VORF-8

2024

Detlef Weigel (15. 12. 1961)

Max Planck Institute for Biology
Department of Molecular Biology
Spemannstrasse 37-39
D-72076 Tübingen
Germany

http://www.weigelworld.org/

detlef.weigel@tuebingen.mpg.de

MAX-PLANCK-GESELLSCHAFT

- narozen ve městě Prisser, Dolní Sasko, Německo (má i americké občanství – 24.5. 2001)

- má syna (19) a dceru (23)
- 1981 – 1983 – University Bielefeld (B.A., biologie)
- 1983 – 1986 – University Köln (M.S., biologie)
- 1988 – Max Planck Institute in Tübingen (Ph.D., genetika, *Drosophila;* při Eberhard-Karls-Universität; FOX=TF)

Prof. Herbert Jäckle

- 1988 – 1989 – research associate, Institute of Genetics, University of Munich
- 1989 – 1993 – post-doc, California Institute of Technology, Pasadena, CA (Elliot Meyerowitz lab)

Prof. Elliot Meyerowitz

- 1993 – 1999 – assistant professor, Plant Biology Laboratory, The Salk Institute, La Jolla, CA

- 1999 – 2002 – associate professor, Plant Biology Laboratory, The Salk Institute, La Jolla, CA

- 1997 – 2001 – assistant adjunct professor, Department of Biology, University of California, San Diego, CA

- 2001 – 2003 – adjunct professor, The Salk Institute, La Jolla, CA

- 2001 – Max Planck Institute for Developmental Biology, Tübingen, zakládá Department for Molecular Biology

- 2004 – adjunct professor, Eberhard-Karls-University Tübingen

- 2002 – dosud – ředitel Max Planck Institute for (Developmental, do r. 2021) Biology, Tübingen

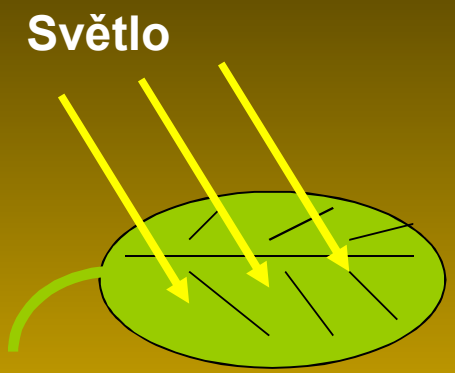
Max Planck Institute
for Developmental Biology,
Tübingen

- Ve svém Department for Molecular Biology vychoval 5% všech vědců, kteří kdy získali ERC grant.

Výzkum

1) Mechanizmus indukce kvetení

Gen *LEAFY*



Signál = florigen?

Místo indukce kvetení

?

?

Hormony:
gibereliny
cytokininy
etylén

Sacharóza

Polyamidy

Hypotéza multifaktoriálního spouštění:
Funkčnost jedné molekuly podmiňuje či ovlivňuje funkci jiné molekuly.

Geny určující identitu květních meristémů

LEAFY (LFY)
TERMINAL FLOWER1 (TFL1)
APETALA1 (AP1)
CAULIFLOWER (CAL)

Mutant *lfy* **-** produkuje více květních stvolů než WT; květy jsou zelené a mají pouze orgány podobné kališním a okvětním lístkům.

Ektopická (a konstitutivní) exprese *LFY1* => předčasné kvetení; stonky se mění v květy

Normální funkce *LFY* = přepíná nedeterminovaný růst na determinovaný

NEdeterminovaný růst

Determinovaný růst

Weigel D, Nilsson O (2002) A developmental switch sufficient for flower initiation in diverse plants. Nature 377: 495 - 500

Přenos genu *LEAFY* z *Arabidopsis* do genomu osiky (aspen) vedl ke zkrácení doby indukce kvetení osiky z původních několika let na několik měsíců => gen *LEAFY* urychluje kvetení.

Důležitý objev: kontrola kvetení hospodářsky významných rostlin.

Gen *FT*

Huang T *et al*. (2005)
Science 309: 1633-1772

Abe M *et al*. (2005)
Science 309: 1052-1056

Wigge PA *et al*. (2005)
Science 309: 1056-1059

Světlo (dlouhý den)

↓

***CO* (*CONSTANS*)**

↓

CO protein
(transkripční faktor)

↓

***FT* (*FLOWERING LOCUS T*)**

↓

Exprese *FT*

↓

mRNA of *FT*

↓

Stonkový vrchol + FD + FT

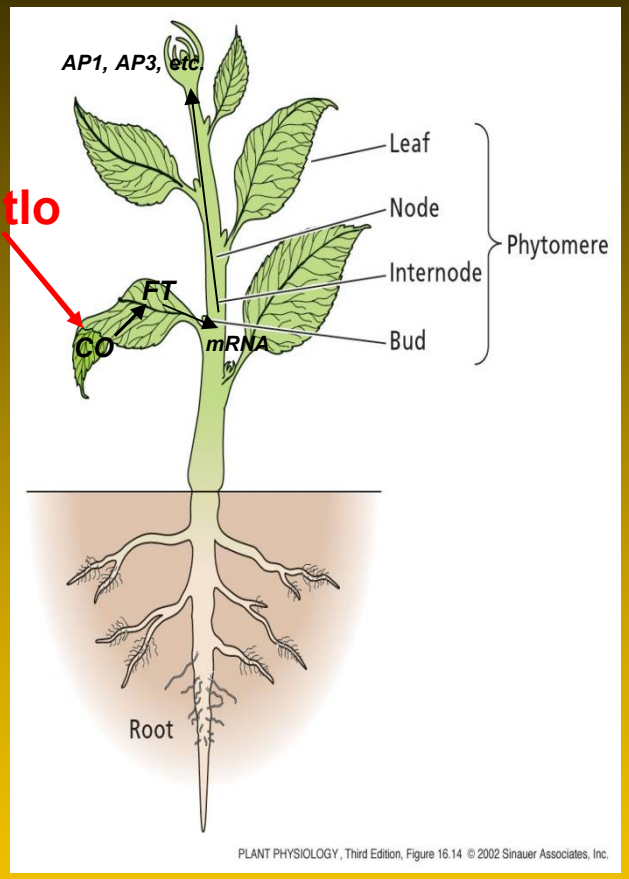
↓

AP1
AP3
LFY
CAL

↓

Indukce kvetení

***FD* (*FLOWERING LOCUS D*)**



2) microRNA

Izolace prvního mutanta *Arabidopsis* s mutací v miRNA => první důkazy o spojení miRNA s vývojem rostlin. Identifikace prvního specifického vývojového procesu regulovaného miRNA.

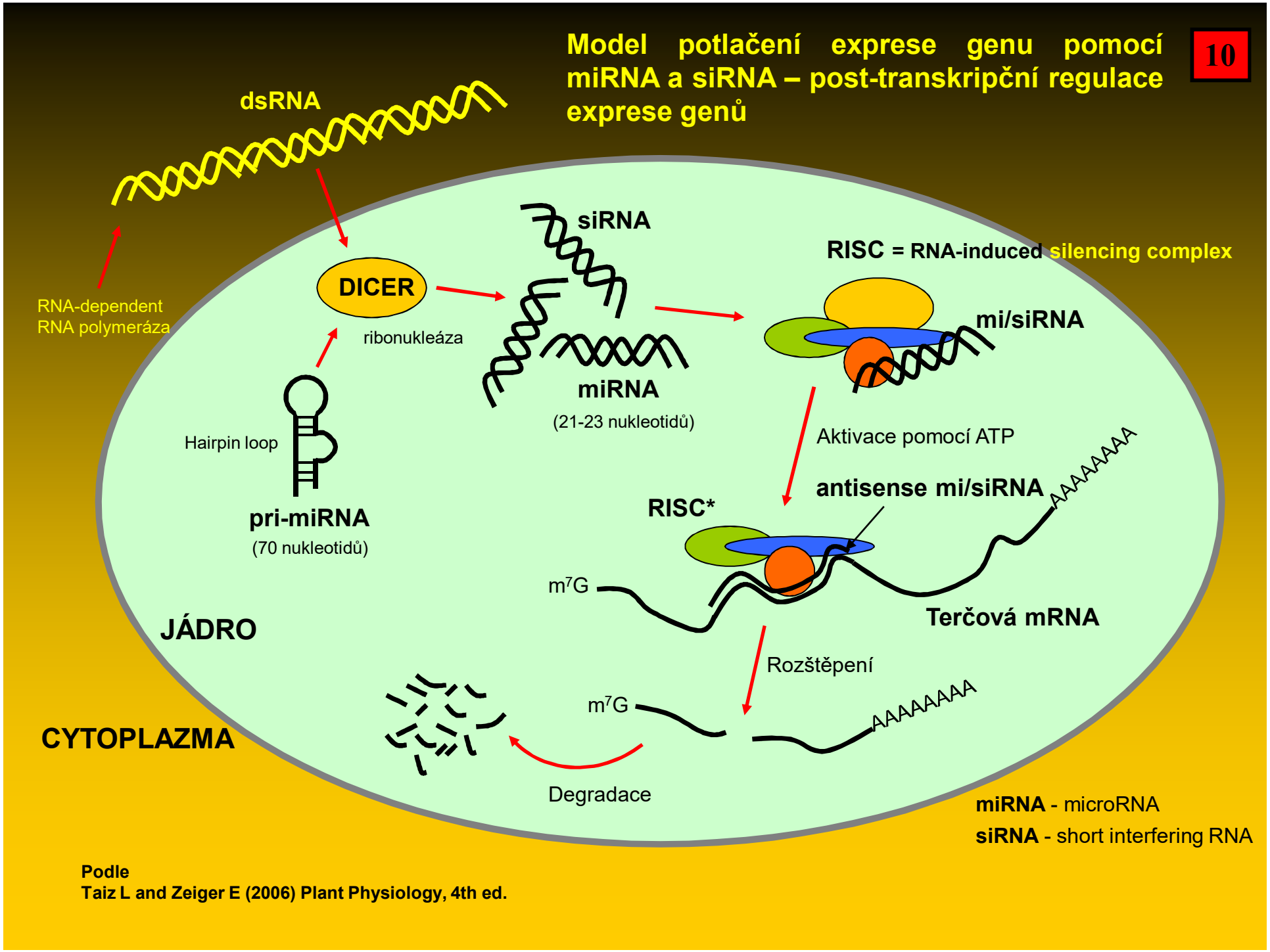
NATURE | VOL 425 | 18 SEPTEMBER 2003 | www.nature.com/nature

Control of leaf morphogenesis by microRNAs

Javier F. Palatnik[1,2], Edwards Allen[3], Xuelin Wu[2*], Carla Schommer[1*], Rebecca Schwab[1*], James C. Carrington[3] & Detlef Weigel[1,2]

Plants with altered microRNA metabolism have pleiotropic developmental defects, but direct evidence for microRNAs regulating specific aspects of plant morphogenesis has been lacking. In a genetic screen, we identified the *JAW* locus, which produces a microRNA that can guide messenger RNA cleavage of several *TCP* genes controlling leaf development. MicroRNA-guided cleavage of *TCP4* mRNA is necessary to prevent aberrant activity of the *TCP4* gene expressed from its native promoter. In addition, overexpression of wild-type and microRNA-resistant *TCP* variants demonstrates that mRNA cleavage is largely sufficient to restrict *TCP* function to its normal domain of activity. *TCP* genes with microRNA target sequences are found in a wide range of species, indicating that microRNA-mediated control of leaf morphogenesis is conserved in plants with very different leaf forms.

Model potlačení exprese genu pomocí miRNA a siRNA – post-transkripční regulace exprese genů



miRNA - microRNA
siRNA - short interfering RNA

Podle
Taiz L and Zeiger E (2006) Plant Physiology, 4th ed.

3) Přirozené genetické změny (Projekt 1001 genomů)

Základní otázka projektu: „Jak se organizmus adaptuje ke změnám prostředí – indukují změny prostředí vznik nových struktur či organizmů?“

Strategie projektu: Srovnání genomů 1001 přirozených linií *Arabidopsis* a sledování spontánních mutací v jejich genomech v závislosti na podmínkách, ve kterých daná linie roste.

První výsledky projektu

Cao J et al. (2011) Whole-genome sequencing of multiple *Arabidopsis thaliana* populations. Nature Genetics 43: 956-963

Hu TT et al. (2011) The *Arabidopsis lyrata* genome sequence and the basis of rapid genome size change. Nature Genetics 43: 476–481

Becker C et al. (2011) Spontaneous epigenetic variation in the *Arabidopsis thaliana* methylome. Nature 480: 245–249

Ocenění za biologii

1989 - Dieter Rampacher Award of the Max Planck Society
1993 - National Science Foundation Young Investigator
1994 - Young Investigator Award of the National Science Foundation
2001 - Charles Albert Shull Award of the American Society of Plant Biologists
2003 - Member of the European Molecular Biology Organization (EMBO)
2007 - Gottfried Wilhelm Leibniz Prize of the Deutsche Forschungsgemeinschaft (DFG)
2008 - Member of the German Academy of Sciences Leopoldina
2009 - Member of the US National Academy of Sciences
2010 - Corresponding Member, Heidelberg Academy of Sciences and Humanities
2010 - Otto Bayer Award of the Bayer Foundations

2010 Otto Bayer Award

(75 000 Euro)

2010 - Foreign Member of the Royal Society of London
2011 - Member of American Association for the Advancement of Science
2011 - State Research Prize of Baden Württemberg
2015 - Mendel Medal of the German National Academy of Sciences Leopoldina (založena 1652)
2016 – Genetics Society of America Medal
2019 – Barbara McClintock Prize for Plant Genetics and Genome Studies
2019 – Gottfried Wilhelm Leibniz Prize (the German Research Foundation) (2,5 milionů Euro)
2019 – Member of American Academy of Arts and Sciences
2020 – Novozymes Prize of the Novo Nordisk Foundation

The Royal Society in Carlton House Terrace in London

State Research Prize, 6. července 2011
(100 000 Euro)

Vychoval více než 100 doktorantů a post-doktorantů z 29 zemí ze všech obydlených kontinentů. Řada z nich pracuje na profesorských pozicích nebo získali významná ocenění.

Slouží v mnoha poradních a redakčních radách. Je jediným rostlinným biologem v lékařské poradním sboru Howard Hughes Medical Institute. Je předsedou Rady European Molecular Biology Organization.

Honorary doctor's lecture at SLU 2016 – Detlef Weigel

SLU = Sveriges lantbruksuniversitet
(Swedish University of Agricultural Science)

https://www.youtube.com/watch?v=7Zahe7T6zZI

Weigel Style (Gangnam Style Parody)

The Weigel lab 2013 Christmas video

https://www.youtube.com/watch?v=FOMOR_RjZWs

https://www.youtube.com/watch?v=-0xaVTzDzq0

Epistasis, the spice of life: Lessons from the study of the plant immune system – Dr Detlef Weigel

Robert Erskine Cleland (30. 4. 1932)

University of Washington
Department of Biology
Hitchcock Hall 428
Seattle, WA 98195-1800
USA

cleland@uw.edu

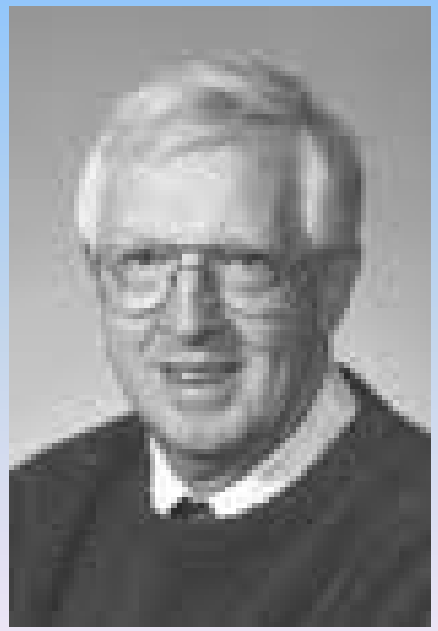
http://www.washington.edu/

UW, Seattle, Hitchcock Hall

UW, Seattle

- 1953 – Oberlin College, Oberlin, Ohio (BA)
- 1957 – California Institute of Technology, Division of Biology, Pasadena, California (Ph.D., fyziologie rostlin)
- 1957 – 1960 – post-doc ve Švédsku a Anglii
- 1960 – 1964 – research associate, University of California, Berkeley, CA
- 1964 – 1968 – associate professor, University of Washington, Seattle, WA

- 1968 – dosud – professor, University of Washington, Seattle, WA
- Nyní – emeritní professor, bývalý ředitel biologického programu na University of Washington, Seattle, WA
- Sabbatical – University of Leeds (UK), University of Edinburgh (UK), Yale University, New Haven, Connecticut



Ocenění za biologii

1965 – 1980 – Člen ediční rady časopisu Plant Physiology

1967 – John Simon Guggenheim fellowship (rostlinná biologie)

(3 500 – 4 000 kandidátů ročně, cena udělována 220 vědcům; New York)

1971 – 1973 – člen výboru American Society of Plant Biologists (ASPB)

1974 – Prezident ASPB

1998 – Člen Committee on Space Biology and Medicine, National Academy of Sciences, USA

Člen panelu Committee on Planetary and Lunar Exploration

2007 – ASPB Award Committee

Člen Association for the Advancement of Science (AAAS)

Předseda Barnes Life Membership Committee (ASPB)

153 publikací, téměř 5600 citací

John Simon Guggenheim Memorial Foundation

Plant Physiol. (1970) 46, 250–253

Enhancement of Wall Loosening and Elongation by Acid Solutions[1]

Received for publication January 20, 1970

DAVID L. RAYLE AND ROBERT CLELAND
Department of Botany, University of Washington, Seattle, Washington 98105

ABSTRACT

The ability of low pH and CO_2 to induce rapid cell elongation and wall loosening in the *Avena* coleoptile has been examined with the use of a continuous growth-recording technique and an Instron extensometer, respectively. In particular, the properties of the response to hydrogen ions have been examined in detail and have been compared with the responses initiated by CO_2 and auxin. The optimal pH for growth is about 3.0, and both the maximal growth rate and wall extensibility are similar to that produced by optimal auxin. The timing (initiated in less than 1 minute) and duration (up to 2 hours) of the response to hydrogen ions, as well as certain other aspects of the growth and wall-loosening responses, are described. It is shown that the pH response can be clearly separated from the CO_2 response. Possible mechanisms for the initiation of the growth response to low pH are briefly discussed.

The ability of hydrogen ions to promote the growth of coleoptile segments has been known for some time; however, this particular phenomenon has not been extensively studied nor has it been described in any detail. In 1934, Bonner (1) reported that the growth of coleoptile sections was 8 times greater at pH 4.1 than at 7.2. He also noted that a low pH induced a rather large increase in the extensibility of the cell wall. Nitsch and Nitsch (9) reported that hydrogen ions had a stimulatory effect on cell enlargement both in the presence and absence of IAA. Evans (5) has also briefly studied the effect of hydrogen ions on elongation and was the first investigator to note the rapidity of the response. Menzel (8) has examined the effect of low pH on the extensibility of plasmolyzed *Helianthus* hypocotyl segments, and has reported that hydrogen ions increase the extensibility of cell walls. Unfortunately, the techniques used in this particular study do not lend themselves to direct comparison with other systems.

In this paper we shall describe in some detail the effect of hydrogen ions on the growth and wall extensibility of coleoptile segments. Because the effect described is in many ways similar to the effect of IAA on growth and wall properties, this information may lead to a more general understanding of the cell enlargement process.

The effect of CO_2-saturated solutions on the growth of coleoptile segments was also investigated and compared with the hydrogen ion effect. The descriptive aspects of the CO_2 response have been investigated in some detail by Evans and his co-workers (5, 7). The response is initiated rapidly (lag 0–2 min) and lasts a relatively short time (about 30–60 min). However, since in most experiments CO_2 was bubbled into water and the solution then tested (pH 3.8), it was never clearly established whether the effect was due to CO_2 or H^+. In this paper we shall show that the two responses can be separated and, indeed, appear to be quite different.

MATERIALS AND METHODS

The plant material used in this study consisted of 10-mm sections cut from the region 3 to 13 mm below the tip of *Avena sativa* var. 'Victory' coleoptiles. *Avena* seedlings were grown as described earlier (2), and coleoptiles were used when they were 25 to 32 mm in length.

The elongation of coleoptiles was measured by the high resolution continuous recording technique of Evans and Ray (6). Briefly, this method consists of positioning a vertical column of coleoptiles (in this case 12 10-mm sections) within a specially constructed glass chamber. A small weight is positioned on the uppermost coleoptile, and an arc lamp is used to cast a shadow of the weight onto a slit. The vertical displacement of the coleoptiles is continuously recorded on a piece of photographic paper moving horizontally behind the slit. The growth curves shown are direct tracings from such shadowgraphic records with the magnification factors and time scales indicated.

Extension analysis of the cell walls was performed with an Instron TM-S linear extensometer as previously described (3). Briefly, the procedure consists of incubation of the sections in the desired medium, followed by killing the sections in boiling methanol, deproteinizing with pronase, and then subjecting the sections to force-extension analysis. The capacity for irreversible extension is expressed as percentage of irreversible extension per 100 g of load. These values are proportional to the plastic compliance since there is no significant change in the mass of the coleoptile during the rather short time intervals used in these experiments. For comparison with previously published results, a value of 10% is equivalent to a plastic compliance of 16.2×10^{-11} cm²/dyne.

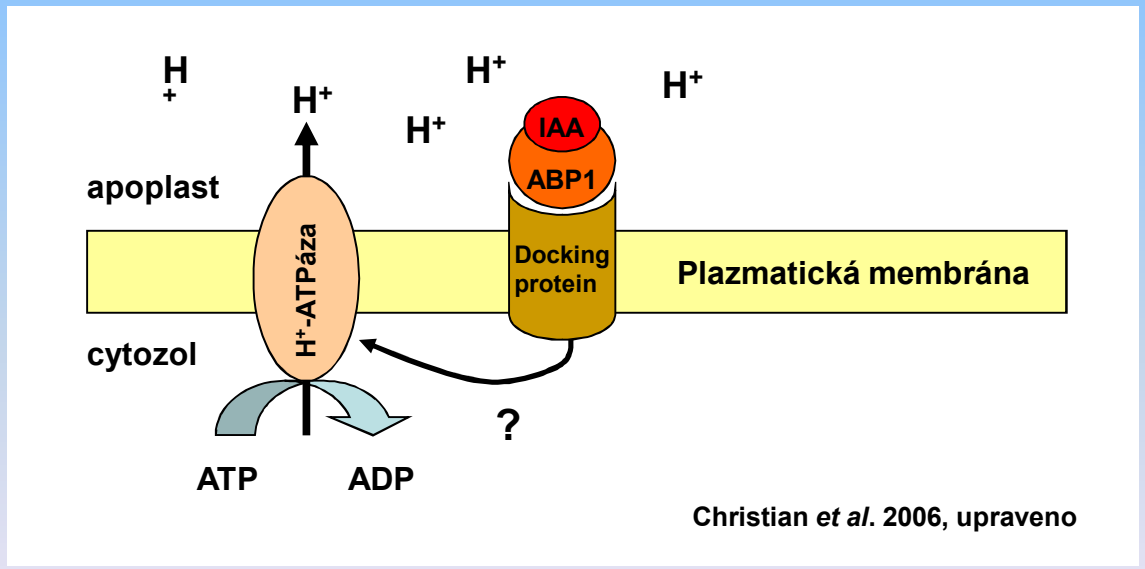
All incubations at pH 7.0 were done with 0.01 M phosphate buffer, and incubations at pH 3.0 were done with 0.01 M citrate buffer or 0.01 M glycine-HCl buffer. All experiments were conducted in dim red light at a temperature of 25 C.

Experiments with CO_2 were performed by saturating the appropriate solution (see figure legends) with 100% CO_2 before its addition to the growth chamber, and then followed by subsequent treatment with CO_2 bubbled into the chamber for the duration of the experiment. In all experiments, the final pH of the CO_2-saturated solution was measured.

[1] This study was supported by National Science Foundation, Grant 5385 X to R.E.C., and by a National Science Foundation Postdoctoral Fellowship to D.L.R.

Acid growth theory - teorie kyselého růstu
(protonová pumpa a draslíkové kanály)

Auxin → Exkrece H^+ do apoplastu → Snížení pH v apoplastu → Aktivace enzymů rozvolňujících buněčnou stěnu



Christian *et al*. 2006, upraveno

Vazba auxinu k ABP1

↓

Stimulace aktivity H^+-ATPázy

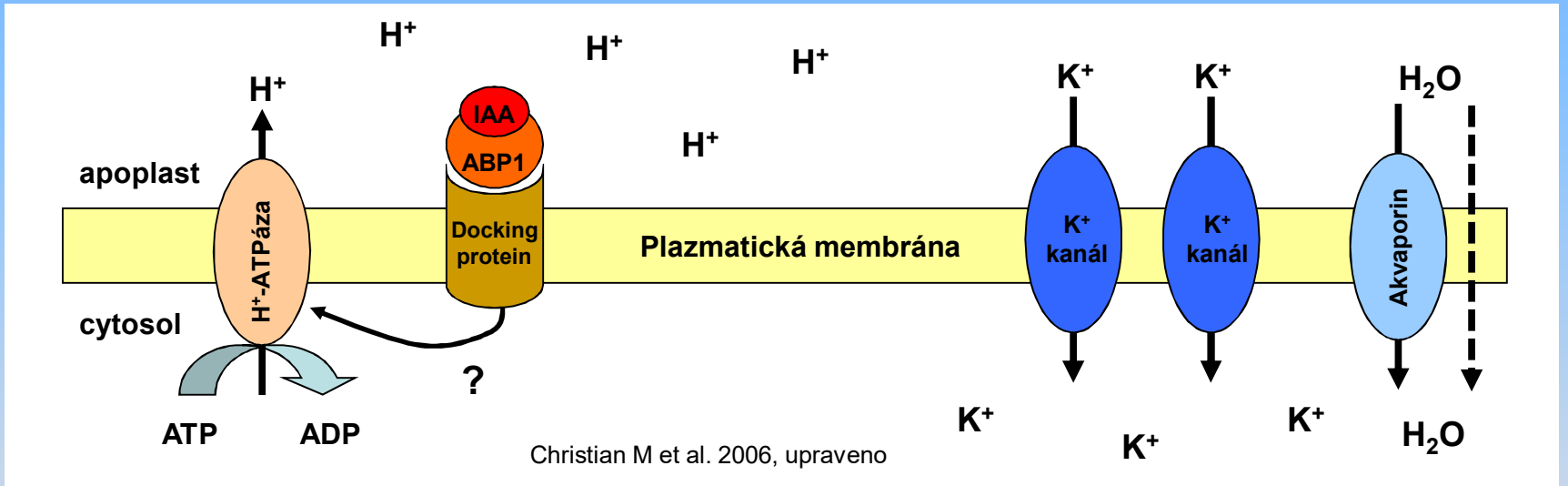
↓

Hyperpolarizace membrány
Acidifikace apoplastu

Podmínkou růstu buňky je turgor. Auxin sám nezvyšuje turgorový tlak.

Akumulace H^+ v apoplastu ➡ Kompenzace náboje v cytosolu

K^+ kanály transportující K^+ dovnitř buňky



Christian M et al. 2006, upraveno

Akumulace K^+ v cytosolu ➡ Transport H_2O do buňky ➡ Turgor ➡ RŮST

Přítomnost K^+ : podmínka udržení trvalé acidifikace a trvalého růstu

Dr. David Rayle, University of California, San Diego, CA

Zemřel ve věku 58 let, brzy po ochodu do důchodu.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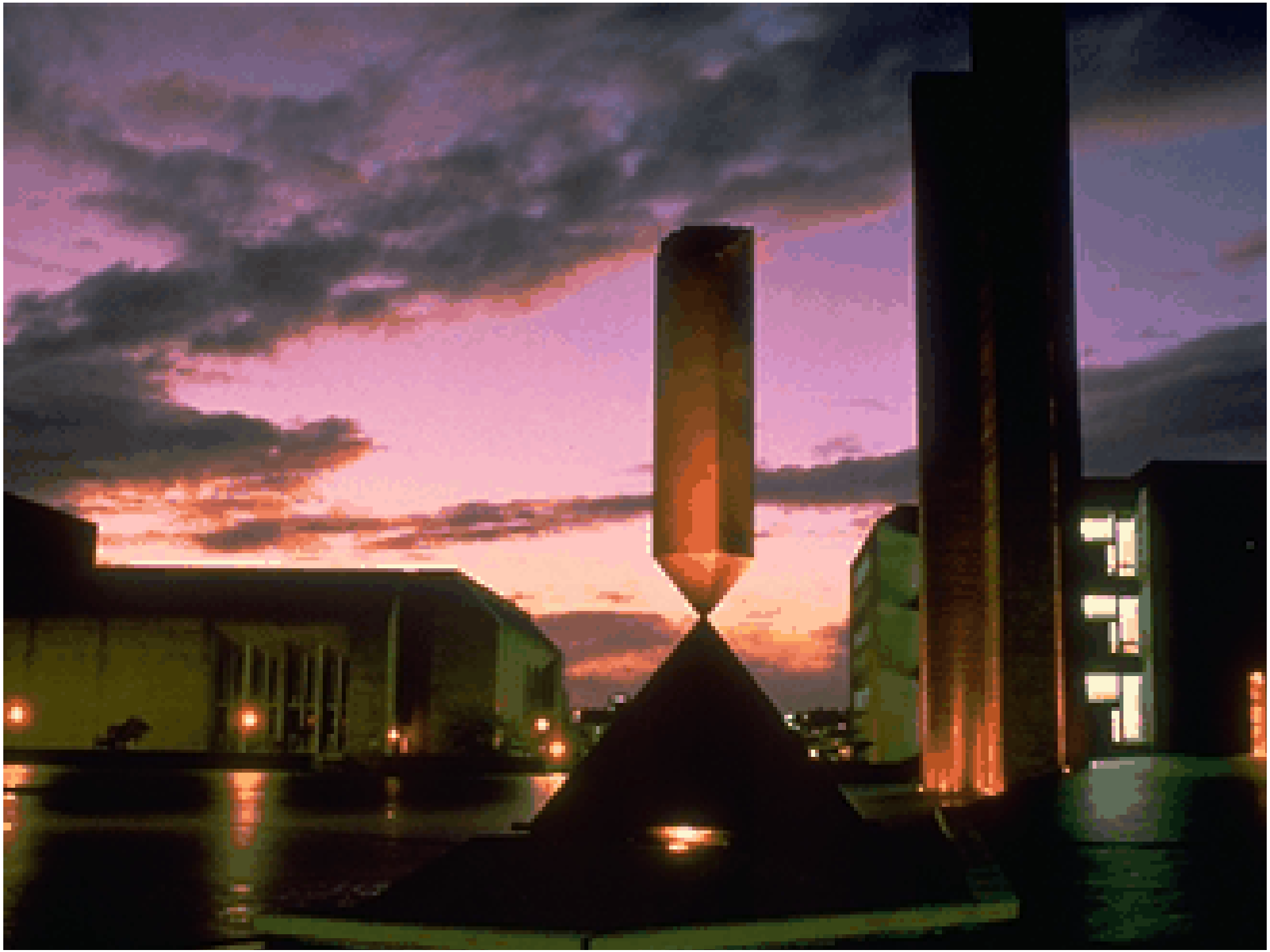


Welcome
Welcome
Welcome
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Olympic National Park
Hurican Ridge