Mike Petersen
Senior Scientist at the Wisconsin Crop Innovation Center (WCIC) at UW-Madison

Beyond CBD:
Optimized Hemp Cultivars
Engineering High Value Hemp Traits

Mike Petersen
Senior Scientist
Wisconsin Crop Innovation Center
WORLD’S 1ST TRANSGENIC HEMP PLANT!

WARF
Wisconsin Alumni Research Foundation
What Can We do With This New Technology?

How to edit cannabis DNA
A genetic-editing technique called Crispr-Cas9 replaces portions of the plant’s genetic material.

1. Cultivators identify the section of the plant DNA to modify.

2. A guide RNA strand is created and attached to an enzyme.

3. The RNA finds the targeted section of DNA while the enzyme works like a pair of scissors cutting the section out.

4. New genetic material is introduced and attaches to the missing segment.

The advantage of genetic editing
The Crispr-Cas9 method provides a cost-effective way to introduce specific changes without introducing foreign DNA.

Possible cannabis changes
- Disease resistance
- Climate tolerance
- Increased trichomes
- Terpene changes
- CBD/THC ratio in hemp
- Rare cannabinoid production
- Biomass improvements
- Plant-wide THC production

Source: Marijuana Business Daily research
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WHY HEMP?

**SEEDS**
- Oil
  - Cooking Oil
  - Fuel
  - Paint
  - Body Care Products
- Seed
  - Flour
  - Beer
  - Animal Feed
  - Butter

**LEAVES and FLOWERS**
- Animal Bedding
- Mulch
- Medicine

**STALK**
- Fiber
  - Textiles
  - Paper
  - Insulation
  - Organic Compost
- Hurd
  - Rope
  - Animal Bedding
  - Molded Plastics
  - Fiber Board

**ROOTS**
- Organic Compost
- Medicine

**INDUSTRIAL HEMP**
Contains Less Than 1% THC
Hemp is NOT a DRUG

**Sustainable**
Over 50,000 Uses
FIBER

$43.75B market by 2027

2x more CO² capture than trees
FIBER

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2x more CO$_2$ capture than trees
FIBER

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Global Hemp Fiber Market

2020-2027
CANNABINOIDS

CBG: $50K/kg
- Lowers blood pressure
- Antibacterial
- Bone Stimulant
- Antifungal
- Anti-Inflammatory

CBD: $2K/kg
- Antioxidant
- Pain Reliever
- Relieves Spasms
- Causes Drowsiness
- Increases Appetite
- Muscle Relaxant
- Reduces Anxiety
- Reduces Nausea
- Decreases Seizures

CBN
- Anti-Inflammatory
- Antioxidant
- Pain Reliever
- Relieves Spasms
- Causes Drowsiness

CBC
- Antibacterial
- Bone Stimulant
- Antifungal
- Anti-Inflammatory

THCV
- Decreases Seizure
- Decreases Appetite
- Bone Stimulant

THC
- Antioxidant
- Pain Reliever
- Relieves Spasms
- Causes Drowsiness
- Increases Appetite
- Reduces Nausea
- Muscle Relaxant
TERPENES

$774M
market by 2026

(360researchreports.com)

100+ types

10 COMMON TERPENES

<table>
<thead>
<tr>
<th>Myrcene</th>
<th>Linalool</th>
<th>Limonene</th>
<th>Pinene</th>
<th>Terpinolene</th>
<th>Carene</th>
<th>Eucalyptol</th>
<th>Caryophyllene</th>
<th>Humulene</th>
<th>Bisabolol</th>
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<tbody>
<tr>
<td>Reduces Inflammation</td>
<td>Inhibits Cancer Growth</td>
<td>Suppresses Muscle Spasms</td>
<td>Antibacterial</td>
<td>Relieves Anxiety/Stress</td>
<td>Sleep Aid/Relaxant</td>
<td>Aids Digestive System</td>
<td>Aids Immune System</td>
<td>Antidepressant</td>
<td>Antimicrobial</td>
</tr>
</tbody>
</table>
TEAM

200 YEARS
COMBINED PLANT ENGINEERING EXPERIENCE

Mike Petersen
Sr. Scientist (WCIC)
Molecular biologist
Industry collaboration

Shawn Kaeppler
Professor
WCIC Director
Crop breeder, geneticist, biotechnologist

Shelby Ellison
Assistant Professor
Industry research & education liaison
Proof-of-concept plants and new traits for **industry customers**

“Zeakal’s Novel Photoseed Trait Boosts Hemp Biomass Oil Output By Up To 50%”

2021 News Release (Zeakal.com)
Proof-of-concept plants and new traits for industry customers

Plantlets for controlling cannabinoid production
Proof-of-concept plants and new traits for **industry customers**

- Plantlets for controlling cannabinoid production
- >$2M funding
SEEKING

INDUSTRY PARTNERS & COLLABORATORS for

- Creating new varieties for commodity growers
- Identifying new traits of interest
- People interested in commercialization
Engineering High Value Hemp Traits

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