

70TH
ANNIVERSARY

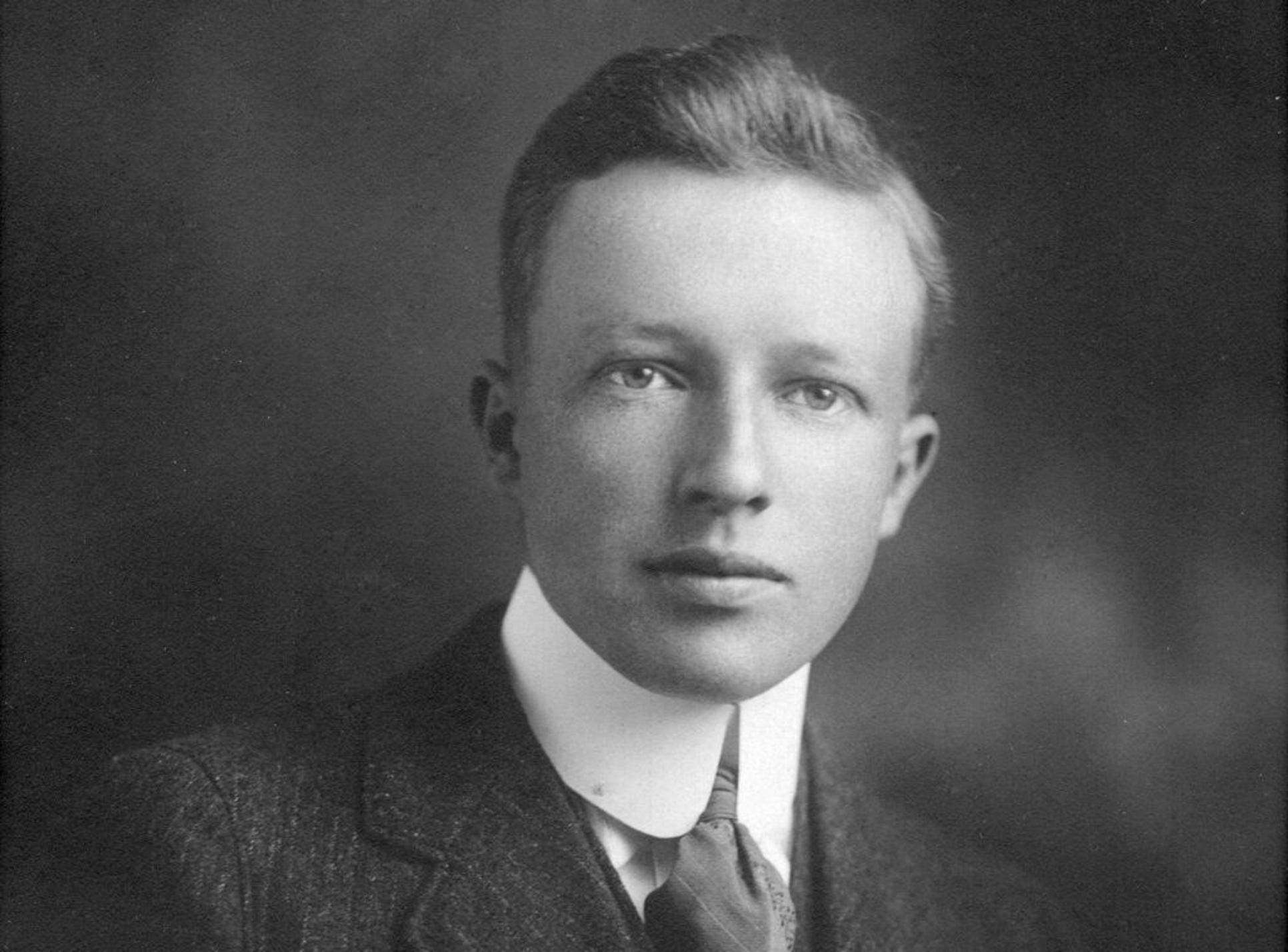
EST. 1945

THE SAMUEL ROBERTS
NOBLE
FOUNDATION

1896







1913



1921

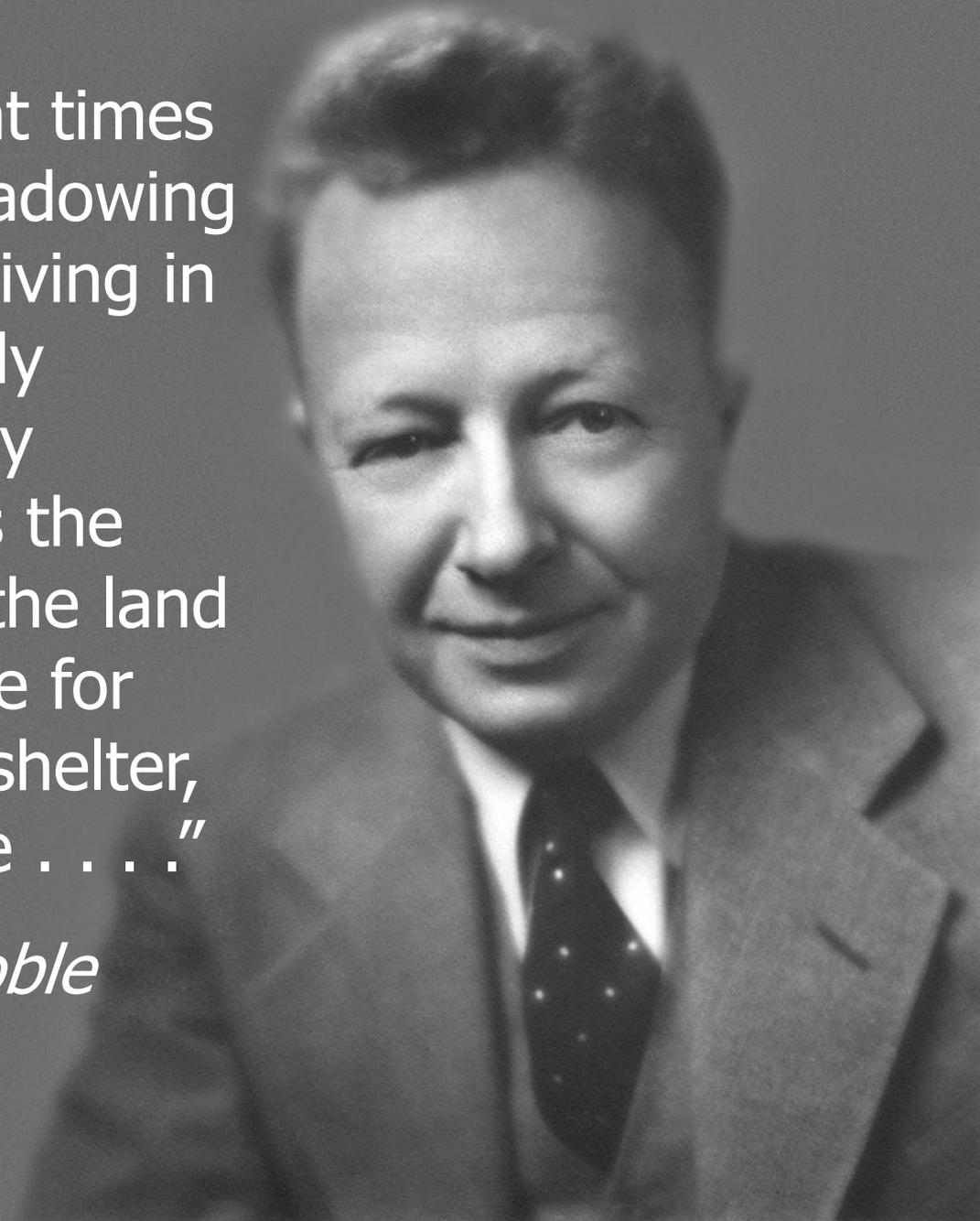


1930s



"We believe that while at times we have felt the overshadowing presence of oil, we are living in an area that is essentially agricultural. This is easily realized when one takes the time to remember that the land must continue to provide for our food, clothing, and shelter, long after the oil is gone"

-Lloyd Noble



1945

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Contests



Consultation

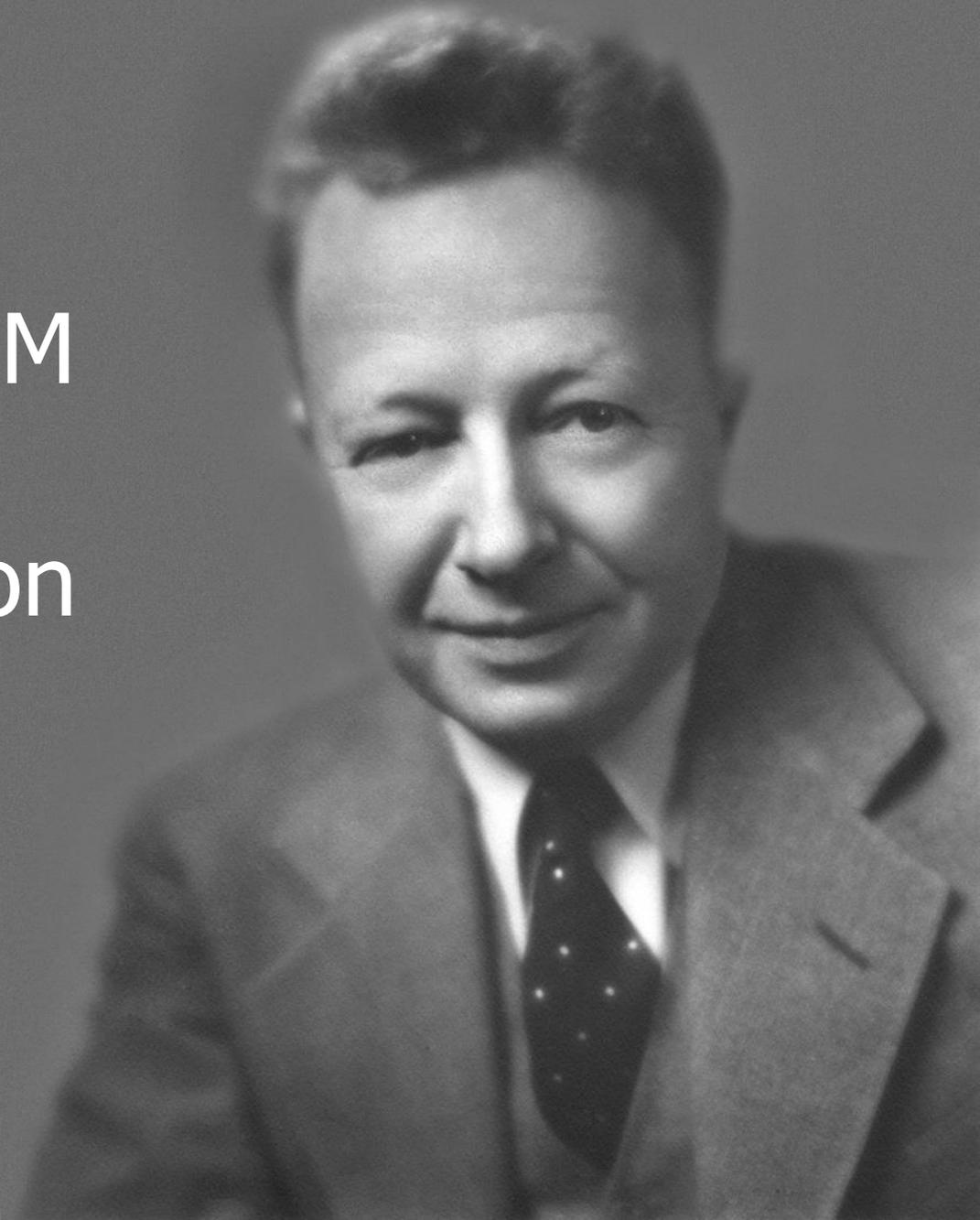


Research



Died 1950

Left bulk of \$10M
estate to the
Noble Foundation





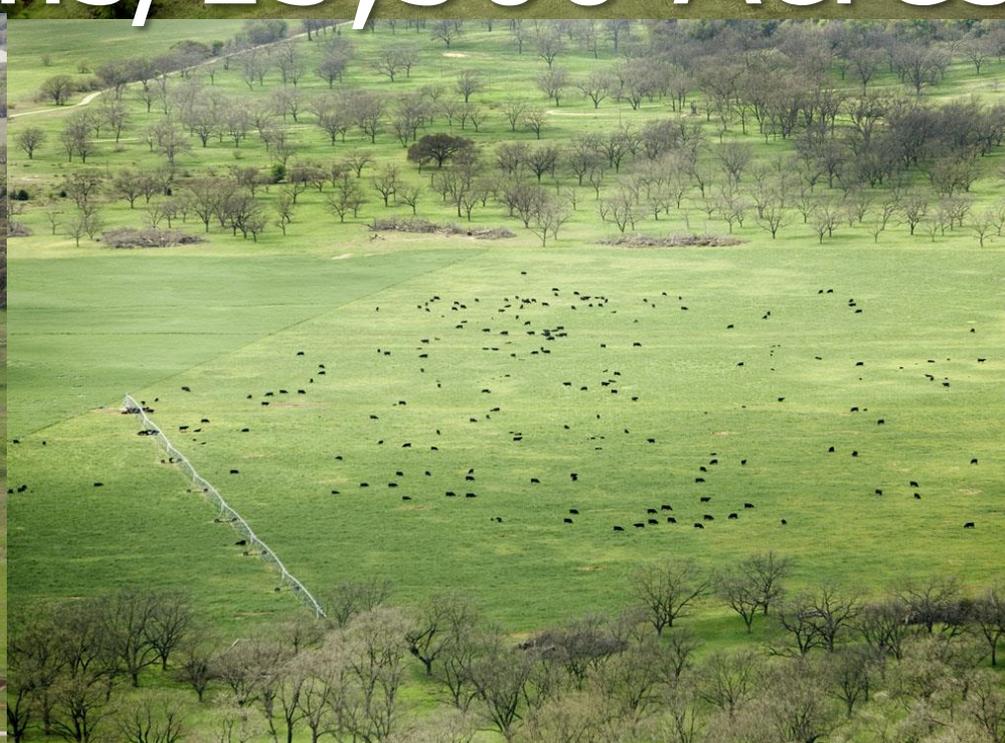
\$1 billion endowment

3 Divisions and Support groups
340 employees from more than
20 countries, 100+ Ph.Ds.





Research Farms/13,500 Acres



FUTURE FARMS

small and smart

SURVEY DRONES

Aerial drones survey the fields, mapping weeds, yield and soil variation. This enables precise application of inputs, mapping spread of pernicious weed blackgrass could increase Wheat yields by 2-5%.

FLEET OF AGRIBOTS

A herd of specialised agribots tend to crops, weeding, fertilising and harvesting. Robots capable of microdot application of fertiliser reduce fertiliser cost by 99.9%.



FARMING DATA

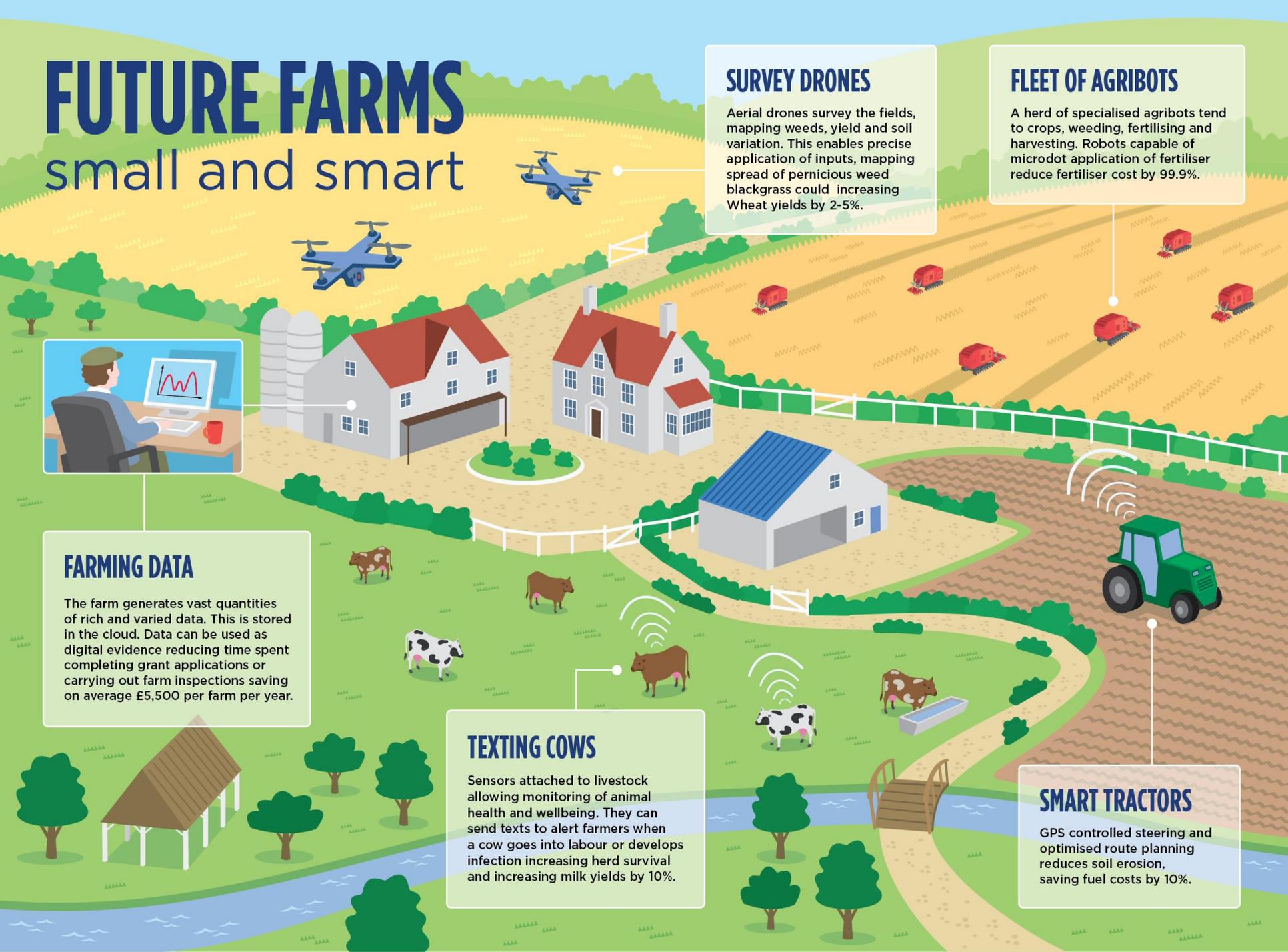
The farm generates vast quantities of rich and varied data. This is stored in the cloud. Data can be used as digital evidence reducing time spent completing grant applications or carrying out farm inspections saving on average £5,500 per farm per year.

TEXTING COWS

Sensors attached to livestock allowing monitoring of animal health and wellbeing. They can send texts to alert farmers when a cow goes into labour or develops infection increasing herd survival and increasing milk yields by 10%.

SMART TRACTORS

GPS controlled steering and optimised route planning reduces soil erosion, saving fuel costs by 10%.



SOIL RENAISSANCE

Initiated in 2013, **Farm Foundation, NFP** and the **Noble Foundation** initiated the Soil Renaissance to advance soil health and make soil health the cornerstone of land use management decisions.



RESEARCH

Convene the research community to advance soil health.



MEASUREMENT

Incorporate soil health measures into standardized soil testing that is readily available, affordable, and commercially viable.



ECONOMICS

Quantify the effects of soil health on economic risks and returns.



EDUCATION

Reawaken the public to the importance of soil health.



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Initial Findings

- Ongoing response and participation excellent
- Clear need to expand mandate for long term impact
- Show value and participation will follow



Summary Findings

- Interest in and awareness of the need to focus on soil health is strong
- Soil Renaissance voluntary participation continued to expand, reinforcing this need
- Several industry-led initiatives exist, but they are fragmented and lack connection
- To advance the soil health conversation, the Renaissance needs to evolve

Introducing



SOIL HEALTH

— I N S T I T U T E —

UNIFY. RESTORE. PROTECT.

Soil Health Institute

- Structure
 - Independent, nonprofit organization
- Activities
 - Governing board for soil measurement standards, and promotion of those standards
 - Conduct soil-related research through grant program
 - Disseminate soil-related research through global access model
 - Advancement of soil-related economics and education
 - Convening global thought leaders
 - Policy development
 - Non-sector engagement



What is Soil Health?

The continued capacity of the soil to function as a vital, living ecosystem that sustains plants, animals and humans.



Mission

Safeguard and enhance the vitality and productivity of the soil through science-based research and advancement.



Vision

The Soil Health Institute will be the primary resource for soil health information and research. Its outcomes will yield healthy, sustainable soils to serve as the foundation for society, benefit the environment and contribute to the productivity and profitability of agriculture.



Value

We believe that healthy soil is the foundation of life and society, and should be treated as an irreplaceable resource. We believe that knowledge advancement and research will improve soil health and sustain earth's most valuable asset.

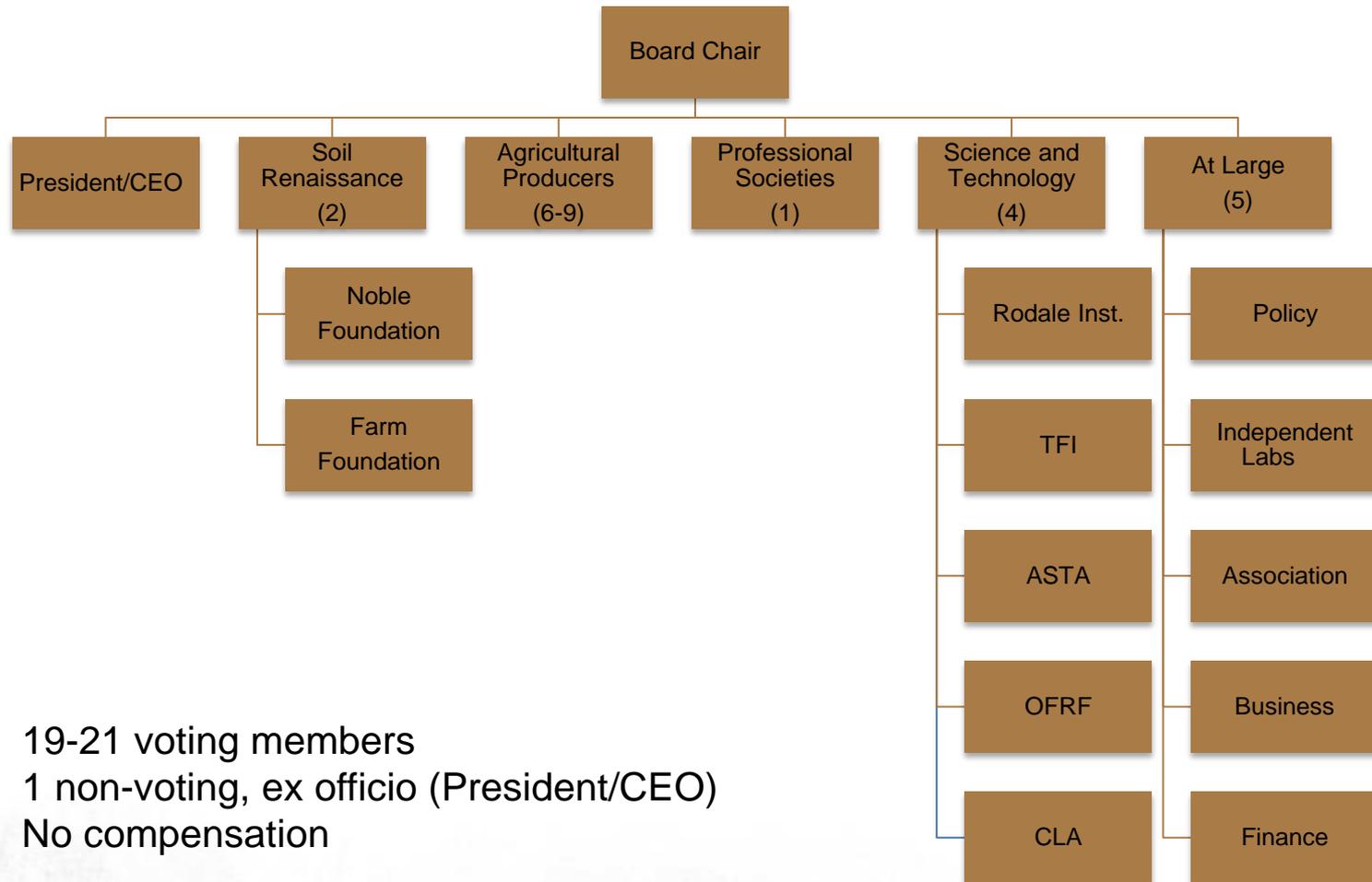


Guiding Principles

- Integrated Science Approach
- Science-based
- Partnership Driven
- Inclusive and representative
- Transparent and open sourced
- Communications at all levels
- Purposeful outcomes with measurable impacts
- Continuing evaluation and improvement

Note: These guiding principles were developed by the Soil Renaissance strategic development committee and adopted by all working groups.

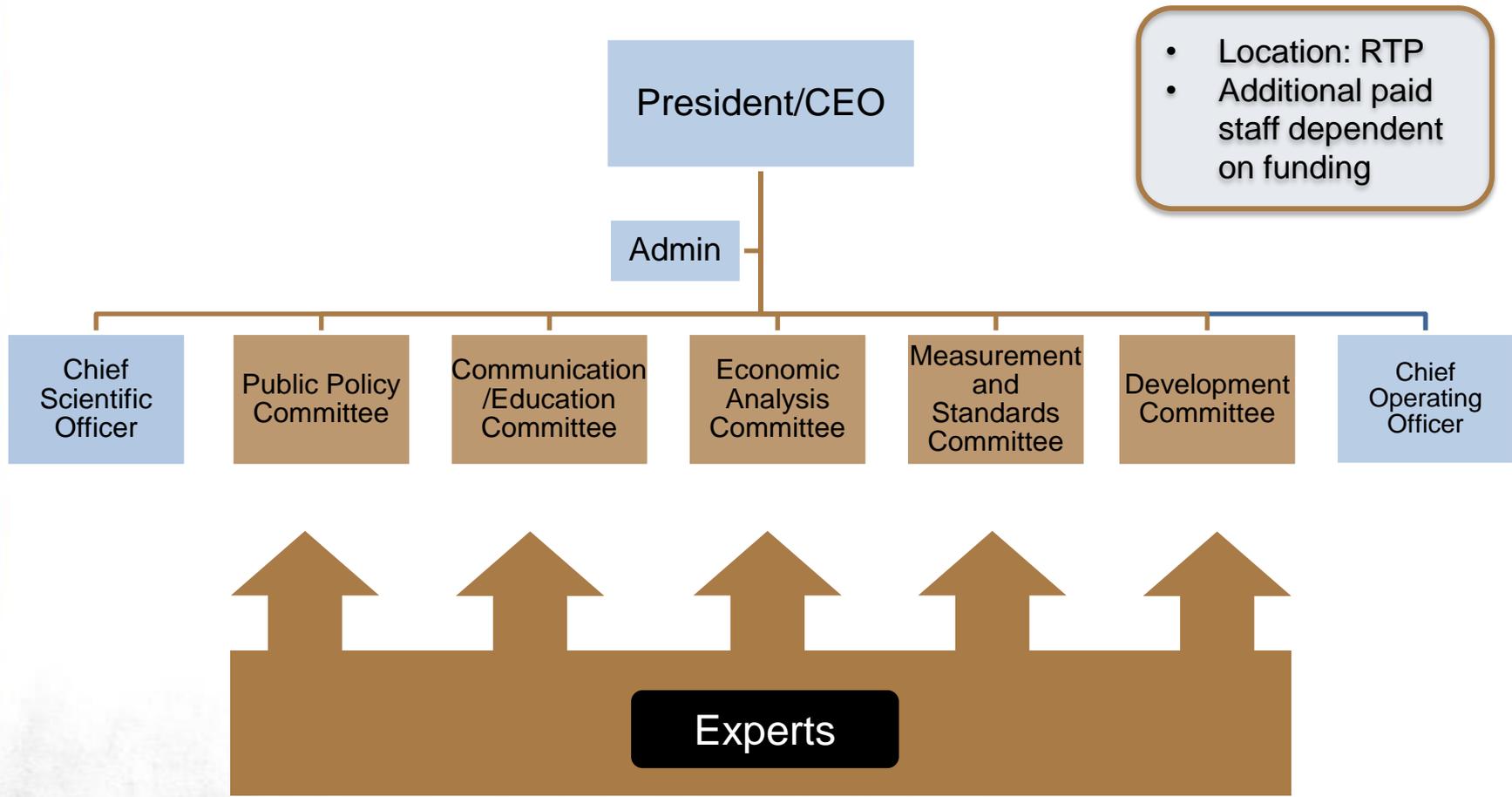
Governing Board



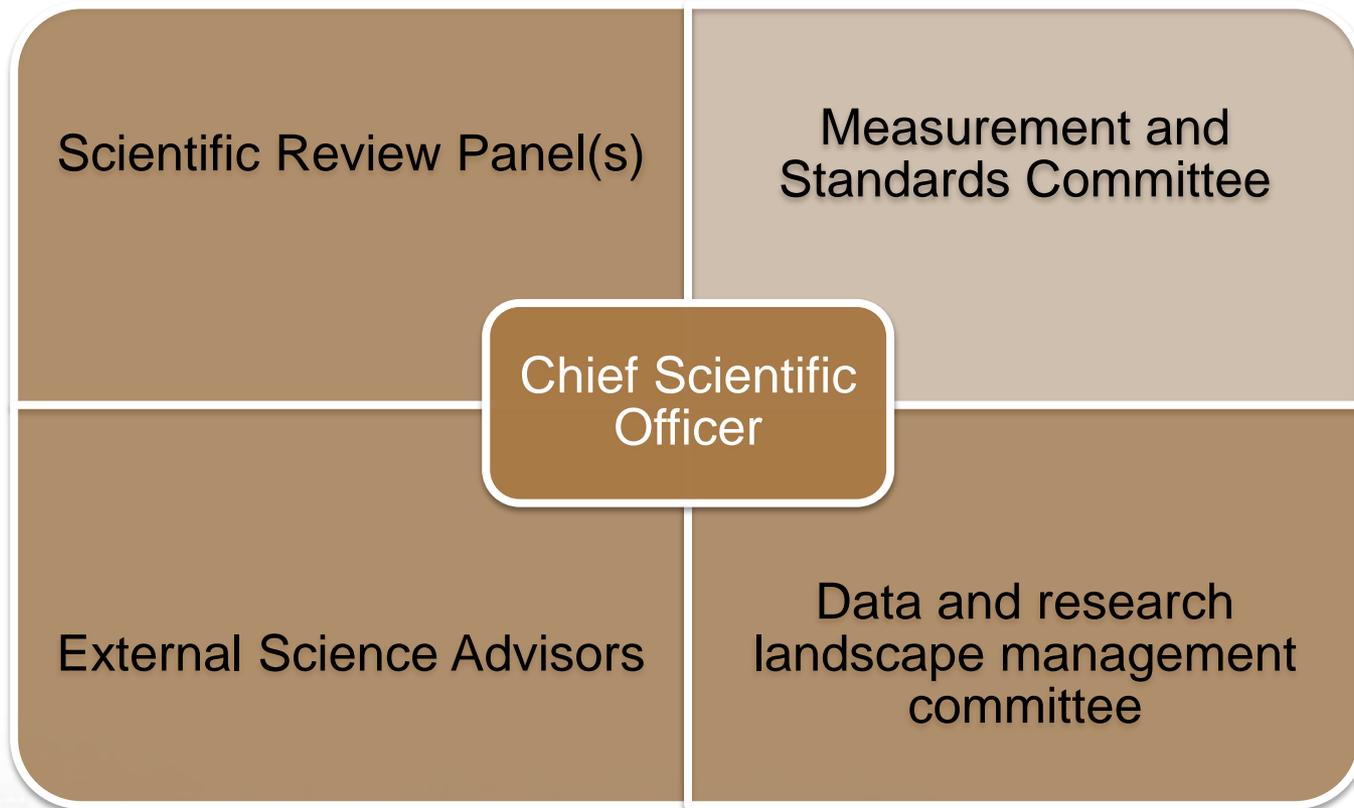
- 19-21 voting members
- 1 non-voting, ex officio (President/CEO)
- No compensation



Operational Structure



Proposed Advisory and Working Committees



Core Research Fundamental to Applied



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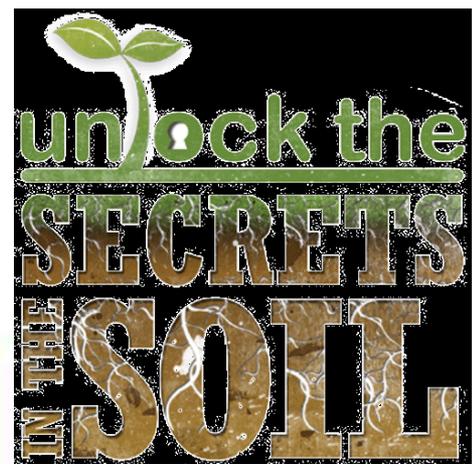
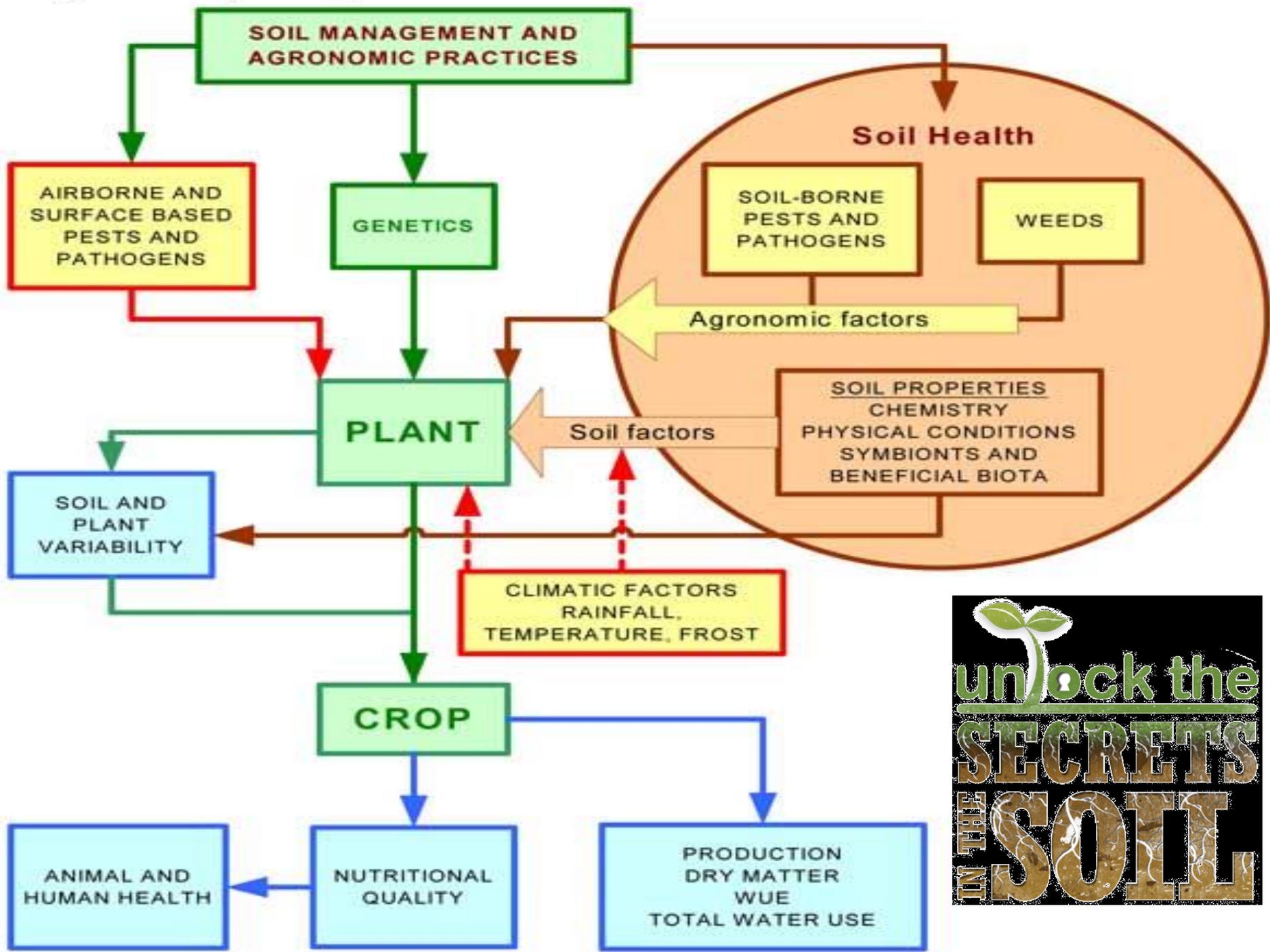
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*“The Soil Health Institute
will be to soil what NASA
is to space”*





The Influence of Microbes on Agriculture Productivity



DONALD DANFORTH
PLANT SCIENCE CENTER
DISCOVERY | COMMUNITY | IMPACT

BENEFICIAL MICROBES

PROTECT THE HOST

FROM ENVIRONMENTAL STRESSES
LIKE DROUGHT, HEAT AND INSECTS



PREVENT DISEASES

BY OUTCOMPETING
HARMFUL MICROBES

PROVIDE NUTRIENTS

LIKE NITROGEN AND PHOSPHORUS
FOR GROWTH AND DEVELOPMENT

DISEASE CAUSING MICROBES



CAN LEAD TO
100%
CROP LOSSES



RESULT IN
10-15%
REDUCTION OF CROP
PRODUCTIVITY ANNUALLY



5 MILLION

TONS OF POTATOES WERE LOST
TO MICROBIAL DISEASE CAUSING
THE IRISH POTATO FAMINE IN 1845

**MICROBIAL
CELLS**

OFTEN OUT NUMBER HOST CELLS

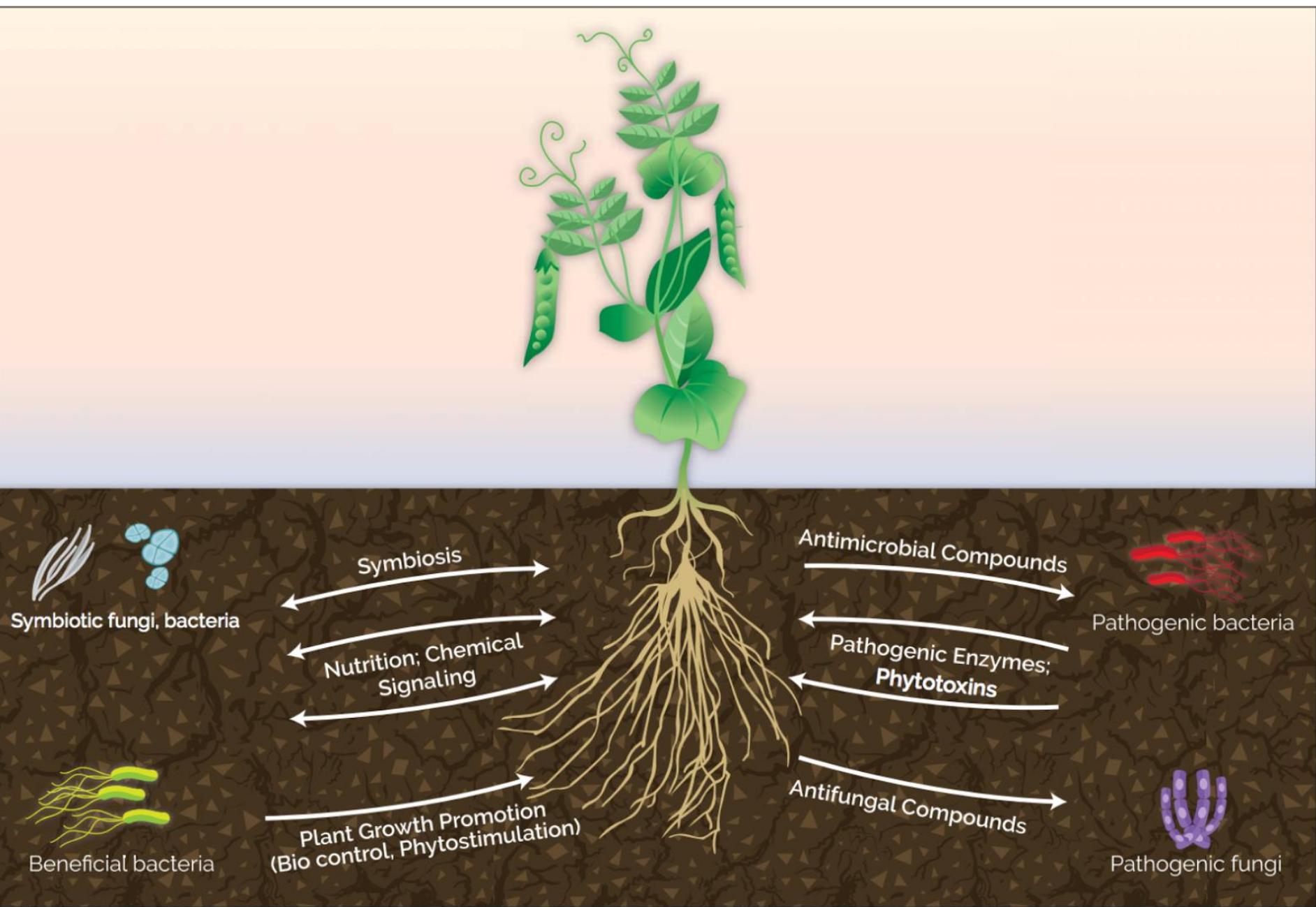
**AN
ESTIMATED
99%**

OF THE BACTERIAL SPECIES ON EARTH HAVE YET
TO BE IDENTIFIED

**THERE CAN
BE BILLIONS
OF BACTERIAL**

CELLS PER GRAM OF SOIL IN AND
AROUND PLANT ROOTS

MICROBES FIRST APPEARED ABOUT
3.5 BILLION
YEARS AGO

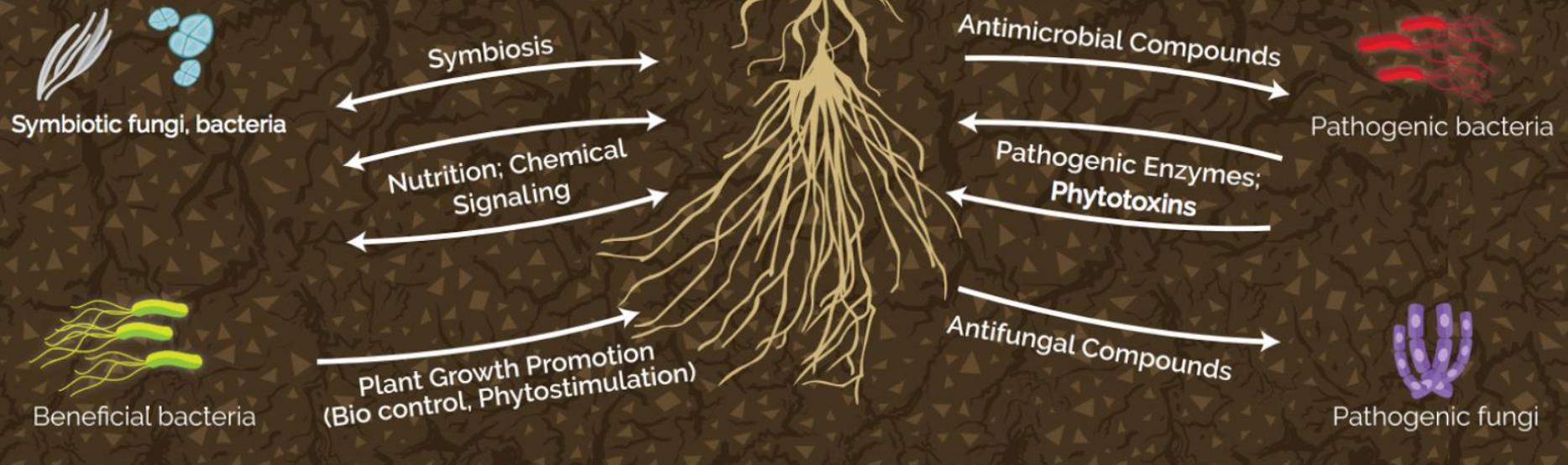


Representation of the complex interactions that take place in the rhizosphere between plant roots and microorganisms (from Haichar et al., 2014).

Future Challenges

- IP
- Genetic variations of soil
- Public good vs private interest
- Public policy
- Value assessment
- Sustainable investments

- Liability
- Regulations
- Ethics
- “The Nexus”
soil, water,
plants & animals



What's on the road ahead?..

Key Thoughts

- The movement on soil health is strong.
 - NRCS created new Soil Health Division
 - Several initiatives on many fronts.
 - Cover crop acres to expand dramatically. 20M acres by 2020. More?
 - Improved cultivar development underway
- As the biology of the soil changes, so will farming practices. What are some of the impacts?



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What's on the road ahead?..

Key Thoughts

As the biology of the soil changes, so will farming practices. What are some of the impacts?

- **Plant R&D**
 - More basic research on the soil/plant interface (Phytobiomes Initiative)
- **Input R&D**
 - Interaction and impact on soil biology and a.i.'s?
 - Precision Ag
- **Expanded retail services**
- **Soil Health Labs**
- **Crop insurance**
- **Real estate values**
- **Big Data**
- **Sustainability Reporting**
- **Etc.**



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Plant breeding



Crop Modification Techniques

Cross Breeding

Combining two sexually compatible species to create a variety with the desired traits of the parents



The Honeycrisp Apple gets its famous texture and flavor by blending the traits of its parents.

Mutagenesis

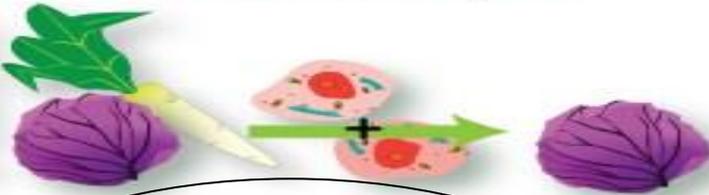
Use of mutagens such as radioactivity to induce random mutations, creating the desired trait



Radiation was used to produce a deeper color in the red grapefruit.

Protoplast Fusion

Fusion of cells or cell components to transfer traits between species



Male sterility is transferred from radishes to red cabbage by fusing their cells. Male sterility helps plant breeders make hybrid crops.

Polyploidy

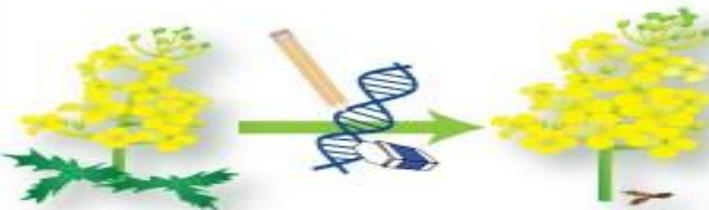
Multiplication of the number of chromosomes in a crop to impact its fertility



Seedless watermelons are created by crossing a plant with 2 sets of chromosomes with another that has 4 sets. The seedless fruit has 3 sets.

Genome Editing

Use of an enzyme system to modify DNA directly within the cell



Genome editing was used to develop herbicide resistant canola to help farmers control weeds.

Transgenesis

Addition of genes from any species to create a new variety with desired traits



The Rainbow Papaya is modified with a gene that gives it resistance to the Papaya Ringspot Virus.

Grasses



Grains



Legumes





Rye



Wheat



Triticale



Oats



Brassicas



Legumes



As I look around at the strides that have been made in our research laboratories, as I look at the things undreamed of a few years ago...the only degree to which we have reached the end of the road of opportunity is the degree to which we have exhausted the imaginative capacity of the human mind.

- Lloyd Noble
Jan. 22, 1948

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Thank you.

