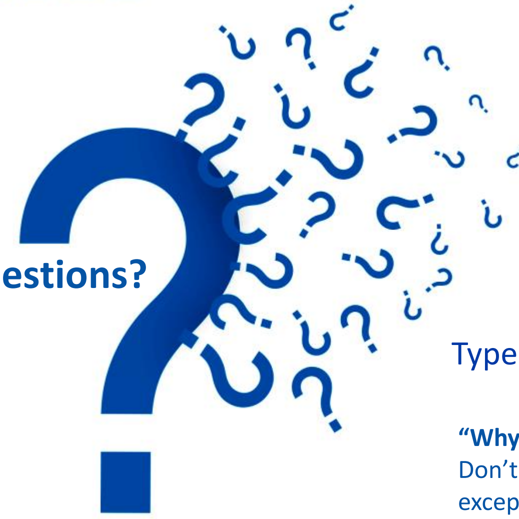
ACS Webinars
CLICK • WATCH • LEARN • DISCUSS

ACS Chemistry for Life®



Have Questions?

Type them into questions box!

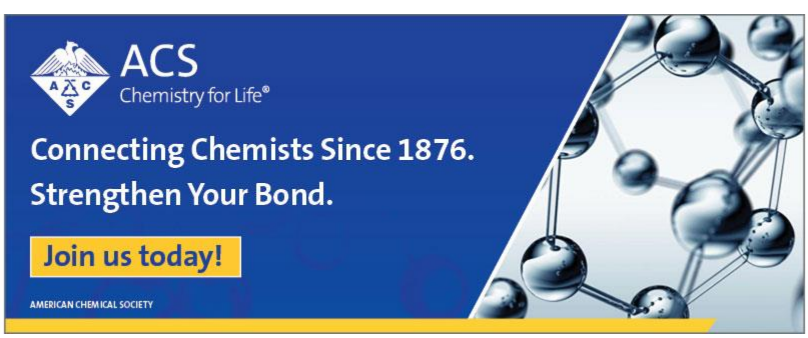
"Why am I muted?"
Don't worry. Everyone is muted except the presenter and host. Thank you and enjoy the show.

Contact ACS Webinars ® at acswebinars@acs.org

ACS Webinars
CLICK • WATCH • LEARN • DISCUSS

ACS Chemistry for Life®

Join a global community of over 150,000 chemistry professionals



Find the many benefits of ACS membership!

http://bit.ly/ACSmembership

ACS Webinars
CLICK • WATCH • LEARN • DISCUSS

ACS
Chemistry for Life®

Benefits of ACS Membership

Chemical & Engineering News (*C&EN*)
The preeminent weekly digital and print news source.

NEW! ACS SciFinder
ACS Members receive 25 complimentary SciFinder® research activities per year.

NEW! ACS Career Navigator
Your source for leadership development, professional education, career services, and much more.

http://bit.ly/ACSmembership

3

ACS Webinars
CLICK • WATCH • LEARN • DISCUSS

@AmericanChemicalSociety

@AmerChemSociety

@AmericanChemicalSociety

https://www.linkedin.com/company/american-chemical-society

Contact ACS Webinars ® at acswebinars@acs.org

4

How has ACS Webinars benefited you?

ACS Chemistry for Life®

"*Sustainable Chemistry is Safer Chemistry* is another great ACS Webinar that educates us chemists all around the world that it is our duty and responsibility to design the proper chem routes and processes to ensure, first and foremost, human and environmental safety."

http://bit.ly/GCisSustainabiltyVideo

Fan of the Week

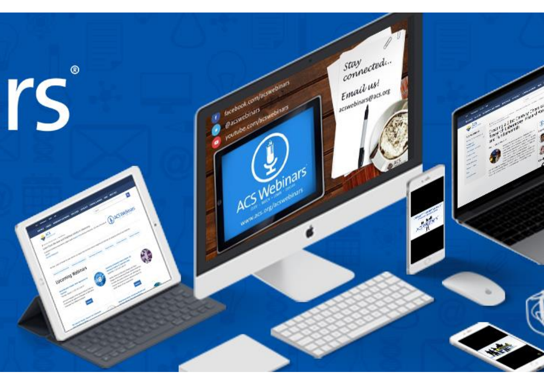
Virginia Castro Ventura
Professor of Chemistry and Biochemistry,
ACS member 1 year strong!

Be a featured fan on an upcoming webinar! Write to us @ acswebinars@acs.org

ACS Webinars®

CLICK • WATCH • LEARN • DISCUSS

LIVE | Thursdays at 2pm ET



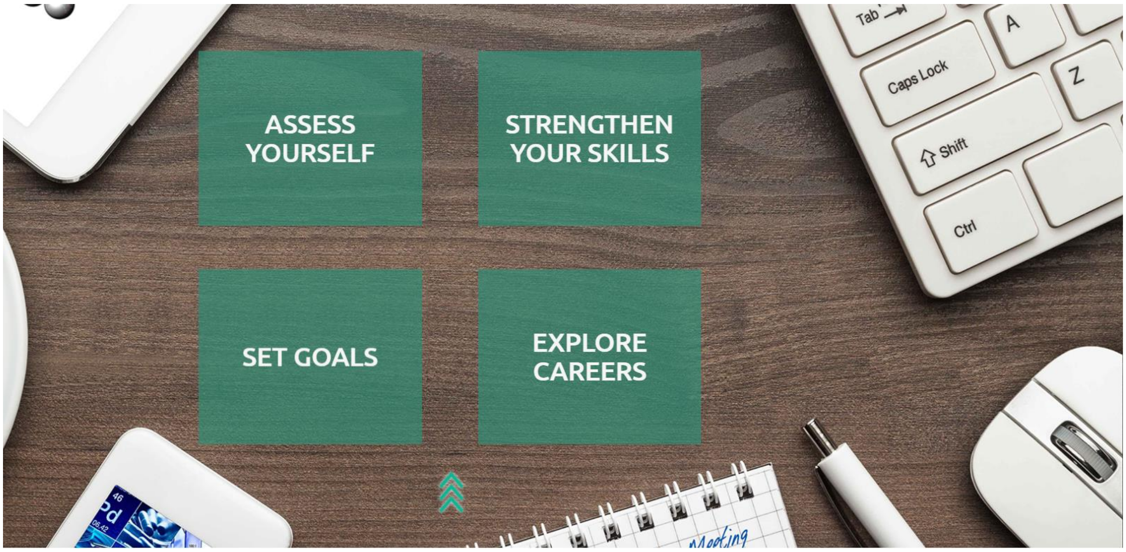
Learn from the best and brightest minds in chemistry! Hundreds of webinars on diverse topics presented by experts in the chemical sciences and enterprise.

Recordings are an exclusive ACS member benefit and are made available to registrants via an email invitation once the recording has been edited and posted.

Live Broadcasts of ACS Webinars® continue to be available to the general public every Thursday from 2-3pm ET!

www.acs.org/acswebinars

An individual development planning tool for you!



ChemIDP.org

7

What is ACS on Campus?

ACS visits campuses across the world offering FREE seminars on how to be published, find a job, network and use essential tools like SciFinder. ACS on Campus presents seminars and workshops focused on how to:

ACS ON CAMPUS

- Publish in top journals
- Find a job
- Effectively use research tools like SciFinder® and ACS ChemWorx
- Communicate your science
- Write grant proposals
- Build industry partnerships
- Prepare for a changing employment landscape

http://acsoncampus.acs.org

8

ACS Green Chemistry Institute®

ACS Chemistry for Life®

CALL FOR ABSTRACTS OPENS NOV 19, 2018

#gcande | @ACSGCI | **gcande.org**

Save the Date

23rd Annual Green Chemistry & Engineering Conference

— and —

9th International Conference on Green and Sustainable Chemistry

RESTON, VA | JUNE 11 - 13, 2019

HIGHLIGHT YOUR BRAND. POSITION YOURSELF AS A GREEN CHEMISTRY CHAMPION.
SPONSOR THE 23RD ANNUAL GREEN CHEMISTRY & ENGINEERING CONFERENCE

www.gcande.org

Upcoming ACS Webinars

www.acs.org/acswebinars

ACS Chemistry for Life®

Thursday, September 20, 2018

A Novel Strategy for the Treatment of Chronic Pain: *Antagonising PAR2 with a Monoclonal Antibody*

Co-produced with ACS Division of Medicinal Chemistry and the American Association of Pharmaceutical Scientists

Experts

Pete Thornton
AstraZeneca

Nurulain Zaveri
Astraea Therapeutics

Thursday, September 27, 2018

Who Will Win the #ChemNobel? *Predicting the 2018 Nobel Laureate(s) in Chemistry*

Co-produced with Chemical & Engineering News

Experts

Carmen Drahl
C&EN

Lauren Wolf
C&EN

Nicole Gaudelli
Beam Therapeutics

Joseph Moran
University of Strasbourg

Neil Garg
UCLA

Contact ACS Webinars ® at acswebinars@acs.org

ACS Webinars
CLICK • WATCH • LEARN • DISCUSS

ACS Chemistry for Life®

***Bioprivileged Molecules:** A New Paradigm for Biobased Chemical Development*

Slides available now and an invitation to view the edited recording will be sent when available.

www.acs.org/acswebinars

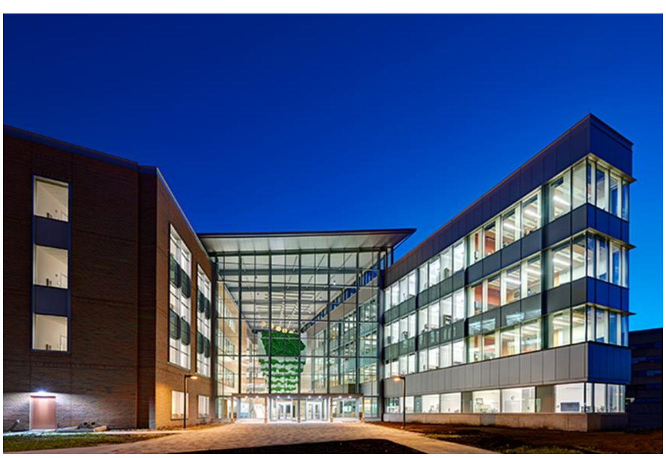
Co-produced with the ACS Green Chemistry Institute

11

CBiRC
NSF Engineering Research Center for Biorenewable Chemicals

Bioprivileged Molecules

A New Paradigm for Biobased Chemical Development

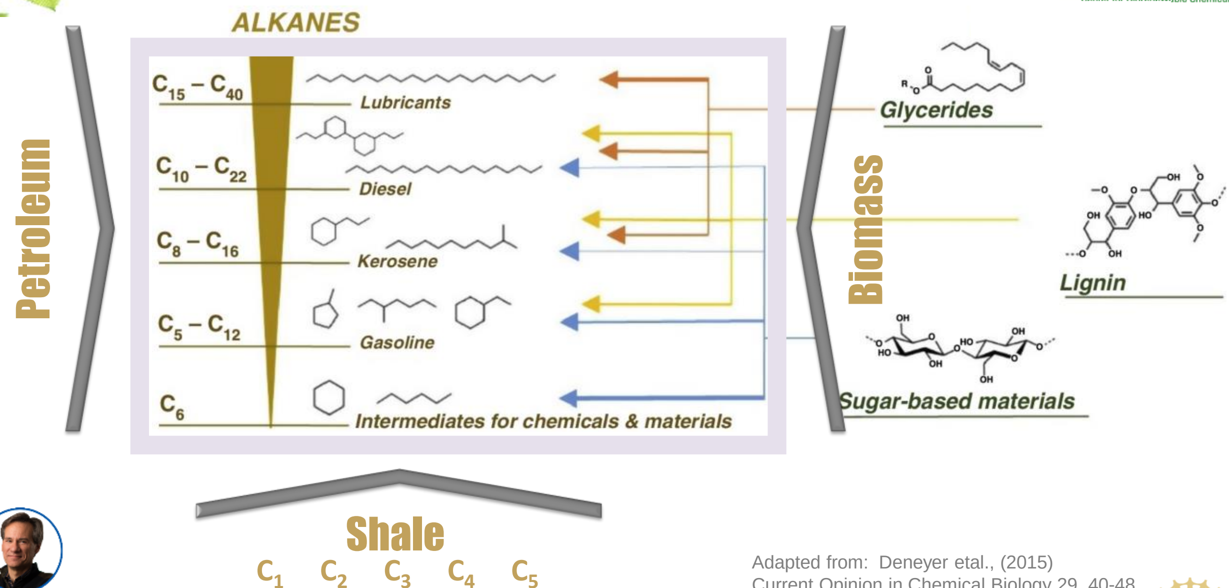


Peter Keeling & Brent Shanks

Iowa State University

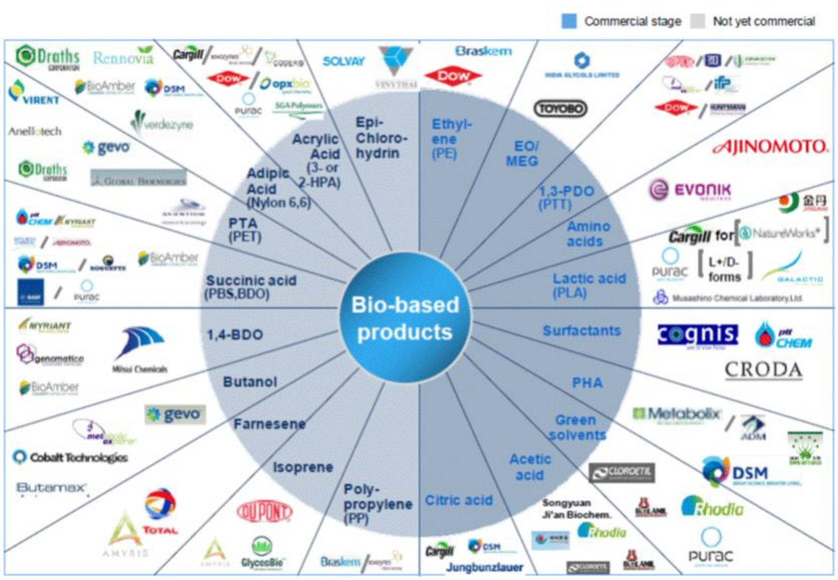
CENTER FOR BIORENEWABLE CHEMICALS 12 NSF

Carbon Sourcing



Adapted from: Deneyer etal., (2015)
Current Opinion in Chemical Biology 29, 40-48

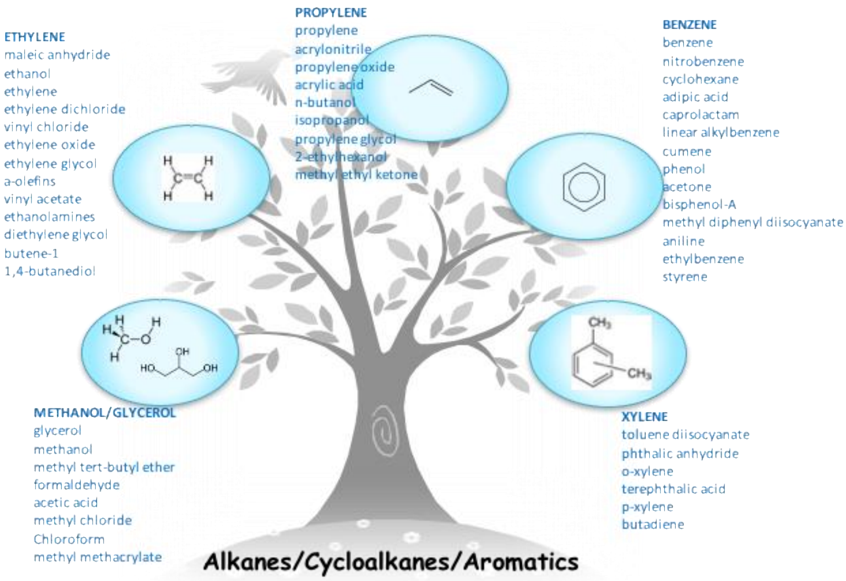
Biobased Chemicals



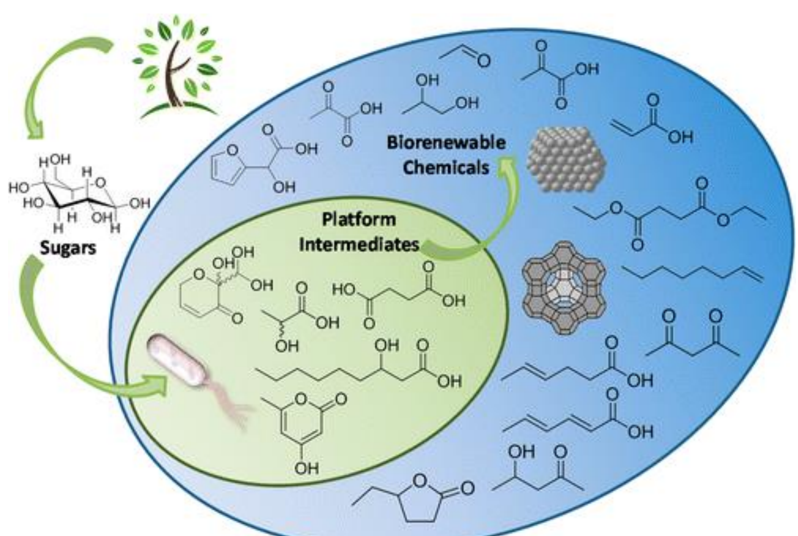
circa 2013

Source: ICIS

Petrochemicals

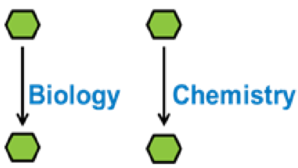


Integrating Biology/Chemistry



Schwartz et al. *ACS Catal*. **4**:2060-2069 (2014)

Biobased Chemicals



How can this address so many chemical targets?

Biology Branches

Chemistry Leaves

Risks, Costs and Return

Risks: Transition from lab to pilot to semi-works and full scale is frequently difficult.

- *Need to focus on fewer biological systems & combine with chemical catalysis for diversification.*

Costs: Capital costs are very significant and not fully derisked.

- *Need to find ways to move step-wise through scale levels for commercialization.*

Return: Competing with commodity chemicals is challenging

- *Need to identify higher value opportunities*

Bioprivileged Molecules

***Biopriviledged molecules** are defined as biology-derived chemical species that can be **efficiently** converted to a diversity of chemical products including both novel molecules and drop-in replacements.*

Shanks, Keeling *Green Chem.* **19**:3177-3185 (2017)

CENTER FOR BIORENEWABLE CHEMICALS

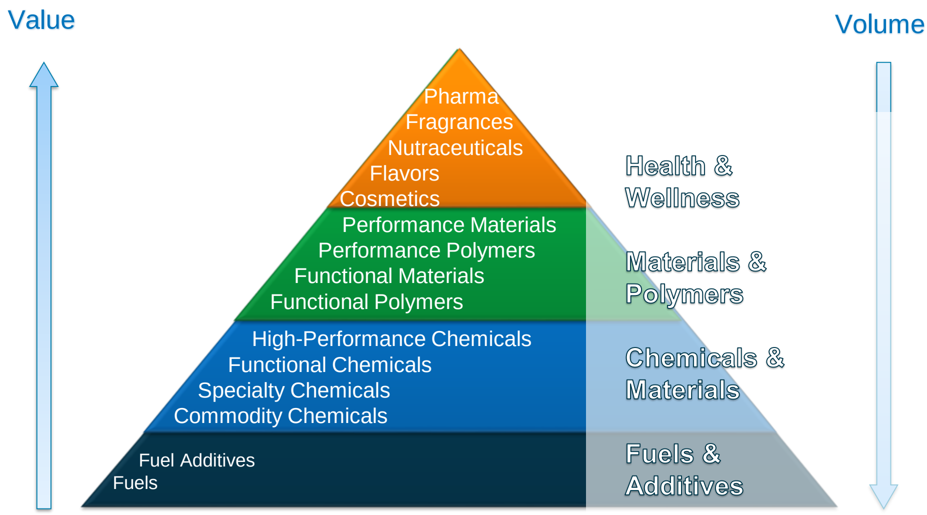
Audience Challenge Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT

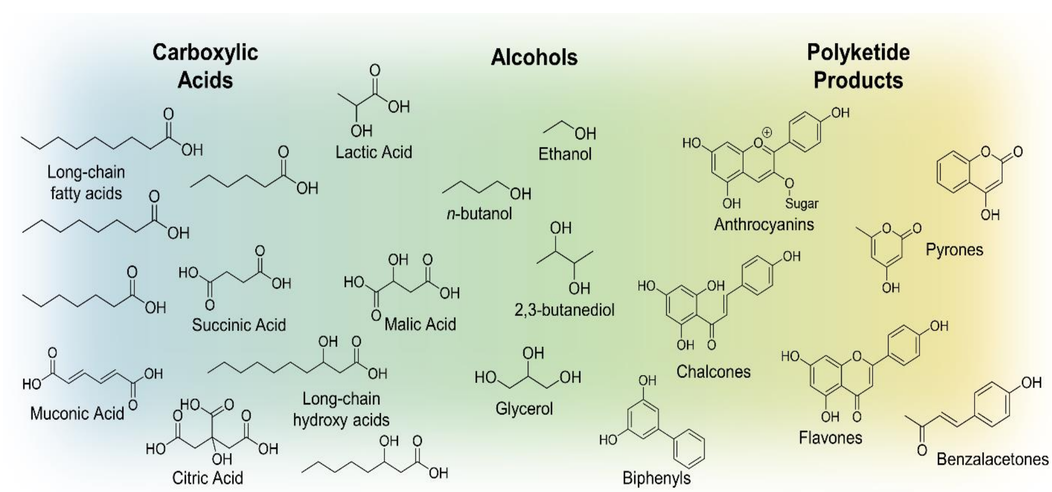
When was the last new petrochemical compound commercialized?

- 1-5 years
- 6-10 years
- 11-15 years
- 16-20 years
- Greater than 20 years

Start with Higher Value MVP



Biology-Derived Molecules



Schwartz et al. *Curr. Opin. Biotechnol.* **38**:54-62 (2016)

Audience Challenge Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT

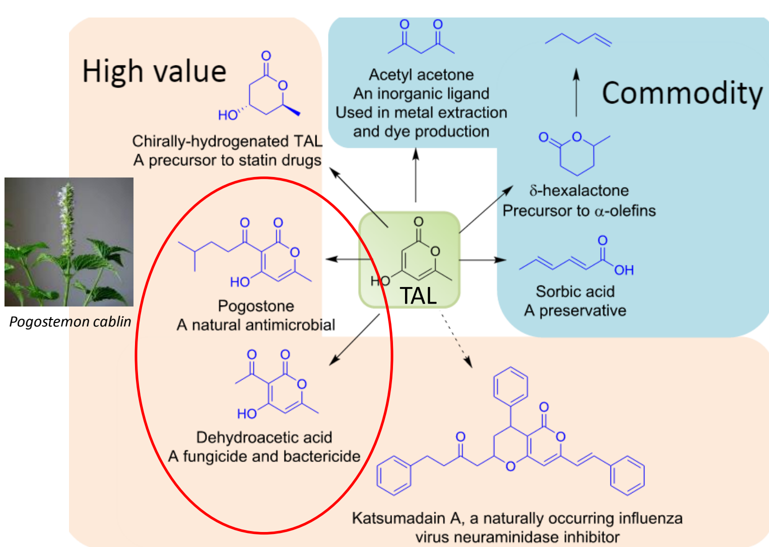
What are the number of possible $C_6H_xO_y$ chemical compounds?

- About 30,000
- About 20,000
- About 15,000
- About 10,000
- About 5,000

23

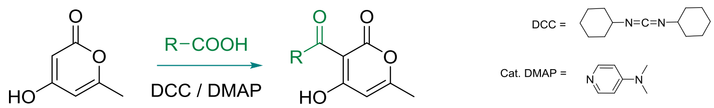
Triacetic Acid Lactone

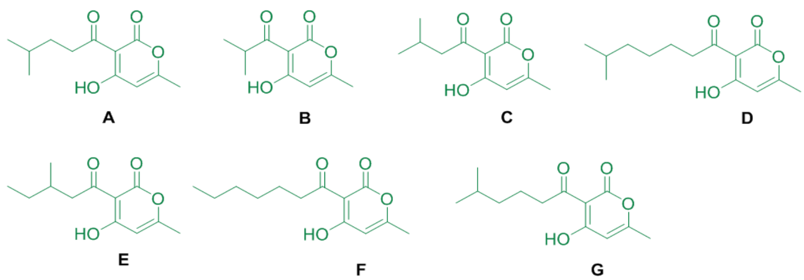
CBiRC NSF Engineering Research Center for Biorenewable Chemicals



CENTER FOR BIORENEWABLE CHEMICALS 24

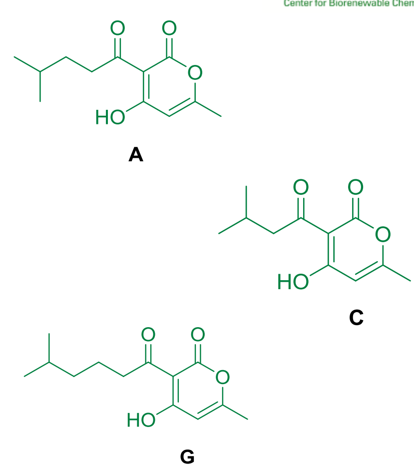
Synthesis of Pogostone and Analogues



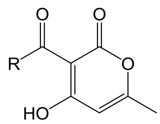


Antimicrobial Activity

Organisms	A	B	C	D	E	F	G
Cryptococcus neoformans	+						+
Geotrichum capitatum	+		+				+
Candida kefyr	+					+	
Candida geochares	+						+
Candida krusei	+		+				+
Yarrowia lipolytica	+		+				+
Trichosporon mucoides			+	+			+
Protohteca wickehamii	+	+	+	+	+	+	+
Ogataea polymorpha	+		+				+
Candida intermedia	+		+				
Candida dubliniensis	+		+				
Cyberlindnera fabianii	+		+				+
Candida tropicalis	+		+				+
Rhodotorula mucilaginosa							+
Candida glabrata	+		+				
Candida parapsilosis							
Saccharomyces bayanus	+		+				+
Hanseniaspora guilliermondii	+		+				+
Cornebacterium glutamicum							+
Staphylococcus saprophyticus							+
Staphylococcus haemolyticus							+
Enterobacter cloacae							+
Chryseobacterium indologenes							+



Insecticidal & Repellency



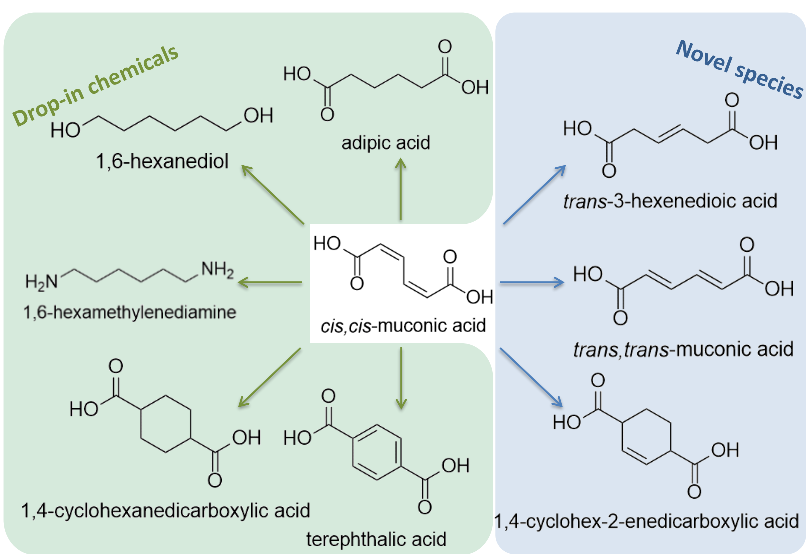
Pogostone Analogs

Compound	Insecticidal				
	0.025%	0.05%	0.1%	0.15%	0.25%
Pogostone Analog 1	0		10	55 ± 5	77.1 ± 10.4
Pogostone Analog 2	0		30	55 ± 25	80
Pogostone Analog 3			0	5	0
Pogostone Analog 4				10	
Natural Pyrethrins	0	0	0	20	10

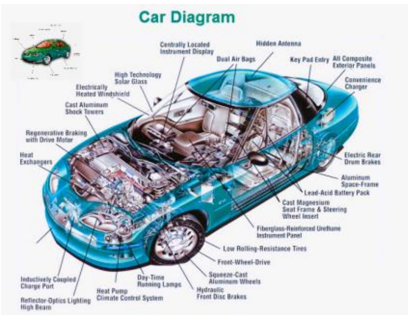
Repellent	Spatial Repellency		
	15 mins	90 mins	150 mins
Control (acetone treated & evaporated)	-7.5	5	-5
DEET	20	50	56.7
Pogostone A	7.5	45	25
Pogostone B	***KD***	***KD***	***KD***
Pogostone C	35	67.5	62.5
Pogostone F	30	15	22.5
Pogostone G	7.5	15	5

Norris and Coats, Pesticide Toxicology Lab

Muconic Acid Platform

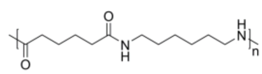
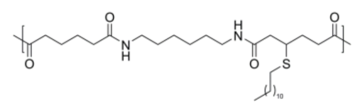


Bioadvantaged Nylon



The mechanical properties of conventional Nylon 6,6 drop by 40% with the absorption of 2% moisture.

Application – Automotive Parts

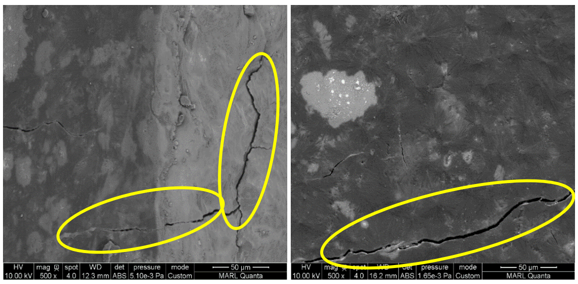
	Nylon 6,6	Bioadvantaged Nylon 6,6 (5 wt% HDA)
Polymer:	Nylon 6,6	Bioadvantaged Nylon 6,6 (5 wt% HDA)
Structure:		
Water Absorption:	4.12 wt% increase	0.69 wt% increase

Physical Properties

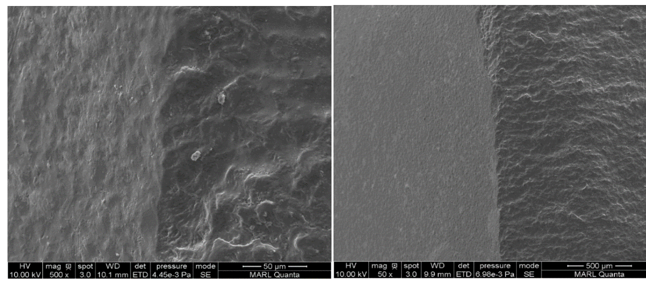
Sample	T_m (˚C)	ΔH_m (J/g)	Crystallinity (%)	T_c, Maxima	ΔH_c (J/g)	T_{d50}
BAN 0	**254.92± 1.98**	**76.285±1.68**	**51.9**	**226.16±1.79**	**75.19±2.34**	**431**
BAN 5	**249.47±0.75**	**62.06±0.80**	**53.6**	**224.06±0.02**	**64.06±4.56**	**430**
BAN 20	**229.27±0.94**	**43.55±1.50**	**44.0**	**196.86±0.93**	**47.98±0.53**	**437**
BAN 40	194.80±1.60	26.94±3.03	31.6	156.85±0.45	34.55±4.13	444
BAN 50	170.02±0.04	23.26±0.30	23.4	114.29±1.69	21.78±2.27	447
BAN 60	-	-	21.0	-	-	448
BAN 80	-	-	0	-	-	451
BAN 100	-	-	-	-	-	452

Halide Resistance Test

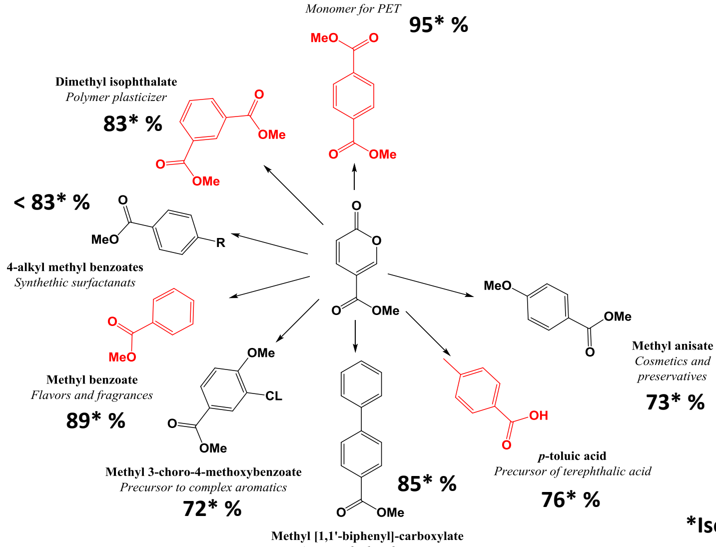
Conventional Nylon



Bioadvantaged Nylon

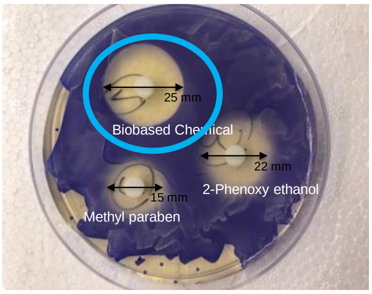


Coumalate Platform



*Isolated yield

MIC Testing



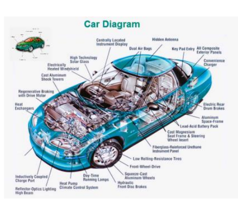
Compounds were tested against a wild type strain of Escherichia coli K-12 expressing a purple chromogenic protein to improve visualization.

	Industry Standard	Pyrone Derivatives * < 0.5 wt% *MIC (minimum inhibitory concentration)*							
Contaminating bacteria	**Phenoxyethanol (PhE)**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Escherichia coli	*	*			*		*		*
Aspergillus braciliennsis	*				*		*		
Pseudomonas aeroginosa	*	*		*	*		*		
Staphylococcus aureus	*	*			*		*		
Salmonella typhimurium	*	*			*		*		
Salmonella abony	*	*			*		*		
Clostridium sporogenes	*	*			*		*		
Candida albicans	*	*			*		*		

* *Salmonella Typhimurium ATCC 14028, Salmonella Abony NCTC 6017, Escherichia coli ATCC 8739, Pseudomonas aeruginosa ATCC 9027, Staphylococcus aureus ATCC 6538, Clostridium sporogenes ATCC 11437, Candida albicans ATCC 10231 and Candida albicans ATCC 90028*

Novel Molecules

Consumer Goods, Materials, Chemicals



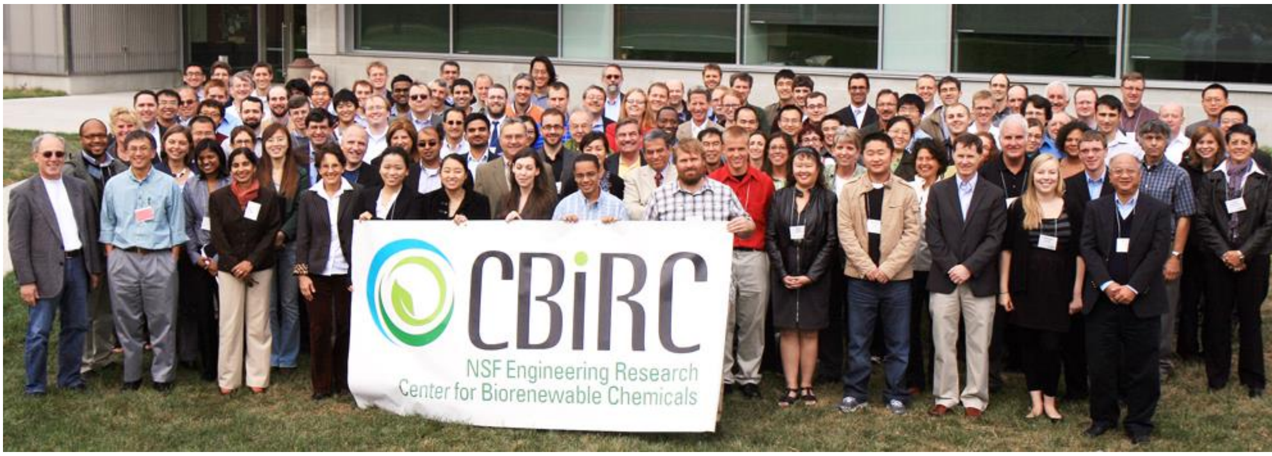
Petrochemicals

- Shifting consumer demand
- Lack of alternatives

Biobased Chemicals

- Consumer opportunity
- Novel alternatives

Thank You



ACS Webinars
CLICK • WATCH • LEARN • DISCUSS

ACS Chemistry for Life®

Bioprivileged Molecules: *A New Paradigm for Biobased Chemical Development*

Slides available now and an invitation to view the edited recording will be sent when available.

www.acs.org/acswebinars

Co-produced with the ACS Green Chemistry Institute

ACS Green Chemistry Institute®

ACS Chemistry for Life®

www.gcande.org

37

Upcoming ACS Webinars
www.acs.org/acswebinars

ACS Chemistry for Life®

Thursday, September 20, 2018

A Novel Strategy for the Treatment of Chronic Pain: *Antagonising PAR2 with a Monoclonal Antibody*

Co-produced with ACS Division of Medicinal Chemistry and the American Association of Pharmaceutical Scientists

Experts

Pete Thornton
AstraZeneca

Nurulain Zaveri
Astraea Therapeutics

Thursday, September 27, 2018

Who Will Win the #ChemNobel? *Predicting the 2018 Nobel Laureate(s) in Chemistry*

Co-produced with Chemical & Engineering News

Experts

Carmen Drahl
C&EN

Lauren Wolf
C&EN

Nicole Gaudelli
Beam Therapeutics

Joseph Moran
University of Strasbourg

Neil Garg
UCLA

Contact ACS Webinars ® at acswebinars@acs.org

38

ACS Webinars
CLICK • WATCH • LEARN • DISCUSS

ACS Chemistry for Life®

***Bioprivileged Molecules:** A New Paradigm for Biobased Chemical Development*

Slides available now and an invitation to view the edited recording will be sent when available.

www.acs.org/acswebinars

Co-produced with the ACS Green Chemistry Institute

39

How has ACS Webinars benefited you?

ACS Chemistry for Life®

"Sustainable Chemistry is Safer Chemistry is another great ACS Webinar that educates us chemists all around the world that it is our duty and responsibility to design the proper chem routes and processes to ensure, first and foremost, human and environmental safety."

http://bit.ly/GCisSustainabiltyVideo

Fan of the Week

Virginia Castro Ventura
Professor of Chemistry and Biochemistry,
ACS member 1 year strong!

40

Be a featured fan on an upcoming webinar! Write to us @ acswebinars@acs.org

ACS Webinars
CLICK • WATCH • LEARN • DISCUSS

@AmericanChemicalSociety

@AmerChemSociety

@AmericanChemicalSociety

https://www.linkedin.com/company/american-chemical-society

Contact ACS Webinars ® at acswebinars@acs.org

41

ACS Webinars
CLICK • WATCH • LEARN • DISCUSS

ACS Chemistry for Life®

Benefits of ACS Membership

Chemical & Engineering News (*C&EN*)
The preeminent weekly digital and print news source.

NEW! ACS SciFinder
ACS Members receive 25 complimentary SciFinder® research activities per year.

NEW! ACS Career Navigator
Your source for leadership development, professional education, career services, and much more.

http://bit.ly/ACSmembership

42

ACS Webinars® CLICK • WATCH • LEARN • DISCUSS

ACS Chemistry for Life®

ACS Webinars® does not endorse any products or services. The views expressed in this presentation are those of the presenter and do not necessarily reflect the views or policies of the American Chemical Society.

Upcoming ACS Webinars

www.acs.org/acswebinars

ACS Chemistry for Life®

Thursday, September 20, 2018

A Novel Strategy for the Treatment of Chronic Pain: *Antagonising PAR2 with a Monoclonal Antibody*

Co-produced with ACS Division of Medicinal Chemistry and the American Association of Pharmaceutical Scientists

Experts

Pete Thornton
AstraZeneca

Nurulain Zaveri
Astraea Therapeutics

Thursday, September 27, 2018

Who Will Win the #ChemNobel? *Predicting the 2018 Nobel Laureate(s) in Chemistry*

Co-produced with Chemical & Engineering News

Experts

Carmen Drahl
C&EN

Lauren Wolf
C&EN

Nicole Gaudelli
Beam Therapeutics

Joseph Moran
University of Strasbourg

Neil Garg
UCLA