Available online at **www.joac.info**

ISSN: 2278-1862

Journal of Applicable Chemistry

2019, 8 (1): 462-469

(International Peer Reviewed Journal)

Knowledge Inn (in nature)

- *Research Profile of Frances Arnold, NL2018Chem*
- *Process knowledge discovery*
- *Knowledge-Based Conformer Generation*

KLab

rsr.chem1979

Nobel Laureate	Frances Arnold	Chemistry	2018

Research ProfileFrances of Hamilton Arnold

Linus Pauling Professor of Chemical Engineering, Bioengineering and Biochemistry
California Institute of Technology, CA, USA;
email: cheme.caltech.edu

Frances Hamilton Arnold

	All	Since 2014
Citations	46, 361	15,188
h-index	118	63
# Publications	**> 600**	

Accessed on 13-01-2019

Born on July 25, 1956
Edgewood, Pennsylvania, U.S.

Directed enzyme evolution technique

- .Evolved enzymes were used to make compounds with bonds that do not occur in biology, Ex. Bonds between carbon and silicon; argon and boron
- Various types of plants, animals, and other living things on Earth have their origin in other pre-existing types. Evolution, fundamental keystone of modern system biology explains

distinguishable differences in species arising due to modifications in successive generations.

+ Unprecedented impact in biocatalysis by redesign of the catalysts of life to match process requirements in terms of specificity, activity and robustness

Academic profile of Frances Hamilton Arnold		
Graduation		
Mechanical and aerospace engineering	Princeton University	1979
Doctoral research		
Chemical engineering	University of California at Berkeley Ph D Director: Harvey Warren Blanch Thesis: Design and Scale-Up of Affinity Separations	1985
Post-Doctoral research		
One year	Postdoctoral fellow at Berkeley	
Progeny		
Academic	Christopher Voigt, Huimin Zhao, Ulrich Schwaneberg	
Biological	William A. Lange Joseph I. Lange James Bailey	
Companies started based on her research outcome		
Gevo	▪ Uses yeast to make isobutanol + can be used instead of ethanol in making fuel	2005
Provivi	Alters insect pheromones so that pests harmful to crops will be unable to mate with each other	2013

Employment	
Assistant professor	1987
Associate professor	1992
Full professor	1996

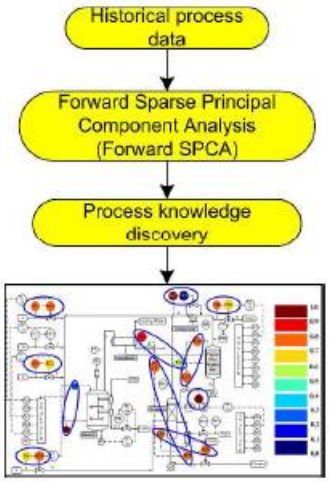
Year	Awards (to Frances Hamilton Arnold)
2018	**Nobel Prize in Chemistry**
2017	Raymond and Beverly Sackler Prize in Convergence Research
2016	Millennium Technology Prize
2013	National Medal of Technology and Innovation
2011	Draper Prize
2007	FASEB Excellence in Science Award
2005	Garvan–Olin Medal

Typical Publications	# Citations	Year of pub
Dynamic pattern formation in a vesicle-generating microfluidic device T Thorsen, RW Roberts, FH Arnold, SR Quake Physical review letters 86 (18), 4163	1950	2001
Molecular evolution by staggered extension process (StEP) in vitro recombination H Zhao, L Giver, Z Shao, JA Affholter, FH Arnold Nature biotechnology 16 (3), 258	1007	1998
Protein stability promotes evolvability JD Bloom, ST Labthavikul, CR Otey, FH Arnold Proceedings of the National Academy of Sciences 103 (15), 5869-5874	799	2006
Why highly expressed proteins evolve slowly DA Drummond, JD Bloom, C Adami, CO Wilke, FH Arnold Proceedings of the National Academy of Sciences 102 (40), 14338-14343	634	2005
Why highly expressed proteins evolve slowly DA Drummond, JD Bloom, C Adami, CO Wilke, FH Arnold Proceedings of the National Academy of Sciences 102 (40), 14338-14343	634	2005
Design by directed evolution FH Arnold Accounts of chemical research 31 (3), 125-131	622	1998
Directed evolution of a thermostable esterase L Giver, A Gershenson, PO Freskgard, FH Arnold Proceedings of the National Academy of Sciences 95 (22), 12809-12813	582	1998
Exploring protein fitness landscapes by directed evolution PA Romero, FH Arnold Nature reviews Molecular cell biology 10 (12), 866	580	2009
Directed evolution of a para-nitrobenzyl esterase for aqueous-organic solvents JC Moore, FH Arnold Nature biotechnology 14 (4), 458	555	1996
Laboratory evolution of peroxide-mediated cytochrome P450 hydroxylation H Joo, Z Lin, FH Arnold Nature 399 (6737), 670	480	1999
Directed evolution of a genetic circuit Y Yokobayashi, R Weiss, FH Arnold Proceedings of the National Academy of Sciences 99 (26), 16587-16591	454	2002
Directed evolution of enzyme catalysts O Kuchner, FH Arnold Trends in biotechnology 15 (12), 523-530	434	1997
How enzymes adapt: lessons from directed evolution FH Arnold, PL Wintrode, K Miyazaki, A Gershenson Trends in biochemical sciences 26 (2), 100-106	416	2001

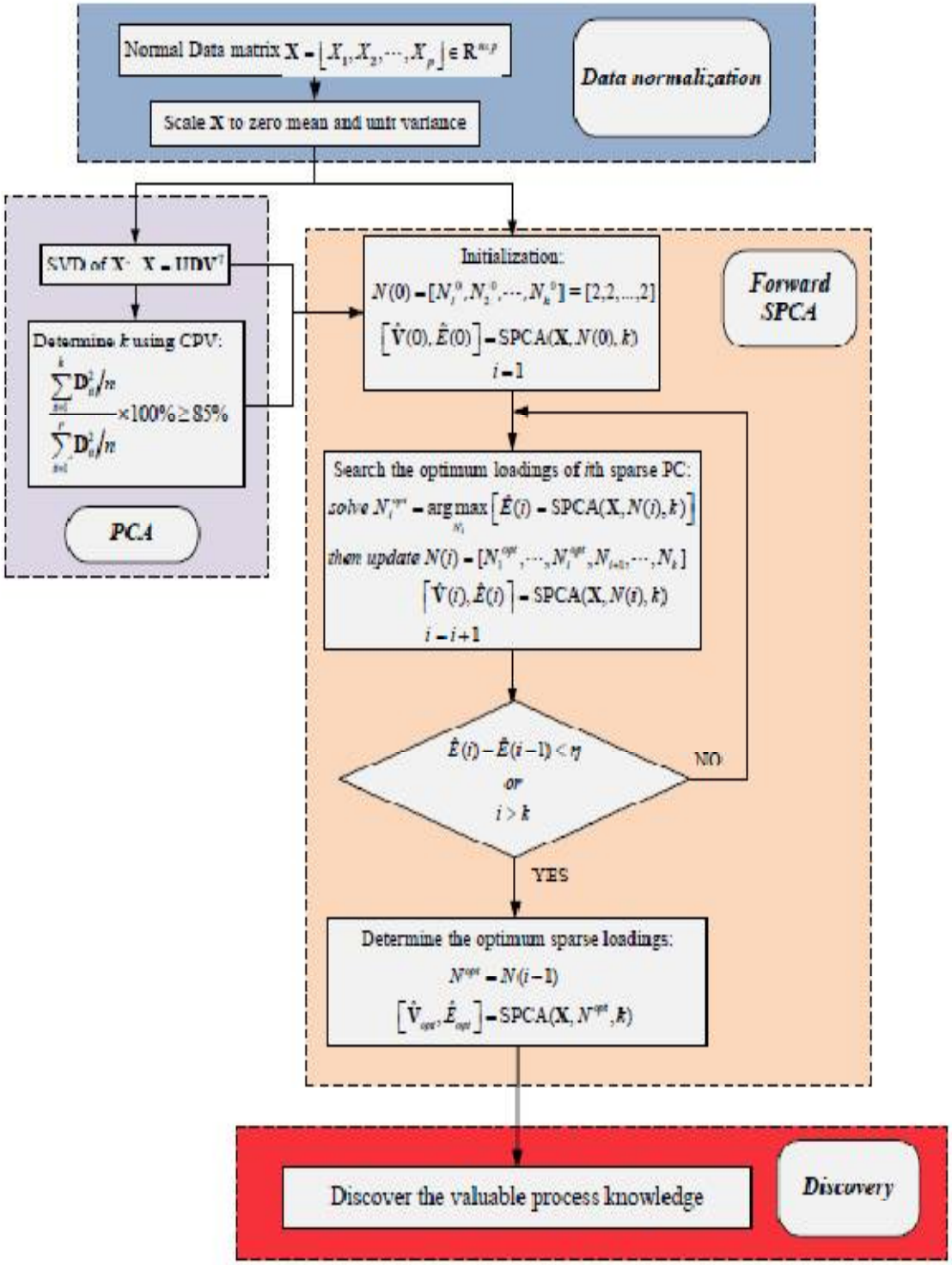
Typical Publications	# Citations	Year of pub
Directed evolution of biocatalysts FH Arnold, AA Volkov Current opinion in chemical biology 3 (1), 54-59	400	1999
Laboratory evolution of a soluble, self-sufficient, highly active alkane hydroxylase A Glieder, ET Farinas, FH Arnold Nature biotechnology 20 (11), 1135	391	2002
Directed evolution converts subtilisin E into a functional equivalent of thermitase H Zhao, FH Arnold Protein Engineering 12 (1), 47-53	374	1999
Directed evolution of subtilisin E in Bacillus subtilis to enhance total activity in aqueous dimethylformamide L You, FH Arnold Protein Engineering, Design and Selection 9 (1), 77-83	361	1996
Evolving strategies for enzyme engineering JD Bloom, MM Meyer, P Meinhold, CR Otey, D MacMillan, FH Arnold Current opinion in structural biology 15 (4), 447-452	349	2005
In the light of directed evolution: pathways of adaptive protein evolution JD Bloom, FH Arnold Proceedings of the National Academy of Sciences 106 (Supplement 1), 9995-10000	345	2009
Directed enzyme evolution ET Farinas, T Bulter, FH Arnold Current opinion in biotechnology 12 (6), 545-551	306	2001
Directed evolution study of temperature adaptation in a psychrophilic enzyme1 K Miyazaki, PL Wintrode, RA Grayling, DN Rubingh, FH Arnold Journal of molecular biology 297 (4), 1015-1026	302	2000
Directed enzyme evolution: climbing fitness peaks one amino acid at a time CA Tracewell, FH Arnold Current opinion in chemical biology 13 (1), 3-9	286	2009
Functional expression of a fungal laccase in Saccharomyces cerevisiae by directed evolution T Bulter, M Alcalde, V Sieber, P Meinhold, C Schlachtbauer, FH Arnold Applied and environmental microbiology 69 (2), 987-995	282	2003
Directed enzyme evolution: screening and selection methods FH Arnold, G Georgiou Springer Science & Business Media	250	2003
Exploring nonnatural evolutionary pathways by saturation mutagenesis: rapid improvement of protein function K Miyazaki, FH Arnold Journal of molecular evolution 49 (6), 716-720	245	1999

Typical Publications	# Citations	Year of pub
Strategies for the in vitro evolution of protein function: enzyme evolution by random recombination of improved sequences1 JC Moore, HM Jin, O Kuchner, FH Arnold Journal of molecular biology 272 (3), 336-347	240	1997
Computational method to reduce the search space for directed protein evolution CA Voigt, SL Mayo, FH Arnold, ZG Wang Proceedings of the National Academy of Sciences 98 (7), 3778-3783	215	2001
Directed evolution: creating biocatalysts for the future FH Arnold Chemical engineering science 51 (23), 5091-5102	167	1996
A high-throughput digital imaging screen for the discovery and directed evolution of oxygenases H Joo, AArisawa, Z Lin, FH Arnold Chemistry & biology 6 (10), 699-706	133	1999
A general mechanism for network-dosage compensation in gene circuits M Acar, BF Pando, FH Arnold, MB Elowitz, A Van Oudenaarden Science 329 (5999), 1656-1660	92	2010

Tennessee Eastman process

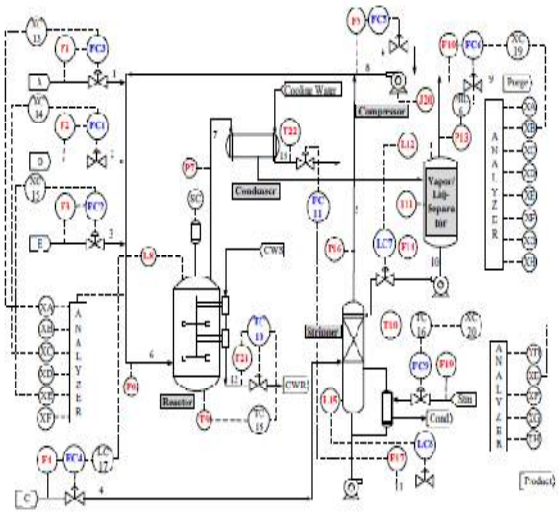


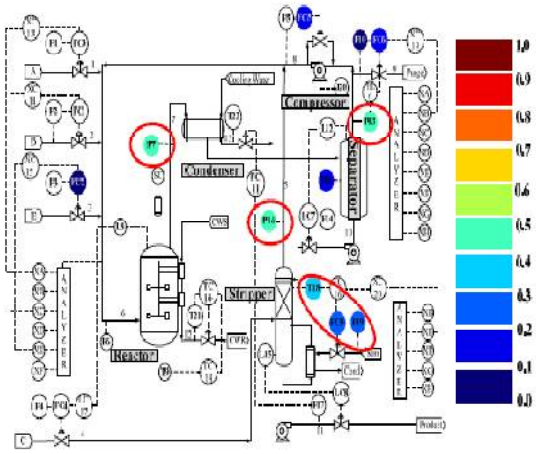
Major components forunit operation	:	: [exothermic reactor; product condenser; vapor-liquid separator; recycle compressor ; reboiled product stripper]
▶ 22 continuous process measurements, ▶ 12 manipulated variables ▶ 19 composition measurements		▶ Total # variables (=33) selected in this study: [22 continuous process measurements + 11 manipulated variables ▶ # samples: 960 normal samples with sampling rateof 3 min ▶ SPCA mode
Input to reactor: Four gaseous reactants (A, C, D, E) + inert B	→	Two liquid products (G, H) + one byproduct F

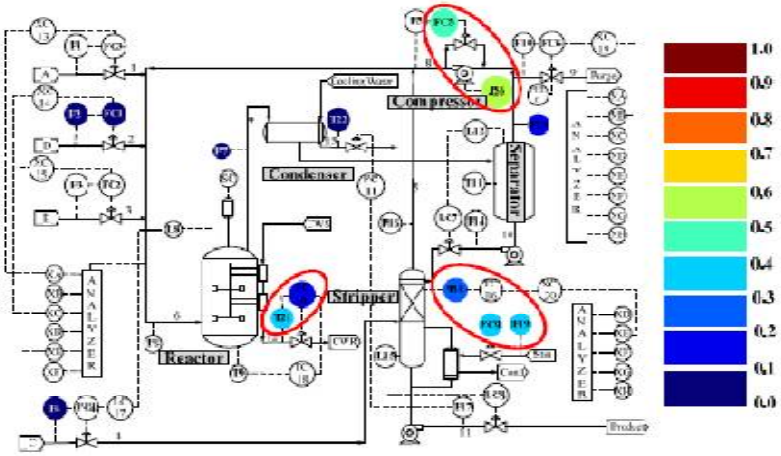


WorkFlow of SPCA method in process knowledge discovery

Process flow diagram of Tennessee Eastman process



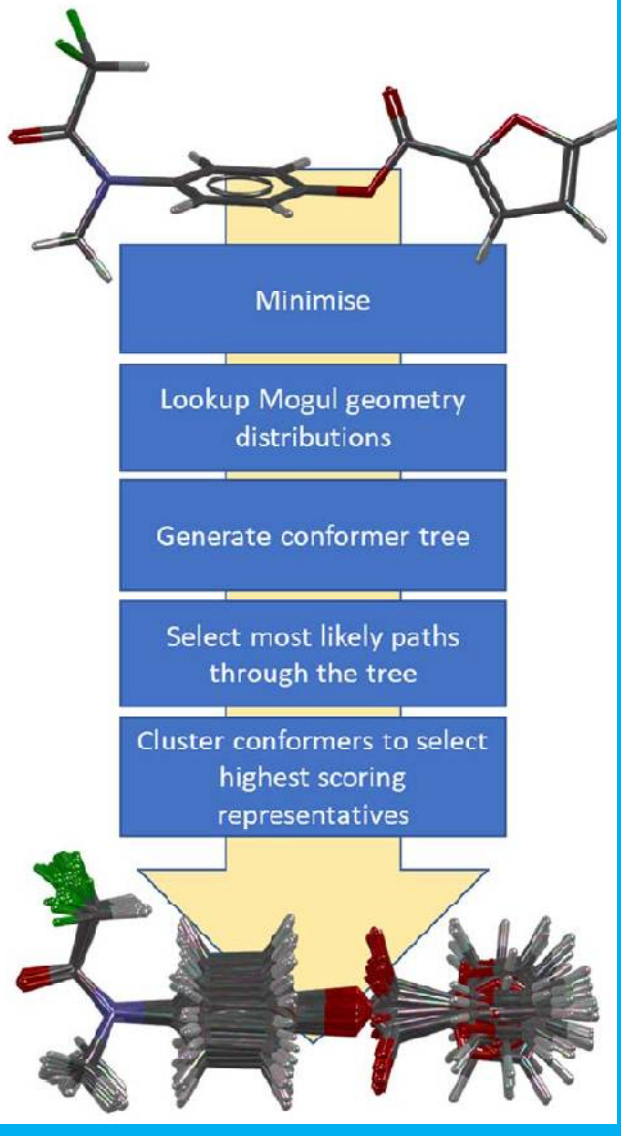




Information Source (is) ACS.org ;

Ti:Process Knowledge Discovery Using Sparse Principal Component Analysis
Au:Huihui Ga, Shriram Gajjar, Murat Kulahci, Qunxiong Zhu, Ahmet Palazoglu
JO:Industrial & Engineering Chemistry Research, 2018

Knowledge-Based Conformer Generation



Information Source (is) ACS.org ;
Ti: Knowledge-Based Conformer Generation Using the Cambridge Structural Database

Au: Jason C. Cole, Oliver Korb, Patrick McCabe, Murray Read, and Robin Taylor
JO:J. Chem. Inf. Model., 2018, 58 (3), pp 615–629
DOI : 10.1021/acs.jcim.7b00697

R. Sambasiva Rao, School of Chemistry
Andhra University, Visakhapatnam
rsr.chem@gmail.com