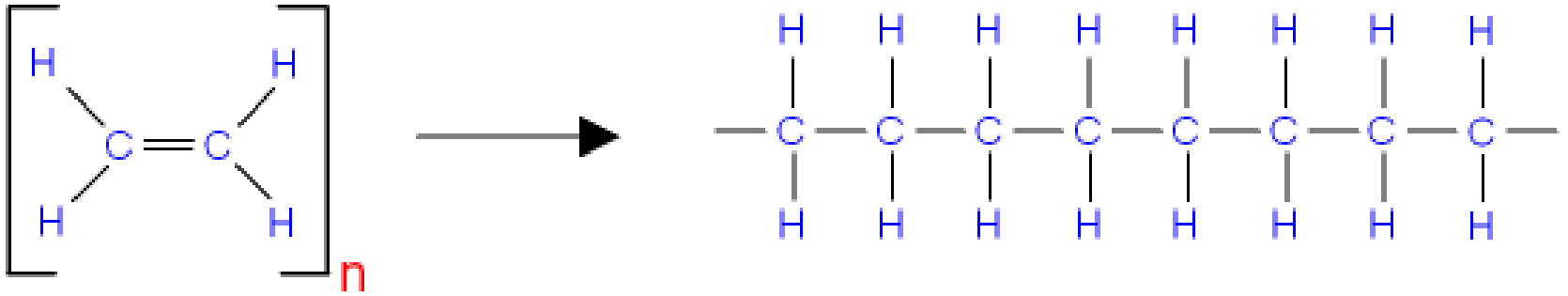
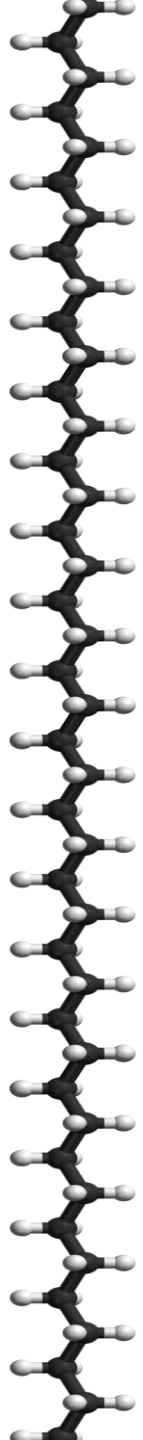
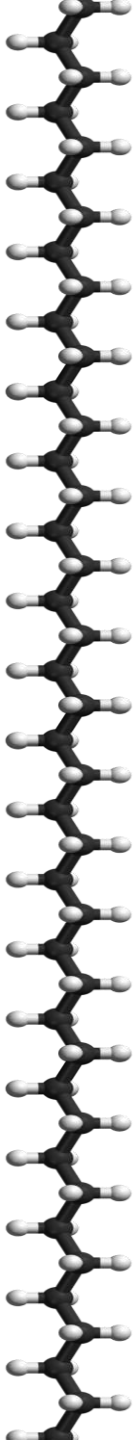
Plastik



Dr. René M. Oetterli MRSC

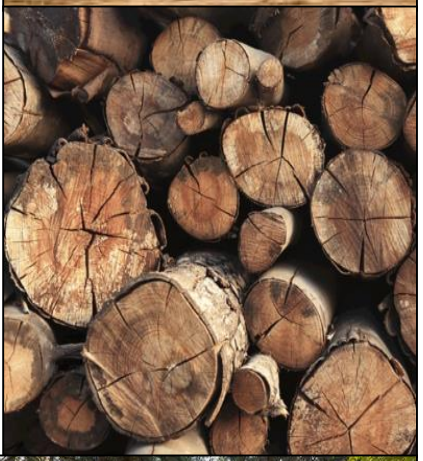


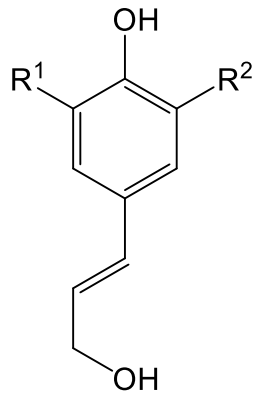
Das Prinzip Polymer



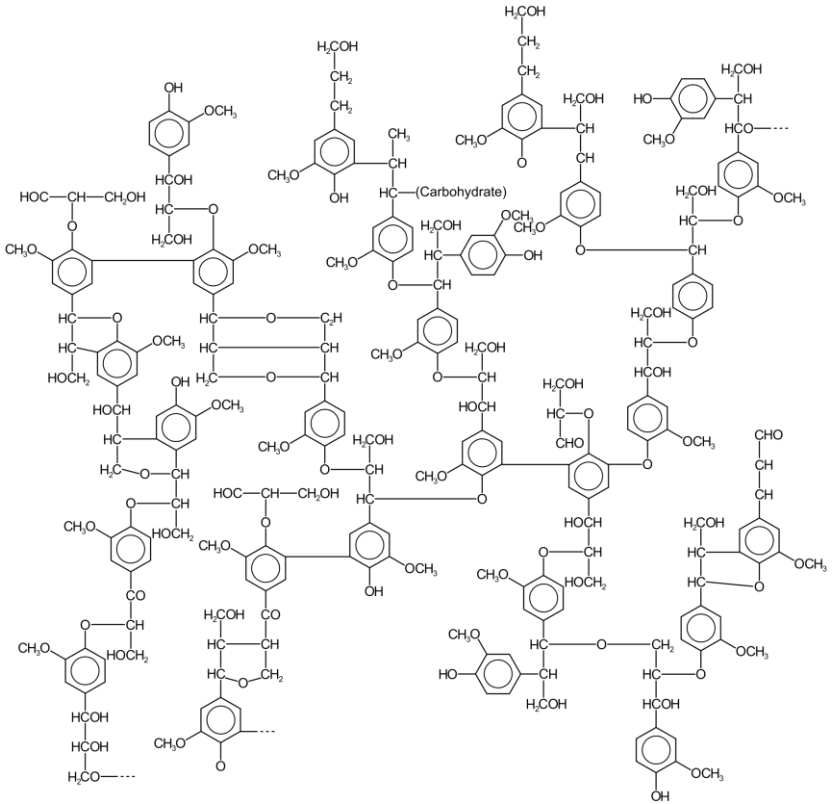
Lignin

Holz





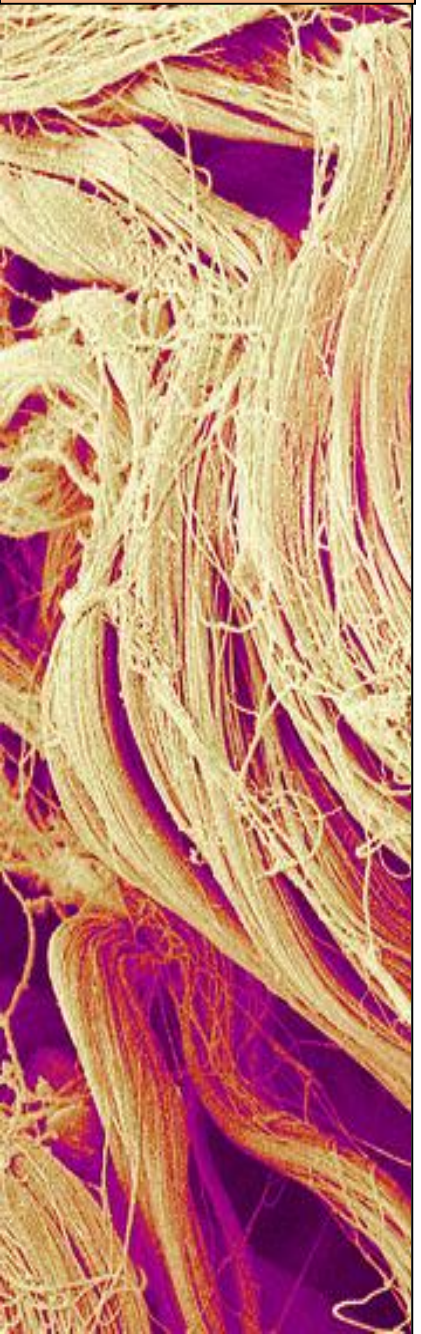
Lignol

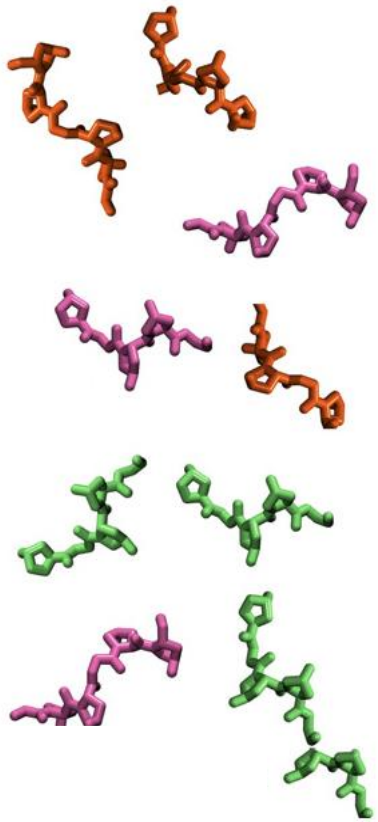


Lignin

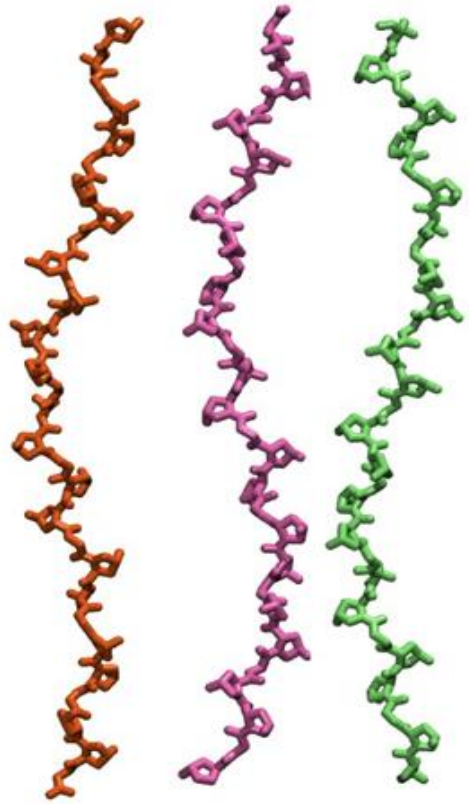
Kollagen

Haut



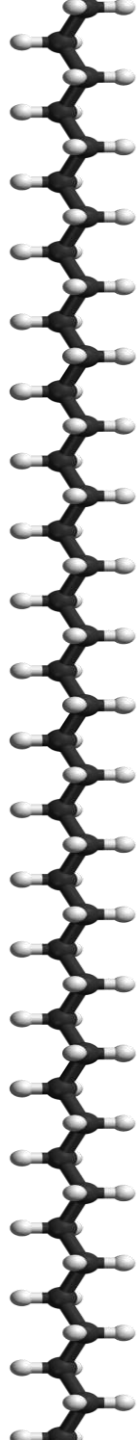


Kollagen Tripeptid



Kollagen Alphaketten

Kollagen



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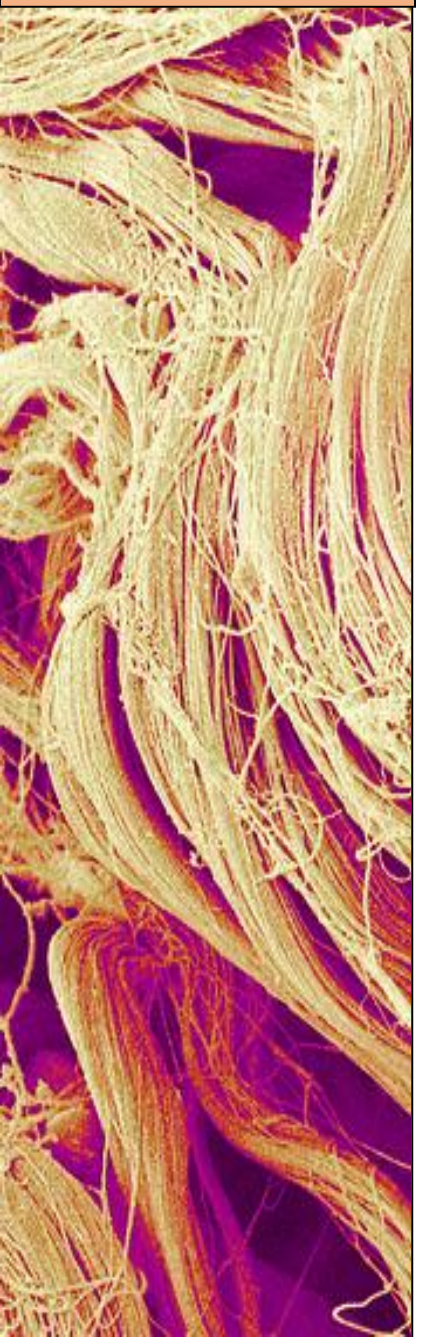

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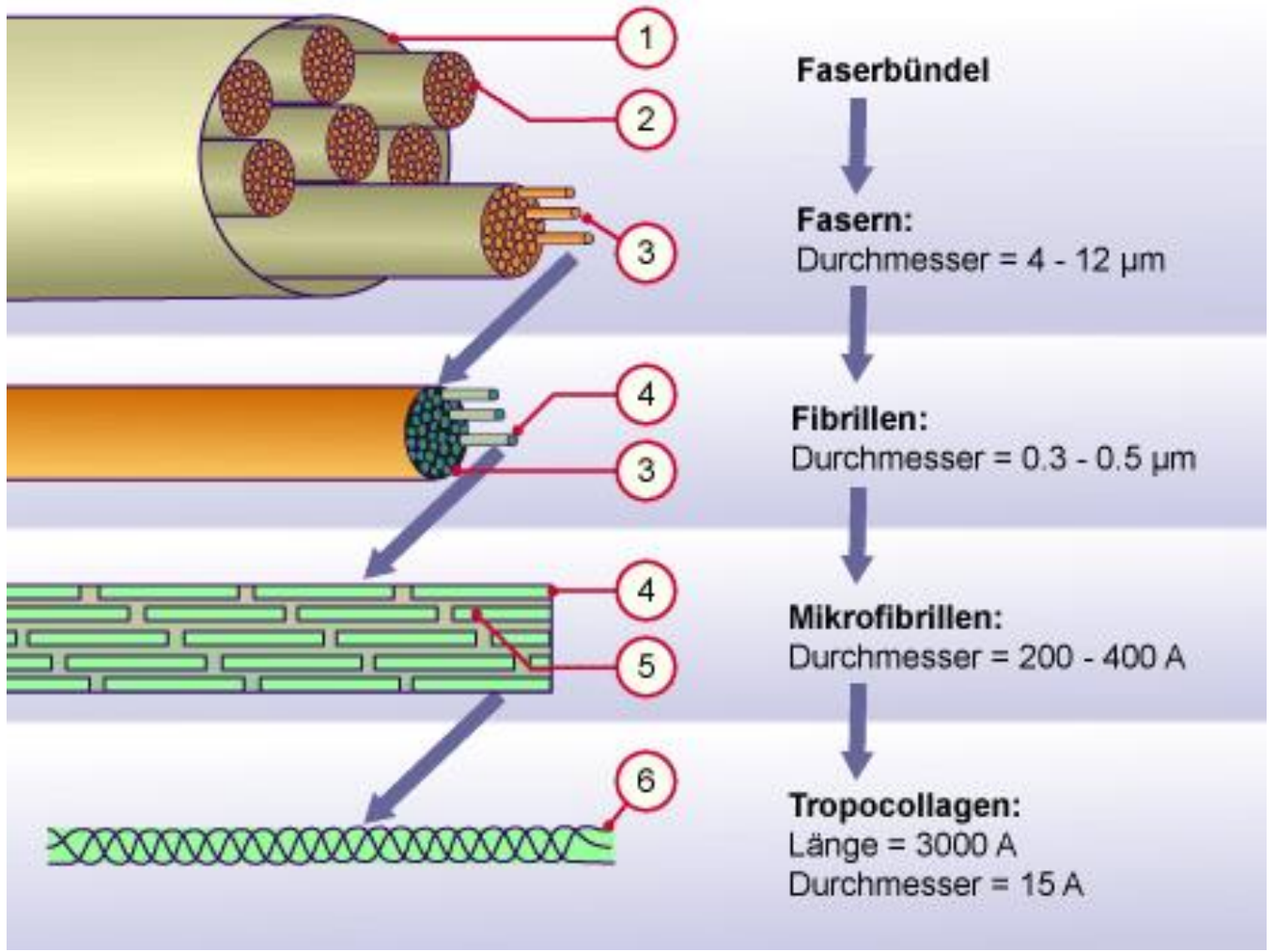
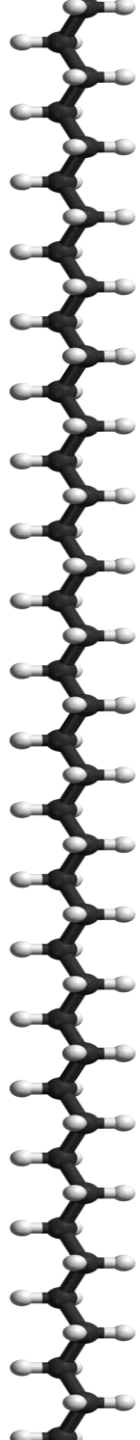
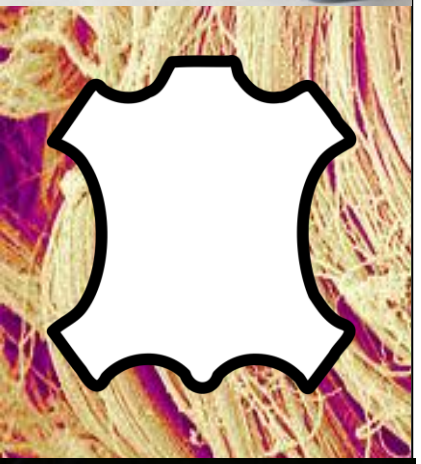




Kollagen

Haut → Leder



Kollagen

AKTUELLE FORSCHUNG

Scientists Create Super-Strong Collagen

Acta Biomater. 2020 Mar 1;104:95-103. doi: 10.1016/j.actbio.2019.12.026. Epub 2019 Dec 23.

Combination and processing keratin with lignin as biocomposite materia manufacturing technology.

Grigsby WJ[1], Scott SM[2], Plowman-Holmes MI[2], Middlewood PG[2], Recabar K[3].

Tissue Eng Part A. 2020 Jan 9. doi: 10.1089/ten.TEA.2019.0181. [Epub ahead of print]

***In Vivo* Evaluation of Three-Dimensional Printed, Keratin-Based Hydrogels in a Pc Burn Model.**

Navarro J[1,2], Clohessy RM[3], Holder RC[3], Gabard AR[3], Herendeen GJ[3], Christy RJ[4], Burnett LR[3], Fisher JP[1,2].

Polymers (Basel). 2019 Dec 23;12(1). pii: E32. doi: 10.3390/polym12010032.

Keratin Associations with Synthetic, Biosynthetic and Natural Polymers: An Exte

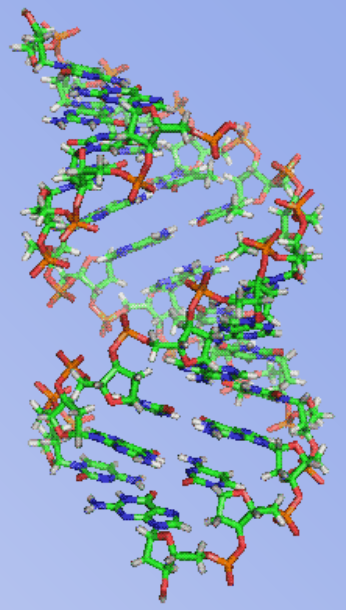
Donato RK[1,2], Mija A[2].

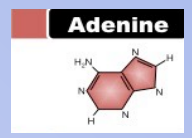
Biomater Sci. 2019 Nov 19;7(12):5451-5466. doi: 10.1039/c9bm01098j.

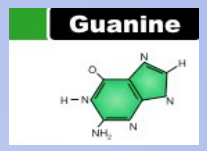
Enhanced performance of chitosan/keratin membranes with potential applicatio nerve repair.

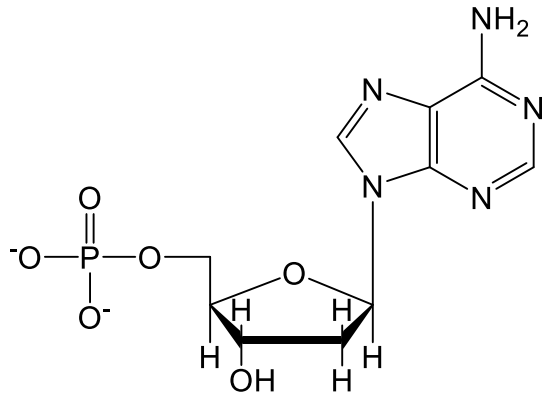
Carvalho CR [1], Costa JB , Costa L , Silva-Correia J , Moay ZK , Ng KW , Reis RL , Oliveira JM .

DNA

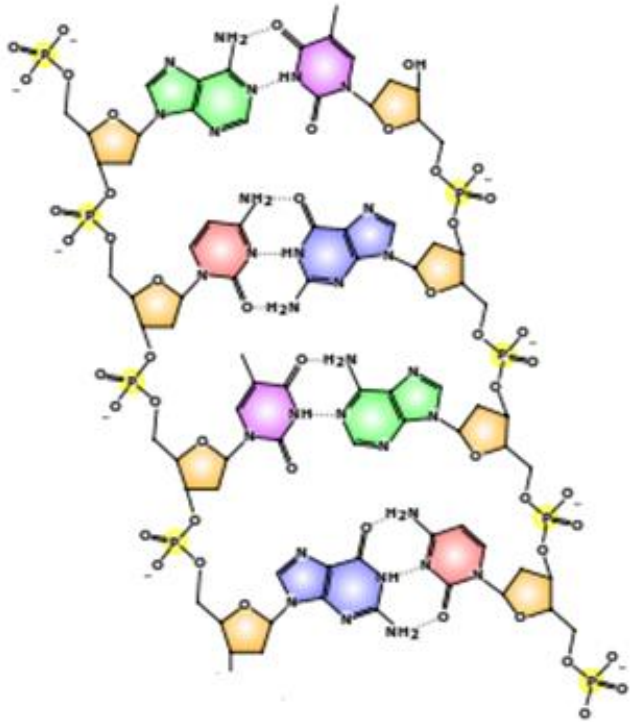




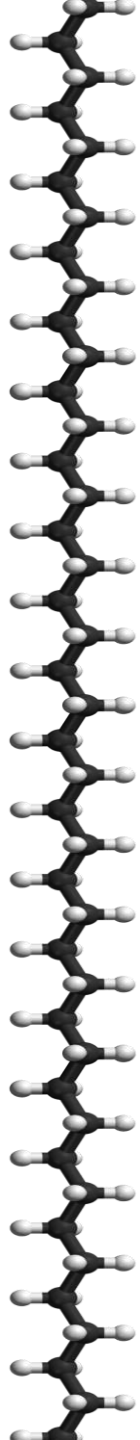




Nucleotid



DNA



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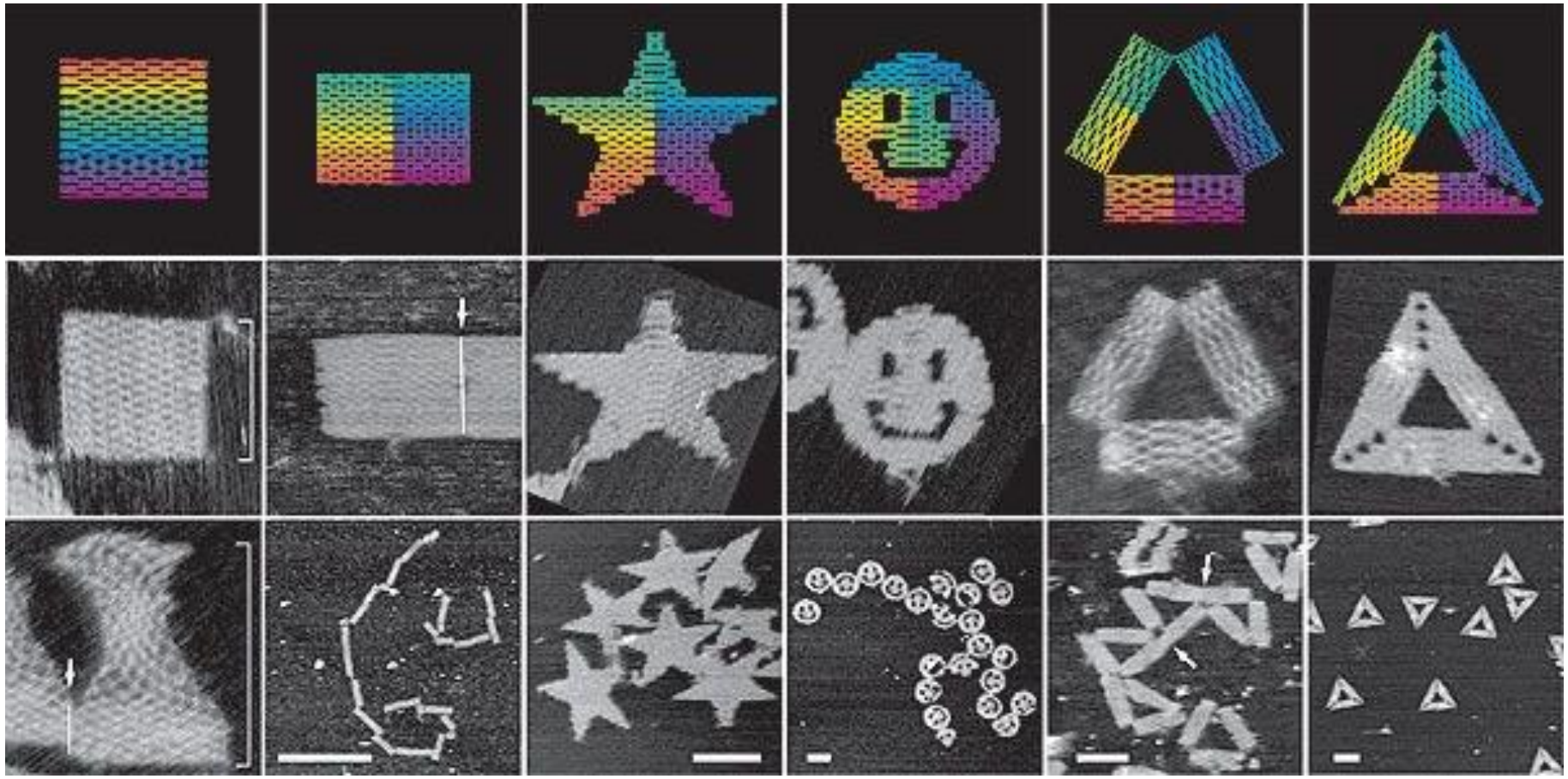
DNA Origami (2D)



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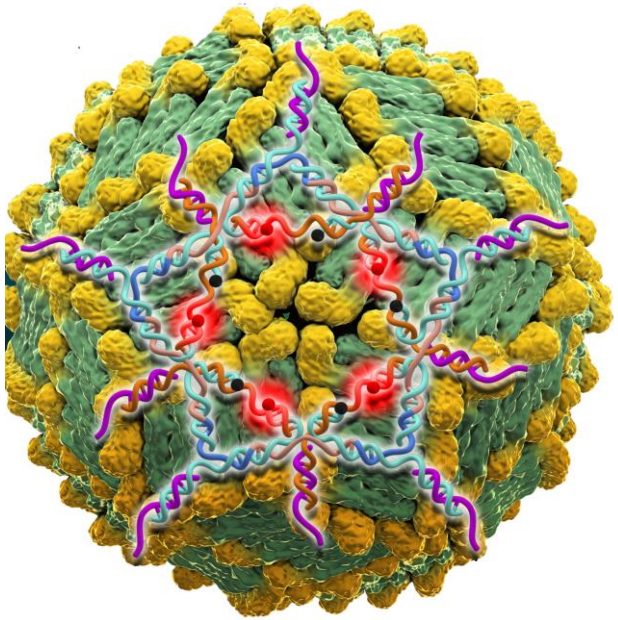

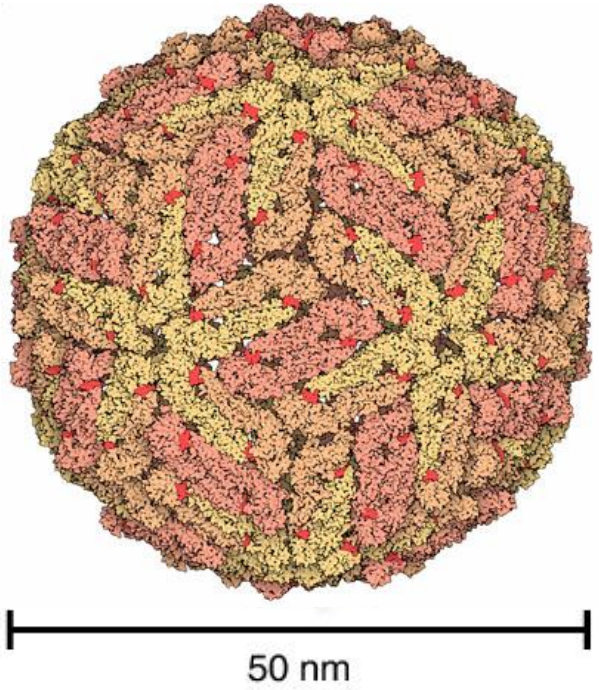

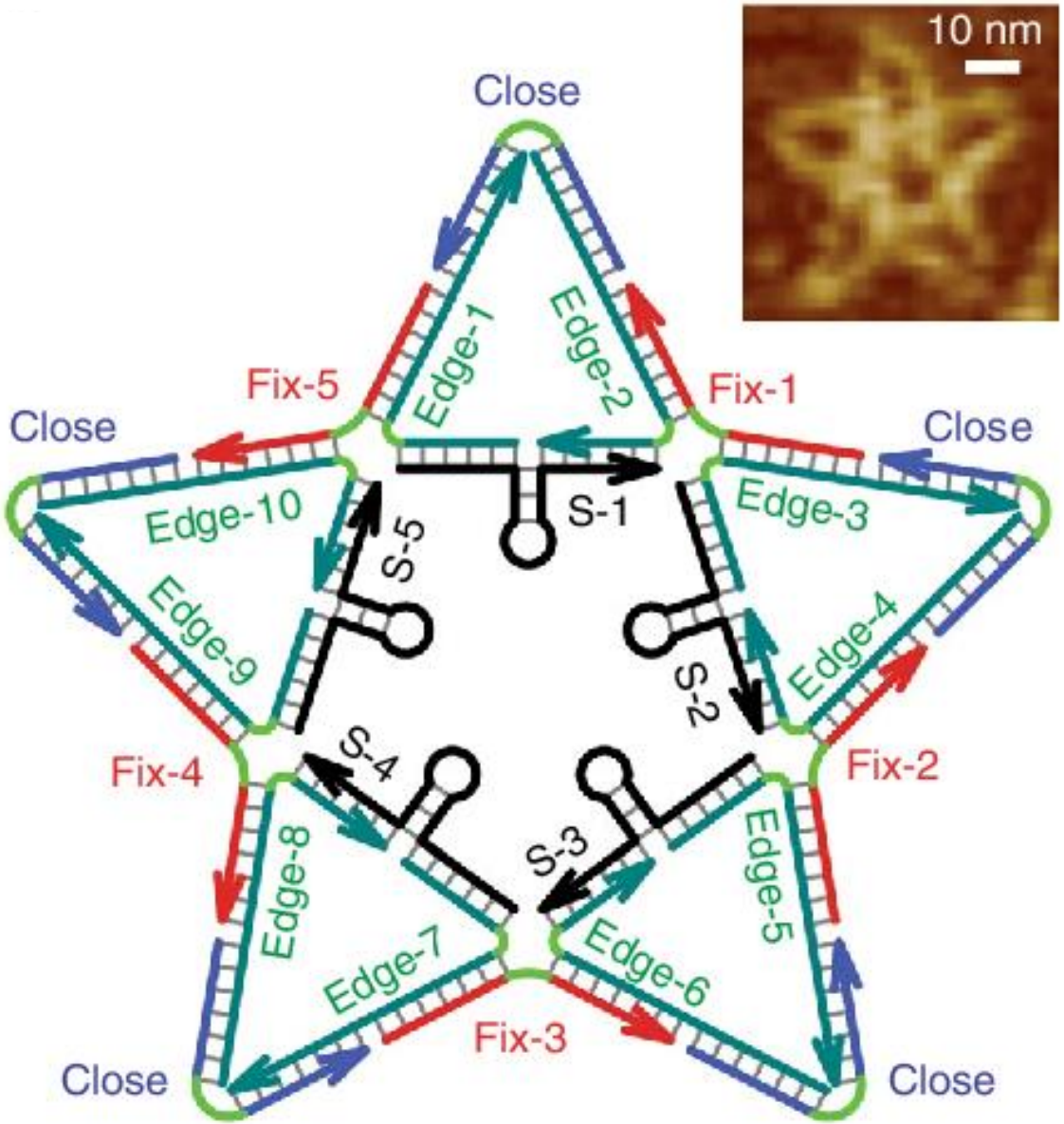

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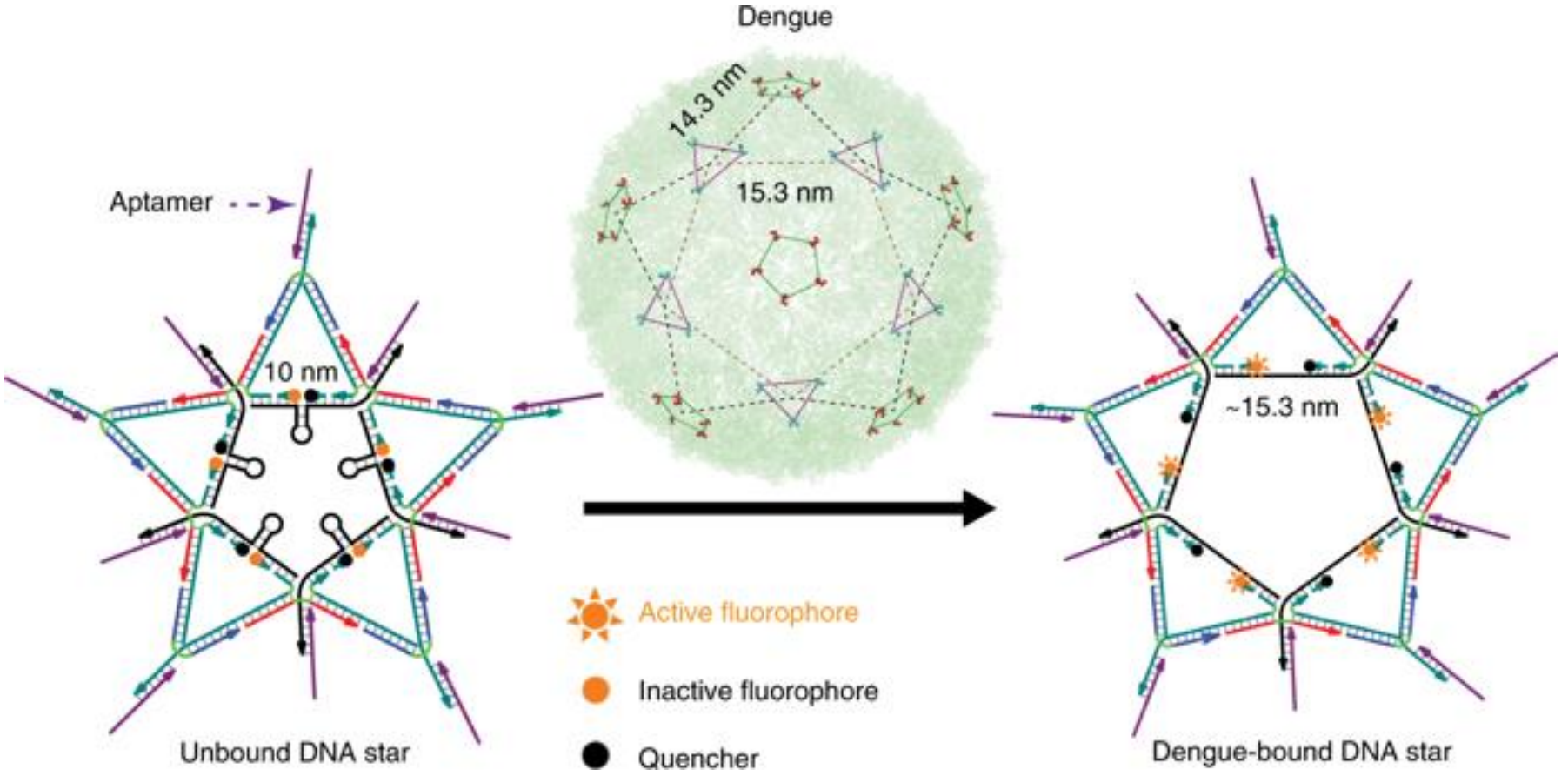

Dezember 2019

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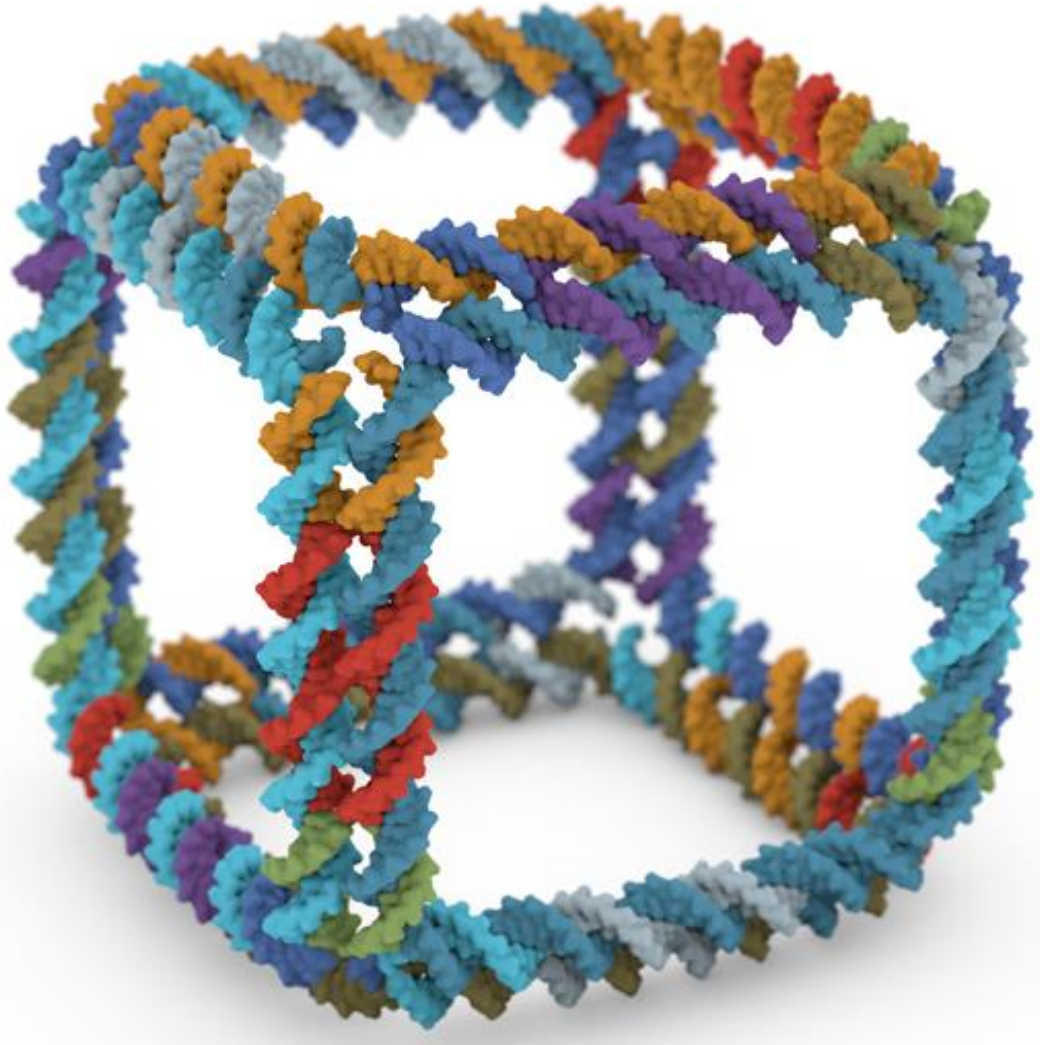
DNA Polyhedra (3D)



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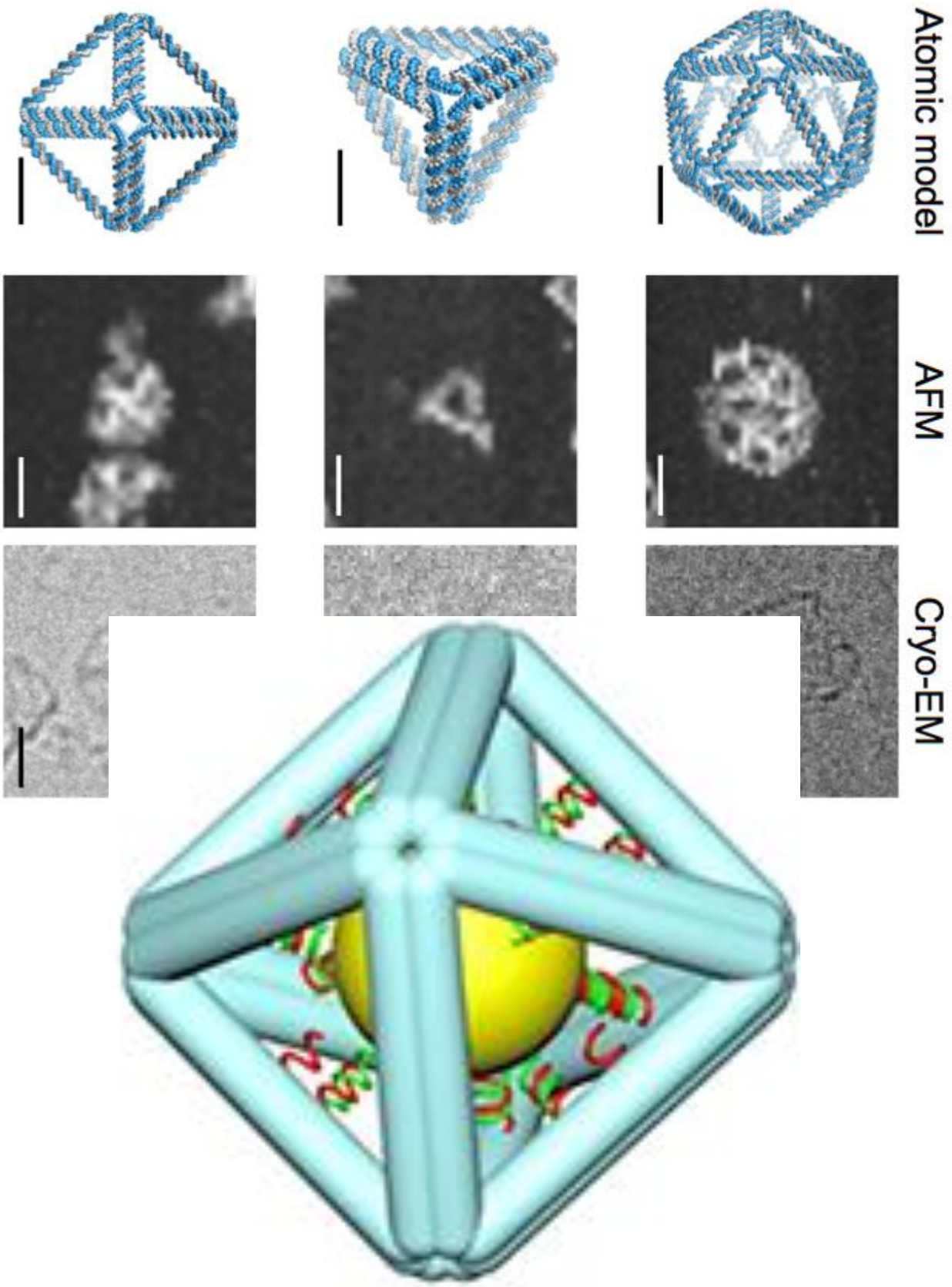
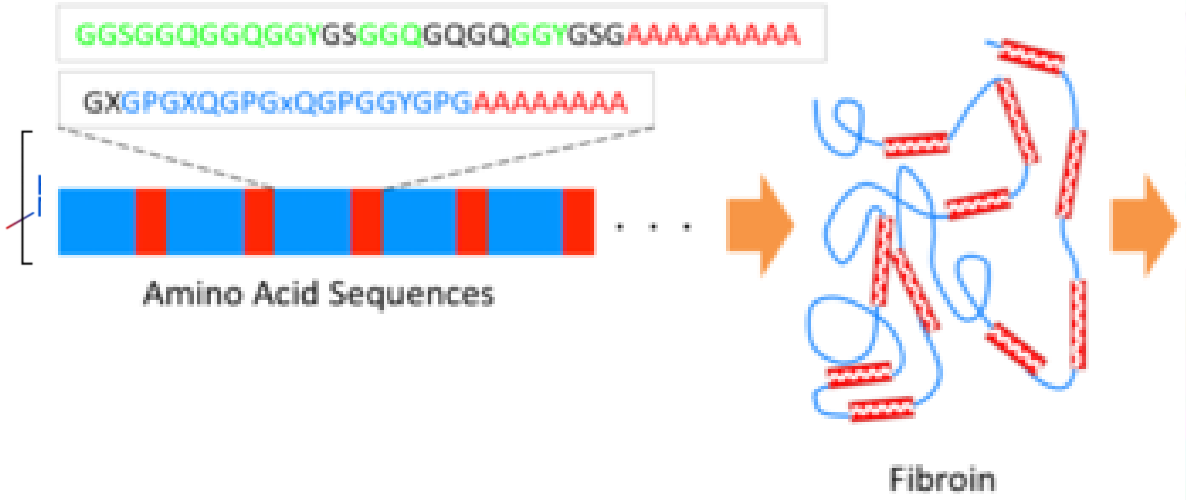


September 2019

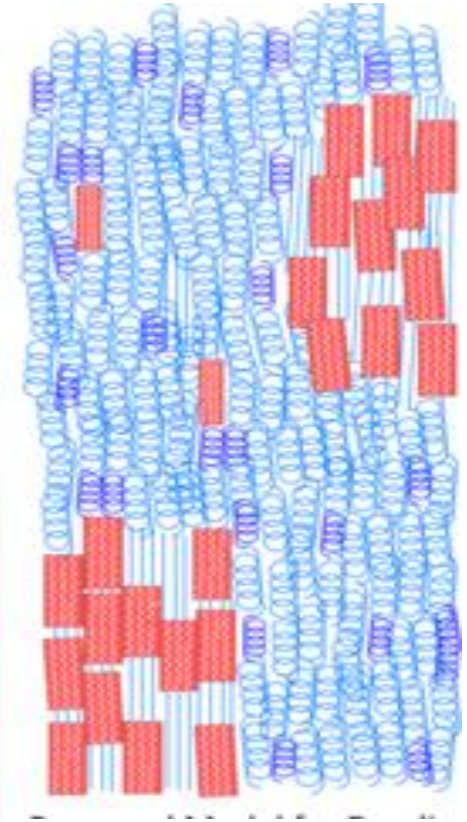
Spidroine

Spinnfäden / Seide



Fibroin (Sericin)

Spidroine



Seide / Spinnfaden

Spidroine

Spinnfäden / Seide

AKTUELLE FORSCHUNG

PLoS One. 2011;6(7):e21833. doi: 10.1371/journal.pone.0021833. Epub 2011 Jul 26.

Artificial skin--culturing of different skin cell lines for generating an artificial skin substitute on cross-weaved spider silk fibres.

Wendt H[1], Hillmer A, Reimers K, Kuhbier JW, Schäfer-Nolte F, Allmeling C, Kasper C, Vogt PM.

Int J Mol Sci. 2018 Dec 24;20(1). pii: E71. doi: 10.3390/ijms20010071.

Co-Culturing Human Adipose Derived Stem Cells and Schwann Cells on Spider Silk-A New Approach as Prerequisite for Enhanced Nerve Regeneration.

Resch A[1,2], Wolf S[3], Mann A[4], Weiss T[5], Stetco AL[6], Radtke C[7,8].

Macromol Rapid Commun. 2020 Jan;41(1):e1900426. doi: 10.1002/marc.201900426. Epub 2019 Nov 7.

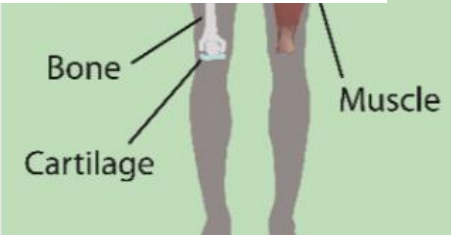
Recombinant Spider Silk-Silica Hybrid Scaffolds with Drug-Releasing Properties for Tissue Engineering Applications.

Kumari S[1], Bargel H[1], Scheibel T[1,2].

Adv Exp Med Biol. 2018;1077:371-387. doi: 10.1007/978-981-13-0947-2_20.

Silk Fibroin-Based Scaffold for Bone Tissue Engineering.

Choi JH[1], Kim DK[1], Song JE[1], Oliveira JM[2,3,4], Reis RL[2,3,4], Khang G[5].



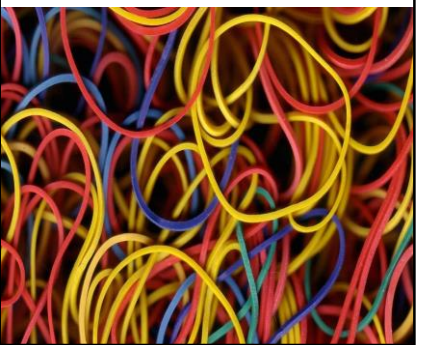
Adv Healthc Mater. 2020 Feb 28:e1901552. doi: 10.1002/adhm.201901552. [Epub ahead of print]

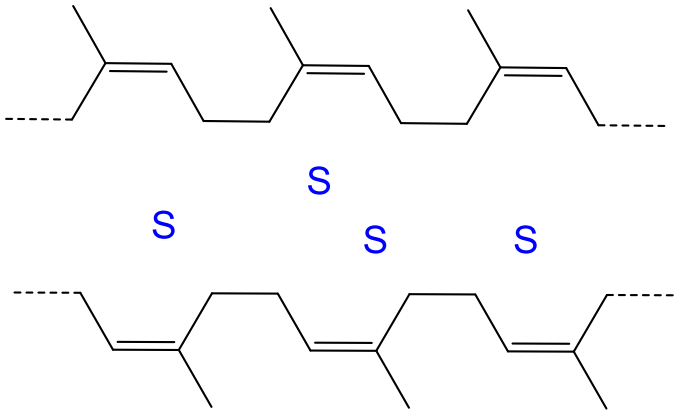
From Silk Spinning to 3D Printing: Polymer Manufacturing using Directed Hierarchical Molecular Assembly.

Mu X[1], Fitzpatrick V[1], Kaplan DL[1].

Gummi

(mindestens seit 1600 BCE)



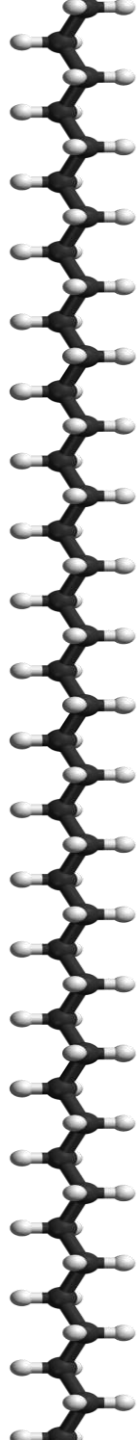


Milchiger Baumsaft
(Kautschuk)

+

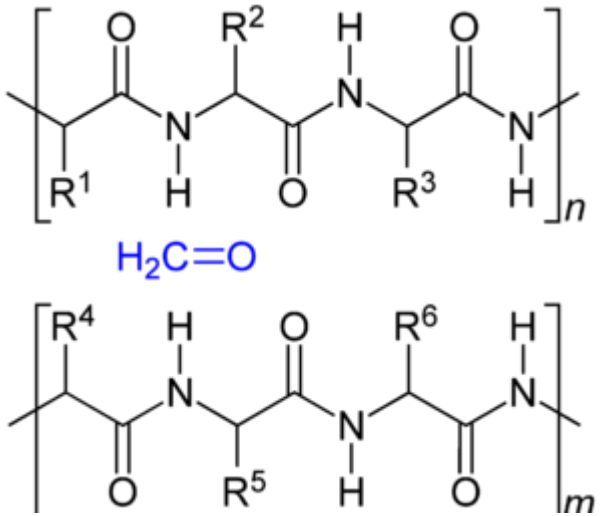
Schwefel

Hayward/Ludersdorf → Goodyear
«Vulkanisierung»

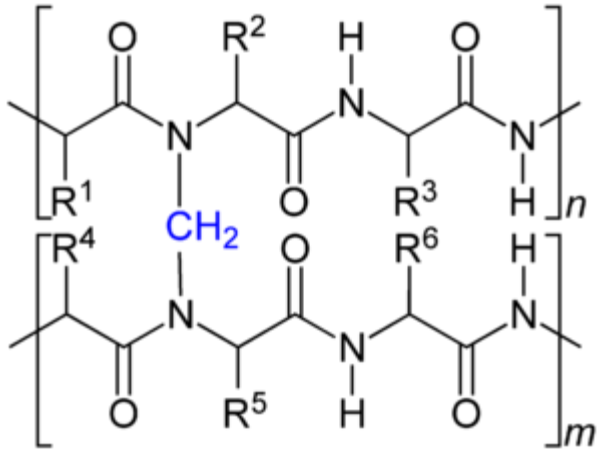


Galalith

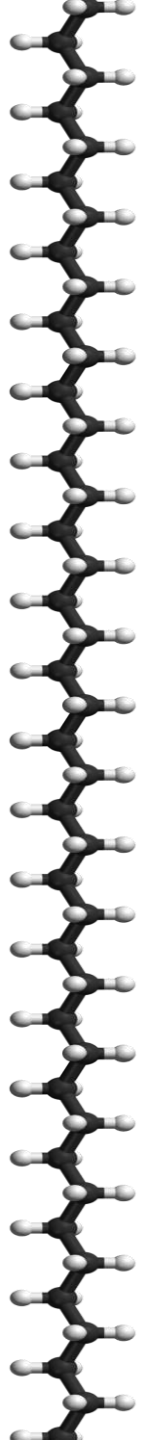
Kunsthorn (mindestens seit 1530)



Kasein + Formaldehyd

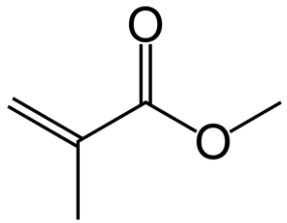


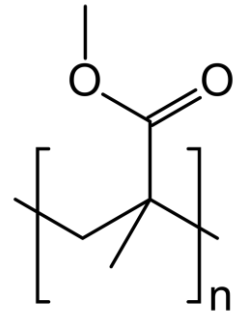
Galalith



Plexiglas

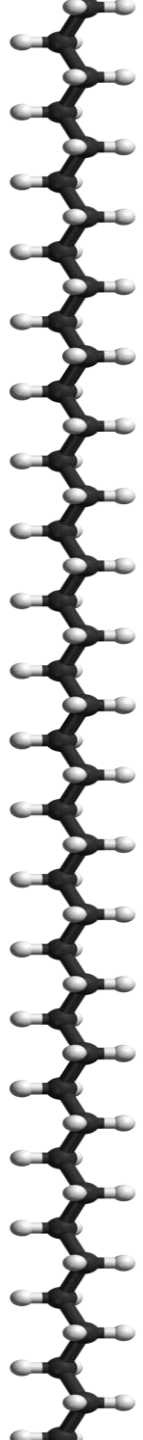
PMMA (Massenproduktion ab 1930)



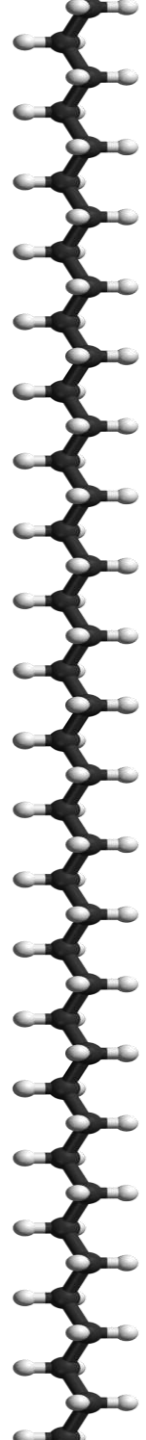


MMA

PMMA

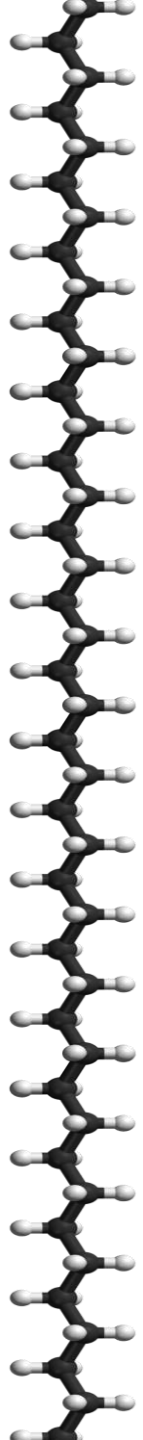


Plastik ist supermegawahnsinnstoll!

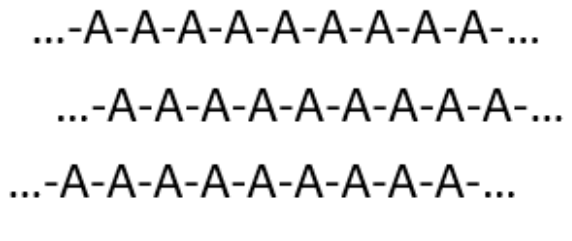


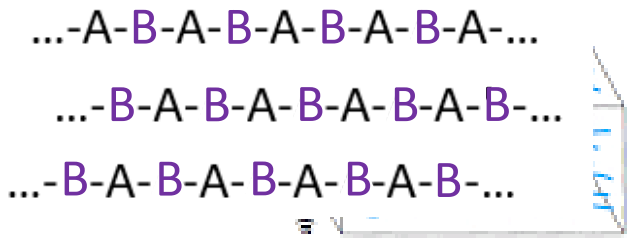
Was macht Plastik so grossartig?

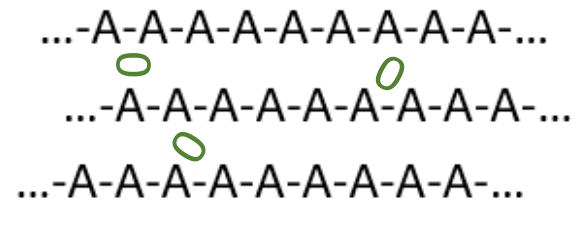
- beliebig hart oder weich
- gut formbar, vom dünnen Faden bis zum Flugzeug
- resistent oder abbaubar
- Leicht (geringe Dichte)
- Leicht herzustellen und anwendungstechnisch zu variieren
- billig

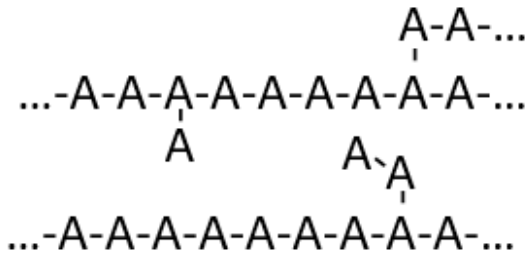


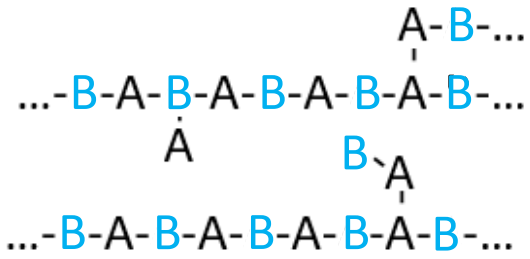
Was macht Plastik so leicht variierbar?

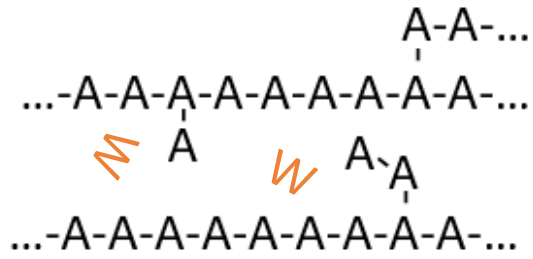


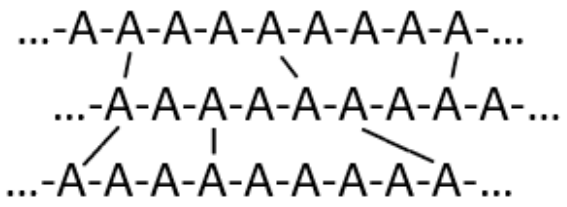


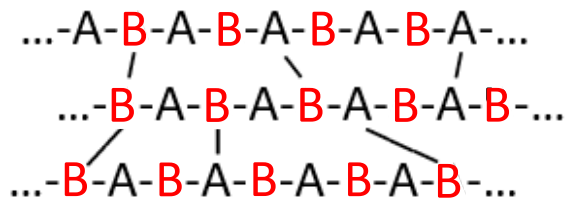


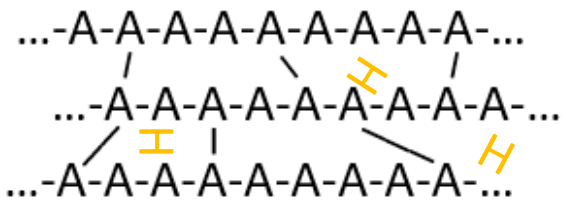


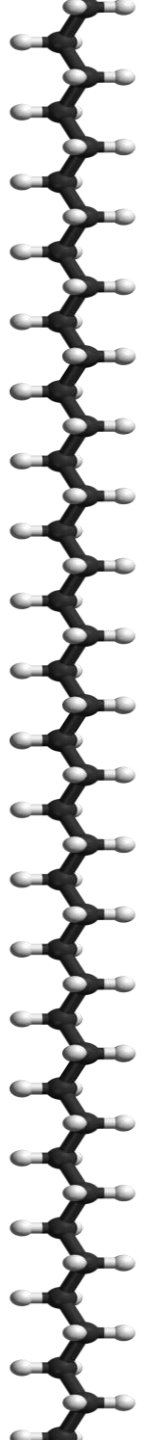






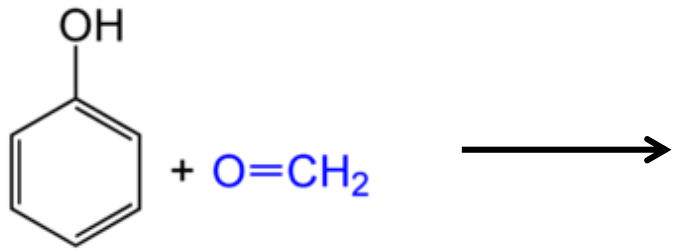


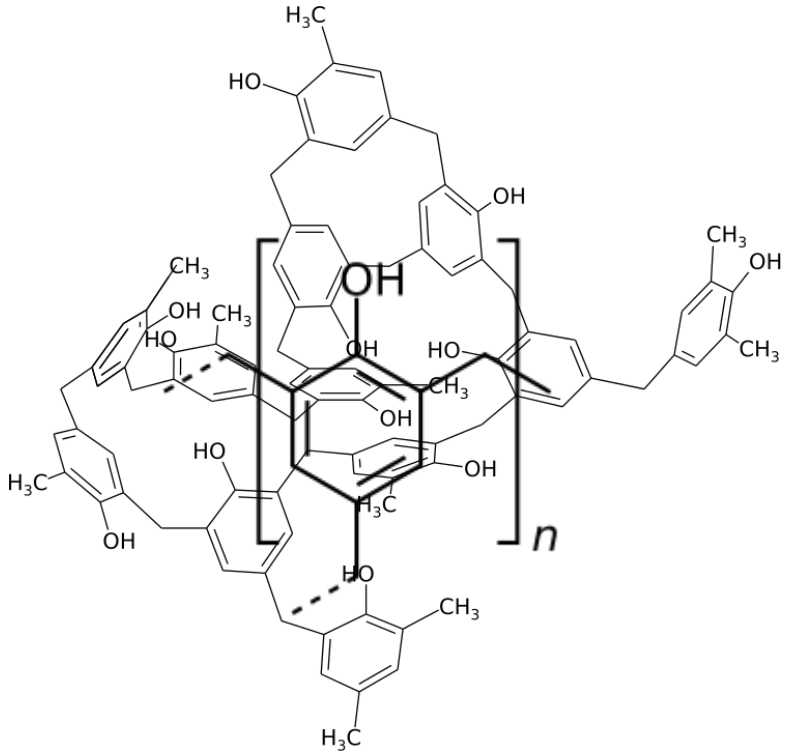




Bakelit

Kunstharz (Massenproduktion ab 1910)

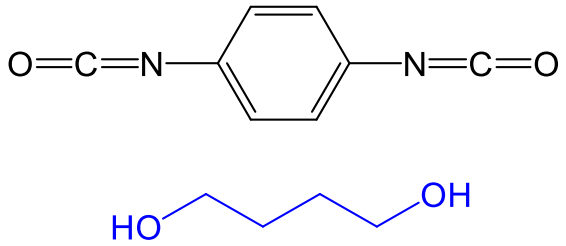




Phenol + Formaldehyd

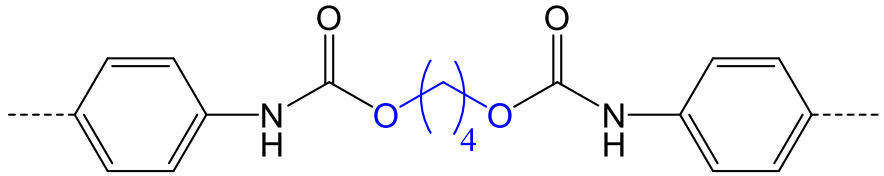
Bakelit

Polyurethan



aus Nebenreaktion

- CO_2

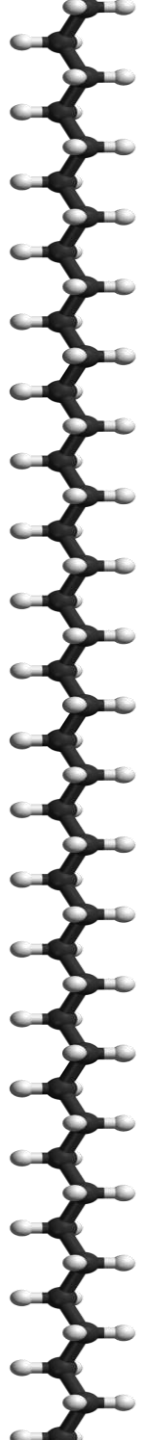


«Desmodur»

+

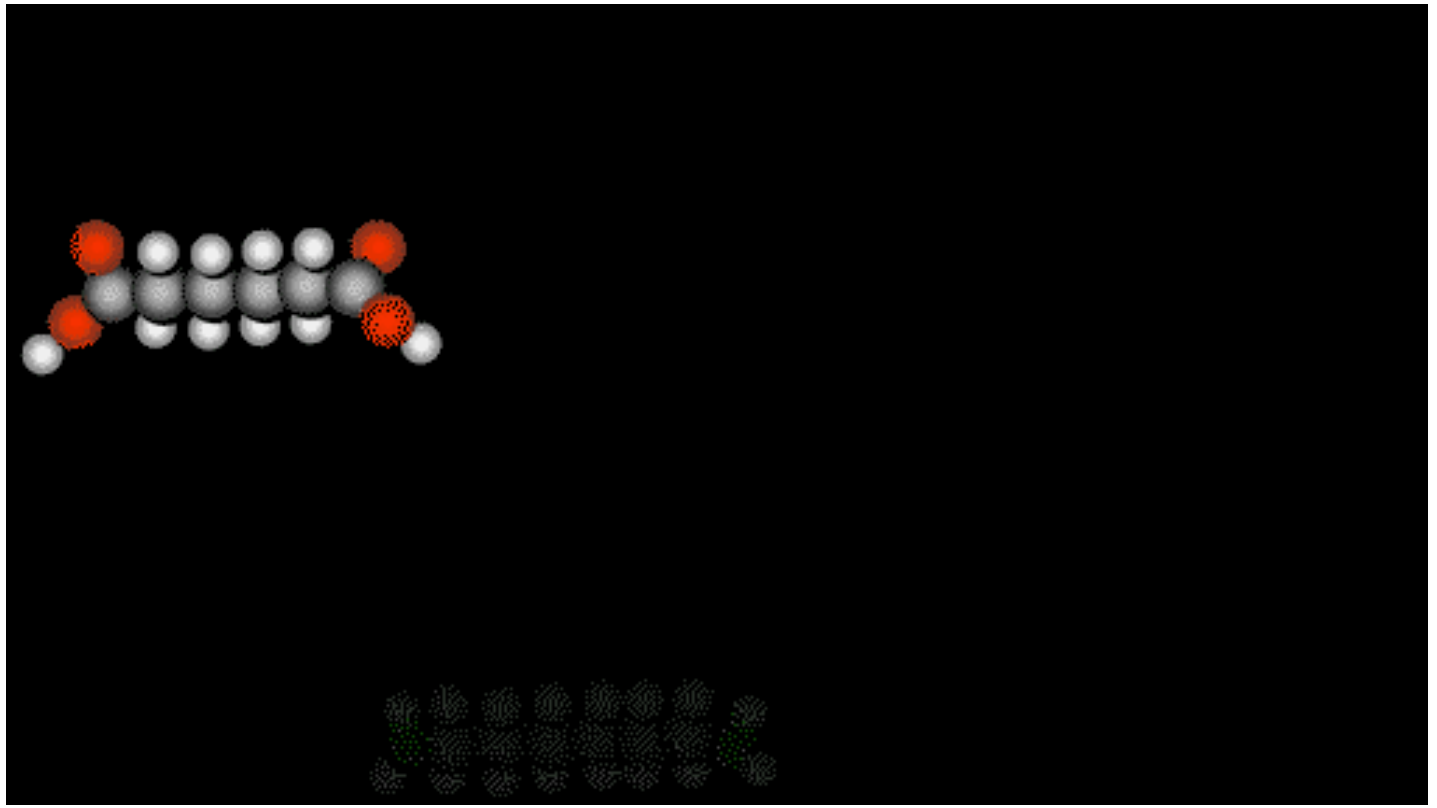
«Desmophen»

Polyurethan



Der Vorgang der Polymerisation

Kondensations-Polymerisation

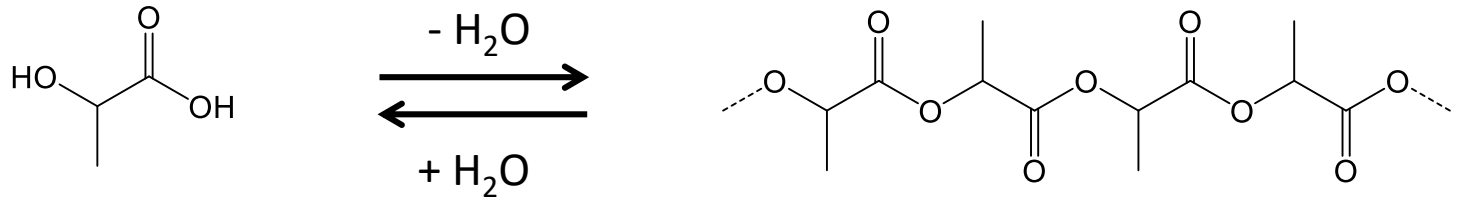


Nylon

Rekordlänge: KS Baden - 25.9.19 - 12.5 m

PLA

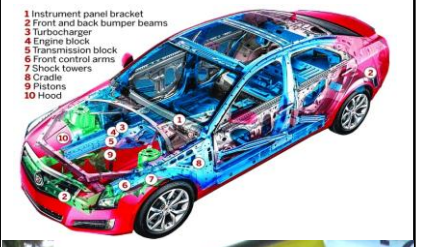
Polymilchsäure

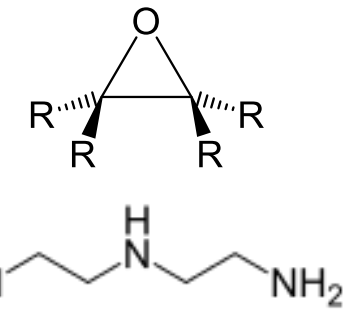


Milchsäure

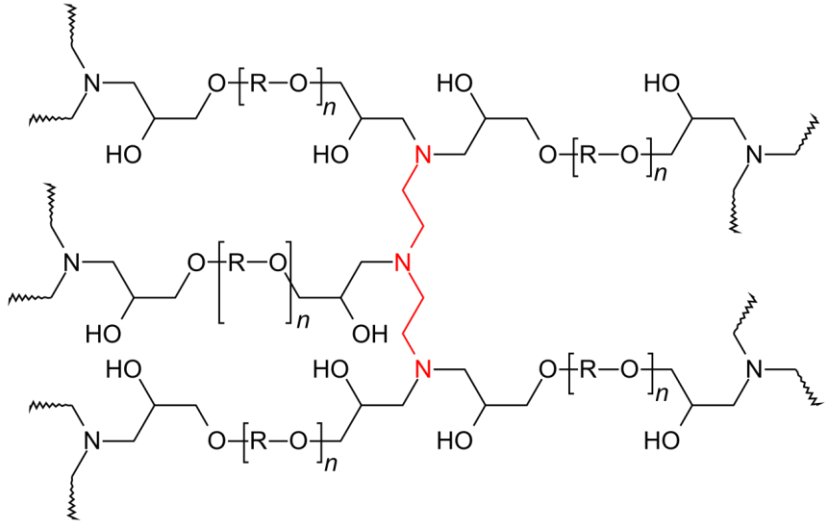
Polymilchsäure

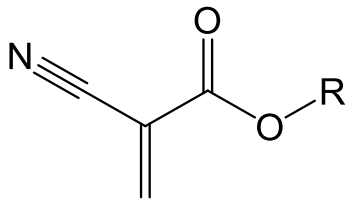
Kleber



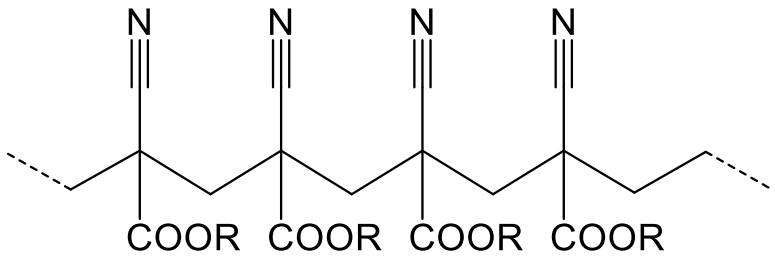


Epoxide / Härter

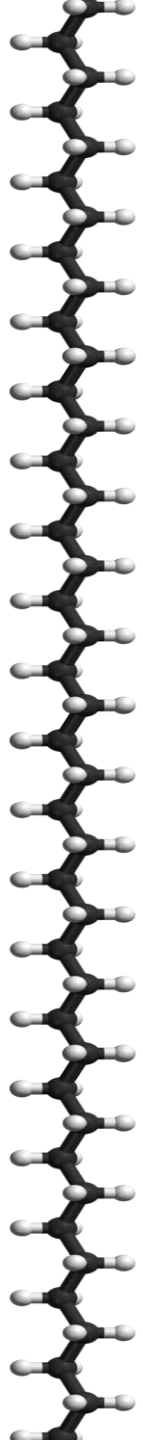




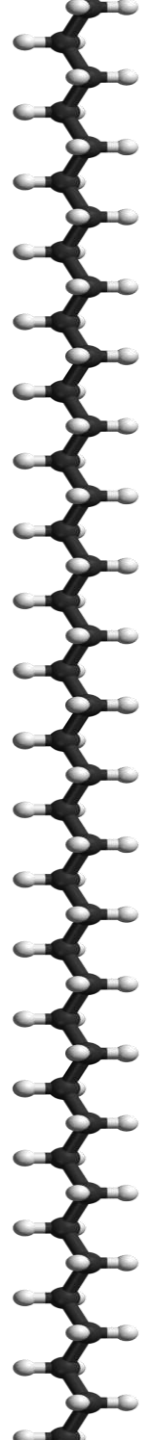
Cyanoacrylat



PCA



Plastik ist eine Katastrophe!



Ein paar Zahlen

<u>Kunststoff-Produktion 1950-2015 weltweit</u> ~ 8,3 Mrd. t
= 1 t / Kopf der Weltbevölkerung

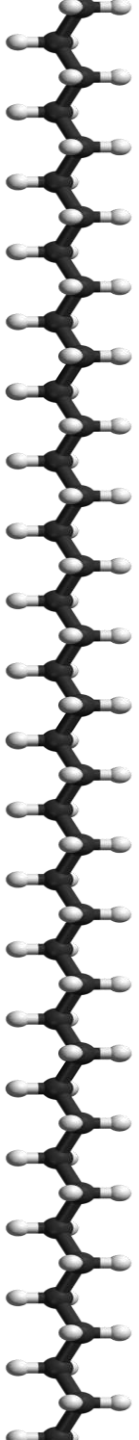
→ davon die Hälfte nach 2000

→ 6,3 Mrd. Tonnen zu Abfall:

→ zu 9 % recyclet

→ zu 12 % verbrannt

→ zu 79 % Müllhalden / Umwelt



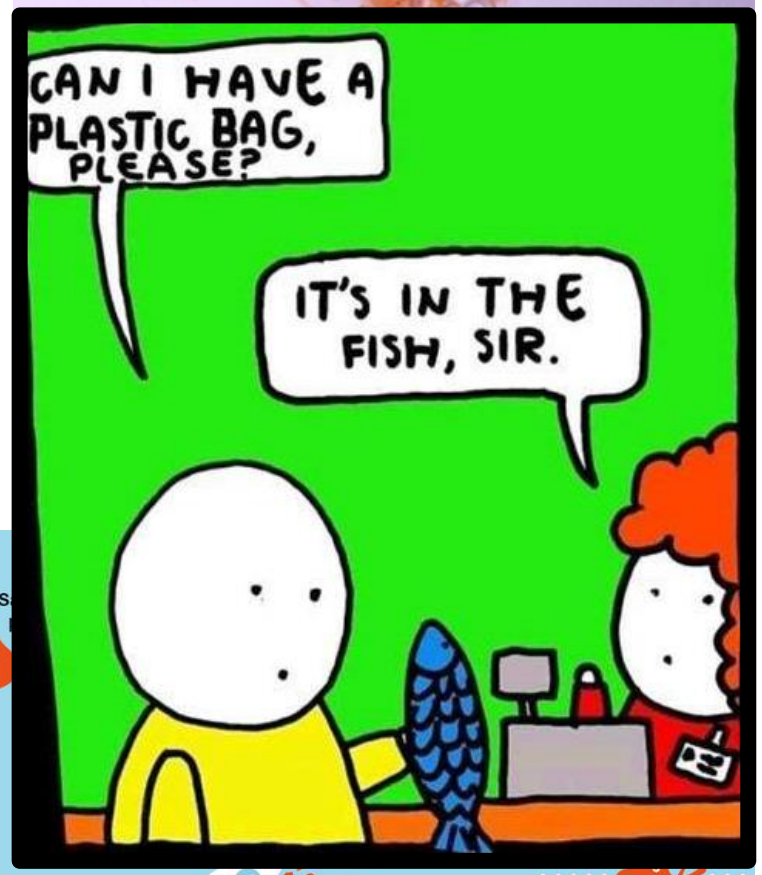
Was sind Probleme mit Plastik?

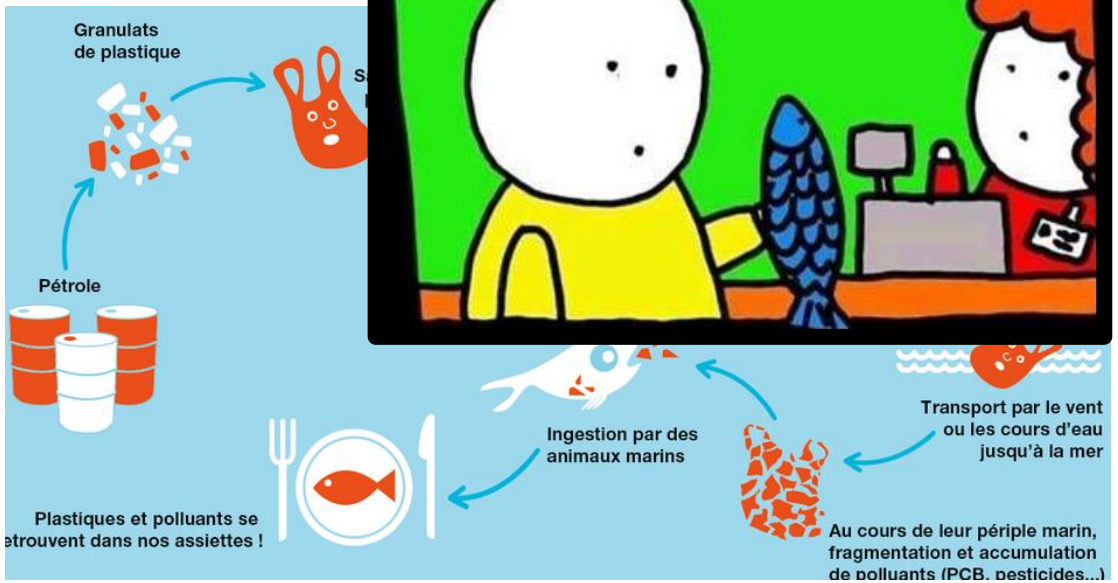
Was sind Probleme mit Plastik?

Plastik baut sich nicht ab

Zerkleinert sich mechanisch → Mikroplastik

→ von Tieren verschluckt → Nahrungskette





Was sind Probleme mit Plastik?

Plastik baut sich nicht ab

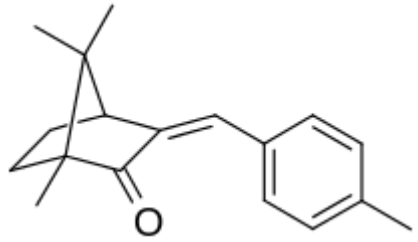
Zerkleinert sich mechanisch → Mikroplastik

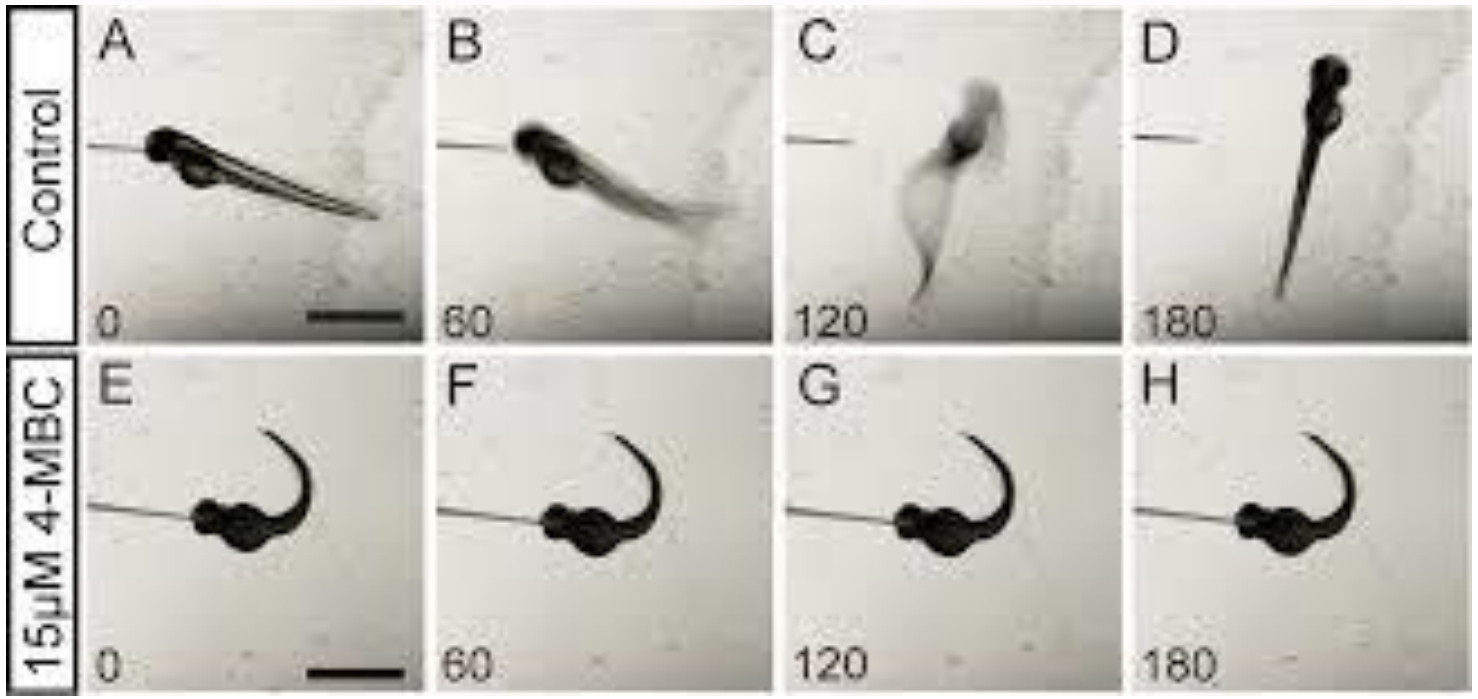
Von Tieren mit Nahrung verwechselt

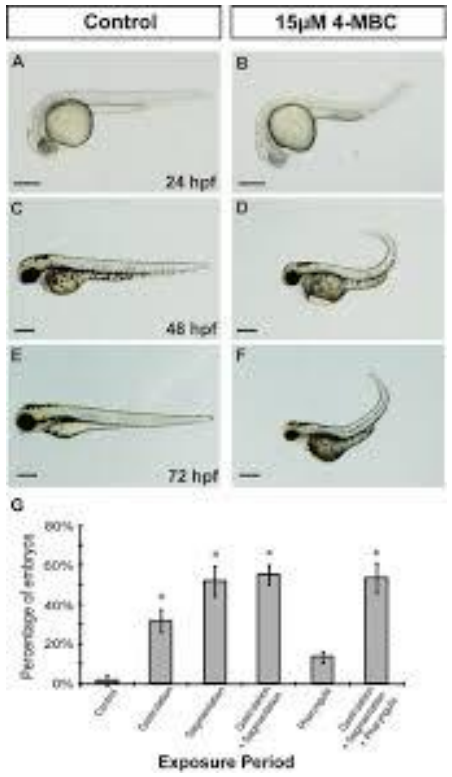
Was sind Probleme mit Plastik?

Environmental Science and Pollution Research
May 2016, Volume 23, Issue 9, pp 8275–8285 | Cite as

Effects of 4-methylbenzylidene camphor (4-MBC) on neuronal and muscular development in zebrafish (*Danio rerio*) embryos







Was sind Probleme mit Plastik?

Plastik baut sich nicht ab

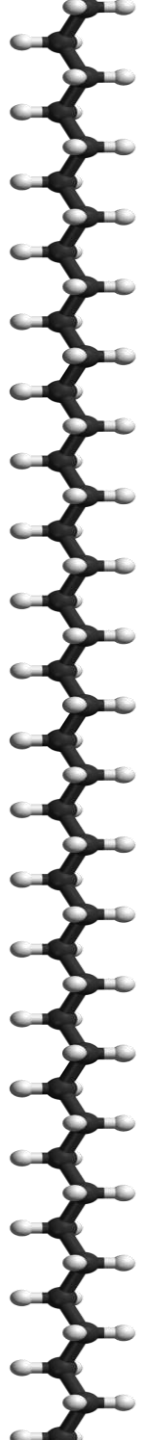
Zerkleinert sich mechanisch → Mikroplastik

Von Tieren mit Nahrung verwechselt

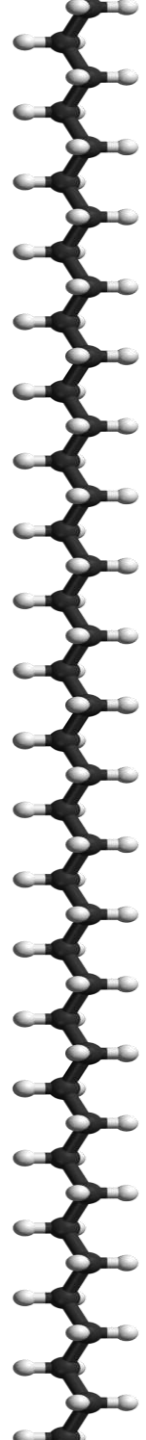
Gibt Zusatzstoffe ab (Weichmacher, …)

→ Tierwohl
→ Veränderung der Biodiversität
→ Zerstörung ganzer Ökosysteme
→ Zusammenbruch der Nahrungskette
→ Akkumuliert sich in Sedimenten

→ Rohstoff Öl
→ auslaufende Ressource (brauchen→wegwerfen)
→ CO_2-Problematik
→ polit. Abhängigkeit



Was machen wir denn jetzt?!

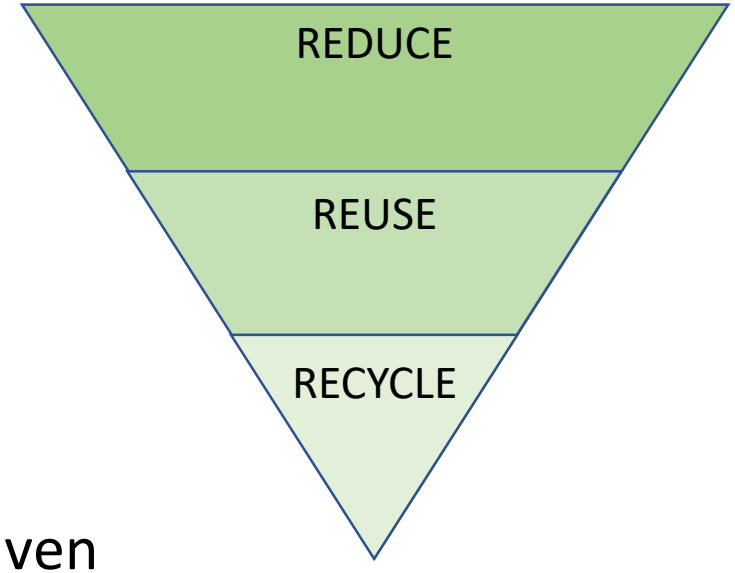


Was machen wir denn jetzt!?

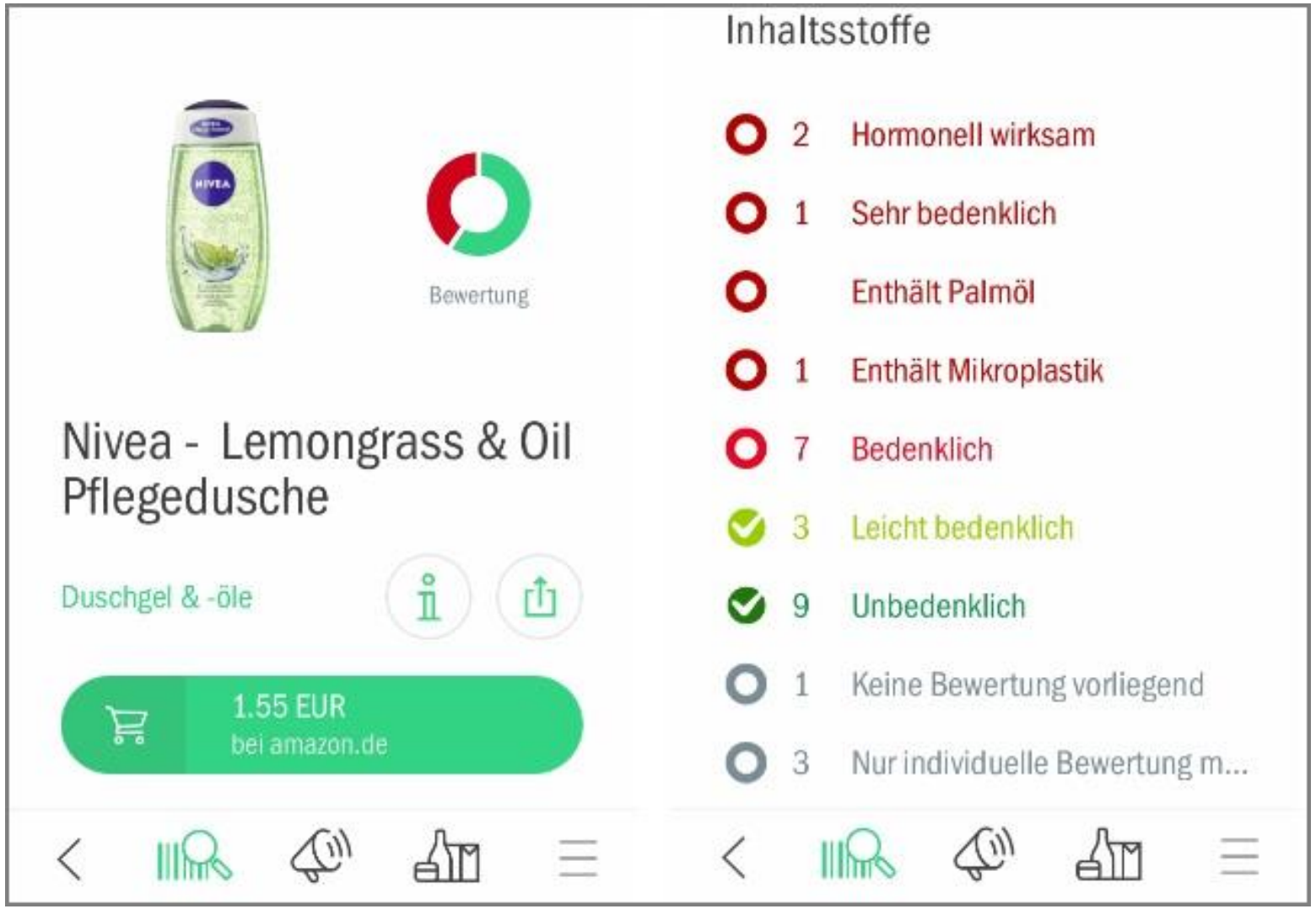
- Konsumverhalten
  → beeinflusst Industrie

- Konsumentenmeinung
  → beeinflusst Politik

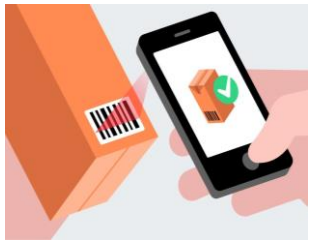
- Reduzierter Einsatz von Plastik / Plastikalternativen
  → Konsumentendruck
  → staatlich regulieren / subventionieren



Was machen wir denn jetzt!?

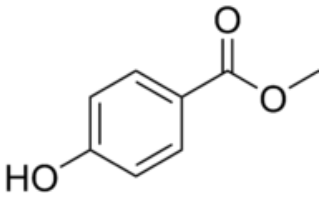


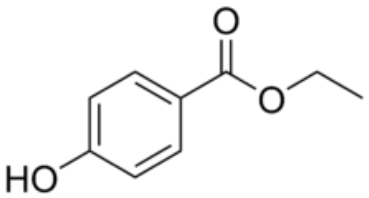
CodeCheck



Was machen wir denn jetzt!?

Methylparaben
Ethylparaben





J Appl Toxicol. 2008 Jul;28(5):561-78. doi: 10.1002/jat.1358.

Paraben esters: review of recent studies of endocrine toxicity, absorption, esterase and human exposure, and discussion of potential human health risks.

Darbre PD[1], Harvey PW.

Toxicology. 2007 Apr 11;232(3):248-56. Epub 2007 Jan 19.

Parabens inhibit human skin estrogen sulfotransferase activity: possible link to paraben estrogenic effects.

Prusakiewicz JJ[1], Harville HM, Zhang Y, Ackermann C, Voorman RL.

Parabens: Potential impact of Low-Affinity Estrogen receptor Binding chemicals on Human health

July 2013 · Journal of Toxicology and Environmental Health Part B 16(5):321-35

DOI: 10.1080/10937404.2013.809252

Potential estrogenic effect(s) of parabens at the prepubertal stage of a postnatal female rat model

June 2010 · Reproductive Toxicology 29(3):306-16

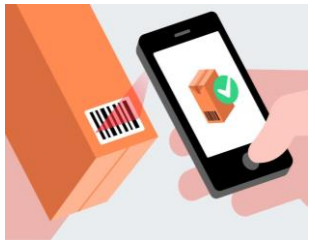
DOI: 10.1016/j.reprotox.2010.01.013

Int J Mol Sci. 2017 Sep; 18(9): 2007.
Published online 2017 Sep 19. doi: 10.3390/ijms18092007

PMCID: PMC5618656
PMID: 28925944

Interference of Paraben Compounds with Estrogen Metabolism by Inhibition of 17β-Hydroxysteroid Dehydrogenases

CodeCheck



Aktuelle Forschungsprojekte

Downcycling

- Rens
- Roscomar
- Rothy's
- Timberland
- Allbirds
- Ocean Refresh
- Suavs
- Vionic
- TropicFeel
- Giesswein
- Astral

Aktuelle Forschungsprojekte

1 PETE	2 HDPE	3 PVC	4 LDPE	5 PP	6 PS	7 OTHER
Polyethylene Terephthalate	**High-Density Polyethylene**	**Polyvinyl Chloride**	**Low-Density Polyethylene**	**Polypropylene**	**Polystyrene**	**Other**
Common products: soda & water bottles; cups, jars, trays, clamshells	Common products: milk jugs, detergent & shampoo bottles, flower pots, grocery bags	Common products: cleaning supply jugs, pool liners, twine, sheeting, automotive product bottles, sheeting	Common products: bread bags, paper towels & tissue overwrap, squeeze bottles, trash bags, six-pack rings	Common products: yogurt tubs, cups, juice bottles, straws, hangers, sand & shipping bags	Common products: to-go containers & flatware, hot cups, razors, CD cases, shipping cushion, cartons, trays	Common types & products: polycarbonate, nylon, ABS, acrylic, PLA; bottles, safety glasses, CDs, headlight lenses
Recycled products: clothing, carpet, clamshells, soda & water bottles	Recycled products: detergent bottles, flower pots, crates, pipe, decking	Recycled products: pipe, wall siding, binders, carpet backing, flooring	Recycled products: trash bags, plastic lumber, furniture, shipping envelopes, compost bins	Recycled products: paint cans, speed bumps, auto parts, food containers, hangers, plant pots, razor handles	Recycled products: picture frames, crown molding, rulers, flower pots, hangers, toys, tape dispensers	Recycled products: electronic housings, auto parts,
						

Aktuelle Forschungsprojekte

→ Recycling Optimierung

→ Abbaubarkeit (biol, ox., Licht)

→ Zusatzstoffalternativen

→ Rohstoffalternativen

→ Plastikabbauende Bakterien

→ Plastik aus CO_2

GLOBALCITIZEN.ORG

Ikea to use mushroom packaging that will decompose in a garden within weeks

Aktuelle Forschungsprojekte

20.02.2018

Viele Bakterien fressen Plastik

Die Natur hat offenbar eine Lösung für das Kunststoff-Müllprobl
von plastikfressenden Bakterien ist größer als angenommen.

→ Rohstoffalternativen

→ Plastikabbauende Bakterien

nature communications

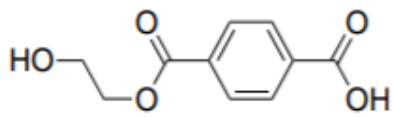
Article | Open Access | Published: 12 April 2019

Structure of the plastic-degrading *Ideonella sakaiensis* MHETase bound to a substrate

Transgenic plants as a source of polyhydroxyalkanoates

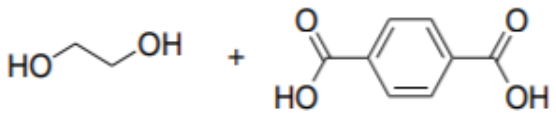
Jędrzej Dobrogojski, Maciej Spychalski, Robert Luciński & Sławomir Borek

Acta Physiologiae Plantarum **40**, Article number: 162 (2018)



MHET

MHET



Ethylene glycol (EG)

Terephthalic acid (TPA)

Aktuelle Forschungsprojekte

O=C=O

02.12.2019

Plastik & Müll

Plastik 2.0: Aus Wasser und CO2 wird Ethylen

Aus CO2, Wasser und elektrischer Energie entsteht in einem Schritt Ethylen, ein in riesigen Mengen benötigtes Basismaterial für die Herstellung von Kunststoffen.

→ Plastik aus CO_2

Aus CO_2 mach Brennstoff

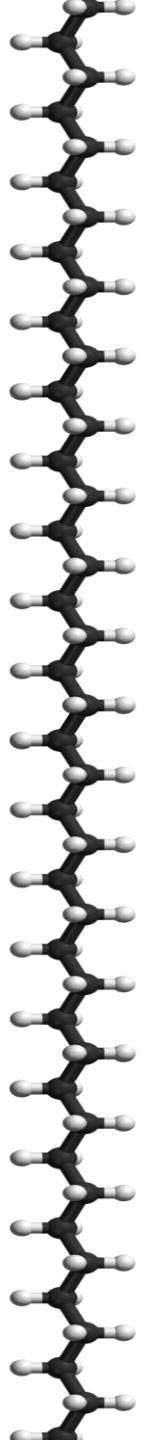
Power-To-Gas

$2\ H_2 + CO_2 \rightarrow CH_4 + O_2$

Aus CO_2 mach Rohstoffe

für Medikamente, Plastik, …

als Treibstoffe (Methanol)



Aktuelle Forschungsprojekte

02.12.2019

Plastik & Müll

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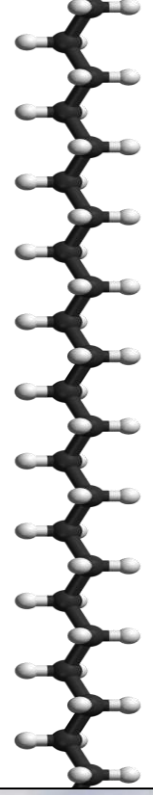
O=C=O



→ Plastik aus CO_2

Schwierigkeit 1

viel Energie und/oder
Schwermetallkatalysatoren

Climeworks
(Hinwil, ETH)

www

www.sciencelab.uzh.ch

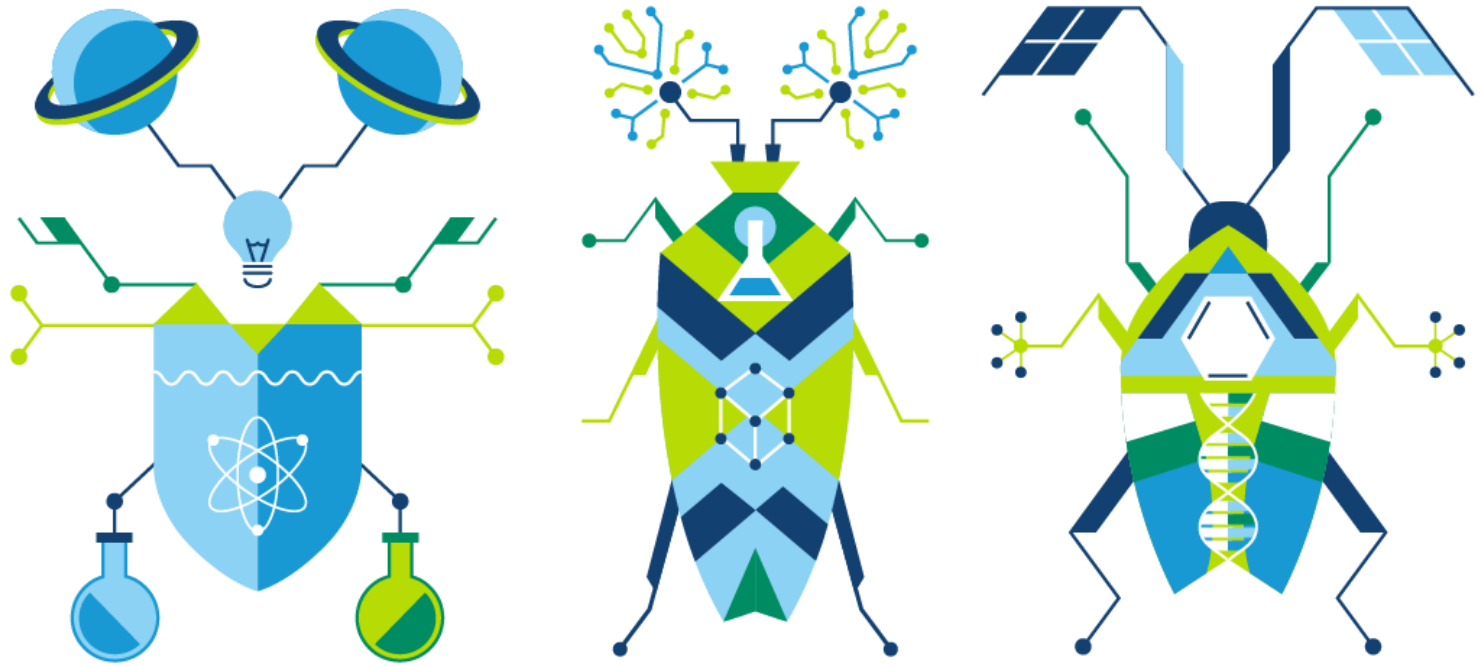
www.chem.uzh.ch

www.ngzh.ch

www.rene-oetterli.com

www.mng.ch

SCIENCE AND NATURE FESTIVAL AM IRCHEL UZH



11. JUNI 2022 | ENTDECKEN | ERFORSCHEN | VIELFALT FEIERN