35%</b> <b>(52)</b>	<b>100%</b> <b>(149)</b>	<b>34%</b> <b>(49)</b>	12% (18)	<b>30%</b> <b>(45)</b>	0.4% (1)	14% (21)
<b>Medicine (184)</b>	9% (16)	<b>65%</b> <b>(117)</b>	<b>69%</b> <b>(124)</b>	<b>47%</b> <b>(85)</b>	14% (25)	11% (20)	3% (5)	0% (0)	15% (27)

- 81% were formally trained in more than one science

41

41

# Nobel Laureates Don't Specialize: Publication Patterns of Top and Bottom Quartile: Scientists of the Eiduson Study

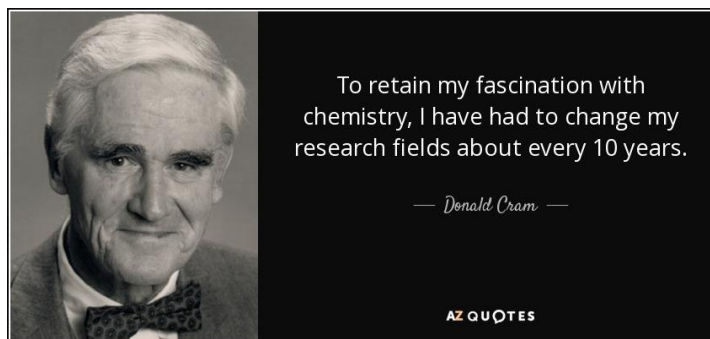


Root-Bernstein, R. S., Bernstein, M. and Schlichting, H. W. "Identification of Scientists Making Long-Term, High Impact Contributions, with Notes on Their Methods of Working," *Creativity Research Journal* 6 (4): 329-343, 1993.

42

42

## Polymathy and the Novice Effect



### Changing fields does two things:

- 1) Returns the investigator to a novice and novices are more likely to make discoveries than old-timers
- 2) Brings previous expertise to bear on new problems

43

43

## Polymathy Correlates with Unusually Broad Nobel Prize Impact: e.g., Doudna and Charpentier, NP 2020



Jeffrey I. Seeman and Guillermo Restrepo (2020) The Mutation of the “Nobel Prize in Chemistry” into the “Nobel Prize in Chemistry or Life Sciences: Several Decades of Transparent and Opaque Evidence of Change within the Nobel Prize Program. *Angewandte Chemie International Edition*, 99: 2942-2961.

44

44

## Intra- and Inter-Disciplinary Polymathy of Science Nobel Laureates

Science Nobel Laureates	Within Scientific Disciplines	Across Non-Scientific Disciplines	Both
Chemistry (149)	122 / 82%	109 / 73%	81 / 54%
Med/Physiology (184)	160 / 87%	121 / 68%	93 / 59%
Physics (177)	131 / 74%	111 / 63%	84 / 47%

Root-Bernstein R, Root-Bernstein M. 2020. A statistical study of intra-domain and trans-domain polymathy among Nobel laureates, *Creativity Research Journal*, DOI: 10.1080/10400419.2020.1751545

45

45

## So, How Does One Put Oneself in the Running for a Nobel Prize?

Students of science are often told:

- 1) Specialize: become an expert!
- 2) The harder you work, the better you'll do



**Nobel laureates certainly work hard but they rarely specialize, often change fields, and play hard, too!**

To perceive new things, or old things in new ways, you need to bring unusual experiences to the table!

**Polymathy provides such experiences.**

46

46

### Recent #ChemNobel winners



- **2019 Winners:** John B. Goodenough, M. Stanley Whittingham and Akira Yoshino *“for the development of lithium-ion batteries”*



- **2020 Winners:** Emmanuelle Charpentier and Jennifer A. Doudna *“for the development of a method for genome editing”*



- **2021 Winners:** Benjamin List and David MacMillan *“for the development of asymmetric organocatalysis”*



- **2022 Winners:** Carolyn Bertozzi, Morten Meldal and K Barry Sharpless *“for the development of click chemistry and bioorthogonal chemistry”*

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48

48



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55

55



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56

56





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57

57



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58

58