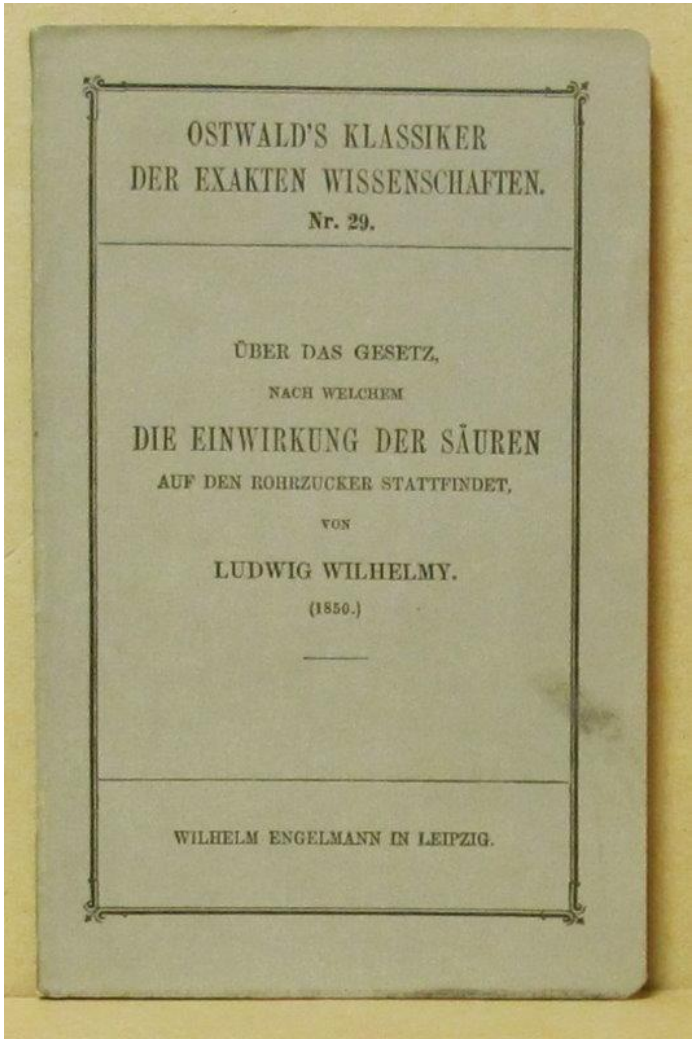
1850

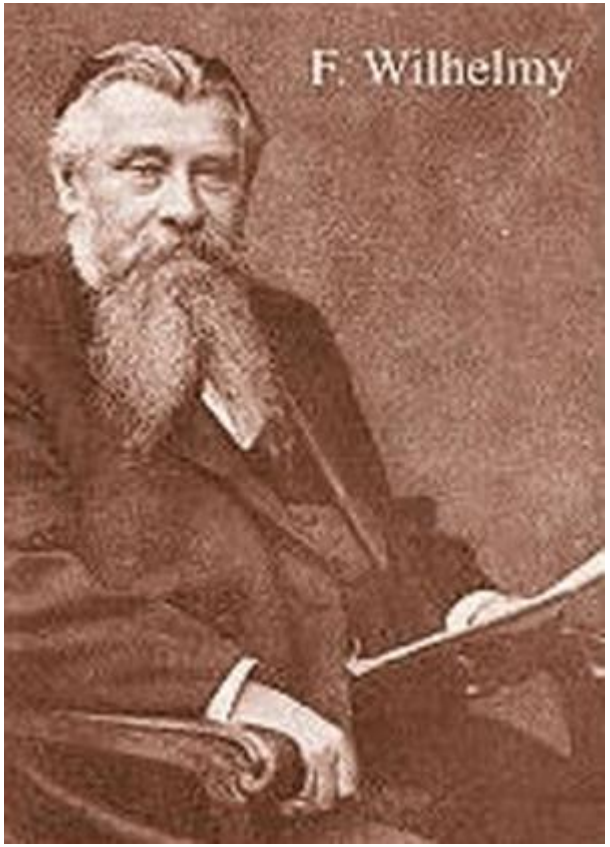
Kinetik der Hydrolyse von Rohrzucker



OSTWALD'S KLASSIKER
DER EXAKTEN WISSENSCHAFTEN.
Nr. 29.

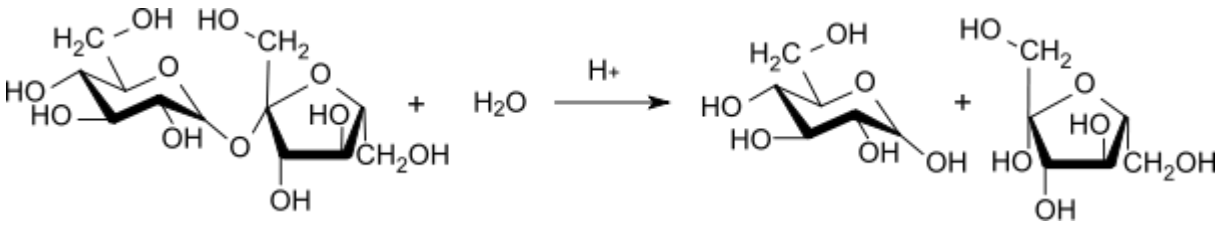
ÜBER DAS GESETZ,
NACH WELCHEM
DIE EINWIRKUNG DER SÄUREN
AUF DEN ROHRZUCKER STATTFINDET,
VON
LUDWIG WILHELMY.
(1850.)

WILHELM ENGELMANN IN LEIPZIG.



Ludwig Ferdinand Wilhelmy (1812-1864)

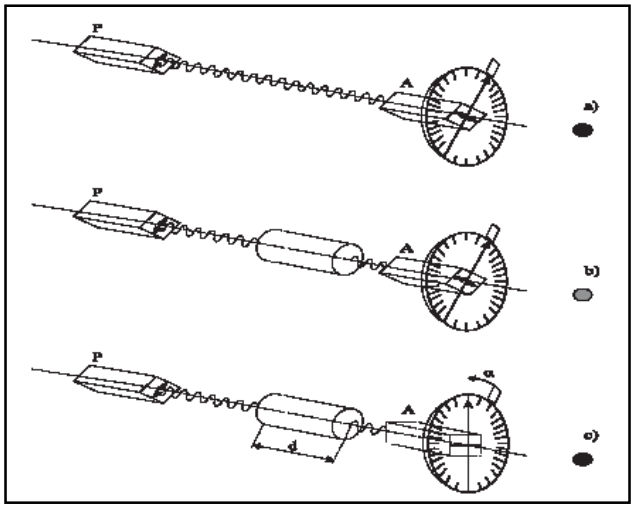
Rohrzuckerinversion/säurekatalysierte Spaltung von Saccharose



Saccharose D-(+)-Glucose D-(-)-Fructose

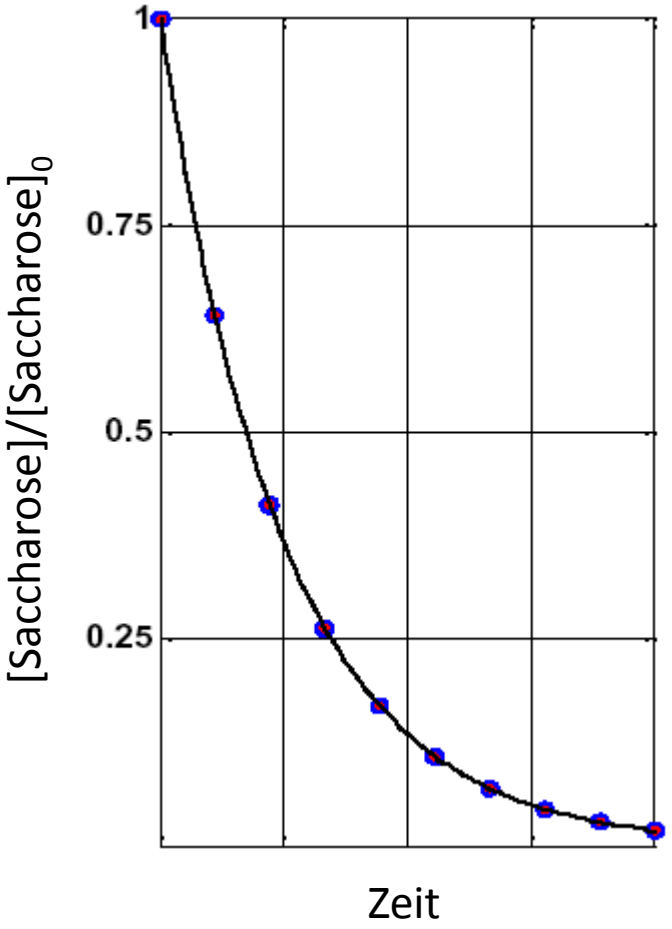
$[\alpha]_D^{20}$ +66.5° +52.7° -92.4°

-19.85°



→ Messung des zeitlichen Verlaufes der Hydrolyse durch laufende Messung des Drehwinkels mit einem Polarimeter (keine Probenentnahme erforderlich).

Rohrzuckerinversion/säurekatalysierte Spaltung von Saccharose



Für $T = 0$ ist $Z = Z_0$, mithin:

$$lZ_0 - lZ = MST \text{ oder } Z = Z_0 e^{-MST}.$$

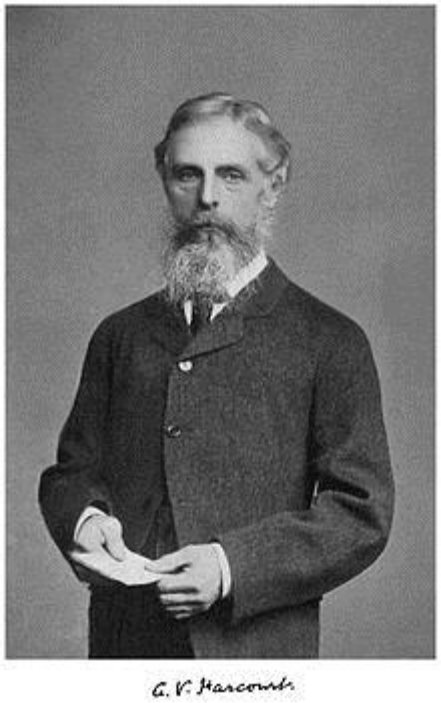
Wilhelmy, 1850

$$[Saccharose] = [Saccharose]_0 e^{-kt}$$

Geschwindigkeitsgesetz

1865

Theorie der Reaktionsgeschwindigkeit



Augustus George Vernon Harcourt (1834-1919)

William Esson (1838-1916)

1865 Theorie der Reaktionsgeschwindigkeit

III. "On the Laws of Connexion between the conditions of a chemical Change and its Amount." By A. Vernon Harcourt and W. Esson. Communicated by Sir B. C. Brodie, Bart., F.R.S. Received September 5, 1865.

(Abstract.)

The amount of a chemical change under any conditions which allow of its completion, depends ultimately upon the amount of that one of the substances partaking in it which is present in the smallest proportional quantity. But if the change be arrested before any one of the reagents is

$$H_2O_2 + 2\,HI \rightarrow I_2 + 2\,H_2O$$

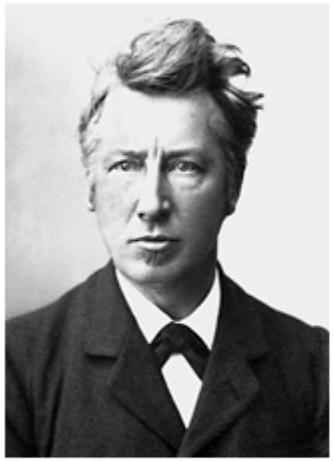
1884

„Etudes de dynamique chimique“, Studien zur chemischen Dynamik

The Nobel Prize in Chemistry 1901
Jacobus H. van 't Hoff

The Nobel Prize in Chemistry 1901

Jacobus H. van 't Hoff



Jacobus Henricus van 't Hoff

The Nobel Prize in Chemistry 1901 was awarded to Jacobus H. van 't Hoff *"in recognition of the extraordinary services he has rendered by the discovery of the laws of chemical dynamics and osmotic pressure in solutions"*.

$$Q_{10} = \left(\frac{R_2}{R_1}\right)^{\frac{10\,\mathrm{K}}{T_2 - T_1}}$$

1887

Theorie der Reaktionsordnung, Katalyse

The Nobel Prize in Chemistry 1909
Wilhelm Ostwald

The Nobel Prize in Chemistry 1909

Wilhelm Ostwald

Wilhelm Ostwald

The Nobel Prize in Chemistry 1909 was awarded to Wilhelm Ostwald *"in recognition of his work on catalysis and for his investigations into the fundamental principles governing chemical equilibria and rates of reaction"*.

1889

Temperaturabhängigkeit der Reaktionsgeschwindigkeit

The Nobel Prize in Chemistry 1903
Svante Arrhenius

The Nobel Prize in Chemistry 1903

Svante Arrhenius

Svante August Arrhenius

The Nobel Prize in Chemistry 1903 was awarded to Svante Arrhenius *"in recognition of the extraordinary services he has rendered to the advancement of chemistry by his electrolytic theory of dissociation"*.

1967

Messung schneller Kinetik durch Relaxation

The Nobel Prize in Chemistry 1967
Manfred Eigen, Ronald G.W. Norrish, George Porter

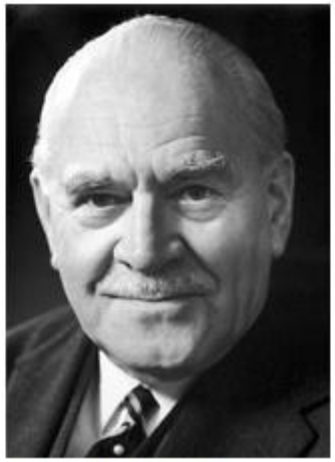
The Nobel Prize in Chemistry 1967

Manfred Eigen

Ronald G.W. Norrish

George Porter

Manfred Eigen



Ronald George Wreyford Norrish

George Porter

The Nobel Prize in Chemistry 1967 was divided, one half awarded to Manfred Eigen, the other half jointly to Ronald George Wreyford Norrish and George Porter *"for their studies of extremely fast chemical reactions, effected by disturbing the equlibrium by means of very short pulses of energy"*.

1999

Messung von Übergangszuständen in chemischen Reaktionen

The Nobel Prize in Chemistry 1999
Ahmed Zewail

The Nobel Prize in Chemistry 1999

Nobel Prize Award Ceremony

Ahmed Zewail

Ahmed H. Zewail

The Nobel Prize in Chemistry 1999 was awarded to Ahmed Zewail *"for his studies of the transition states of chemical reactions using femtosecond spectroscopy"*.

2014

The Nobel Prize in Chemistry 2014
Eric Betzig, Stefan W. Hell, William E. Moerner

Share this:

The Nobel Prize in Chemistry 2014

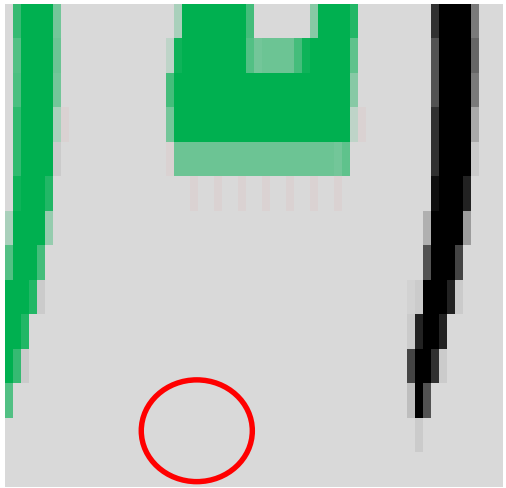
Photo: A. Mahmoud
Eric Betzig
Prize share: 1/3

Photo: A. Mahmoud
Stefan W. Hell
Prize share: 1/3

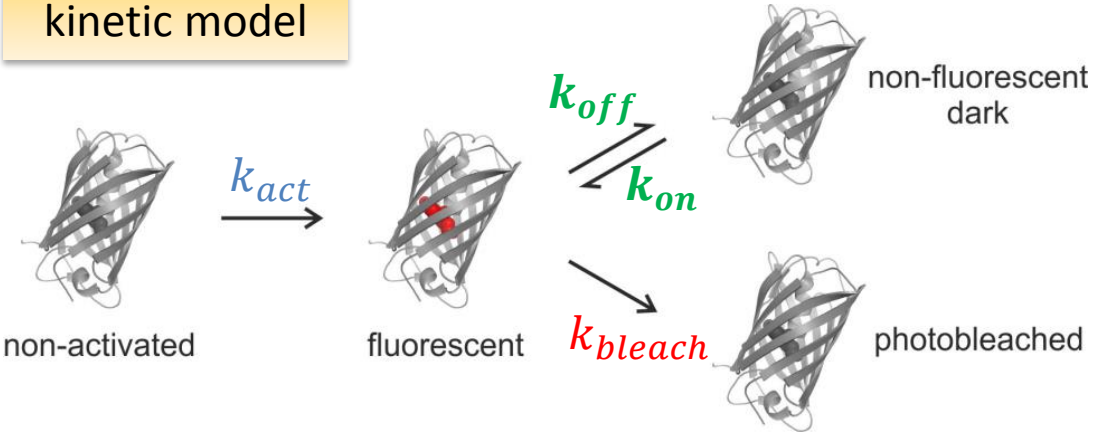
Photo: A. Mahmoud
William E. Moerner
Prize share: 1/3

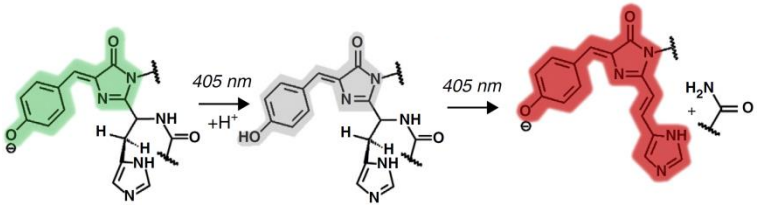
The Nobel Prize in Chemistry 2014 was awarded jointly to Eric Betzig, Stefan W. Hell and William E. Moerner *"for the development of super-resolved fluorescence microscopy"*.

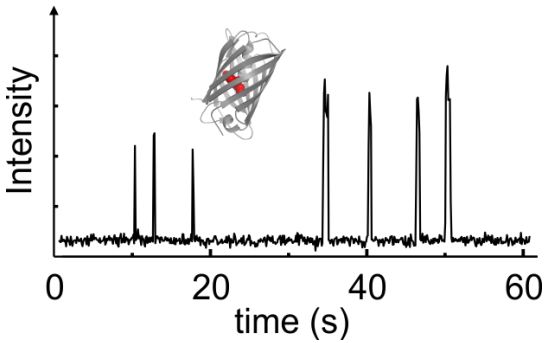
Reaktionskinetik einzelner Moleküle

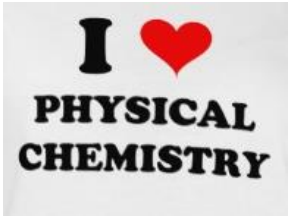


kinetic model









Anwendungsgebiete der Kinetik

Biologie	Physiologische Prozesse, Zellwachstum
Chemie	Reaktionsmechanismen
Elektrochemie	Elektrodenprozesse, Akkumulatoren
Technische Chemie	Reaktorchemie
Pharmakologie	Kinetik von Wirkstoffen
Physik	Diffusion, Kernprozesse

Zeitlicher Ablauf chemischer Reaktionen

s – min	Rohrzuckerinversion, Zerfall von N_2O_5, alkalische Esterverseifung
10^{-3} s	Redoxreaktionen, Enzymkinetik, Komplexbildung
10^{-6} s	Neutralisationsreaktionen, Rekombinationen ($2\ I \rightarrow I_2$)
10^{-9} s	Radikalreaktionen
10^{-12} s	Elektronen-/Protonentransfer (bspw. in der Photosynthese), Prädissoziation
10^{-15} s	Übergangszustände, Dissoziationsreaktionen

Reaktionsordnung

$$H_3CBr + OH^- \rightarrow H_3COH + Br^-$$

$$\upsilon = -\frac{d[H_3CBr]}{dt} = -\frac{d[OH^-]}{dt} = k[OH^-][H_3CBr]$$

$$[k] = \frac{L}{mol \cdot s}$$

$$CH_3CHO \rightarrow CH_4 + CO$$

$$\upsilon = k[CH_3CHO]^{3/2}$$

$$H_2 + Br_2 \rightarrow 2HBr$$

$$\upsilon = k_1 \frac{[H_2][Br_2]^{3/2}}{[Br_2] + k_2[HBr]}$$

$$H_2 + I_2 \rightarrow 2HI$$

$$\upsilon = k[H_2][I_2]$$

Komplexe Reaktionen oder Elementarreaktionen?

$$Na + Br_2 \rightarrow NaBr + Br\cdot$$

$$CO + H_2O \rightarrow CO_2 + H_2$$

$$H_2O \rightarrow OH + H\cdot$$
$$OH + CO \rightarrow CO_2 + H\cdot$$
$$2H\cdot \rightarrow H_2$$

$$nC_7H_{16} + 10O_2 \rightarrow 6CO_2 + 7H_2O + CO + H_2$$

$$2H_2 + O_2 \rightarrow 2H_2O$$