Responsive Agriculture
What Do We Want From The Food System?

Patrick Stover, Ph.D.
Men in tanks must eat quickly and well

Artificial meat made from the non-aqueous fat contained in beef, chicken, and other meats can be produced in a variety of forms and cooked in a variety of ways. This meat can be used in a variety of dishes, from stir-fries to soups to casseroles. It is also high in protein and fiber, making it a healthy choice for soldiers on the go.

In addition to artificial meat, tanks can also eat fruits and vegetables, which are a great source of vitamins and minerals. They can also eat bread, cheese, and other dairy products, which are essential for maintaining a strong immune system.

Overall, tanks need to eat a balanced diet to stay healthy and strong. With the right food, they can continue to fight and protect their country.
GREATEST CHALLENGES OF OUR TIME:
Population Growth and Food/Nutrition

**Worldwide:**

- **2019** - 690 M malnourished people
- **2030** - 840 M malnourished people
- **2 billion** food insecure

**In the United States:**

- **50%** of all adults suffer from pre-diabetes or diabetes.

The treatment of diabetes alone is **160 billion/year**, more than the annual budget of many key federal agencies

Diabetes and Obesity In the U.S.

“We cannot solve our problems with the same thinking we used when we created them”

https://www.cdc.gov/diabetes/data/center/slides.html
Adult Obesity Prevalence Maps

U.S. Adults

Non-Hispanic Asian Adults

Non-Hispanic Black Adults

Non-Hispanic White Adults

Non-Hispanic American Indian or Alaska Native Adults

Hispanic Adults

https://www.cdc.gov/obesity/data/prevalence-maps.html#race
U.S. LIFE EXPECTANCY AT BIRTH, PROVISIONAL MORTALITY DATA FOR 2021

The non-Hispanic American Indian and Alaska Native (AIAN) population experienced the largest decline in life expectancy between 2019 and 2021.

- Non-Hispanic AIAN: -6.6 years
- Hispanic: -4.2 years
- Non-Hispanic Black: -4.0 years
- Non-Hispanic White: -2.4 years
- Non-Hispanic Asian: -2.1 years

Can we have a stable society with these statistics?
New Expectations:
Agriculture and Food Systems

Historical Expectations

Produce
• Food
• Fiber
• Fuel

New Expectations

Nourish and Sustain
• Food for life-long health
• Protect and sustain our environment
• Ensure agriculture is economically viable
TEMPORARILY CLOSED UNTIL COVID 19 CRISIS IS OVER
H. Rept. 116-107 - AGRICULTURE, RURAL DEVELOPMENT, FOOD AND DRUG ADMINISTRATION, AND RELATED AGENCIES APPROPRIATIONS BILL, 2020

116th Congress (2019-2020)
Hunger $\rightarrow$ Health
Folic Acid
Success Story

https://pristinepremixes.com/why-fortification/
Neural Tube Defects (NTDs)

Neural Tube Closure requires precise coordination of:
- Cell Proliferation
- Survival
- Differentiation
- Migration

Neural Tube Defects
- spina bifida
- anencephaly
Neural Tube Defects

- “Common” congenital abnormality at birth in US (1-2 in 1000 births).
- 2,500 affected births in the US/year
- Rate is 5-10/1000 in developing countries.
- Recurrence rate is 1-5/100.
- Critical period within a month of fertilization (6 weeks after LMP).
Public Health Success Story
Neural Tube Defect Prevention

Mother exhibited:
- Formiminoglutamate in urine
- Lower RBC folate
- Elevated Homocysteine
Public Health Success Story
Neural Tube Defect Prevention

1960s

• 1991 MRC NTD Recurrence Trail

• 1992 Occurrence Trail
  • 72% reduction in NTD frequency in folic acid supplemented group
Public Health Success Story
Neural Tube Defect Prevention

Clinical Observations
Clinical Trials
Recommendations
Food Policy
Evaluation

1960s
Present

Before you get pregnant, folic acid may help to prevent your unborn baby against birth defects of the spine and brain. All women of childbearing age need folic acid every day. A daily intake of 0.4 mg of folic acid is recommended by Health Canada. You can get this by eating foods rich in folic acid and by taking a 0.4 mg folic acid supplement every day.
Public Health Success Story
Neural Tube Defect Prevention

US Fortification of the Food Supply with Folic Acid

In January 1998, the FDA mandated that enriched flour and grain products include folic acid at levels from 0.095-0.308 mg folic acid/100 g product.
Public Health Success Story
Neural Tube Defect Prevention

- Clinical Observations
- Clinical Trials
- Recommendations
- Food Policy
- Evaluation

1960s

Present

![Bar chart showing percent decline in Neural Tube Defects](chart.png)

- Prenatal diagnosis
- 7 Provinces
- Quebec
- Ontario
- Newfoundland

- United States (19 to 32%)
- Canada (32 to 78%)

*Berry et al. Folate in Health and Disease 2nd edition (1999)*
Folic Acid Fortification Worldwide

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5931a2.htm
Why don’t all countries fortify the food supply with folic acid?

- First fortification initiative that did not seek to remedy a nutritional deficiency, but rather sought a HEALTH outcome: remedy a “rare” disorder
- Exposes everyone, but targets a small population subgroup (who benefits, who accrues risk?)
- Mechanism of folate-NTD relationship unknown; Mechanism of folate-cancer relationship unknown
- Observational studies of risk with high folate and low B12 status
- Biological activity of unmetabolized folic acid
- Exacerbate common concerns of unintended consequences
Diseases of nutrient deficiencies have a single cause and manifest similarly in most people in populations. Must consider other effects of food: inflammation, stress, immune, ....

Diet-related chronic diseases are complex in their etiology with many interacting risk factors (Nutrition, sleep, exercise, genetics, etc) that exhibit great heterogeneity in populations. Few chronic diseases are affected by:
- single nutrients
- single pathways

Bioactive Food Components are Eligible for DRIs.

Responders and Non-Responders
Biological Premise of Precision Nutrition
The Vision in Action:
Two Initiatives to Support the Shift in Focus

PRODUCERS
Responsive Agriculture

CONSUMERS
Precision Nutrition

Institute for Advancing Health Through Agriculture

DECISION/POLICYMAKERS
Agriculture, Food and Nutrition – Scientific Evidence Center
Responsive Agriculture

An agricultural system and food environment that supports health through nutrition while ensuring the system is economically and environmentally sustainable for future generations.

The Food System is global and interconnected

Agriculture is more than food

Individual choices and individual agency affect health
We can dream – Technology

We have the unprecedented ability to manage and engineer agriculture, food and the environment to achieve whatever goals we can imagine.
<table>
<thead>
<tr>
<th>Animal/Plant</th>
<th>Vitamin/Nutrient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomato</td>
<td>Folate</td>
</tr>
<tr>
<td>Tomato</td>
<td>β-carotene, Lycopene</td>
</tr>
<tr>
<td>Rice</td>
<td>β-carotene</td>
</tr>
<tr>
<td>Rice</td>
<td>Iron, Zinc</td>
</tr>
<tr>
<td>Maize</td>
<td>β-carotene</td>
</tr>
<tr>
<td>Maize</td>
<td>β-carotene, ascorbate, folate</td>
</tr>
<tr>
<td>Maize</td>
<td>Vitamin E</td>
</tr>
<tr>
<td>Wheat</td>
<td>Zinc</td>
</tr>
<tr>
<td>Pearl Millet</td>
<td>Iron, Zinc</td>
</tr>
<tr>
<td>Carrot</td>
<td>Iodine, Selenium</td>
</tr>
<tr>
<td>Sweet Potato</td>
<td>β-carotene</td>
</tr>
<tr>
<td>Grapes</td>
<td>Zinc</td>
</tr>
<tr>
<td>Strawberries</td>
<td>Iodine</td>
</tr>
<tr>
<td>Strawberries</td>
<td>Vitamin C</td>
</tr>
<tr>
<td>Strawberries</td>
<td>Selenium</td>
</tr>
<tr>
<td>Canola</td>
<td>Vitamin E</td>
</tr>
<tr>
<td>Potato</td>
<td>β-carotene, lutein</td>
</tr>
</tbody>
</table>
Agriculture is the Solution.
Agriculture for Health Conference
Priority Setting to Solve the Ultimate Grand Challenge

Purpose: To establish the need to set priorities that achieve an additional endpoint of the food system: **Human Health Through Responsive Agriculture**
Moving Forward with Human Health as the Endpoint

Thought Leader Committees (TLCs): Domains of Responsive Agriculture

**CHRONIC DISEASE REDUCTION**
What are the priorities to achieve a food system that supports lifelong health and reduces health care costs?

**SUSTAINABLE FOOD PRODUCTION**
What are the priorities to achieve rural and urban agriculture ecosystems that ensure adequate capacity and resiliency for food production and distribution that promotes health through food? What are the priorities to achieve an agriculture and food system economy that supports human health through food?

**NUTRITION EQUITY**
What are the priorities to achieve a food environment that supports stable, consistent access for all to make dietary choices that optimize health through food?

**Responsive Agriculture** promotes innovations in the agricultural system and food environment to optimize human health while ensuring the system is economically robust and environmentally sustainable.
New Expectations:
The Role of Evidence and Public Trust in Achieving New Expectations

### About half of the public has a positive view of nutrition research scientists

<table>
<thead>
<tr>
<th>% of U.S. adults who say the following about nutrition research scientists</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall view of nutrition research scientists</td>
</tr>
<tr>
<td>All or most of the time</td>
</tr>
</tbody>
</table>

### Nutrition research scientists do each of the following ...

<table>
<thead>
<tr>
<th>Nutrition research scientists do each of the following ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Care about the best interests of the public</td>
</tr>
<tr>
<td>Do a good job conducting research</td>
</tr>
<tr>
<td>Provide fair and accurate information</td>
</tr>
<tr>
<td>Are transparent about conflicts of interest</td>
</tr>
<tr>
<td>Admit mistakes and take responsibility</td>
</tr>
</tbody>
</table>

### Problem of research misconduct

<table>
<thead>
<tr>
<th>Problem of research misconduct</th>
<th>Very big problem</th>
<th>Moderately big problem</th>
<th>Small problem</th>
<th>Not a problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>All or most of the time</td>
<td>12</td>
<td>31</td>
<td>45</td>
<td>10</td>
</tr>
</tbody>
</table>

### Face serious consequences for misconduct

<table>
<thead>
<tr>
<th>Face serious consequences for misconduct</th>
<th>All or most of the time</th>
<th>Some of the time</th>
<th>Only a little/none of the time</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>38</td>
<td>53</td>
<td></td>
</tr>
</tbody>
</table>

Note: Respondents who did not give an answer are not shown. “Neither” means “neither positive nor negative.”

Source: Survey conducted Jan. 7-21, 2019.

“Trust and Mistrust in Americans’ Views of Scientific Experts”

Best practices in nutrition science to earn and keep the public's trust

Cutberto Garza, Patrick J Stover, Sarah D Ohlhorst, Martha S Field, Robert Steinbrook, Sylvia Rowe, Catherine Woteki, Eric Campbell

The American Journal of Clinical Nutrition, Volume 109, Issue 1, January 2019, Pages 225-243,
https://doi.org/10.1093/ajcn/nqy337

Published: 18 January 2019   Article history ▼
New Expectations: The Role of Evidence and Public Trust in Achieving New Expectations

Why is Evidence Important in Agriculture?

- Clarity on the strength-of-the-science
- Differentiates Science from Preferences, Beliefs and Values
- Common Evidentiary Standards Across Multiple Outcomes
  - Assess synergies and tradeoffs (Human, Environmental and Economic Health)
- Promotes Public Trust
  - Transparency
2022 AAAS Annual Meeting

- Agriculture & Food: Achieving the New Expectations with Evidence-Based Science
- February, 2022
Texas A&M Agriculture, Food & Nutrition Evidence Center

Announcement

November 10, 2021

Texas A&M University System Chancellor John Sharp, along with government and business leaders from Fort Worth and across Texas, announced plans to build a new research campus and collaborative innovation hub in downtown Fort Worth.
We’ve done it before.
We must do it again.
Connect with the IHA