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GMOs and Citrus- Can We Get a Do Over?

*Future Citrus Disease Management will
Require a Multifaceted Approach-
Targeting the Consumer*

nature
genetics

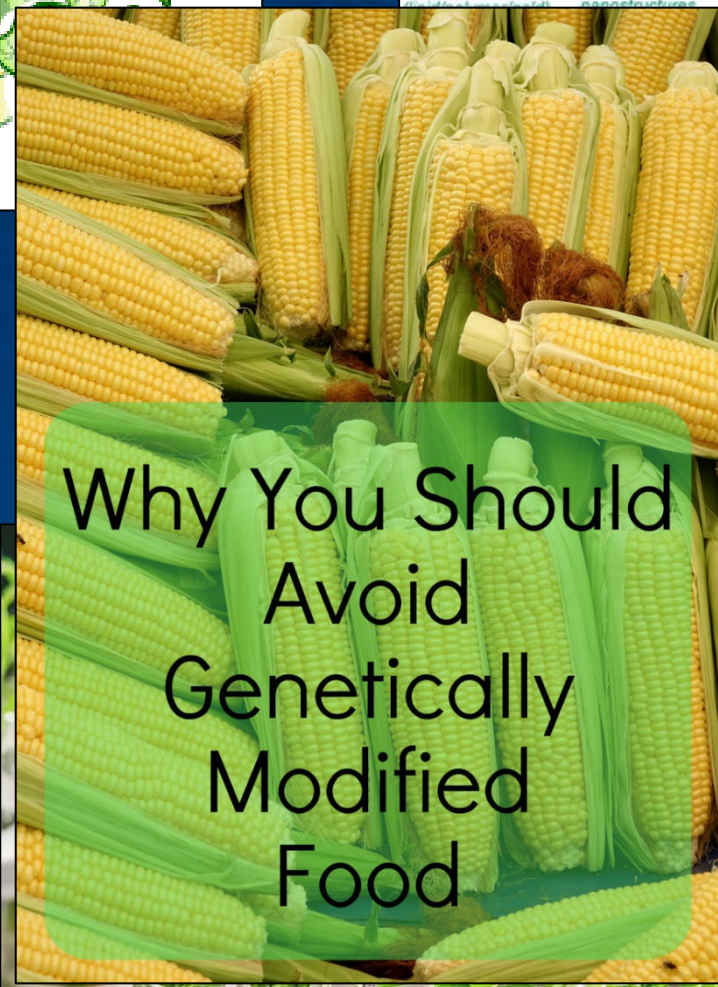
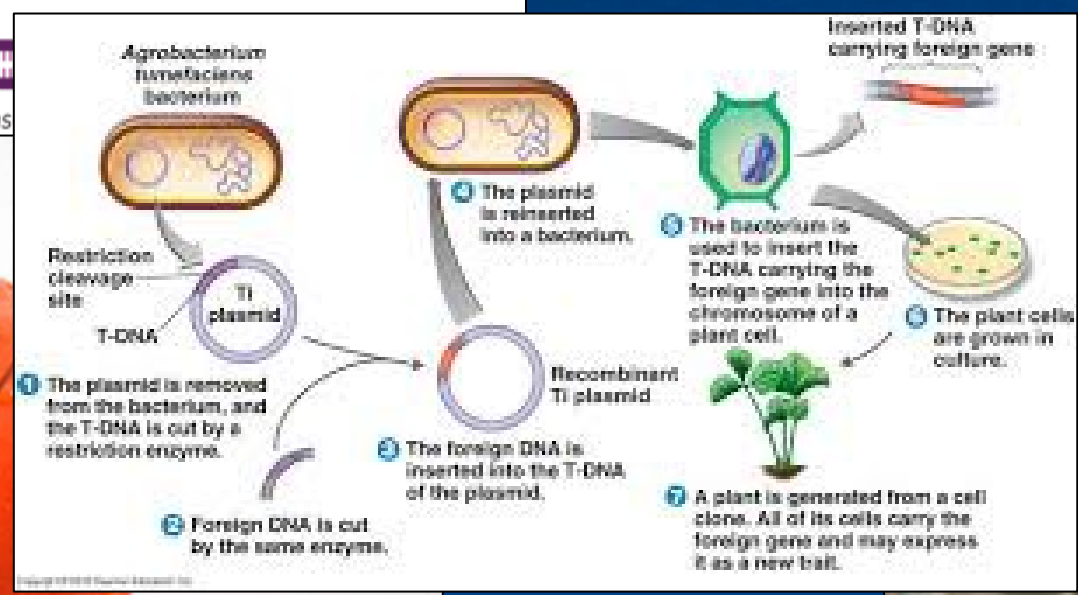
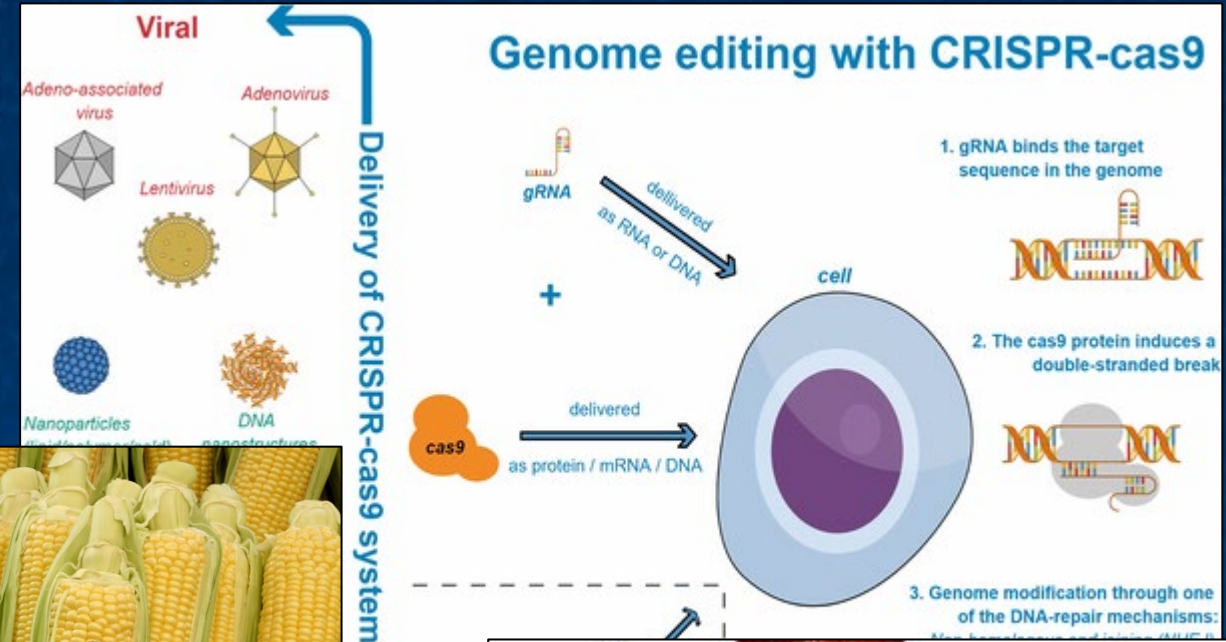
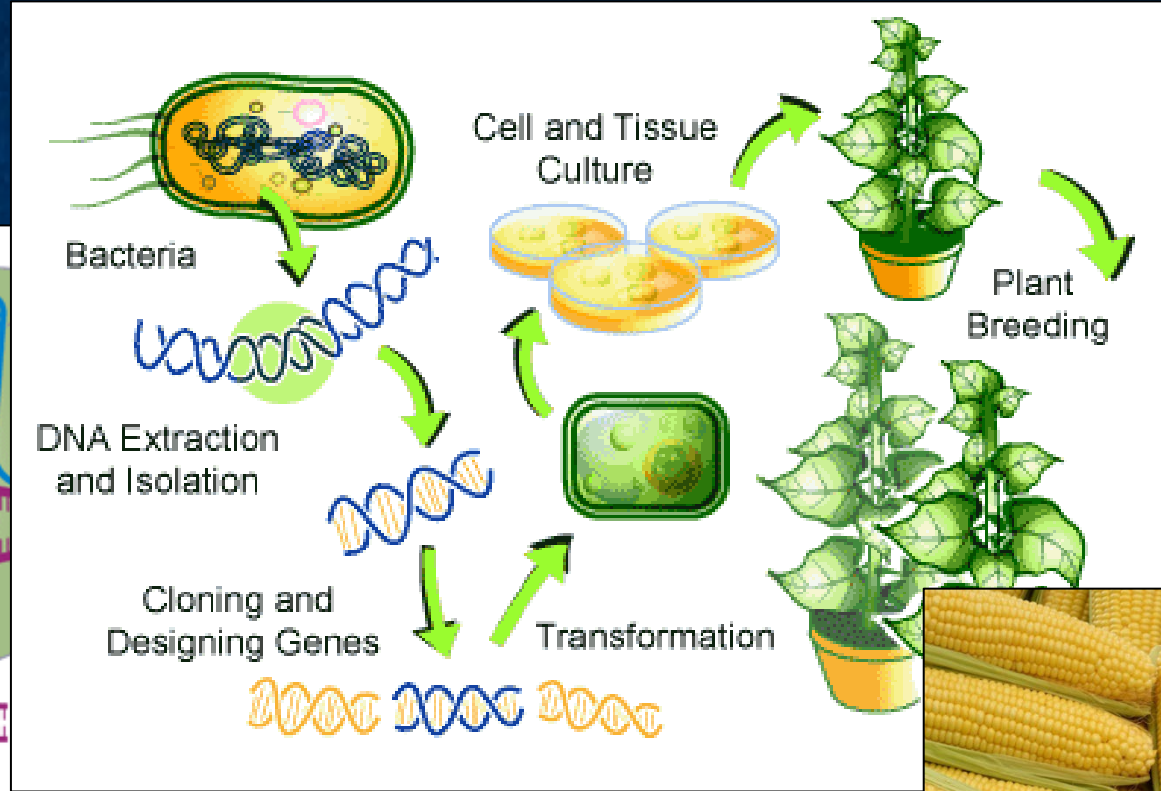
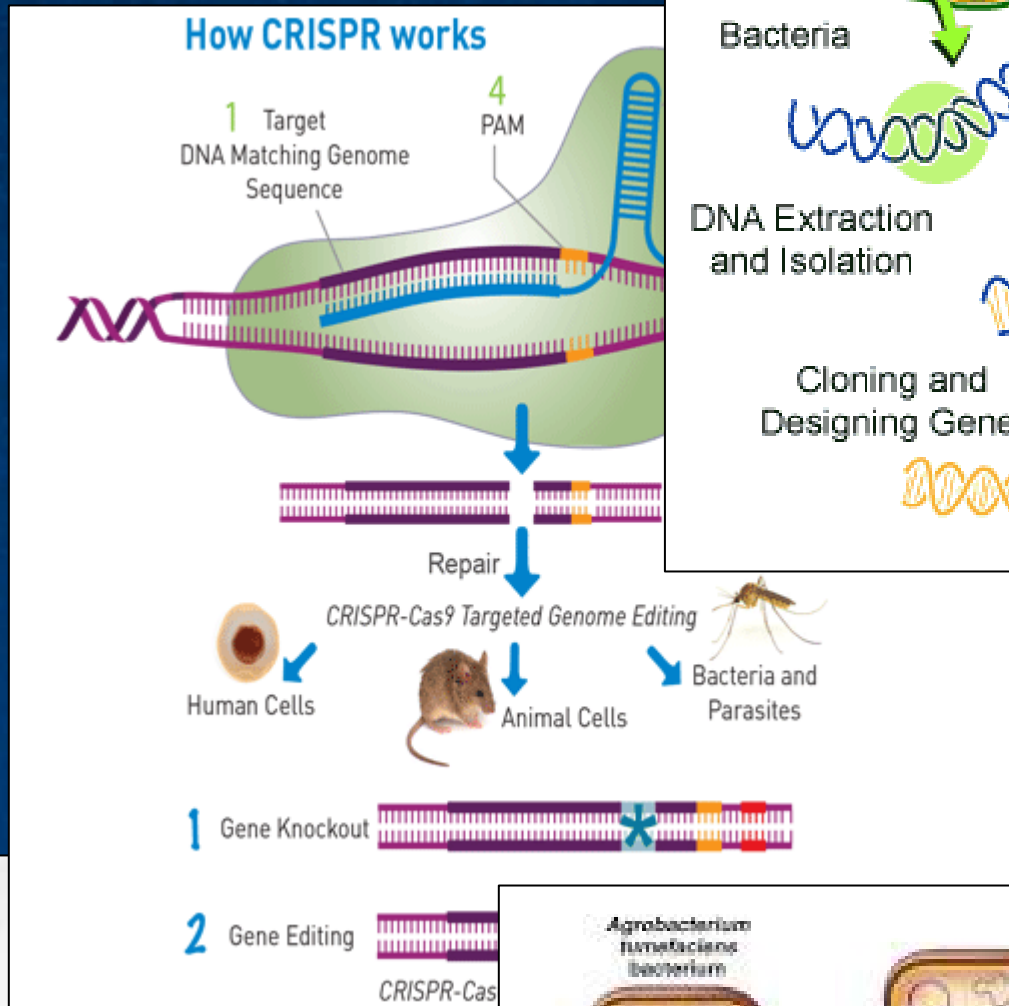
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www.nature.com/naturegenetics



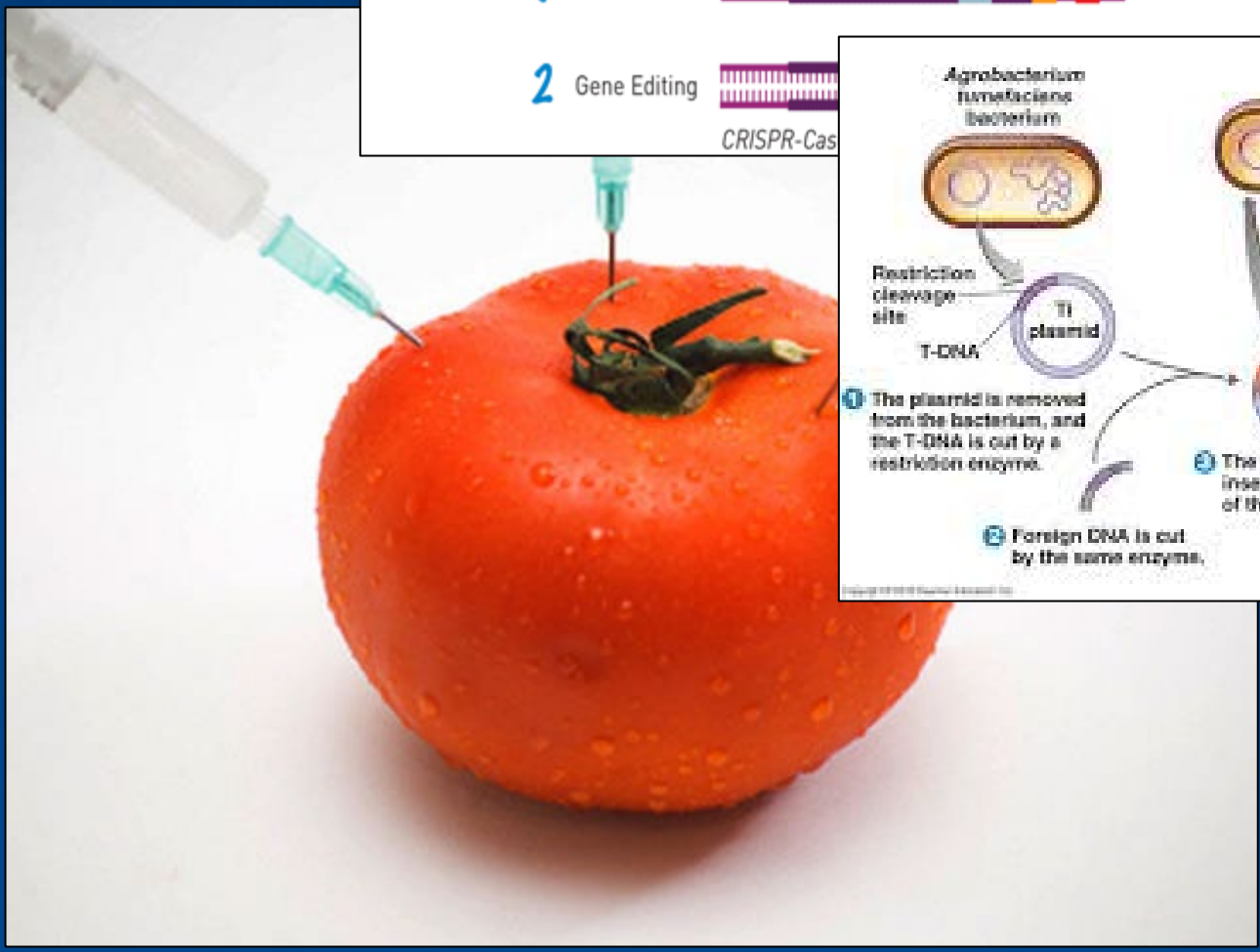
Maize leaf traits
Strawberry genome
Cacao genome

Why I'm here





Why You Should Avoid Genetically Modified Food

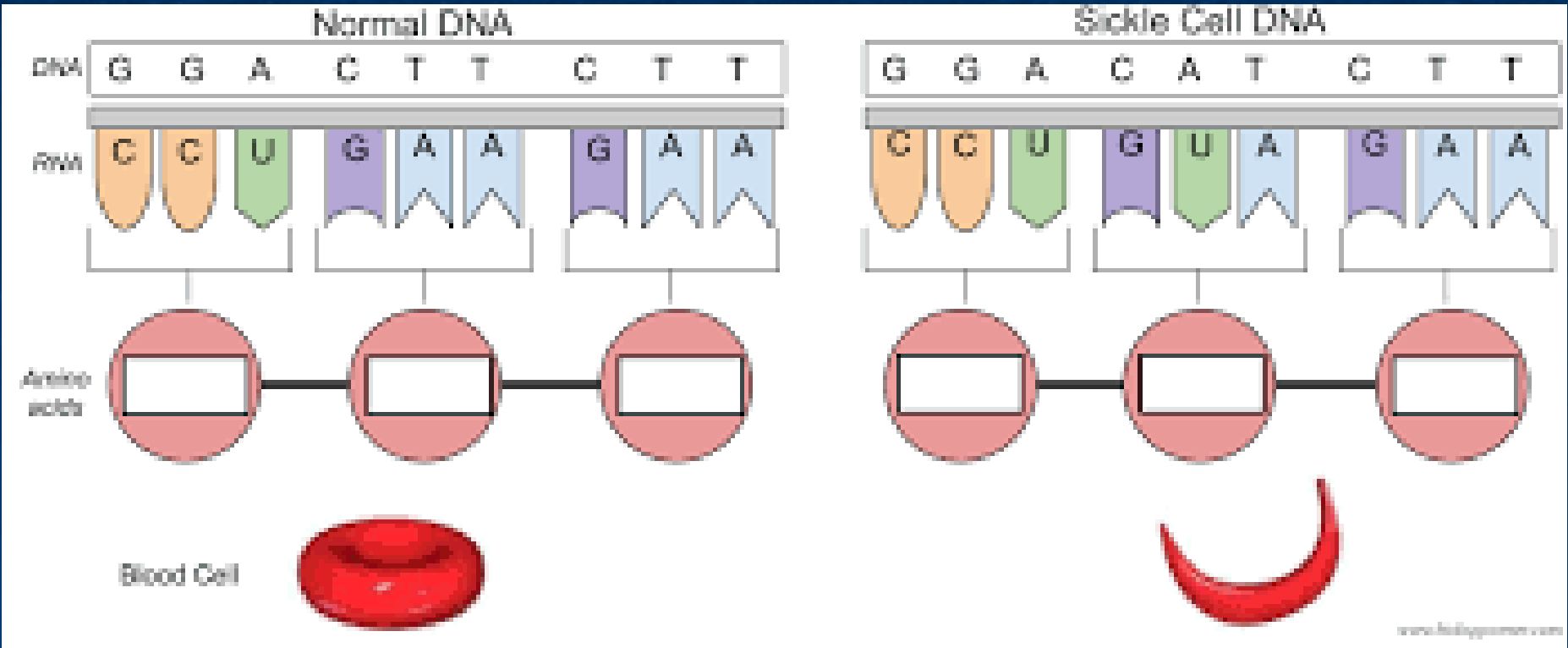




10,000 lbs. of pancreas glands
produce 1 lb. of concentrated insulin crystals









First sickle cell patient treated with CRISPR gene-editing still thriving

December 31, 2021 · 5:05 AM ET

Heard on Morning Edition

 **ROB STEIN**  

 **4-Minute Listen** [+ PLAYLIST](#)   





Citrus 2.0

NOW




THEN



2005



Florida Citrus Growers Facing New Trial

 Share full article



By **Warren E. Leary** and **Terry Aguayo**

Oct. 14, 2005

After battling intense hurricane seasons and plant-destroying citrus canker, Florida citrus growers now have another threat to deal with.

A plant condition from China known as yellow dragon disease or citrus greening has been found in southeast Florida and appears to be spreading, agricultural authorities say.

The bacterium causing the disease, also known by its Chinese name huanglongbing, is spread by a small, winged insect called the Asian citrus psyllid. The bug was first seen in the state in 1998, but the disease was not seen until August, when it was found in Homestead, south of Miami.



Would the industry embrace genetic engineering as a potential tool...

Or deprioritize a potential remedy to avoid the hassles from a tiny population of disgruntled activists?



GMO-FREE

Tropicana[®]

the **TRUTH:**

There are no GMO oranges

Peel Back The Label

A graphic with a white background. At the top left is an orange banner with 'GMO-FREE' in white. Below it is the Tropicana logo in green. To the right is a green banner with 'the TRUTH:' in white. Below that is the text 'There are no GMO oranges' in bold black. At the bottom left is a small blue and white logo that says 'Peel Back The Label'. In the center is a whole orange with a red and white striped straw sticking out of it.



Milk
\$4.00

Milk
Gluten Free
Non-GMO
\$6.00

Milk
Gluten Free
Non-GMO
No Antibiotics
No Hormones
\$8.00



THIS IS WHY WE CANT

HAVE NICE THINGS

imgflip.com



NOW

THEN

**Prediction: The future
will include
biotechnology
approaches**



NOW _____ THEN

If we have a GE solution will we be willing to use it?

NOW ———— / / ———— THEN

**Never hide from a
technology that
can be beneficial.**



Suppression of Avian Influenza Transmission in Genetically Modified Chickens

Jon Lyall,¹ Richard M. Irvine,² Adrian Sherman,³ Trevelyan J. McKinley,¹ Alejandro Núñez,² Auriol Purdie,^{3*} Linzy Outtrim,² Ian H. Brown,² Genevieve Rolleston-Smith,³ Helen Sang,^{3†} Laurence Tiley^{1††}

Infection of chickens with avian influenza virus poses a global threat to both poultry production and human health that is not adequately controlled by vaccination or by biosecurity measures. A novel alternative strategy is to develop chickens that are genetically resistant to infection. We generated transgenic chickens expressing a short-hairpin RNA designed to function as a decoy that inhibits and blocks influenza virus polymerase and hence interferes with virus propagation. Susceptibility to primary challenge with highly pathogenic avian influenza virus and onward transmission dynamics were determined. Although the transgenic birds succumbed to the initial experimental challenge, onward transmission to both transgenic and nontransgenic birds was prevented.

The diversity of avian influenza viruses (AIVs) and their propensity for inter-species transmission make them a global threat to animal and public health communities. Cross-species transmission of influenza viruses mediate host species that amplify and diversify virus populations, notably domestic chickens, ducks, and pigs (*1*). Although control of AIV infection in its wild aquatic bird reservoir is impractical, control of AIV in domesticated hosts is

The diversity of viral antigenic sub-



Downloaded from



Science 331:223-226. **2011** SCIENCE VOL 331 14 JANUARY 2011

A new H9 influenza virus mRNA vaccine elicits robust protective immunity against infection

Shengkui Xu¹, Bowen Zhang¹, Jieli Yao¹, Wenke Ruan²

Affiliations + expand

PMID: 37005103 DOI: 10.1016/j.vaccine.2023.03.049

Abstract

Avian influenza virus (AIV) poses a great threat to the poultry industry and public health. However commercial vaccines only provide limited immunity due to rapid virus mutation and rearrangement. Here, we developed an mRNA-lipid nanoparticle (mRNA-LNP) vaccine expressing AIV immunogenic protein hemagglutinin (HA) and also assessed its safety and immune-protection efficacy in vivo.

NOW ————— / / ————— THEN

DEFINE THE RIGHT AUDIENCE

The Public is Unsure what to Believe

Pesticides

Antibiotics

Hormones

Fertilizer

Gluten

Synthetic Biology

Glyphosate

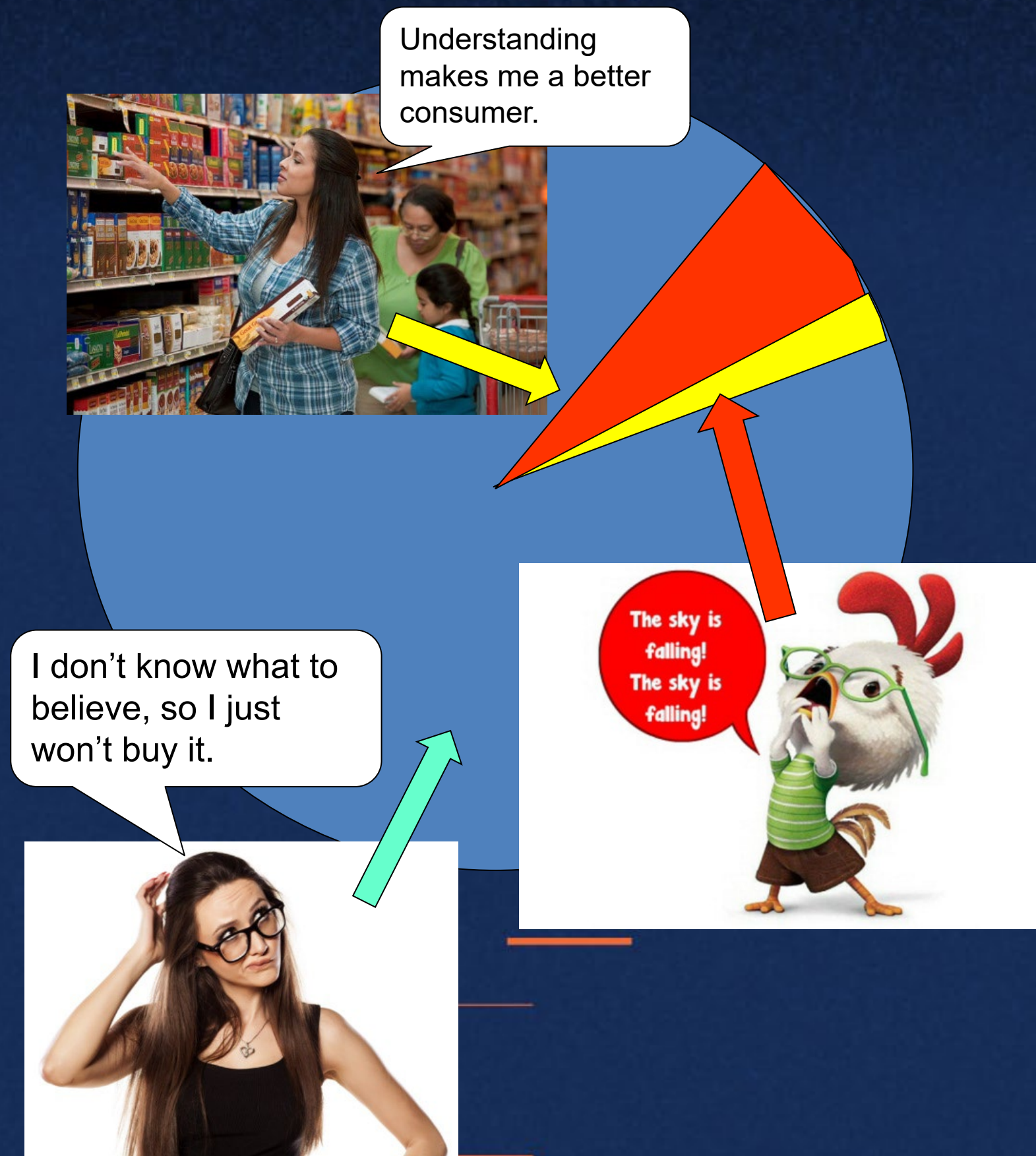
Neonics

GMOs

Dihydrogen
monoxide

BPA

MSG



NOW ————— / / ————— THEN

**FACTS DON'T
MATTER**

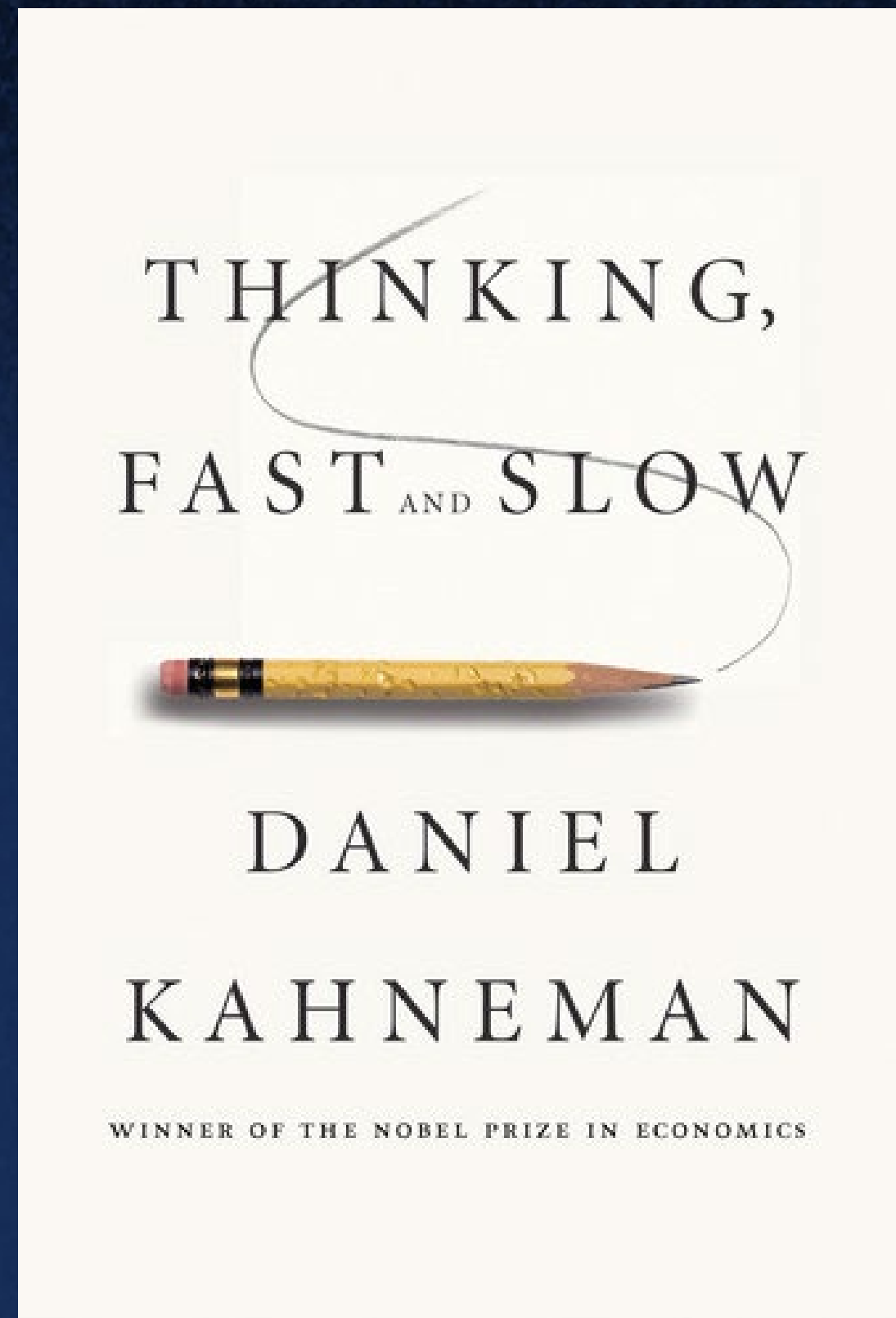
**It is not about “educating
the consumer”**

**It is about building a
relationship with the
consumer**

How we process information

System 1 – Emotional, irrational, reactive

System 2 – Logical, strategic, calculating



“I’ve learned that people will forget what you said, people will forget what you did, but people will never forget how you made them feel.”

- Maya Angelou

WHY FACTS DON'T CHANGE OUR MINDS

New discoveries about the human mind show the limitations of reason.



By Elizabeth Kolbert

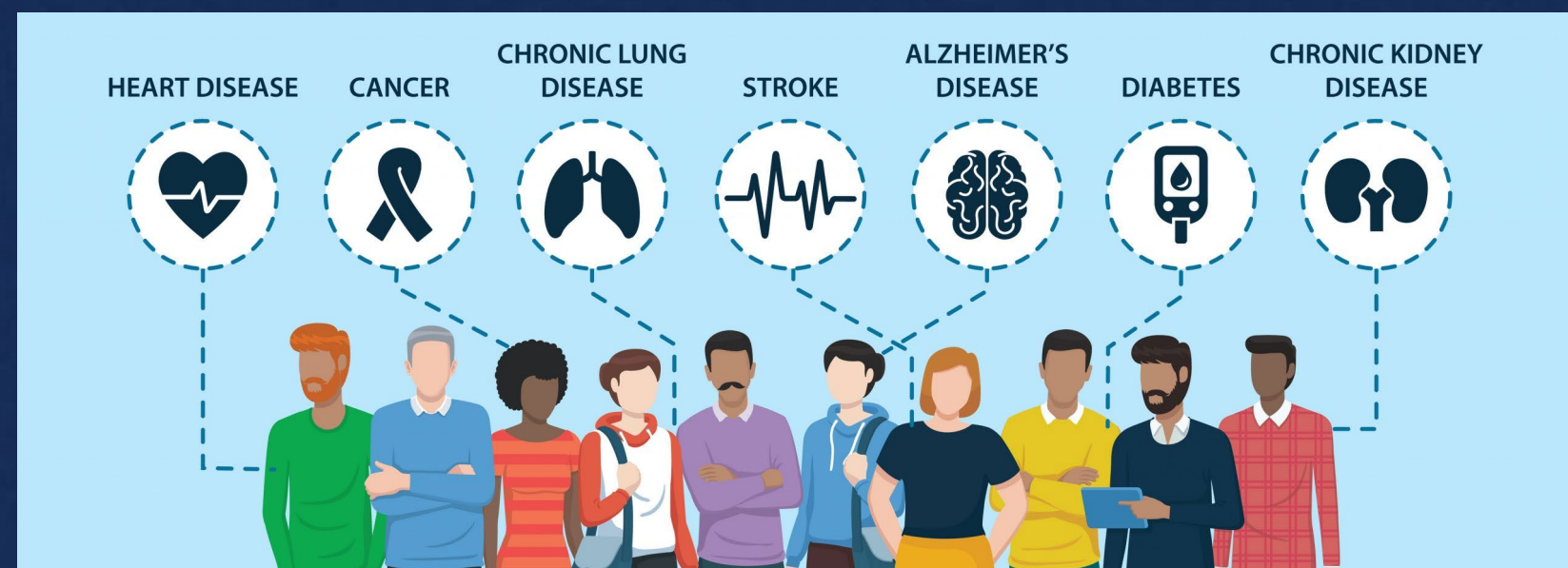


Facts do not matter
... until you've established
trust.

Trust Equation

$$\text{TRUST} = \frac{\text{Competence} + \text{Reliability} + \text{Intimacy}}{\text{Self Motivation}}$$

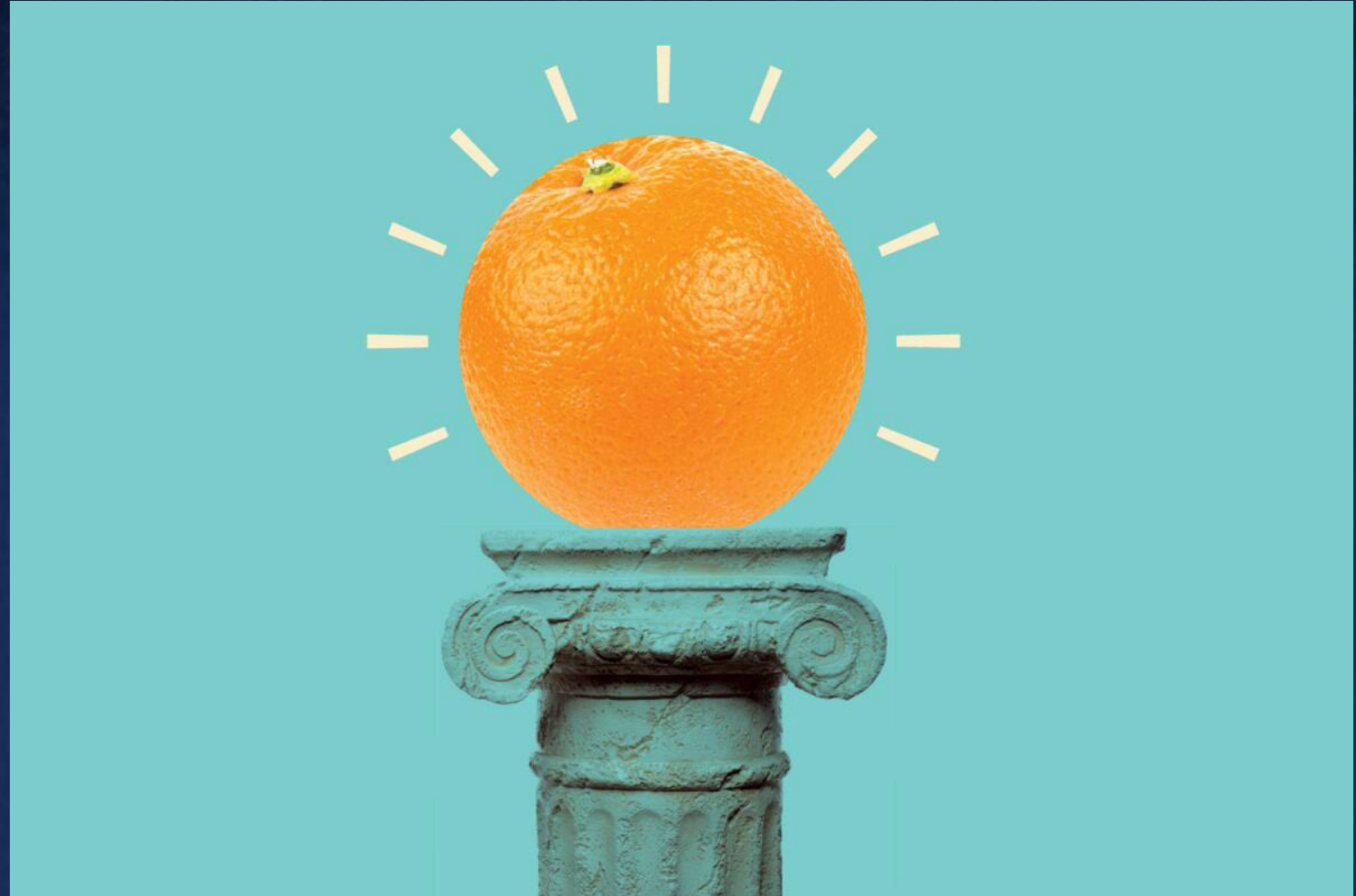
What are unifying themes?





NOW ————— / / ————— THEN

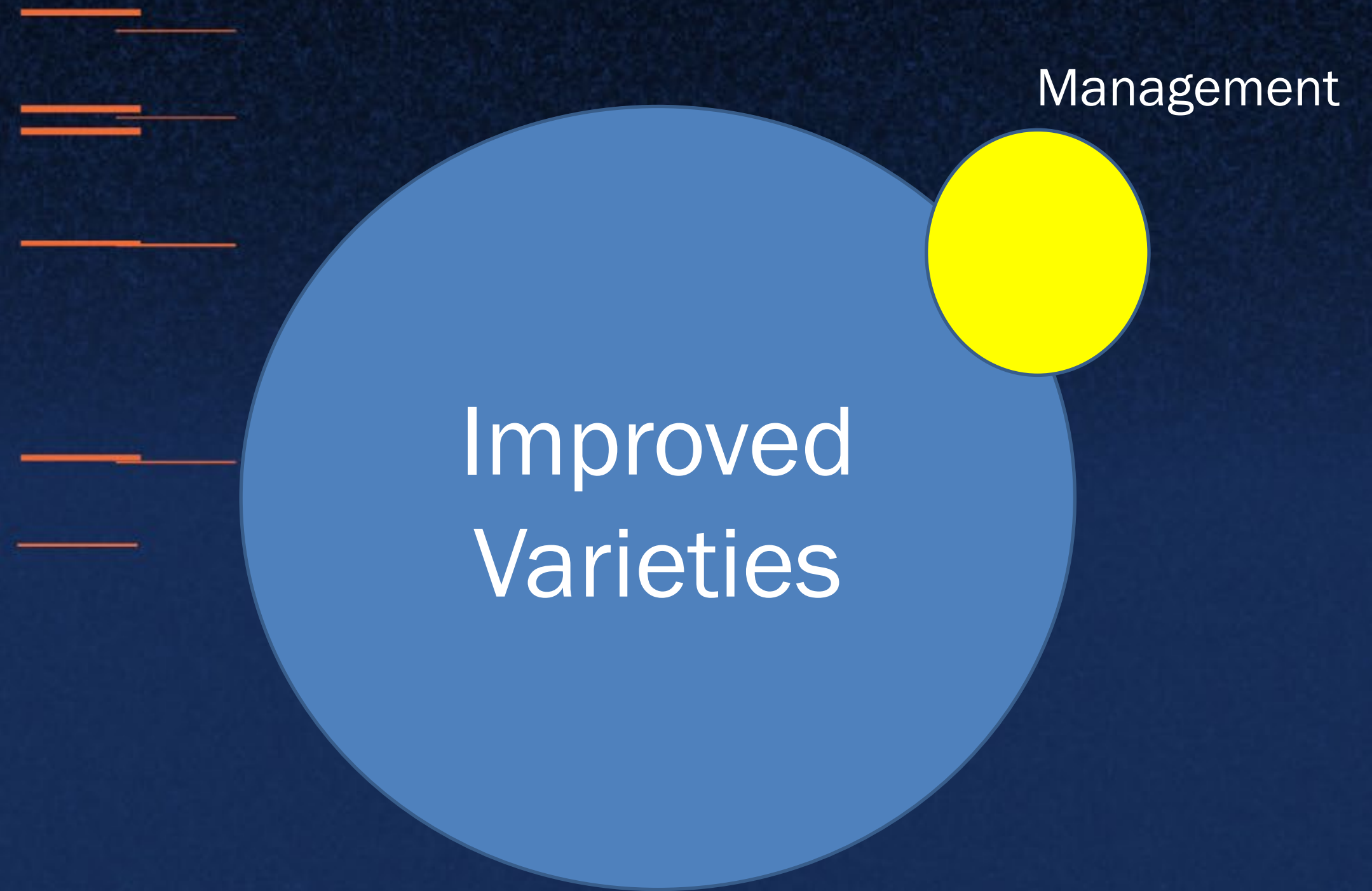
**NEVER
OVERSTEP
THE DATA**



NOW ———— / / ———— THEN

USE ALL APPROACHES

The Future of Citrus will Require Integrated Approaches



90% Rootstock and Scion Improvement - Traditional Breeding, Genomic Selection

10% Genetic Engineering - 5% Transgenic, 5% Gene Editing

Changing priorities



NOW



THEN

**THERE IS
VALUE IN
NOVELTY**



FREAKY
FRUIT

NOW



THEN

Invest heavily in biotechnology solutions

Invest even more heavily in variety improvement

Communicate the value of citrus to the consumer

Use strategies to build trust

Lead the conversation in traditional and social media

We (academia, industry, gov't) must control the narrative

Thank You!
kfolta@ufl.edu



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30,000 monthly downloads

