

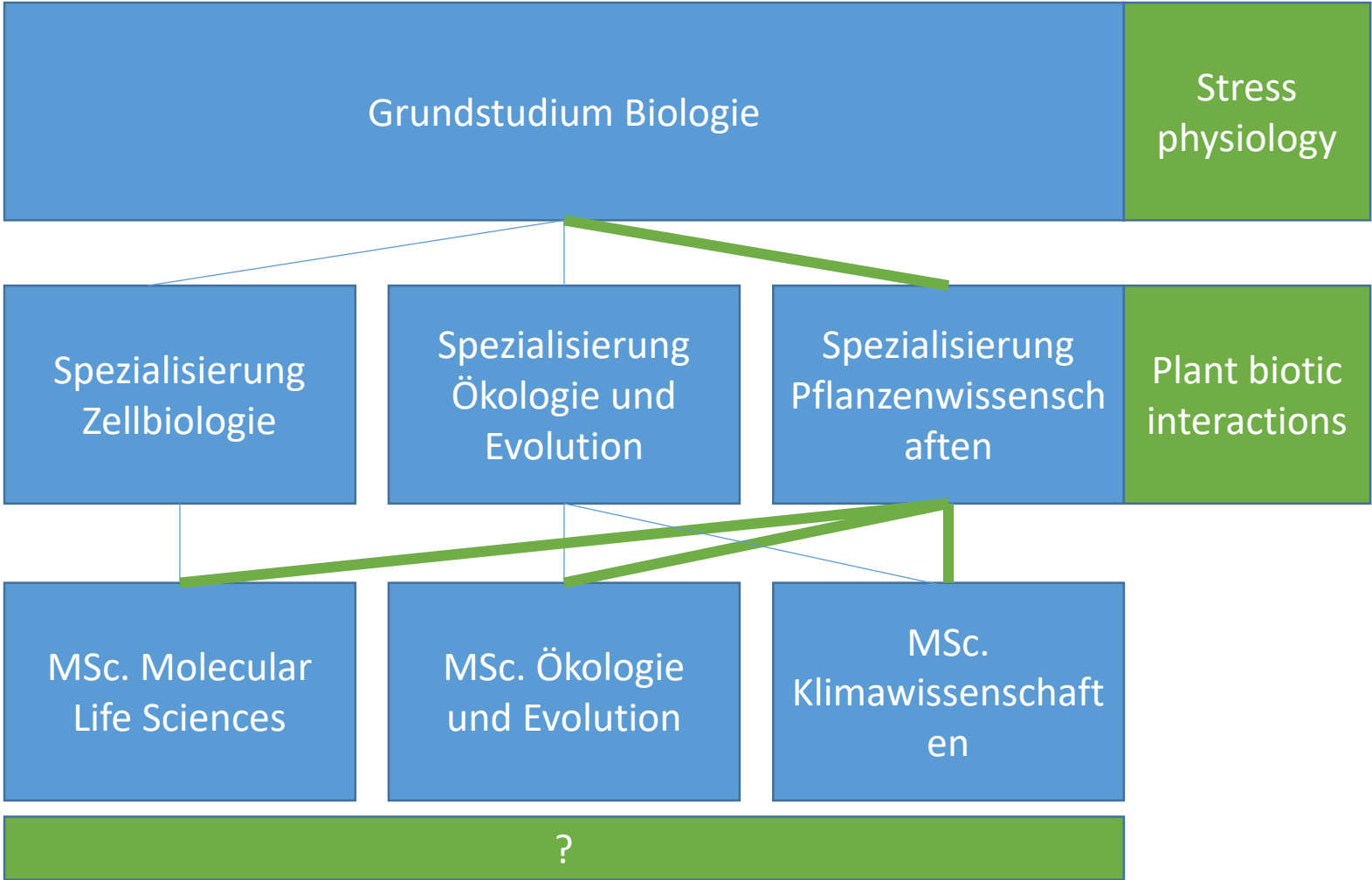
Inverted Classroom, Challenge-Based Learning und die Interaktive Leseplattform Perusall- Praktische Erfahrungen aus einem neu etablierten MSc.-Kurs der Biologie

Dr. Christelle Robert, Prof. Matthias Erb

Institut für Pflanzenwissenschaften

Universität Bern

Was war die Motivation, diesen Kurs aufzubauen?



Grundstudium Biologie

Stress physiology

Spezialisierung Zellbiologie

Spezialisierung Ökologie und Evolution

Spezialisierung Pflanzenwissenschaften

Plant biotic interactions

MSc. Molecular Life Sciences

MSc. Ökologie und Evolution

MSc. Klimawissenschaften

?

Transition von passivem zu aktivem Lernen

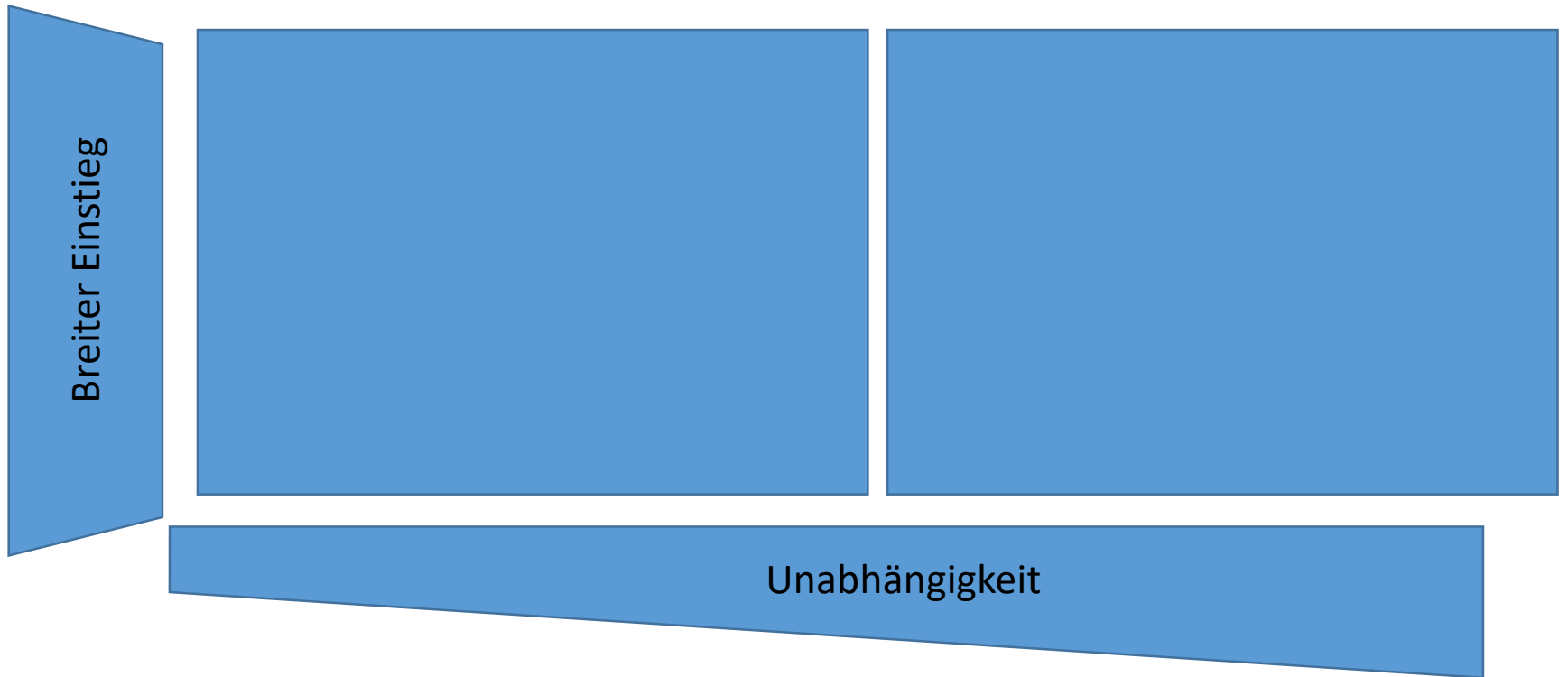
Wie haben wir die Kursstruktur an diese Anforderungen angepasst?

Modul 1-3:  
Theorie

Modul 4-6:  
Praxis

Breiter Einstieg

Unabhängigkeit



- Module 1: Basics in Plant-Herbivore Interactions
- Module 2: Frontiers in Plant-Herbivore Interactions
- Module 3: Scientific Experimentation in Plant-Herbivore Interactions

Flipped/ inverted classroom





**ILIAS®**

**1. ILIAS e-learning platform:**

Allgemeine Informationen

Kurzinput-Videos

Weiterführende Literatur

Forum

**Perusall**

**2. PERUSALL reading platform**

Interaktive Diskussion der

Literatur

**u<sup>b</sup>**

b

**UNIVERSITÄT  
BERN**

**3. Kurse @ IPS**

Antworten auf offene Fragen

Zusätzliche Diskussionen



# 436479-HS2018-0: Solving Current Challenges in Plant-Herbivore Interactions



Aktionen ▾

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Neues Objekt hinzufügen ▾

## INHALT

[Course Materials](#) ▾

[Course program 2018](#) ▾  
 Updated program  
 pdf 17,9 KB 18. Sep 2018, 12:38 Anzahl Seiten: 1

[General Communications & Questions Forum](#) ▾  
 Ask your general questions here. Course tutors will also post announcements and important messages here, so check frequently!  
**Beiträge (Ungelesen): 9 (4) Neue Beiträge: 2**  
 Letzter Beitrag: Thank you for your comment and the li... von c.senn, 05. Dez 2018, 14:56

## Neuigkeiten

(1-5 von 64) weiter

Forum: General Communications & Questions Forum  
3 Beiträge hinzugefügt.

Datei: Course program 2018.pdf  
Die Datei wurde aktualisiert.

Forum: General Communications & Questions Forum  
Es wurde ein Beitrag hinzugefügt.

Datei: EcologyEvolution.pptx  
Die Datei wurde hinzugefügt.

Datei: Course program 2018.pdf  
Die Datei wurde hinzugefügt.

## Kalender

◀ Dez 2018 ▶

KW	Mo	Di	Mi	Do	Fr	Sa	So
48						1	2
49	3	4	5	6	7	8	9
50	<b>10</b>	11	12	13	14	15	16
51	17	18	19	20	21	22	23
52	24	25	26	27	28	29	30
01	31						



## Part 3: Defense phenotypes


Aktionen ▾


**Inhalt** Info Einstellungen Lernfortschritt Export Rechte



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Neues Objekt hinzufügen ▾

### INHALT

- 
3 Defense phenotypes
▾

mp4 47,6 MB 09. Mär 2018, 13:07
- 
Defense phenotypes
▾

pptx 3,5 MB 09. Mär 2018, 13:06
- 
elife-13720-v1 
▾

pdf 1,4 MB 09. Mär 2018, 13:06
- 
elife00007 
▾

pdf 2,4 MB 09. Mär 2018, 13:06

Lernvideos



## Solving Curre... X

← My Courses and Cl...

🏠 Course home

⚙️ Course setup

📅 Gradebook

👤 People

📧 Notifications

📅 Add to my calendar

## Readings ⚙️

## Documents

InsectPlantBiology\_Ch...

InsectPlantBiology\_Ch...

elife00007

elife-13720-v1

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Show more...

## Assignments

Oct 24: EMBR-16-1250

Oct 24: platt1964

Oct 24: festing2003

Oct 24: vaux2014

Oct 10: Reading for M...

● Oct 10: Reading for M...

Oct 10: Reading for M...

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Oct 3: Reading for Mo...

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## Chats ⚙️ ?



RESEARCH ARTICLE



## Herbivory-induced volatiles function as defenses increasing fitness of the native plant *Nicotiana attenuata* in nature

Meredith C Schuman, Kathleen Barthel<sup>1</sup>, Ian T Baldwin\*

Department of Molecular Ecology, Max Planck Institute for Chemical Ecology, Jena, Germany

**Abstract** From an herbivore's first bite, plants release herbivory-induced plant volatiles (HIPVs) which can attract enemies of herbivores. However, other animals and competing plants can intercept HIPVs for their own use, and it remains unclear whether HIPVs serve as an indirect defense by increasing fitness for the emitting plant. In a 2-year field study, HIPV-emitting *N. attenuata* plants produced twice as many buds and flowers as HIPV-silenced plants, but only when native *Geocoris* spp. predators reduced herbivore loads (by 50%) on HIPV-emitters. In concert with HIPVs, plants also employ antidigestive trypsin protease inhibitors (TPIs), but TPI-producing plants were not better than TPI-silenced plants. TPIs weakened a specialist herbivore's behavioral evasive responses to simulated *Geocoris* spp. attack, indicating that TPIs function against specialists by enhancing indirect defense.

DOI: 10.7554/eLife.00007.001

\*For correspondence: baldwin@ice.mpg.de

**Present address:** Federal Research Center for Cultivated Plants, Institute for Breeding Research on Horticultural and Fruit Crops, Julius Kühn Institute, Dresden, Germany

**Competing interests:** See page 26

**Funding:** See page 26

**Received:** 7 May 2012

**Accepted:** 11 July 2012

**Published:** 15 October 2012

**Reviewing editor:** Detlef Weigel, Max Planck Institute for Developmental Biology, Germany

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Schuman et al. eLife 2012;1:e00007. DOI: 10.7554/eLife.00007

1 of 29

eLIFE Research article

Genomics and evolutionary biology | Plant biology

**eLife digest** As the population of the world continues to increase beyond 7 billion, and agricultural pests continue to rapidly evolve resistance to pesticides, it is becoming ever more important to cultivate arable land in a way that is sustainable for both humans and the environment. A better understanding of the different mechanisms used by wild plants to deter herbivores will help to increase crop production without harming the environment.

Plants use both direct and indirect methods to fend off herbivores. Direct defense methods include the production of chemicals that are toxic to herbivores or give them indigestion, and the growth of sticky prickles and spines that can injure or kill the herbivore. Indirect defense methods, on the other hand, generally rely on the plant attracting organisms that are either predators or parasites of the herbivore.

Plants produce odors known as herbivory-induced plant volatiles (HIPVs) that are thought to

All conversations X

Page 4

? irLOX2: I found that ir is an abbreviation for inverted-repeat.D...

I wonder where the precursor molecules of these two genes ... 2

Page 5

? Hemizygous means one allele is missing (so one instead of... 2

Page 17

I think that, in a next study, it will be very interesting to stu...

This is a pertinent study that shows how direct plant defens...

This study is very informative, as it shows the effect of HIPV in n...

? Would the results differ if the plant is dependend on pollin... 2

- Module 4: Find Your Own Challenge in Plant-Herbivore Interactions
- Module 5: Solve Your Challenge through Experimentation
- Module 6: Understand and Communicate Your Knowledge

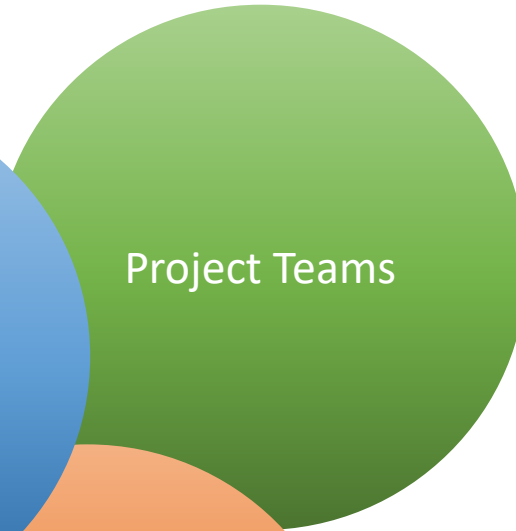
Challenge-based learning

## Undabhängige Experimente

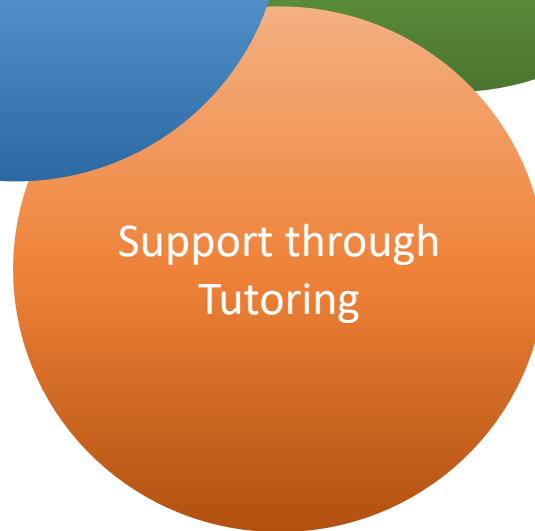
Do-it yourself labor



Do-It-Yourself  
Lab



Project Teams



Support through  
Tutoring

## Projektteams

Frage zusammen identifizieren

Experimente planen

Arbeit koordinieren

## Projektbetreuung

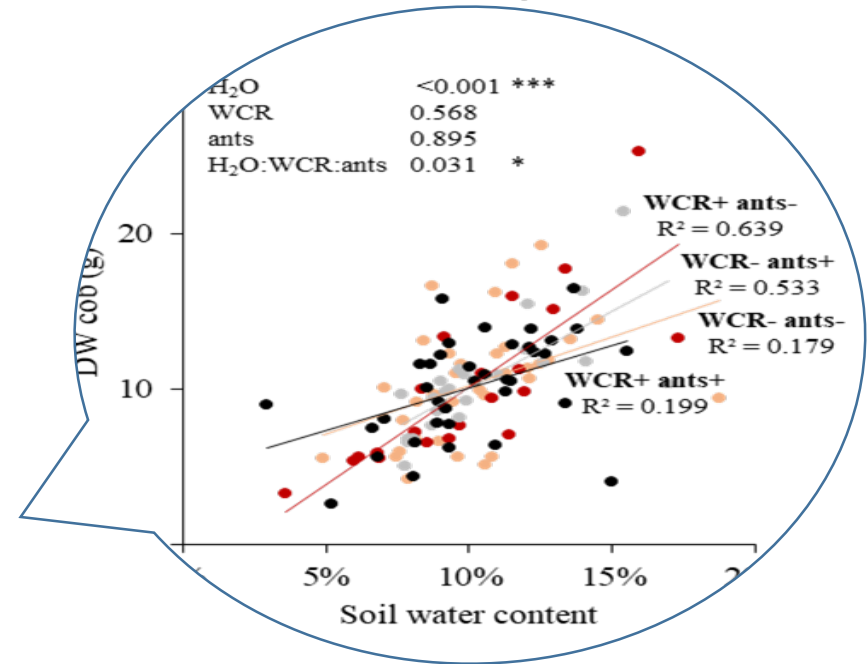
Forum auf Ilias

Projektpräsentation & Diskussion @IPS

Individuelle Unterstützung



Ziel für die Studenten: Ein experimenteller Test einer eigenen Hypothese, als Präsentation den Kursteilnehmern vorgestellt.



Wie haben wir den Kurs validiert?



Erik Poelman, Professor für  
Entomologie, Wageningen  
University



Thomas Tribelhorn, Leiter  
Hochschuldidaktik &  
Lehrentwicklung, Universität Bern

Vorbereitungsphase: Was hat funktioniert,  
was nicht?

# Videos erstellen: Sehr effizient dank low-tech

The screenshot displays the Camtasia software interface during a recording session. The title bar reads "Camtasia - Welcome.tscproj". The top menu bar includes "Aufnahme" (Recording), "Bearbeiten" (Edit), "Ändern" (Change), "Ansicht" (View), "Weitergeben" (Share), and "Hilfe" (Help). The main workspace is divided into several sections:

- Left Panel:** A vertical toolbar with icons for "Medien" (Media), "Anmerkungen" (Annotations), "Übergangseffekte" (Transition Effects), "Verhalten" (Behavior), "Animationen" (Animations), and "Cursoreffekte" (Cursor Effects). Below this is a "Mehr" (More) button.
- Clip-Auswahl (Clip Selection):** A central area showing a preview of the recorded clip, labeled "Course Introduct...".
- Preview Window:** A large window showing a video of a man speaking, overlaid with a screenshot of a website. The website screenshot has two blue callout boxes with text: "Contact your tutors" and "Ask questions in the Blackboard forum".
- Right Panel:** A text box with the instruction: "Klicken Sie auf ein Objekt auf der Timeline, um dessen Eigenschaften anzuzeigen." (Click on an object on the timeline to display its properties).
- Timeline:** A horizontal timeline at the bottom showing a duration of 00:00:00 to 00:05:30:00. It features playback controls (stop, play, next, previous) and a progress indicator showing "12:19 / 12:38".
- Tracks:** Below the timeline, there are two tracks: "Spur 3 Course Introduction (Audio)" and "Spur 2 Course Introduction (Kamera)".

Additional UI elements include a "Weitergeben" (Share) button in the top right, a "Eigenschaften" (Properties) gear icon in the bottom right, and a "32%" zoom level indicator in the top center.

# Ilias und Perusall- einfaches Management

ILIAS Universität Bern

**u<sup>b</sup>** PERSÖNLICHER SCHREIBTISCH • MAGAZIN •

Magazin • Philosophisch-naturwissenschaftliche Fakultät • Pflanzenwissenschaften • HS2018 • Kurs • 436479-HS2018-0: Solving Current Challenges in Plant-Herbivore Interactions

## 436479-HS2018-0: Solving Current Challenges in Plant-Herbivore Interactions

Aktionen ▾

Inhalt Info Einstellungen Mitglieder Lernfortschritt Metadaten Export Rechte Vorsicht als Mitglied aktivieren ▸

Zeigen Verwalten Sortierung Seite gestalten

**Neues Objekt hinzufügen ▾**

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(1-3 von 4) wocher

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52	24	25	26	27	28	29	30
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ICAF

## Perusall

Solving Current Challenges in Plant Herbivore Intera... All comments ▾

### Solving Curre... X

- My Courses and Cl...
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- Course setup
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- People
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- Add to my calendar

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### Documents

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### Chats

## eLIFE

RESEARCH ARTICLE

### Herbivory-induced volatiles function as defenses increasing fitness of the native plant *Nicotiana attenuata* in nature

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Department of Molecular Ecology, Max Planck Institute for Chemical Ecology, Jena, Germany

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DOI: 10.15252/elife.00007

### Introduction

Plant indirect defenses are traits that deter or remove herbivores by manipulating tri-trophic interactions to the advantage of the plant (Purr et al., 1988). They attract and inform the third trophic level: predators or parasitoids, resulting in increased attacks on herbivores (Turling and Wikman, 2006). Indirect defenses are widespread and include domains, molecular motifs, and food bodies which provide shelter and nutrition for predators and parasitoids, as well as herbivory-induced plant volatiles (HIPVs) which convey information about feeding herbivores (Heit, 2008). Field studies with the native tobacco *Nicotiana attenuata*, a short annual, and with maize have shown that HIPVs can reduce herbivore loads by 20% to more than 90%, by increasing both predation and parasitization of herbivores (Kessler and Baldwin, 2001; Bauman et al., 2009; Halitschke et al., 2009; Depamont et al., 2009; Alomir and Baldwin, 2010) and deterring herbivore reproduction (Kessler and Baldwin, 2001). If HIPVs really function as defenses, they should increase *Nicotiana* fitness, defined as successful reproduction, for plants under herbivore stress (Kessler and Baldwin, 1999). But because HIPVs can be generated by many other members of the ecological community—from herbivores, pollinators, predators and parasitoids to competing or parasitic plants—it is not clear whether HIPVs increase plant fitness in nature (Dicks and Dicks, 2010; Kessler and Heit, 2011). The field studies described above have either ignored how fast a time to reveal *Nicotiana* fitness benefits, or have not reported fitness data at all (Kessler and Baldwin, 2001; Bauman et al., 2009; Halitschke et al., 2009; Depamont et al., 2009; Alomir and Baldwin, 2010). Two laboratory studies showed that parasitization of herbivores can increase plant reproduction (van Loon et al., 2000; Halitschke and Turling, 2005), but the parasitization in these studies was not mediated by HIPVs. Hence three decades after their description, it remains unclear whether HIPVs are really indirect defenses.

Long-term field studies comparing HIPV-emitting vs. -deficient plants are required in order to demonstrate a defensive function for HIPVs. Experimental additions of pure volatiles or mixes to demonstrate a defensive function for HIPVs. Experimental additions of pure volatiles or mixes to demonstrate a defensive function for HIPVs.

Schuman et al. eLife 2012;7:00007. DOI: 10.15252/elife.00007

1 of 29

### eLIFE Research article

Genetics and evolutionary biology | Plant biology

### eLife digest

As the population of the world continues to increase beyond 7 billion, and agricultural pests continue to rapidly evolve resistance to pesticides, it is becoming ever more important to cultivate crops in a way that is sustainable for both humans and the environment. A deeper understanding of the different mechanisms used by wild plants to deter herbivores will help to increase crop production without harming the environment.

Plants use both direct and indirect methods to fend off herbivores. Direct defense methods include the production of chemicals that are toxic to herbivores or give them indigestion, and the growth of sticky prickles and spines that can injure or kill the herbivores. Indirect defense methods, on the other hand, generally rely on the plant attracting organisms that will either predation or parasitize of the herbivore.

There used to be some concern on herbivory-induced plant volatiles (HIPVs) that they would attract

# Zeitplanung des Kurses- schwer

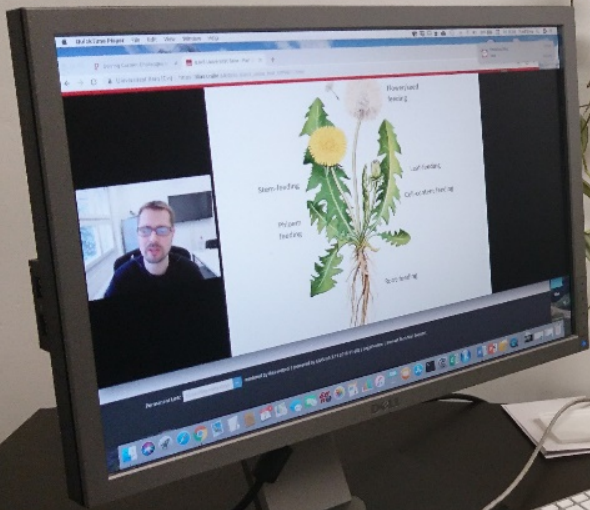
Timing is everything

Wie haben wir den Kurs angestossen?



Apéro als Einstieg

Wie hat der «Inverted Classroom» Teil funktioniert?



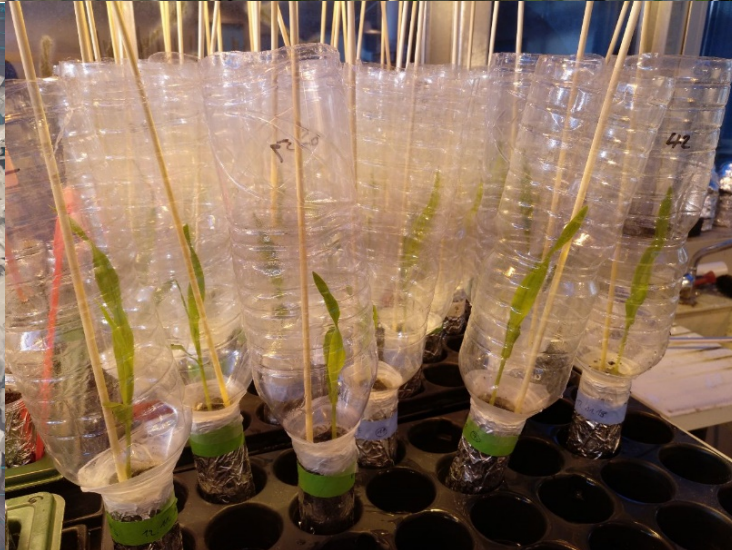
# Perusal<sup>all</sup>

Every student prepared for every class.

[Get started now](#)

# Gruppendiskussionen

Wie hat der «Challenge-Based Learning» Teil funktioniert?









Durchführungsphase: Was hat funktioniert,  
was nicht?

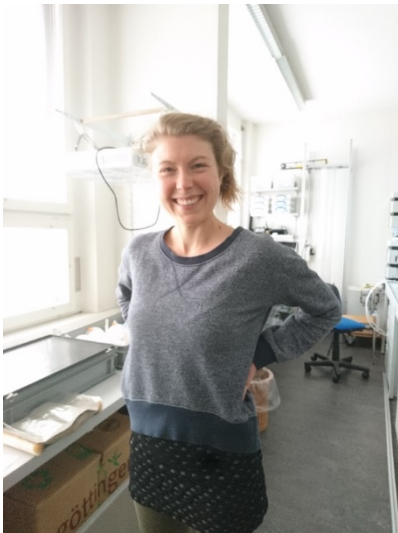
# Videos, Ilias & Perusall: Gute Kombination

The screenshot shows the Ilias LMS interface. At the top, it says 'ILIAS Universität Bern'. Below that is the course title '436479-HS2018-0: Solving Current Challenges in Plant-Herbivore Interactions'. The interface includes a navigation menu with options like 'Info', 'Einstellungen', 'Mitglieder', 'Lernfortschritt', 'Metadaten', 'Export', and 'Rechte'. There is also a 'Neuigkeiten' (News) section on the right side of the page.

The Perusall logo is displayed in a large, white, sans-serif font. Below the logo, the tagline 'Every student prepared for every class.' is written in a smaller, white, sans-serif font. A 'Get started now' button is visible at the bottom of the image.

The video thumbnail features a close-up of a green plant stem with a small, green caterpillar-like insect on it. The text 'Module 1, Part 4a' is at the top, followed by 'How plants perceive herbivores'. At the bottom, it identifies the speaker as 'Prof. Matthias Erb, Institute of Plant Sciences, University of Bern'. A small inset image shows a man in a dark shirt looking at a potted plant.

# Entwicklung der Studierenden: positiv



# Eigenes Projekt entwickeln: Schwierig für die Studierenden

# Gute Lehre an der Universität Bern



Projekte / Fördermassnahmen

Dienstleistungen

Veranstaltungen

Über uns

## Förderung Innovative Lehre (FIL)



Christelle Robert



Erik Poelman



Thomas Tribelhorn



Claudia Buser