ISSN: 2278-1862

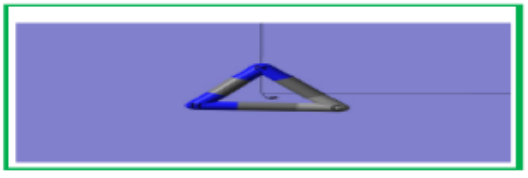
Journal of Applicable Chemistry

2018, 7 (1):276-290

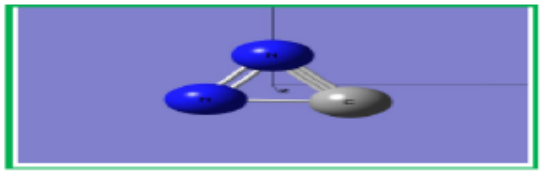
(International Peer Reviewed Journal)

New Chemistry News

$^{-}N=C=N^{-}$



New News of Chem (NNC)



ChemNewsNew (CNN)

ChemBiol– III (Science Direct)#

(A consequence of evolution in nature)

Reviews

ChemBiol: Innovative Solutions for Diverse Challenges

Chemistry & Biology 12(6)(2005)617-620
doi = 10.1016/j.chembiol.2005.06.004

[glycobiology, neurochemistry, drug discovery, molecular biophysics, and molecular genetics]

Joshua A. Kritzer, Nathan W. Luedtke

ChemBiol: Innovative Solutions for Diverse Challenges

Cur OpiniChemBiol 6(3)(2002)359-366
doi = 10.1016/S1367-5931(02)00323-X

Miniaturization: [{biochemical assay + integration of microchip-technologies} + (combinatorial library screening)]
Arrays : [Small-molecule micro-, protein ; cell-based; conventional \{DNA\}] microfluidic approaches in \{HTS\}

Julia Kh,urina, , rásGuttman

Dynamic combinatorial chemistry

Drug Discovery Today 7(2)(2002)-117-125

[differences of dynamic & traditional combinatorial chemistries;]

Sijbren Otto, Ricardo L.E Furlan, Jeremy K.M S,ers

# AAA (CNN)	JOAC, 2015, 4 (5), 1561-1573	Chemical biology-I
AAA (CNN)	JOAC, 2016, 5 (4) 894- 896	Chemical biology-II

Applications of synthetic carbohydrates to ChemBiol

Current Opinion in ChemBiol
14(3)(2010)404-411
doi = 10.1016/j.cbpa.2010.02.016

[synthetic diverse carbohydrate structures;-- glycobiology]
[carbohydrate-based drugs, vaccines, adjuvants as well as novel drug delivery systems]

"Bernd Lepenies and Jian Yin and Peter H Seeberger

Combining functional genomics and ChemBiol to identify targets of bioactive compounds

Current Opinion in ChemBiol
15(1)2011)66-78
doi = 10.1016/j.cbpa.2010.10.023

[yeast chemical genomic assays strategies for drug target identification]

CheukHei Ho and Jeff Piotrowski and Scott J Dixon and Anastasia Baryshnikova and Michael Costanzo and Charles Boone

Drug Discovery-- ChemBiol

Systems Biology and Systems Chemistry: New Directions for Drug Discovery

Chemistry & Biology
19(1)(2012)23-28
doi = 10.1016/j.chembiol.2011.12.012

[systems-level research for drug design and discovery,awareness of multiple interactions from both ligand and protein perspectives.

one-to-one drug design: adverse reactions in patients; → remedy multiple interactions from both ligand and protein

J.B. Brown and Yasushi Okuno

Structural genomics—Impact on biomedicine and drug discovery
[Special Issue Celebrating the 60-Year Anniversary of \{ECR\} and the 200-Year Anniversary of the Karolinska Institute]

Exp Cell Research
316(8)(2010)1332-1338
doi = 10.1016/j.yexcr.2010.02.041

[structural genomics → impact on biomedicine and drug discovery, ChemBiol
[purified proteins →generation of tool reagents, such as chemical probes and antibodies, → explore protein function in the cell

Johan Weigelt

Established, Emerging Trends in Computational Drug Discovery in the Structural Genomics Era

Chemistry & Biology
19(1)(2012)29-41

[compound collection preparation; virtual screening, protein docking, → systems pharmacology→ChemBiol→ drug discovery;]
[free software packages]

Drug Discovery and ChemBiol of Cancer Epigenetics

Cell ChemBiol
24(9)(2017)1120-1147
doi = 10.1016/j.chembiol.2017.08.020

[genetic mutations in epigenetic genes {CMP\}; inhibitors suitable for preclinical studies]

Bibliometry– PubChem

PubChem applications in drug discovery: a bibliometric analysis

Drug Discovery Today
19(11)(2014)1751-1756
doi = 10.1016/j.drudis.2014.08.008

[PubChem (1132 research publications)→lead identification and optimization, compound–target profiling, polypharmacology studies and unknown chemical identity elucidation] → [drug innovation and repurposing.]
[ChemBiol, medicinal chemistry and informatics]

Tiejun Cheng and Yongmei Pan and Ming Hao and Yanli Wang and Stephen H. Bryant

Metal ions--ChemBiol

Metal transporters and disease

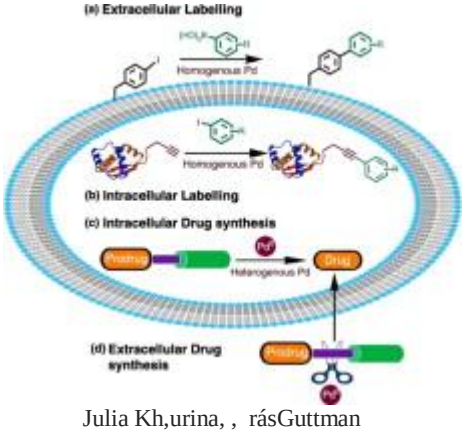
[transport of iron and copper; defects in these steps lead to human diseases like hemochromatosis, Menkes disease and Wilson disease]

Nancy C Andrews

Cur Opinion in ChemBiol
6(2)(2002)181-186
doi = 10.1016/S1367-5931(02)00307-1

Palladium-mediated chemistry in living cells

[Pd-mediated reactions in living systems; → protein modifications to in cellulo synthesis or activation of drugs]
[copper mediated catalysis]

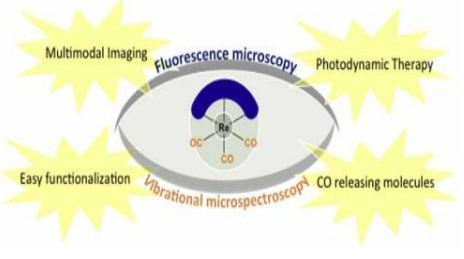


Julia Kh,urina, , rásGuttman

Cur OpiniChemBiol
21(2014)128-135
doi = 10.1016/j.cbpa.2014.07.007

Re(I) carbonyl complexes: Multimodal platforms for inorganic ChemBiol

[visualization of biomolecules]
[metal complexes]

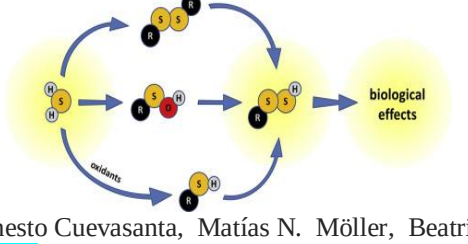


CoordChem Rev
351(2017)172-188
doi = 10.1016/j.ccr.2017.05.004

Small inorganic molecules--ChemBiol

Biological chemistry of hydrogen sulfide, persulfides

[ChemBiol of H2S]



Ernesto Cuevasanta, Matías N. Möller, Beatriz Alvarez

Archives of Biochem, Biophys
617(2017)9-125
doi = 10.1016/j.abb.2016.09.018

The chemistry of nitroxyl (HNO) and implications in biology

[most common donors of \{HNO\}
current understanding of the aqueous chemistry of \{HNO\}
synthesis, consumption and reactivity of \{HNO\} in a cellular environment]
[cellular signaling and pharmacological potential of \{NO\}]

Katrina M. Miranda

CoordChem Rev
249(3-4)(2005)433-455
doi = 10.1016/j.ccr.2004.08.010

Protein (Function) -- ChemBiol

Chemical Strategies for Controlling Protein Folding, Elucidating the Molecular Mechanisms of Amyloid Formation, Toxicity

Journal of Molecular Biology
421(2-3)(2012)204-236
doi = 10.1016/j.jmb.2012.01.051

[protein folding/misfolding/ aggregation →effect in health/ disease]→ [chemistry, biology interface]

Timothy N Lambert, Bradley D Smith

Helix mimetics: Recent developments

Progress in Biophysics, Molecular Biology
119(1)(2015)33-40
doi = 10.1016/j.pbiomolbio.2015.05.001

[small molecule α-helix mimetics (proteomimetic); protein–protein interaction (PPIs) inhibitors]

The recombinant protein array: use in target identification and validation

Drug Discovery Today: \{TARGETS\}
3(6)(2004)246-252
doi = 10.1016/S1741-8372(04)02460-0

[protein function recombinant protein arrays]
[diversity of proteins produced]
[human genome :~30,000 genes→encode up to a million different proteins]

Mark J. Schofield and Neil Sharma and Hui Ge

The ChemBiol of Apoptosis: Exploring Protein-Protein Interactions and the Life and Death of Cells with Small Molecules

Chemistry & Biology
9(10)(2002)1059-1072
doi = 10.1016/S1074-5521(02)00247-8

[small molecules targeted to proteins of the Bcl-2 and \{IAP\} families.
[basic mechanism of molecule recognition underling the life and death of cells]

Ziwei Huang

Chemical 'omics' approaches for understanding protein cysteine oxidation in biology

Current Opinion in ChemBiol
15(1)(2011)88-102
doi = 10.1016/j.cbpa.2010.11.012

[redox proteomics: oxidative biochemistry in health and disease]
[ChemBiol→ direct detection of specific cysteine oxoforms based on their distinct chemical attributes]

Stephen E Leonard and Kate S Carroll

Membrane binding of lipidatedRas peptides and proteins — The structural point of view

Biochimica et BiophysicaActa (BBA) – Biomembranes
1788(1)(2009)273-288
doi = 10.1016/j.bbamem.2008.08.006

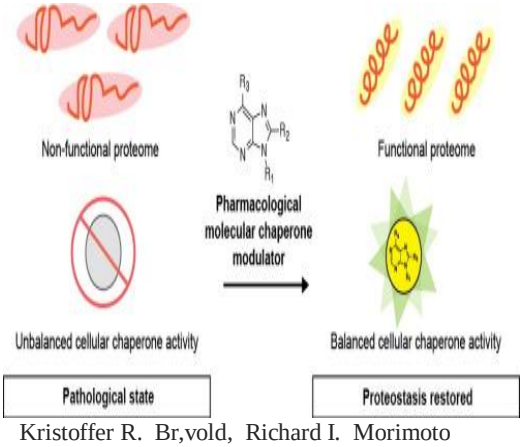
[ChemBiol of Ras: biophysical and structural features of the membrane bound C-terminus of the protein]

Luc Brunsveld and Herbert Waldmann and Daniel Huster

The ChemBiol of Molecular Chaperones—Implications for Modulation of Proteostasis

J Mol Biology
427(18) (2015) 2931-2947
doi = 10.1016/j.jmb.2015.05.010

[misfolding, aggregation,, aberrant regulation of cell stress responses;]→ [increasing the risk for diseases]
[role of molecular chaperones in [protein synthesis, folding, disaggregation,, degradation; ChemBiol of proteostasis;]



Kristoffer R. Br,vold, Richard I. Morimoto

Protein semi-synthesis: New proteins for functional and structural studies

Biomolecular Engineering
22(5-6)(2005)153-172

[protein structure and function] at the level of [isolated molecules, cells and organisms]

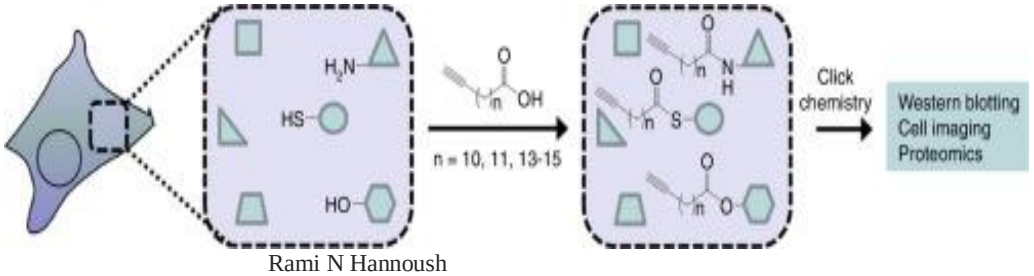
Intein or protein introns:A segment of a protein that is able to excise itself and join the remaining portions (the exteins) with a peptide bond in a process termed protein splicing.

Thomas Durek and Christian F.W. Becker

Synthetic protein lipidation

Cur Opinion in ChemBiol
28(2015)39-46doi =
10.1016/j.cbpa.2015.05.02
5

Protein fatty acylation: [palmitoylation ; myristoylation] modulation → influence on human physiology and diseasei.e.ChemBiol



Rami N Hannoush

ChemBiol Methods for Investigating G Protein-Coupled Receptor Signaling

Chemistry & Biology
21(9)(2014)1224-1237
doi = 10.1016/j.
chembiol.2014.08.009

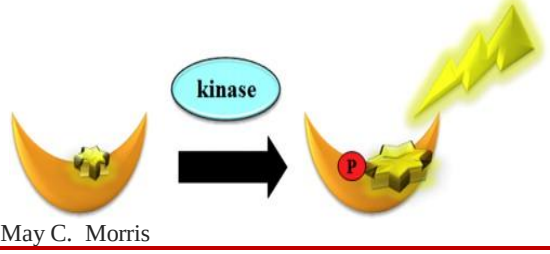
[bioorthogonal functional groups on \{GPCRs\}; bioorthogonal chemical reactions]
[conformational dynamics of \{GPCR\} signaling complexes ("signalosomes")]
[time-resolved information using receptors tagged with fluorescent or structural probes]

author = "Thomas Huber and Thomas P. Sakmar

Fluorescent biosensors — Probing protein kinase function in cancer and drug discovery

Biochimica et BiophysicaActa (BBA) - Proteins and Proteomics
1834(7)(2013)1387-1395
doi = "
10.1016/j.bbapap.2013.01.025

[visualize biomolecules in their natural environment, in real-time and in a non-invasive fashion,→
to gain insight into their physiological behavior and highlight alterations in pathological settings→ to devise appropriate therapeutic strategies]

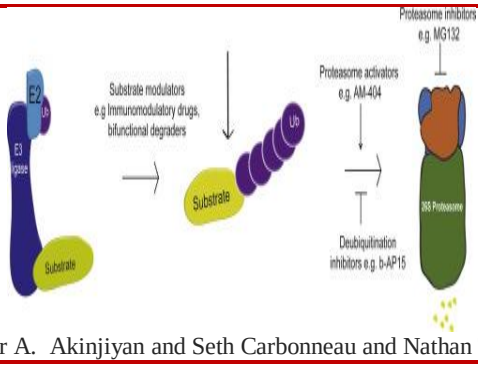


May C. Morris

Lead discovery and ChemBiol approaches targeting the ubiquitin proteasome system

Bioorganic & Medicinal Chemistry Letters
27(20)(2017)4589-4596
doi = 10.1016/j.bmcl.2017.08.058

[screening methods and ChemBiol tools]
[Protein degradation --- proteostasis]



Favour A. Akinjiyan and Seth Carbonneau and Nathan T. Ross

Omics - ChemBiol

'Omic' approaches for unraveling signaling networks

Current Opinion in Cell Biology
14(2)(2002)173-179
doi = 10.1016/S0955-0674(02)00315-0

[genomics + proteomics → global analysis of cell signaling]
[gene expression, protein–protein interaction methods, protein microarrays, mass spectroscopy and gene-disruption]

Heng Zhu and Michael Snyder

RNA/ DNA -- ChemBiol

Targeting the eIF4A \{RNA\} helicase as an anti-neoplastic approach

Biochimica et BiophysicaActa (BBA) - Gene Regulatory Mechanisms
1849(7)(2015)781-791
doi = 10.1016/j.bbagrm.2014.09.006

[eIF: eukaryotic initiation factor]
[cellular regulation of eIF4A activity and its potential as a therapeutic target]
[Translation and Cancer]

Jennifer Chu and Jerry Pelletier

Mechanism of interaction of small transcription inhibitors with \{DNA\} in the context of chromatin and telomere

Biochimica et BiophysicaActa (BBA) - Gene Regulatory Mechanisms
1799(10-12)(2010)795-809

[prokaryotic and eukaryotic organisms] → transcription apparatus in the cell --- genomic \{DNA\}association withproteins[ChemBiol]

Saptaparni Ghosh and ParijatMajumder and Suman Kalyan Pradhan and Dipak Dasgupta

Labeled ChemBiol tools for investigating sphingolipid metabolism, trafficking and interaction with lipids and proteins

Biochimica et BiophysicaActa (BBA) - Molecular and Cell Biology of Lipids
1841(8)(2014)1161-1173
doi = 10.1016/j.bbalip.2013.12.011

[fluorescent and/or radio-labeled and other artificial substrates, (mechanism-based) enzyme inhibitors, cross-linking probes or artificial membrane models
[Tools to study lipid functions]

Paul Workman and Ian Collins

Mimicry of bioactive peptides via non-natural, sequence-specific peptidomimetic oligomers

Current Opinion in ChemBiol
6(6)(2002)872-877
doi = 10.1016/S1367-5931(02)00385-X

[Non-natural, sequence-specific peptidomimetic oligomers are being designed to mimic bioactive peptides, with potential therapeutic application]
[Pseudo-tertiary structure in β-peptides and peptoids may herald the creation of entirely artificial proteins]

James A Patch and Annelise E Barron

Protein-X interactions

X: [protein; small molecule; [metal ion complex; organic solvent; amino acid]]

Post-translational myristoylation: Fat matters in cellular life, death

Biochimie
93(1)(2011)-18-31
doi = 10.1016/j.biochi.2010.10.018

[Myristoylation; protein-membrane interactions as well as protein–protein interactions] → [health; disease]
[functions of Myristoylated proteins: signalling pathways, oncogenesis or viral replication]

Dale D.O. Martin, Erwan Beauchamp, Luc G. Berthiaume

Neutralizing endogenous chemokines with small molecules: Principles and potential therapeutic applications

Pharmacology & Therapeutics
126(1)(2010)39-55
doi = 10.1016/j.pharmthera.2009.12.003

[Regulation of cellular responses to external stimuli such as hormones, neurotransmitters, or cytokines is achieved through the control of all steps of the complex cascade starting with synthesis, going through maturation steps, release, distribution, degradation and/or uptake of the signalling molecule interacting with the target protein
[ligand neutralization and tries to determine to what extent small chemical molecules could substitute for neutralizing antibodies in therapeutic approaches]

Jean-Luc Galzi and Muriel Hachet-Haas and Dominique Bonnet and Francois Daubeuf and Sandra Lecat and Marcel Hibert and Jacques Haiech and Nelly Frossard

Synthetic receptors for phospholipidheadgroups;35 Years of Synthetic Anion Receptor Chemistry 1968-2003

Coordination Chemistry Reviews
240(1-2)(2003)129-141
doi = 10.1016/S0010-8545(02)00257-6

[biological phospholipid receptors; synthetic receptors reported;]
[tools of ChemBiol→pharmaceuticals; Small molecules that recognize phospholipids selectively]

Timothy N Lambert, Bradley D Smith

Revisiting bleomycin from pathophysiology to safe clinical use

Critical Reviews in Oncology/Hematology
87(1)(2013)90-100;
doi = 10.1016/j.critrevonc.2012.12.003

[molecular pharmacology; bleomycin; curative chemotherapy-Hodgkin lymphoma (HL), testicular germ-cell tumours (GCT)]

MariosFroudarakis, EleftheriaHatzimichael, LydiaKyriazopoulou, Konstantinos Lagos, Periklis Pappas, , reas G. Tzakos, Vasilis Karavasilis, DanaiDaliani, Christos Pap,reou, EvangelosBriasoulis

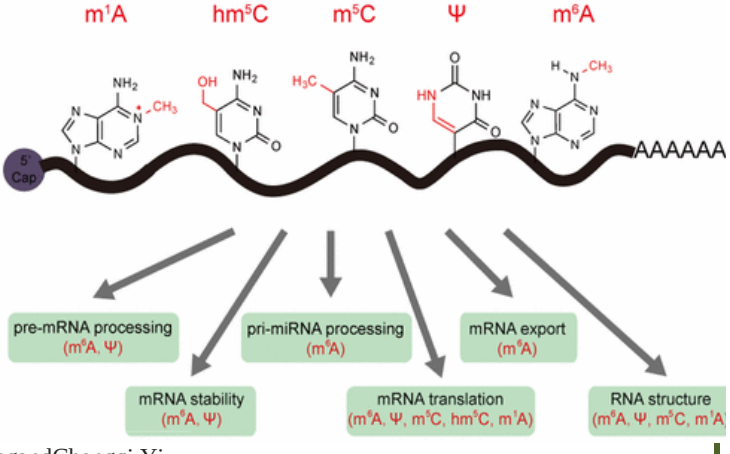
ChemBiol – III (ACS)

Chemical Modifications to RNA: A New Layer of Gene Expression Regulation

ACS Chem. Biol., 2017, 12 (2), pp 316–325
DOI: 10.1021/acschembio.6b00960

Epitranscriptomics: multitude of RNA modifications

chemical modifications to mRNA;
dynamic modifications to RNA have been identified in the transcriptome, including N6-methyladenosine (m6A), inosine (I), 5-methylcytosine (m5C), pseudouridine (Ψ), 5-hydroxymethylcytosine (hm5C), and N1-methyladenosine (m1A) – collectively called epitranscriptome

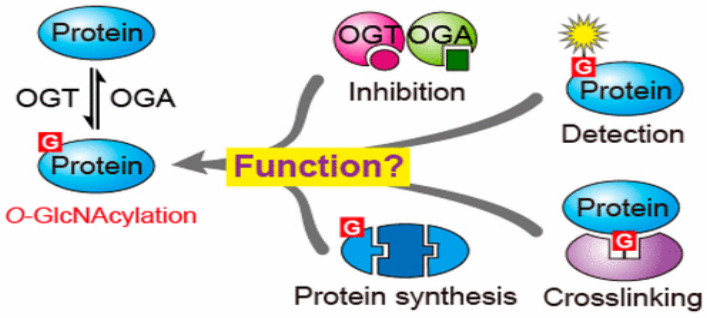


JinghuiSongandChengqi Yi

Deciphering the Functions of Protein O-GlcNAcylation with Chemistry

ACS Chem. Biol., 2017, 12 (2), pp 326–335
DOI: 10.1021/acschembio.6b01065

precise role of dysregulation of O-GlcNAcylation and its cycling enzymes (OGT and OGA) in normal and disease states (diabetes, cancer, and Alzheimer's disease) remains elusive--
gaps in our toolbox for studying O-GlcNAcylation

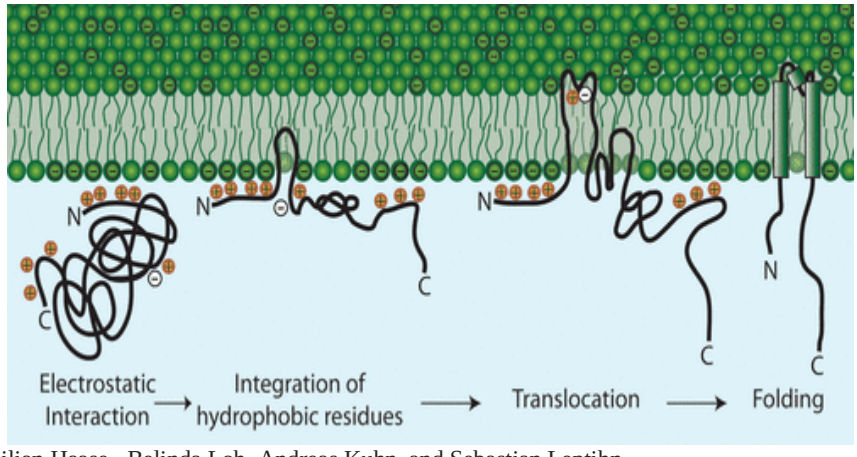


Matthew Worth, Hao Li, and Jiaoyang Jiang

Mechanism of the Spontaneous and Directional Membrane Insertion of a 2-Transmembrane Ion Channel

ACS Chem. Biol., 2017, 12 (2), pp 380–388
DOI: 10.1021/acschembio.6b01085

[insertion of model protein KcsA, a 2-transmembrane ion channel—] Thermodynamic parameters—
electrostatic interactions between membrane and protein
charged amino acids are crucial for the insertion of the unfolded protein into membrane



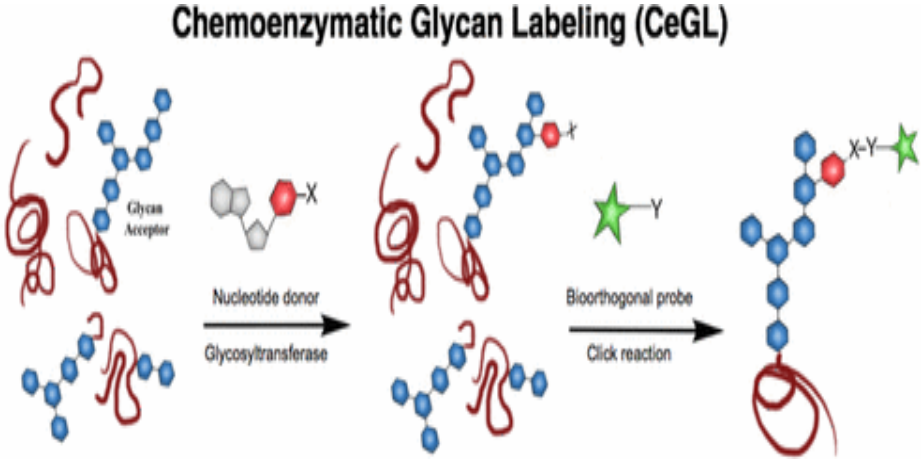
Steffen Altrichter, Maximilian Haase, Belinda Loh, Andreas Kuhn, and Sebastian Leptihn

Tools for Studying Glycans: Recent Advances in Chemoenzymatic Glycan Labeling

ACS Chem. Biol., 2017, 12 (3), pp 611–621
DOI: 10.1021/acschembio.6b01089

[Human health and diseaseand target validation --
functional roles of glycans]

[Chemoenzymatic glycan labeling (CeGL)] –
available to characterize cell-surface and intracellular glycans
Appl: imaging glycan expression status in live cells and tissue samples, proteomic analysis of glycoproteins



Aime Lopez Aguilar, Jennie Grace Briard, Linette Yang, Ben Ovryn, Matthew Scott Macauley, and Peng Wu

sciencedirect.com (SD): Information Source (is)
Acs.org (ACS): Information Source (is)

Object Oriented Vocabulary of
ChemBiology

Biological system	→	Single_Speciesor organism [[combination → cell →cell division → … fetes ….]; → birth →growth [health; disease]; death; → ….]
Single_Species	→	Set of [organs; cells; tissues;; biological fluids; …] at a specific instant of time
Each organ	→	Multiple cells [Multiple functions]
Cell	→	🕮 Composition:[[Two-thirds of a cell is water]; [mixture of proteins; lipids; carbohydrates] [DNA; multitude of compounds] 🕮 Building blocks of life: basic structural, functional, and biological unit of all known living organisms; smallest unit of life that can replicate independently. 🕮 Cells transform raw materials in the food eaten into the molecules the body needs, using thousands of different chemical reactions. Cell means "small room" from Latin word cella [living cells; dead cells]
Living cells	→	Composed of molecules that collectively provide a chemical environment. When energy provided, it continues function, adapts to the environment and reproduces
Dead cells	→	[Ex. Hair; finger nails; hard portion of bones]

Life	→	[Origin [Basic requirements]; evolution (past, present, future); [extinct in past; now existing; originating in future(near; far off)] Environment for habitability [necessities; Limits beyond which species die]
Life on $$	→	[solar system; elsewhere [galaxy]]
Life on solar system	→	[Life_on earth; Life on (in) Sun; Life on Mars]
Life_on earth $$	→	[terrestrial[surface; inside]; [arboreal(on trees)]; aquatic [marine; riverine;], atmospheric]
Life_ on Mars	→	[Mars rover 2020]

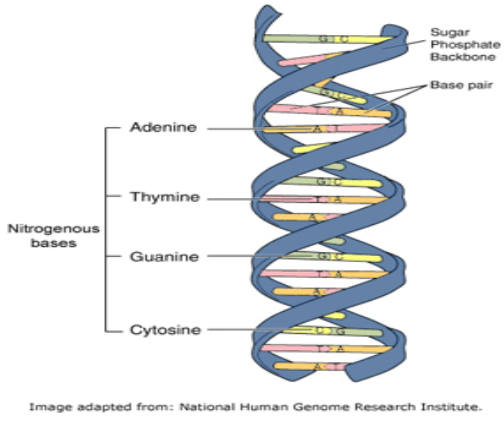
… →Phenomenon → perceived →science → simulated → compared→ ….

What is 'Life'?	Life is what it is. Life is not what it is not.
How much Science knows it today?	Wait to know more!!
Known with what accuracy	Truth value increases and falsehood decreases with time and perception

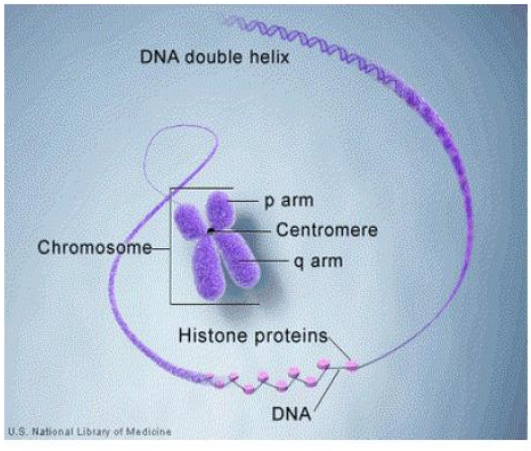
Environment conditions	→	[Temperature, pressure, nutrient concentration, atmospheric composition of gases; Light; gravity, electro-magnetic radiation; …]
Terrestrial	→	[normal environment; extreme env]
Extreme env	→	[Temperature; Pressure; light; nutrient concentration]
Temperature_extreme zones	→	[Hydro thermal vents (upto 400oC) [deep sea]; geo-thermal hot springs]; extremely cold (sea ice); salt conc [high salinity; high con of compounds]
Habitable zones_life	→	[Universe[……[solar system [earth[moon]; Mars []; …Jupitor]]
Habitable zone (HZ)	→	A region of space where environmental conditions are best for life to form and survive. The synonyms of HZ are "life zone", "comfort zone", "green

		belt".
Living organisms	→	$$_phile : [Mesophiles or Neutrophils; Extremophile]
Extremophile	→	It is an organism that thrives and lives in physically or geochemically extreme conditions ofpressure and temperature that are detrimental to most life on Earth. Ex.: Bacteria often form on the rocks near the hydrothermal vents.
Mesophiles or Neutrophils	→	organisms that live in moderate environments prevalent on earth

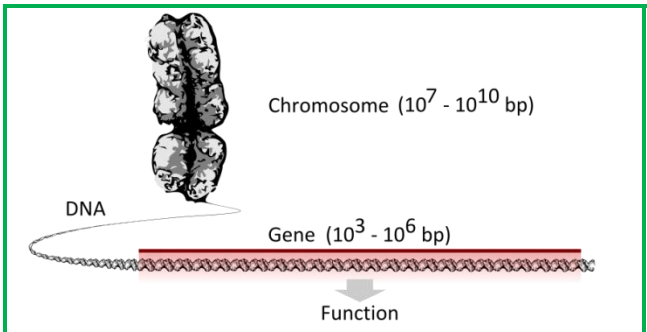
Chromosome	→	[Chromosomes are strings of genes] ; protein +single molecule DNA]
DNA	→	[DNA molecule stores the code for building living bodies in genes]→ DNA chain made from nucleotide subunits (adenine, cytosine, guanine, and thymine which are nitrogen-containing bases), each composed of: a five-carbon sugar (2'-deoxyribose), a phosphate group and nucleic acids of joined by sugar-phosphate backbone (specific instructions that make each type of living creature unique)
Genes	→	[gene is segment of DNA] instruct cells to produce particular proteins, which in turn determine traits
	→	DNA copied to RNA
RNA	→	RNA [directly functional or intermediate template] for a protein
Protein	→	Performs a function → amino-acid → functional groups → atoms
	→	[nature (in vivo of Biosystems); Laboratory (in vitro); Virtual PM (computational);]
Protein machine:		
Protein design methods	→	[De novo] [biotechnology and chemical biology] Computational;
Protein characteristics	→	fold, fold faster, catalyze, catalyze faster, signal, adopt preferred conformational states
Protein functions	→	[structural, catalytic, sensory, regulatory]

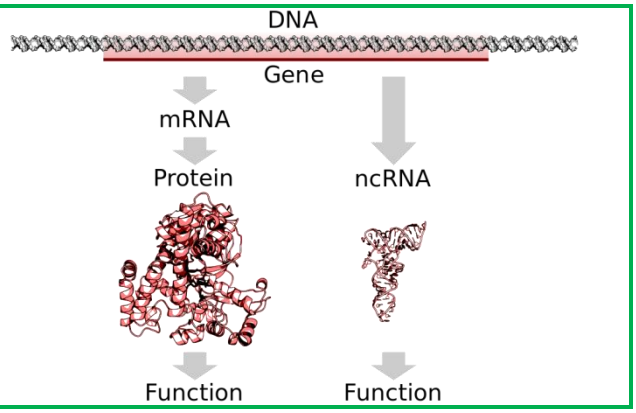


The DNA double helix showing base pairs

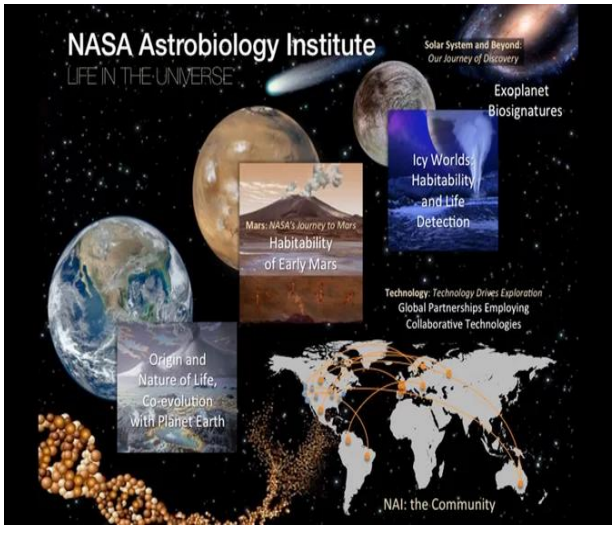


The packaging of DNA into chromosomes





Physiological enzymology,	Quantifies the function and regulation of enzymes and proteins at the cellular level Special Issue entitled: Physiological Enzymology and Protein Functions. " doi = "https://doi.org/10.1016/j.bbapap.2015.07.011",
Projects_Life exploration	Mars [Phoenix: pathfinder; Global surveyor; …] Titan [Cssini Huygens] Mars Exploration Rovers, the Mars Phoenix Lander (Kepler, James Webb Space Telescope) →searching for Earth-like planets around other stars
Probes (instruments)	[temperature and mineralogy on Mars] ← Mars Odyssey and the Mars Reconnaissance Orbiter [signs of past life on Mars] ←Mars Science Laboratory [sources and sinks of CO2 on Earth] ←Orbiting Carbon Observatory-2



Disciplines in different bands energy and surroundings

From	→	To
Blobology		Chemistry
BioChemistry		Chemistry
…..		

From	→	To
Chemistry		Physics
Physical chemistry		Physics
Chemical Physics		Physics

From	→	To
Physics		Quantum Physics

From	→	To
Physics		Energy

		Particle Physics
		….

Glowing flash in the middle:
WHL J24.3324-8.477 A **brightest galaxy**
Each glowing speck is a distinct galaxy
(Detector: NASA/ESA Hubble Space Telescope);

DefBase.ChemBiol	
Astronomy	🕮 Formation, functioning and interaction of stars, galaxies, planets, moons, asteroids, comets and nebulae 🕮 Explains supernovae explosions, gamma ray bursts, and cosmic microwave background radiation. 🕮 The physics, chemistry, and evolution of such objects, and phenomena that originate outside the atmosphere of Earth. 🕒 Probes of research: Telescopes and radio dishes are used from the surface of the Earth to study visible light, near infrared light, and radio waves (E-M Band) 🕒 Exoplanet (extrasolar planet) is a planet that orbits a star other than our own
Astrophysics	Space science probing with laws of physics to explain the birth, life and death of stars, planets, galaxies, nebulae and other objects in the universe.
Astro (or Cosmo) chemistry	Processes and chemical composition of matterprimarily through the study of the chemical composition of meteorites and other physical samples in the universe over time. The basis is that the asteroid parent bodies of meteorites were some of the first solid material to condense from the early solar nebula.
Astrobiology	▪ Search for life beyond the Earth in our solar system and then in universe (Exobiology) ▪ Tools in vogue are knowledge in astronomy, biology, chemistry, geology, atmospheric science, oceanography and m ▪ g of planetary/ stellar processes ▪ Search for and study of life elsewhere in the universe.
Bioorthogonal chemistry	Chemical reaction that can occur inside of living systems without interfering with native biochemical processes. The term was coined by Carolyn R. Bertozzi in 2003.
Chemical genetics	Complementary approach involving the use of small molecules capable of either inactivating or activating their targets Use of small molecule compounds to perturb a biological system to explore the outcome. Chemical genetics is also used to describe the technique of screening for small molecule modulators.

Chemical probes for interrogating biological processes	✓ [Cell permeable small molecule tools] ✓ Objective : minimizing the generation of poor quality and misleading biological data, thus increasing understanding of the particular biological area ✓ Goal:basic research and drug discovery
Chemical proteomics	☼ Detects proteomes with specific chemical molecules that interact with target proteins ◷ [Mass spectrometry-based affinity chromatography approach] → identifies proteome-wide small molecule–protein interactions.
How to understand biology	? Selectively perturb with external stimuli and observe (measure) the consequent response of a bio-system ? With model systems; model compounds; model processes ? In-vitro studies ? In-vivo probes ? Evolutionary knowledge ? Synthetic(artificial) bio-systems

Interdisciplinary sciences
(Binary,Ternary,Quaternary)

Sciences :

[Mathematical [Pure_Mathematics; Statitics; Nature_ mimicking algorithms]
Physical [Physics; chemistry;
Natural [Biology
Applied [Geology; Oceanography; Astronomy;
…..
]

Unary					Binary	
					A + B → physics → chemistry	A + B → chemistry physics →
					Physics[of $$ in]	$$ [of Physics in]
	Physics	+	Chemistry	→	Physical Chemistry	Chemical Physics
Physics	Physics	+	Astronomy	→	Physical Astronomy	Astro(logical) Physics
Chemistry	Physics	+	Biology	→	Physical Biology	Bio(logical) Physics
Astronomy						
Biology	Chemistry	+	Astronomy	→	Chemical Astronomy	Astro Chemistry
….	Chemistry	+	Biology	→	Chemical Biology	Biological Chemistry
….						
	Astronomy	+	Biology	→	Astro Biology	Biological Astronomy

Ternary

Chemistry	+	Biology	+	Astronomy	→	☼ Chemistry of (biological astronomy) ☼ Chemistry of (astro biology) ☼ ☼ Biology of (chemical astronomy) ☼ Biology of (astro chemistry) ☼ ☼ Astro (Chemical biology) ☼ Astro (Biological chemistry)
Chemistry	+	Biology	+	Physics	→	☼ Chemistry of (biological physics) ☼ Chemistry of (physics of biology) ☼ ☼ Biology of (chemical physics) ☼ Biology of (physics of chemistry) ☼ ☼ Physics (Chemical biology) ☼ Physics (Biological chemistry)

Quaternary

Physics	+	Chemistry	+	Astronomy	+	Biology	→	● Physics of (chemical (astro biology)) ● Physics of (astrochem biology) ● Physics & chemistry of (astro biology) ● Chemistry of (Physics of (astro biology)) ● Physics and/or Chemisty and/or PhysChem and/or ChemPhys/ (astrobiology)

		Mathematical Sciences
Mathematical Sciences		[[Mathematics [Algebra [linear; Boolean; operator]; Functional analysis;]; Statistics; Fuzzy theory; Possibility [St+Fuzzy]; Nature_inspired_methods]

Omni_metrics	**Discipline**
bio_metrics	Biology

Omni_omics	
Gen_omics	Genetics
Epige_omics	epigenetics

Medicino_metrics	Medicine
Pharmaco_metrics	Pharmacy
Pisci_metrics	Fisheries
Chemo_metrics	Chemistry
Environ_metrics	Environment
Kineto_metrics	Kinetics
Specio_metrics	Species
Biblio_metrics	Bibliography
Performance_metrics	Performance
Metrics_metrics]	Measurement

Prote_omics	Protein
Metabol_omics	metabolome (Small molecule metabolic products- metabolytes)
Splice_omics	splicing
Pharmacogen_omics	Pharmacogenetics
Transcript_omics]	Transcriptome

Omni_$$$		[-ics; -omics; -istry; -ology; -metrics]

Measurement (Direct/ indirect) + Mathematical tools

Metrics + Computation → parameters →→→ Information extraction Informatics

Chemistry	+	Informatics	→	Chemo_informatics
Biology	+	Informatics	→	Bio_informatics
Chemical biology	+	Informatics	→	ChemBiol_informatics

Informatics_in_ Future: Imbibes Kids (knowledge, intelligence and data systems) with hierarchical/parallel/sequential links governed by meta(-meta) Kids

Tools or toolboxes	[Chemometrics; System_Biology; Chemical Biology; [Mensuration; Mensurometrics [Instrumentation; [Models; solutionMethods [Knowledge_eXtration]

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