

# Responsive Agriculture

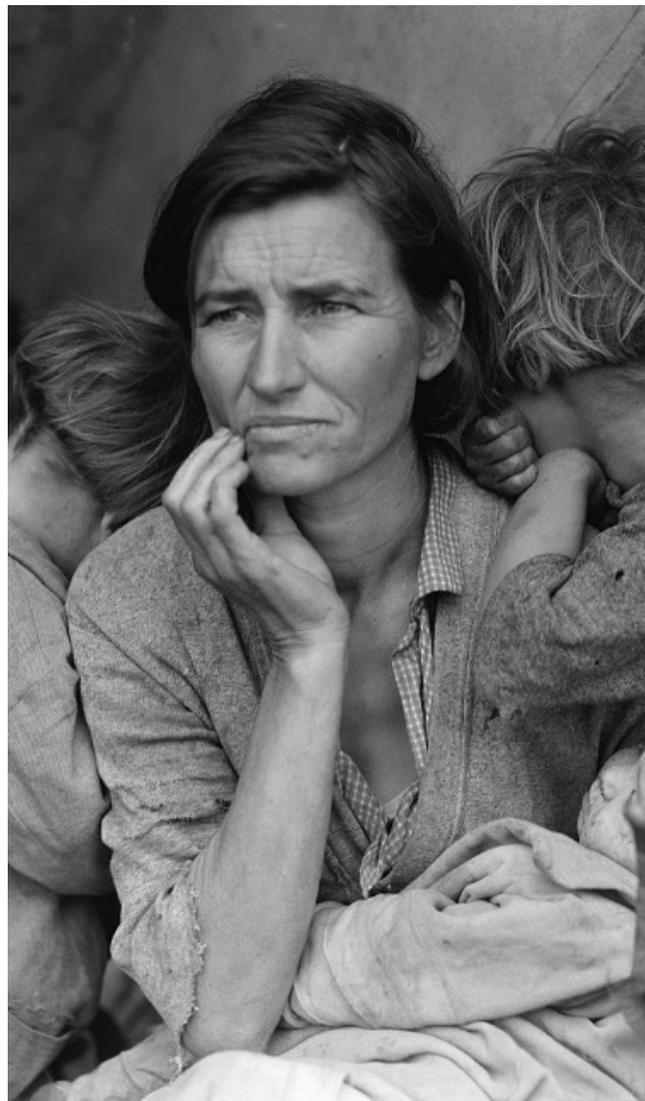
## What Do We Want From The Food System?

Patrick Stover, Ph.D.

TEXAS A&M  
AGRILIFE

INSTITUTE FOR ADVANCING  
HEALTH THROUGH AGRICULTURE





## Men in tanks must eat quickly and well

**Actual meat meals from the new 5-in-1 Ration carried by U. S. Armored Forces operating in enemy territory**

When U. S. tanks smash their way through enemy lines our men are often in the thick of fighting for days at a time. That's when food is a No. 1 mission - when time lost preparing meals can turn victory to defeat. Yet, even during active fighting, U. S. soldiers get three well-balanced meals, their pound of mashing meat per man per day - through this new 5-in-1 ration. Developed by U. S. Army Quartermaster Corps for mechanized

units, landing parties, all mobile operations - this ration is usually composed of canned and dehydrated foods.

Armour and Company, largest producer of canned meats in America, is supplying millions of tons of meat for Army rations. And Armour, with the other packers, is also providing millions of pounds of fresh meat and dairy products every day for America's war needs.

That's why civilians must get along on less meat... why every loyal American will seek only his fair share. By limiting the amount of meat you eat, you'll be doing your part to help keep our fighters better fed - and maintain the strength of our nation at home.



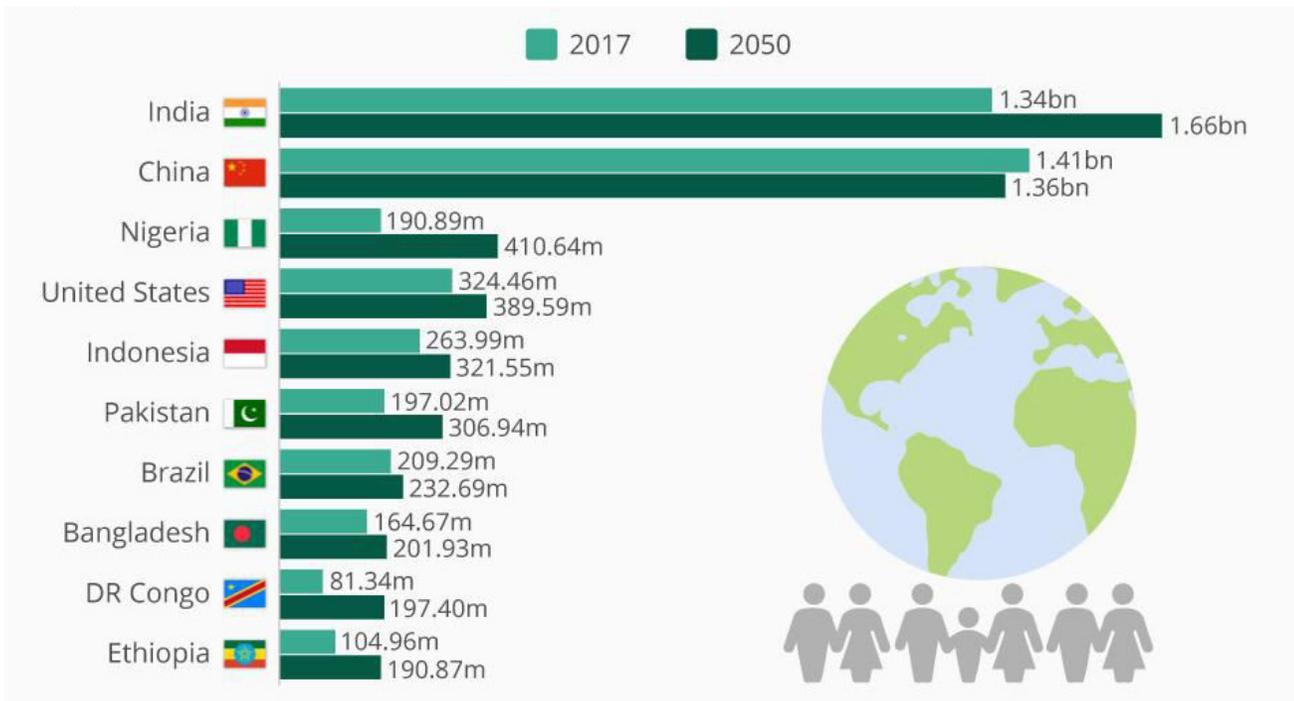
**Breakfast**  
Turkey and Corned (dehydrated)  
Spiced Ham (dehydrated)  
Shrimp Cocktail Sauce  
Coffee (instant)  
Biscuits  
Sugar and Condensed Milk  
Cigarettes

**Supper**  
Beef and Vegetable Stew  
Potatoes  
Apple Pie (dehydrated)  
Candy  
Sugar and Condensed Milk



# GREATEST CHALLENGES OF OUR TIME:

## Population Growth and Food/Nutrition



<https://www.forbes.com/sites/niallmccarthy/2017/06/22/the-worlds-most-populous-nations-in-2050-infographic/#726189339f60>

### *Worldwide:*

**2019 - 690 M** malnourished people

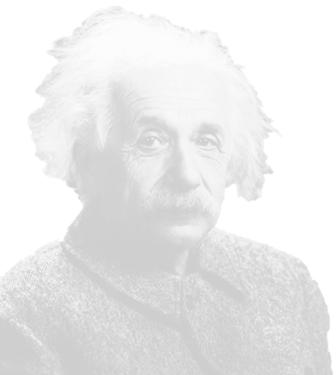
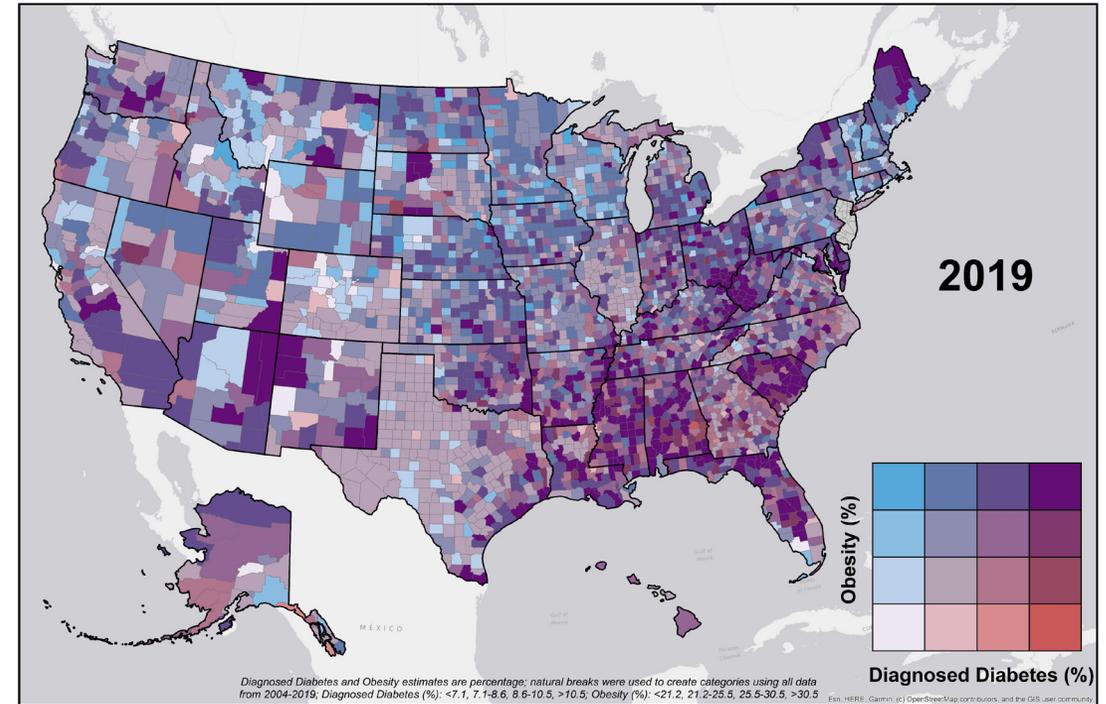
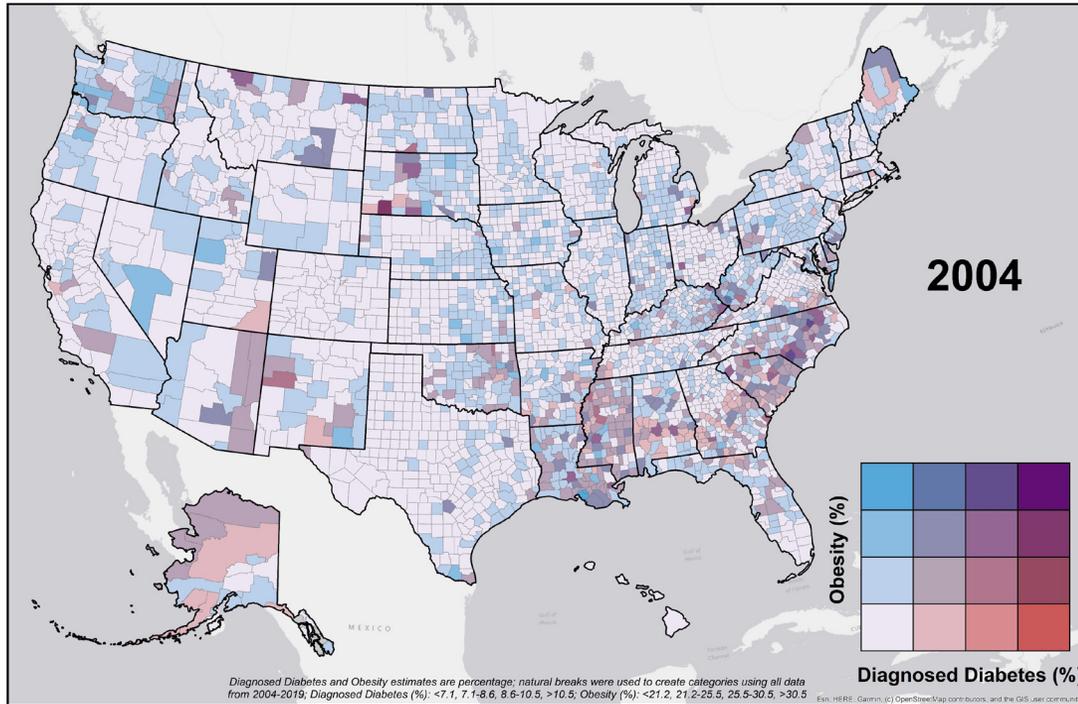
**2030 - 840 M** malnourished people  
- **2 billion** food insecure

### *In the United States:*

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

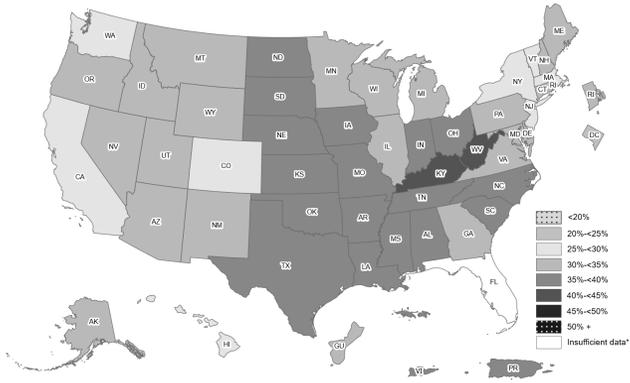
The treatment of diabetes alone is **160 billion/year**, more than the annual budget of many key federal agencies

# Diabetes and Obesity in the U.S.

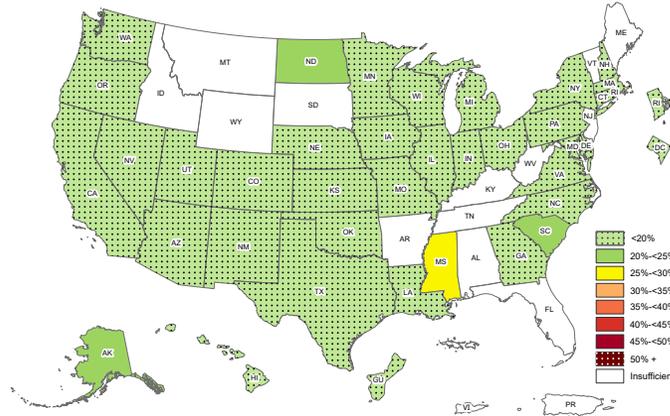


**“We cannot solve our problems with the same thinking we used when we created them”**

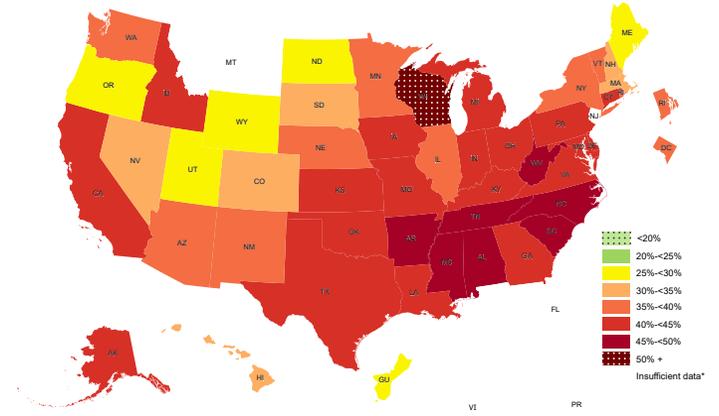
# Adult Obesity Prevalence Maps



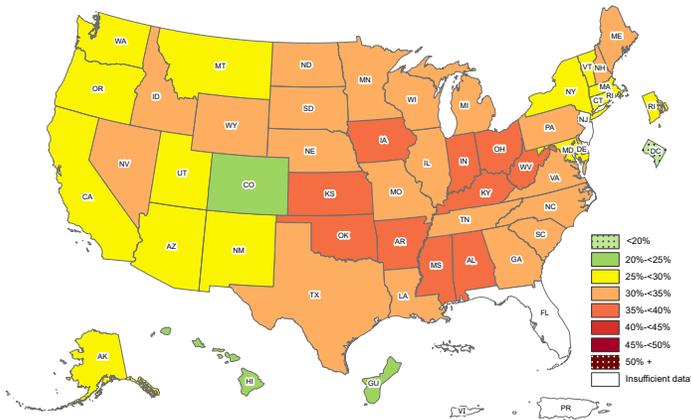
U.S. Adults



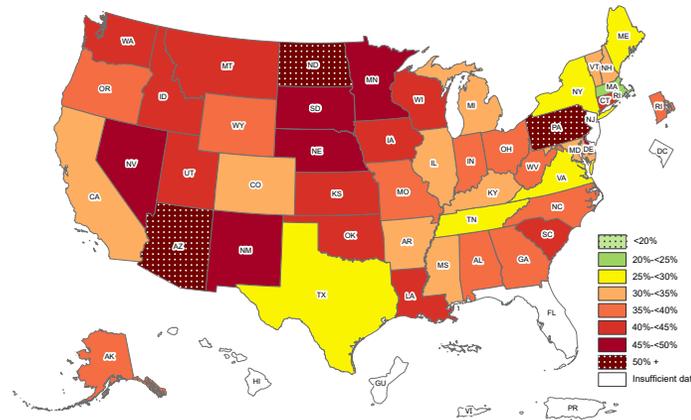
Non-Hispanic Asian Adults



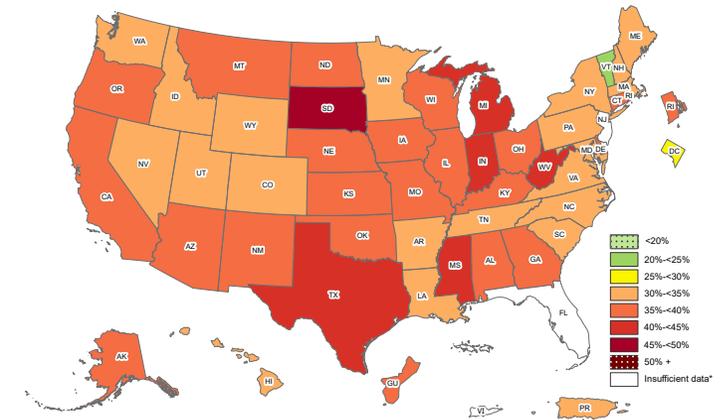
Non-Hispanic Black Adults



Non-Hispanic White Adults



Non-Hispanic American Indian or Alaska Native Adults



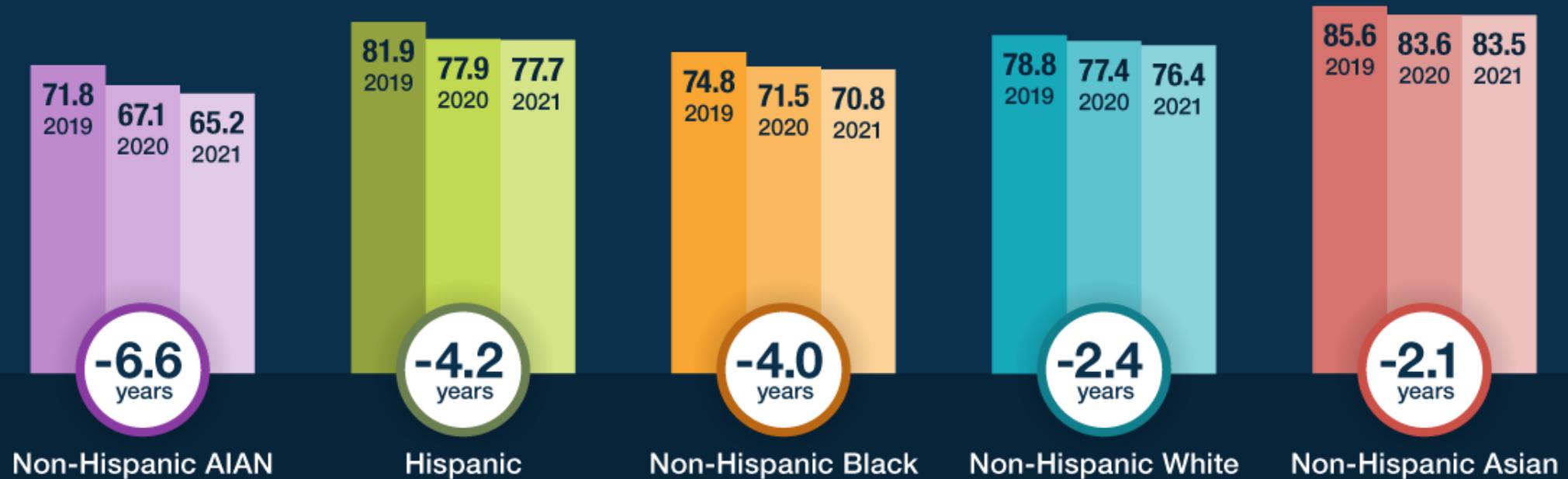
Hispanic Adults

**NCHS**

National Center  
for Health Statistics

# 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



SOURCE: National Center for Health Statistics, National Vital Statistics System.  
For more information, visit [www.cdc.gov/nchs/data/vsrr/vsrr023.pdf](https://www.cdc.gov/nchs/data/vsrr/vsrr023.pdf).

CS332757

[www.cdc.gov](https://www.cdc.gov)

**Can we have a stable society with these statistics?**

A photograph of a dining table with a wooden chair in the foreground. The table is set with a meal, including a plate of food and a glass. The background is blurred, showing a person sitting at the table. The text "Can we have a stable society with these statistics?" is overlaid on the image.

# New Expectations:

## *Agriculture and Food Systems*



### Historical Expectations

#### **Produce**

- Food
- Fiber
- Fuel

### New Expectations

#### **Nourish and Sustain**

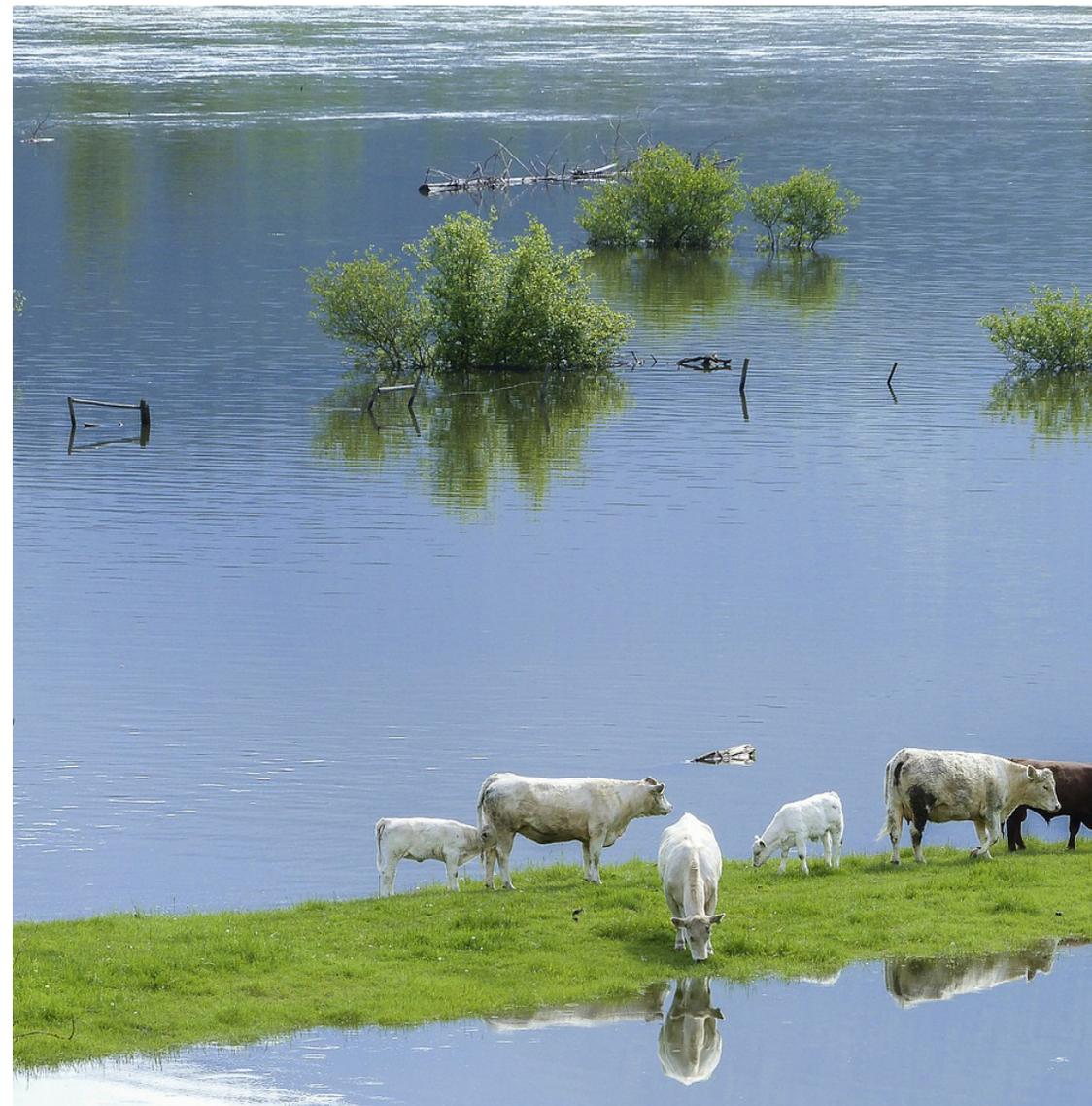
- Food for life-long health
- Protect and sustain our environment
- Ensure agriculture is economically viable

**BREAKFAST  
LUNCH • DINNER**

**TEMPORARILY  
CLOSED UNTIL  
COVID 19 CRISIS  
IS OVER**



<https://farmingbase.com/what-is-the-difference-between-residual-soil-and-transported-soil/>



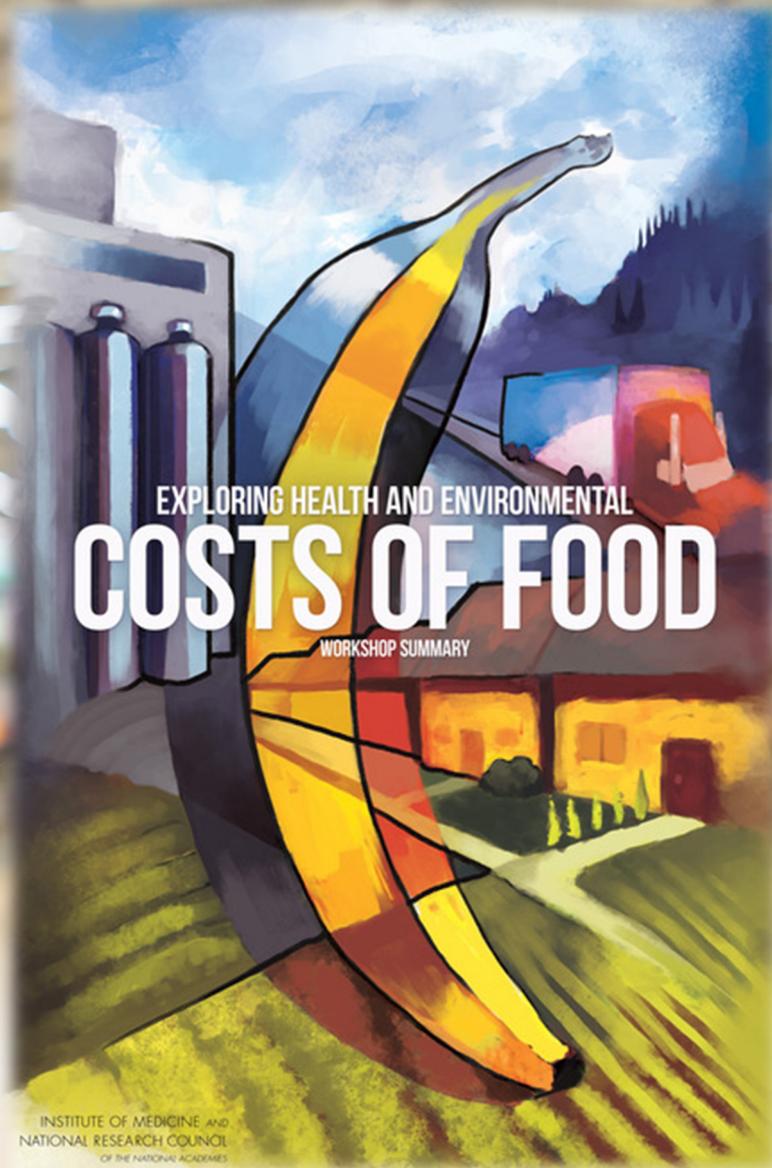
<https://fve.org/publications/natural-disasters-and-one-health-conclusions/>



<https://www.alamy.com/stock-photo/des-moines-sprawl.html?sortBy=relevant>



<https://www.mprnews.org/episode/2021/12/02/climate-cast-utility-delays-stymy-hundreds-of-solar-projects-and-jobs-in-minnesota>



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### H. Rept. 116-107 - AGRICULTURE, RURAL DEVELOPMENT, FOOD AND DRUG ADMINISTRATION, AND RELATED AGENCIES APPROPRIATIONS BILL, 2020

116th Congress (2019-2020)

[COMMITTEE REPORT](#) | [Show Overview](#)





**FOOD**

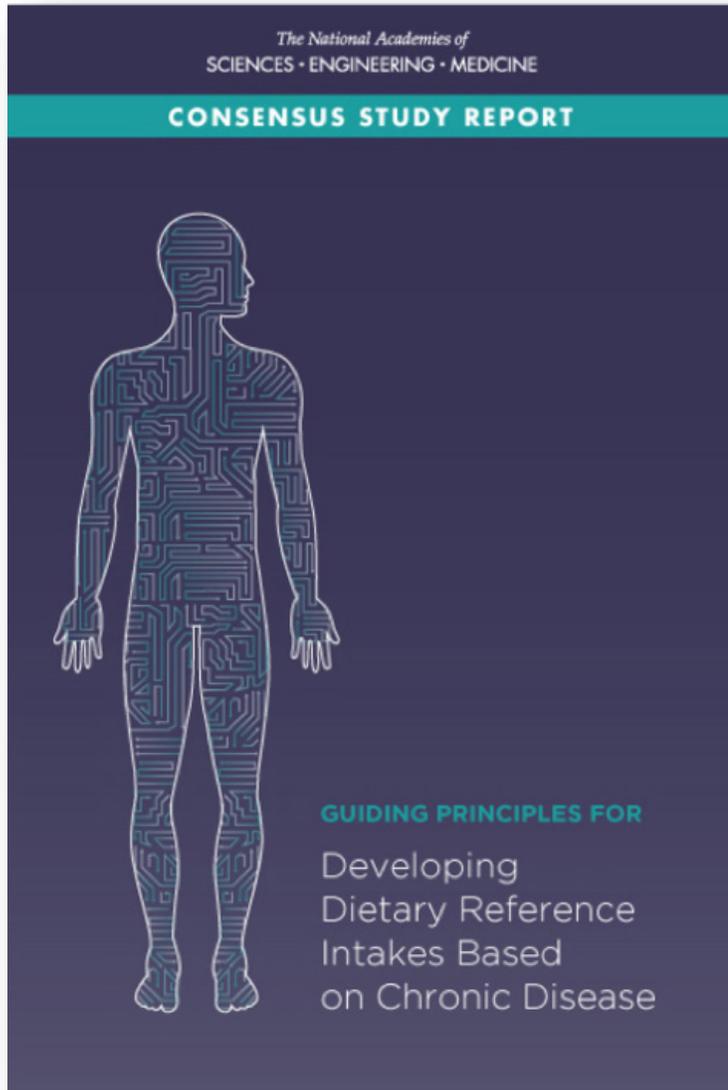
**PEOPLE**

**ECONOMICS**

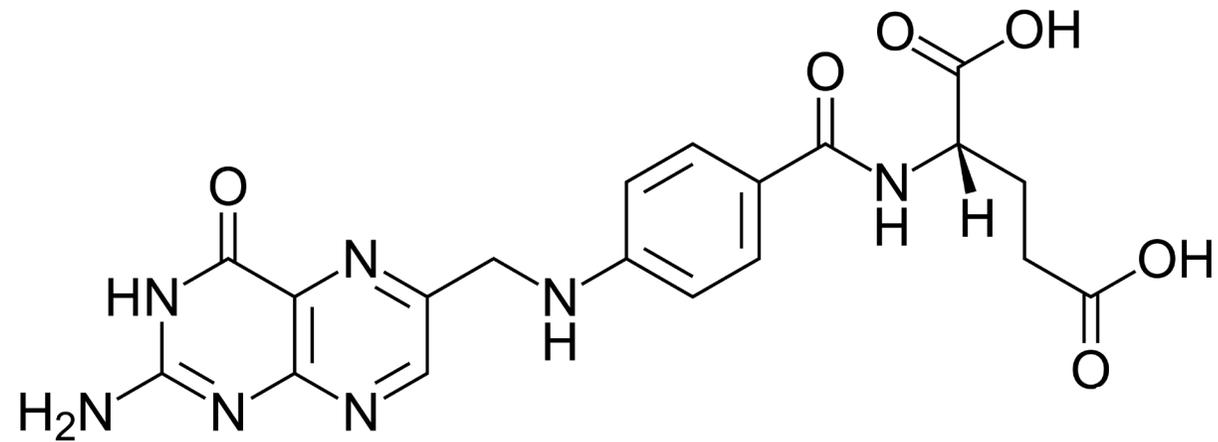
**ENVIRONMENT**







**Hunger → Health**

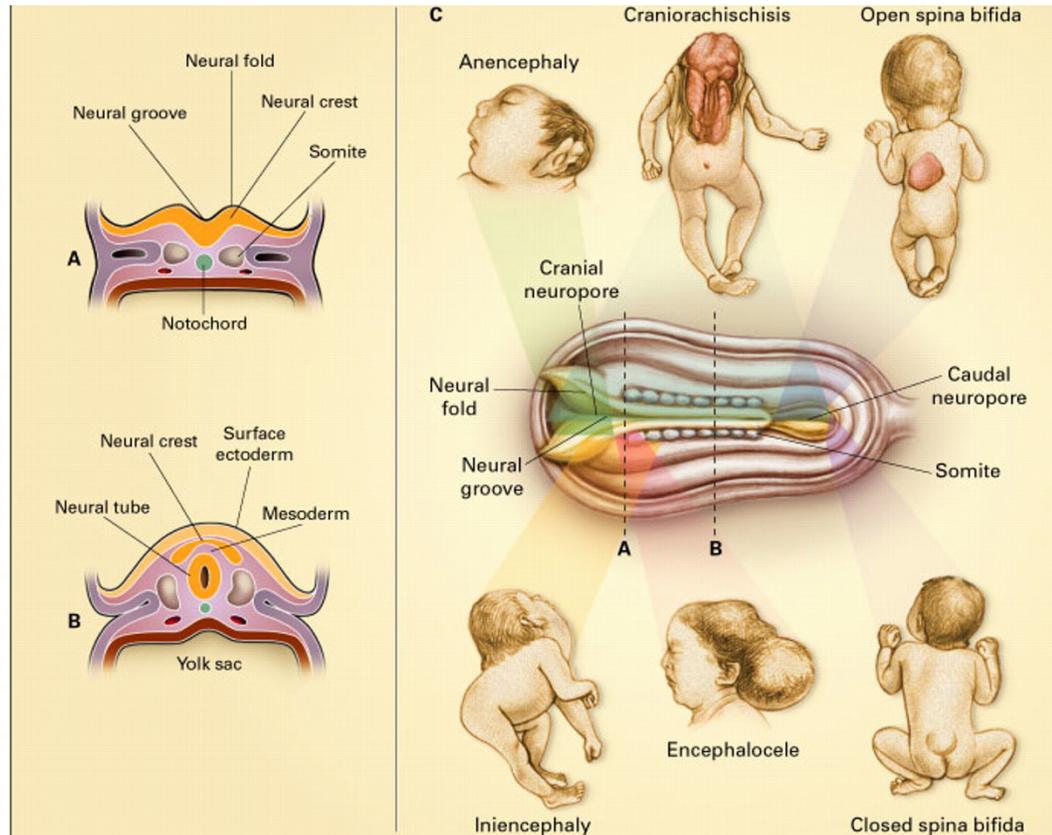


# Folic Acid Success Story

<https://pristinepremixes.com/why-fortification/>



# Neural Tube Defects (NTDs)



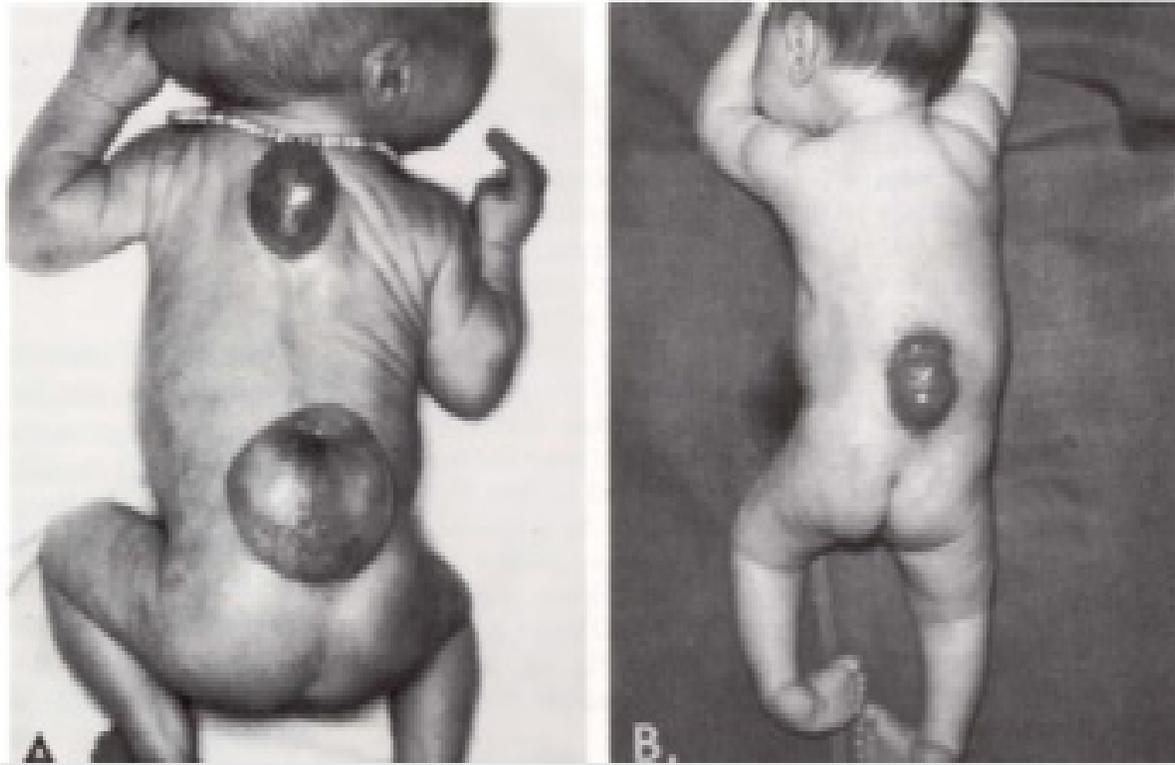
## Neural Tube Closure requires precise coordination of:

- Cell Proliferation
- Survival
- Differentiation
- Migration

## Neural Tube Defects

- spina bifida
- anencephaly

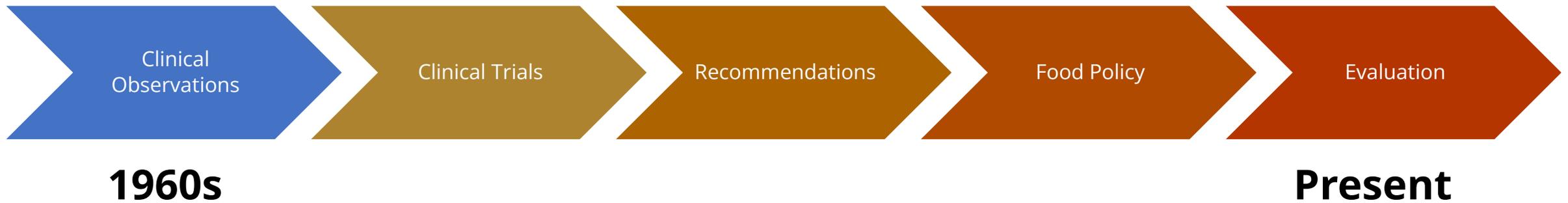
# Neural Tube Defects



- “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

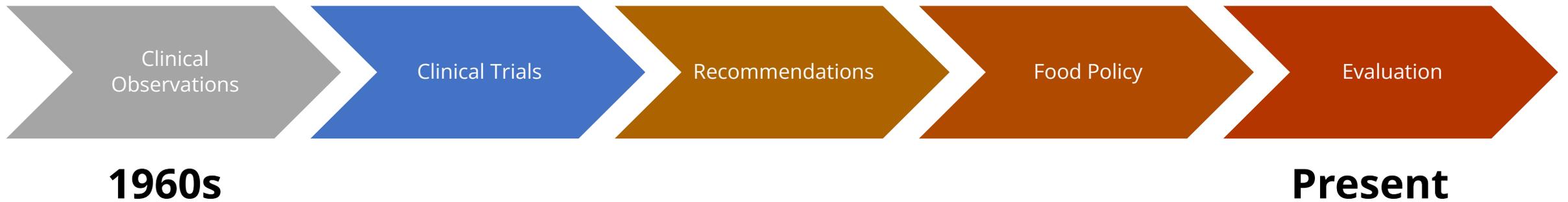


## Mother exhibited:

- Formiminoglutamate in urine
- Lower RBC folate
- Elevated Homocysteine

# Public Health Success Story

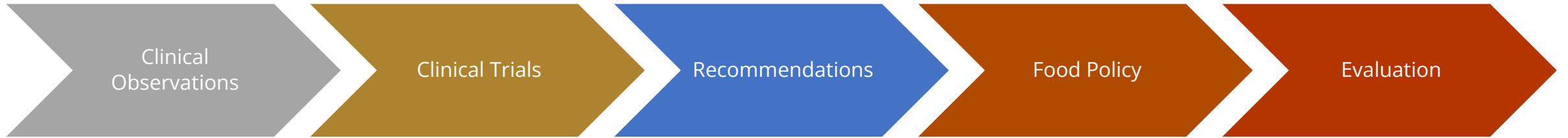
Neural Tube Defect Prevention



- **1991 MRC NTD Recurrence Trail**
- *The Lancet*, 1991 **338**, 131.
- **1992 Occurrence Trail**
- **72% reduction in NTD frequency in folic acid supplemented group**

# Public Health Success Story

## Neural Tube Defect Prevention



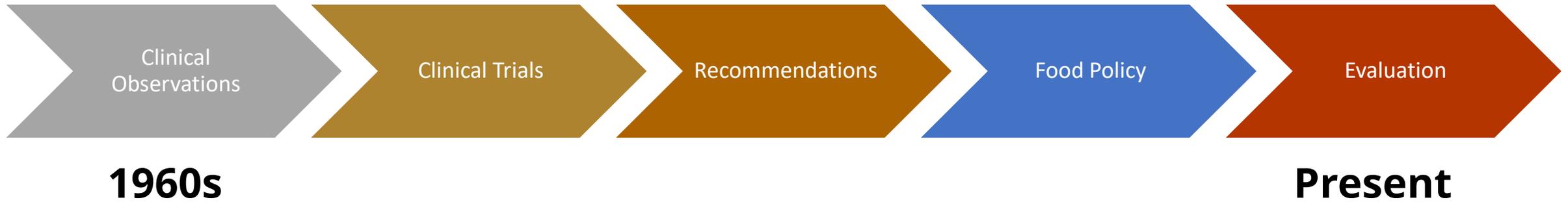
1960s

Present



# Public Health Success Story

Neural Tube Defect Prevention

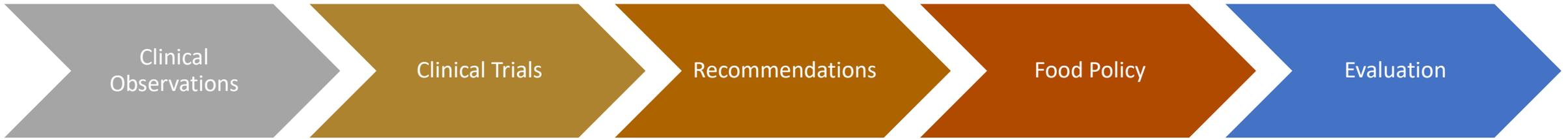


## US Fortification of the Food Supply with Folic Acid

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.

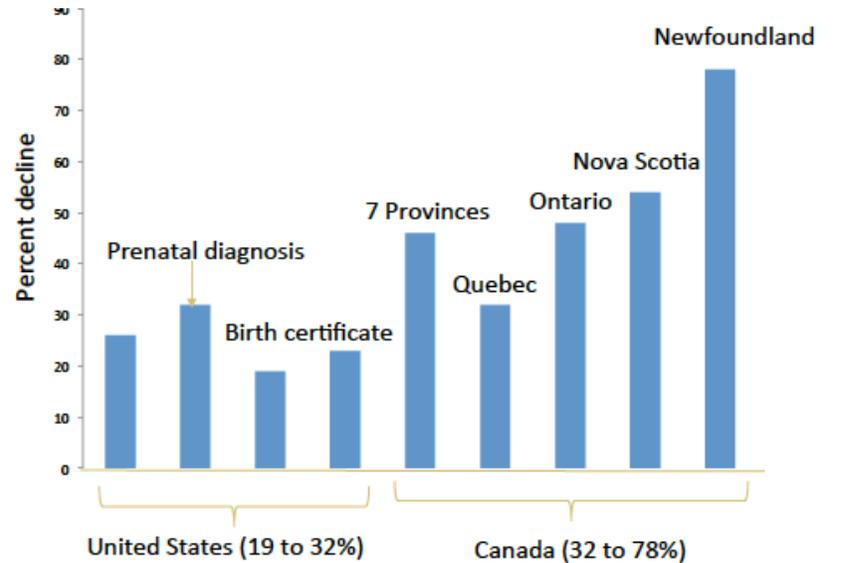
# Public Health Success Story

Neural Tube Defect Prevention



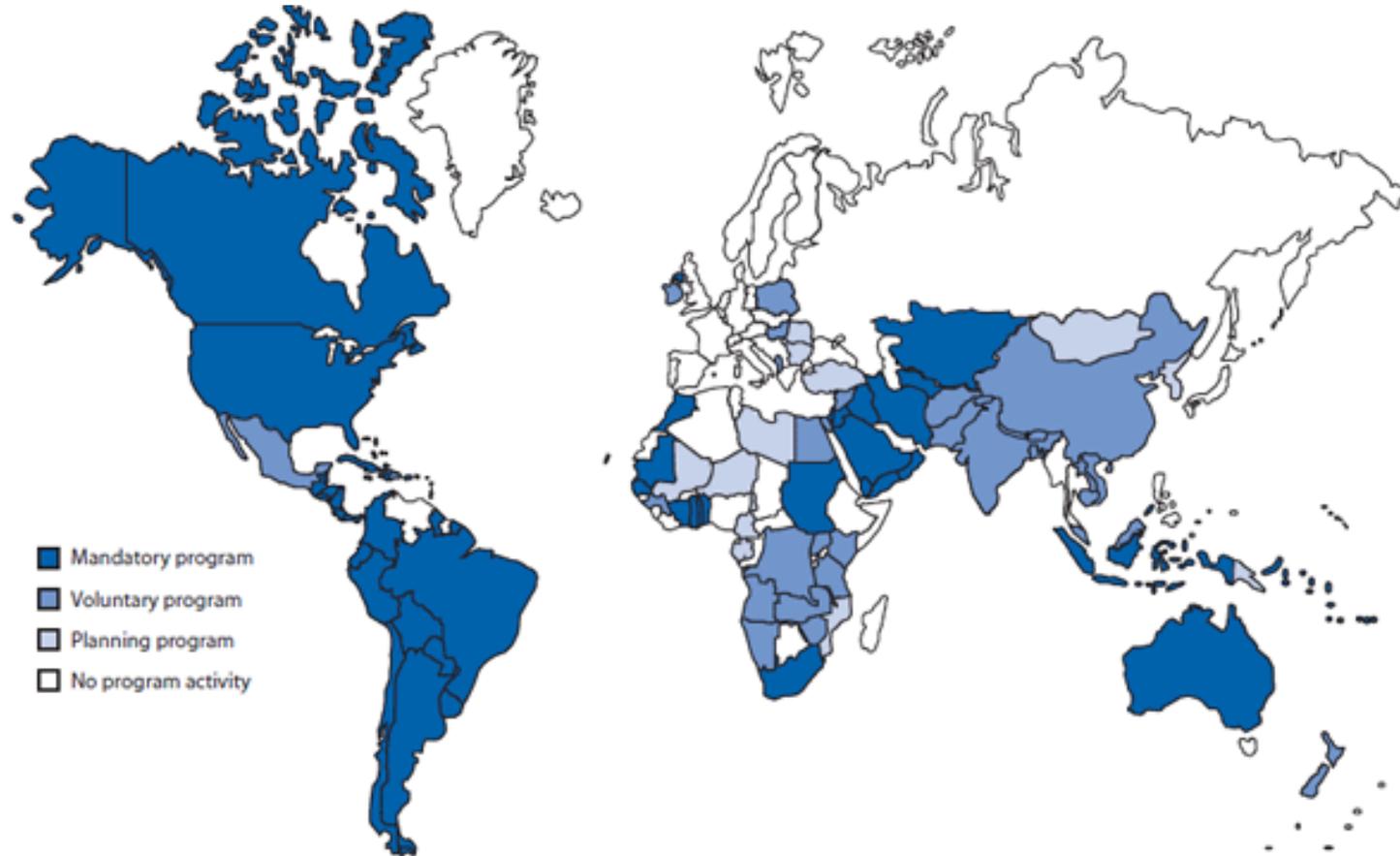
1960s

Present



Berry et al. Folate in Health and Disease 2<sup>nd</sup> edition (1999)

# Folic Acid Fortification Worldwide



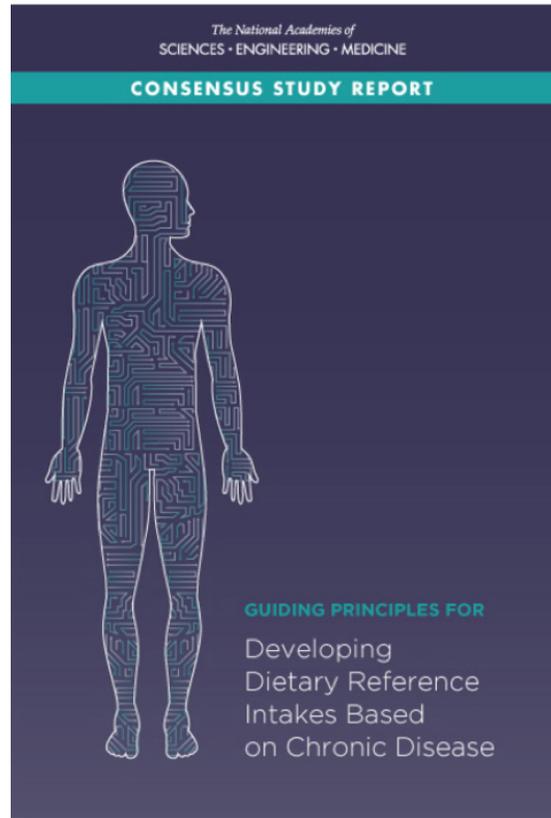
# Why don't all countries fortify the food supply with folic acid?

- 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



# Chronic Disease Endpoints:

Nutrient Deficiency Endpoints → Chronic Disease Endpoints



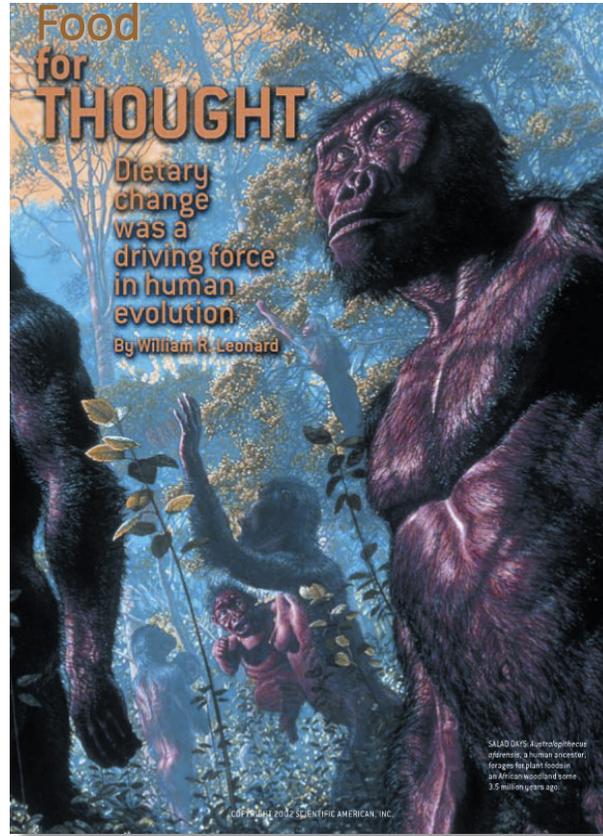
2017

- 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



National Institutes  
of Health



Scientific American November 13, 2002 William R. Leonard





**American  
Diet**

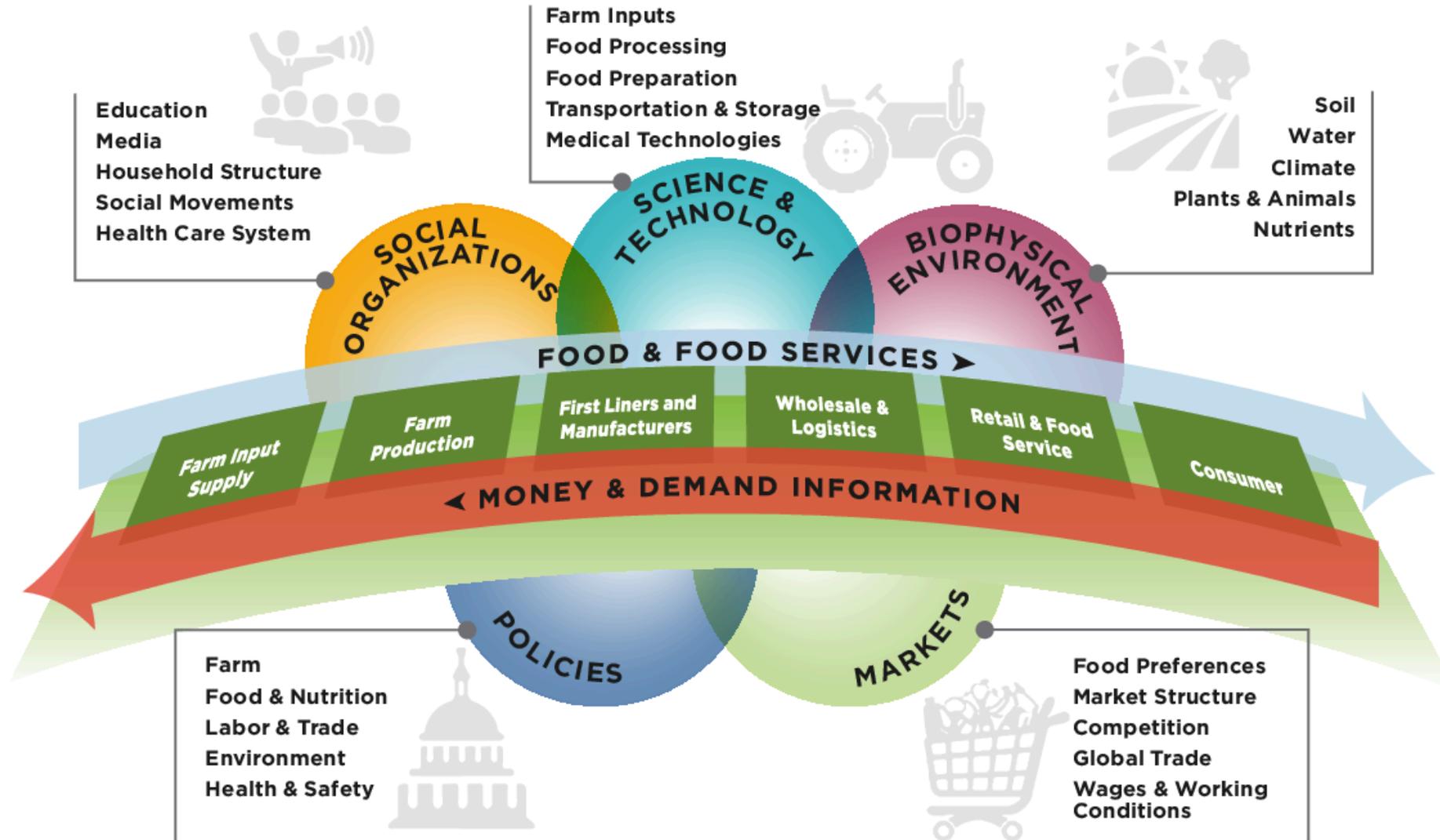
**Mediterranean  
Diet**

**Japanese  
Diet**

**Maasai/  
ketogenic**

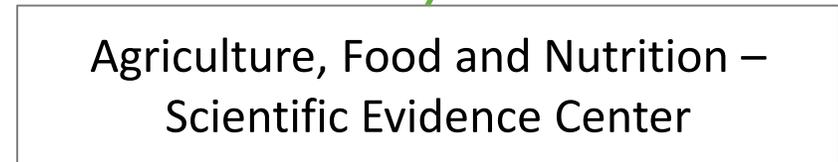
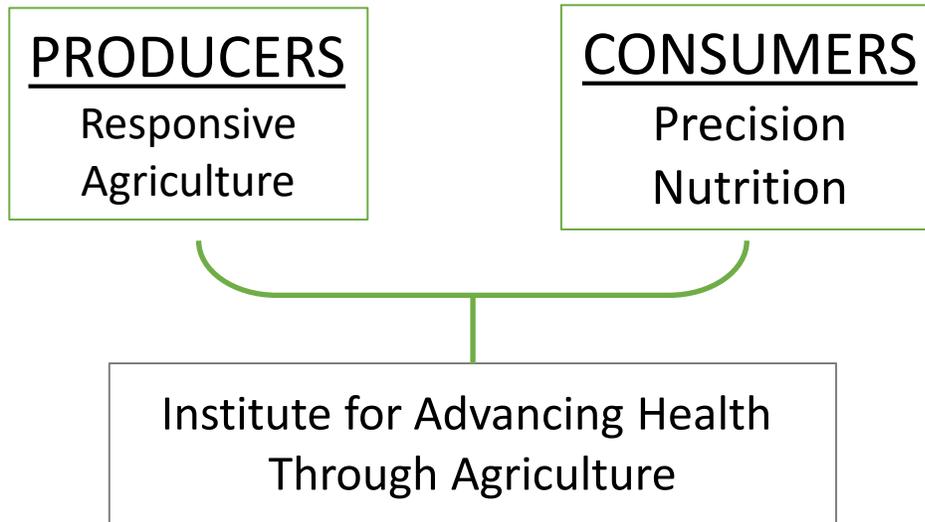






# The Vision in Action:

Two Initiatives to Support the Shift in Focus



## **Responsive Agriculture**

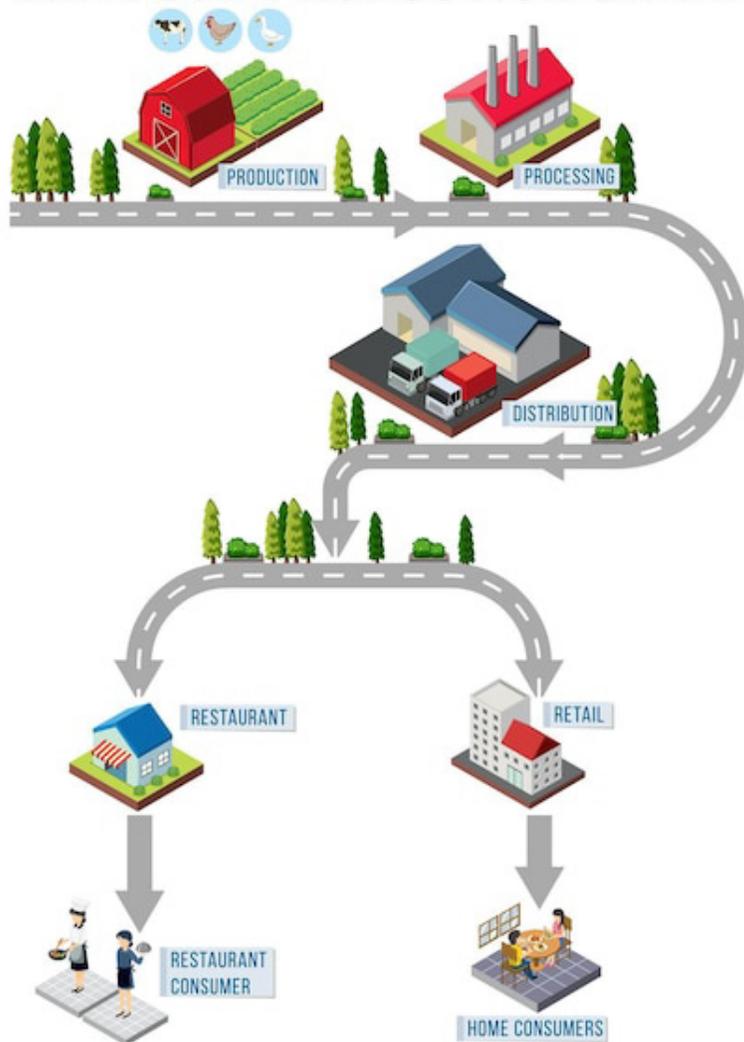
An agricultural system and food environment that supports health through nutrition while ensuring the system is economically and environmentally sustainable for future generations.

*The Food System  
is global and  
interconnected*

*Agriculture is  
more than food*

*Individual choices and  
individual agency  
affect health*

# THE FOOD PRODUCTION CHAIN



## 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



**Animal/Plant**    **Vitamin/Nutrient**

Tomato	Folate
Tomato	$\beta$ -carotene, Lycopene
Rice	$\beta$ -carotene
Rice	Iron, Zinc
Maize	$\beta$ -carotene
Maize	$\beta$ -carotene, ascorbate, folate
Maize	Vitamin E
Wheat	Zinc
Pearl Millet	Iron, Zinc
Carrot	Iodine, Selenim
Sweet Potato	$\beta$ -carotene
Grapes	Zinc
Strawberries	Iodine
Strawberries	Vitamin C
Strawberries	Selenium
Canola	Vitamin E
Potato	$\beta$ -carotene, lutein





# 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**



Keynote Address



World-Renown Speakers



Audience Reaction



Interdisciplinary Collaboration

# 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:

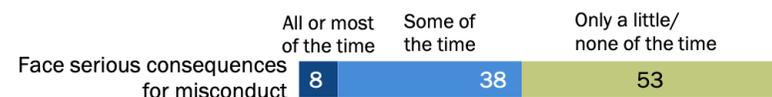
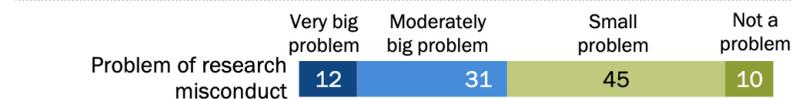
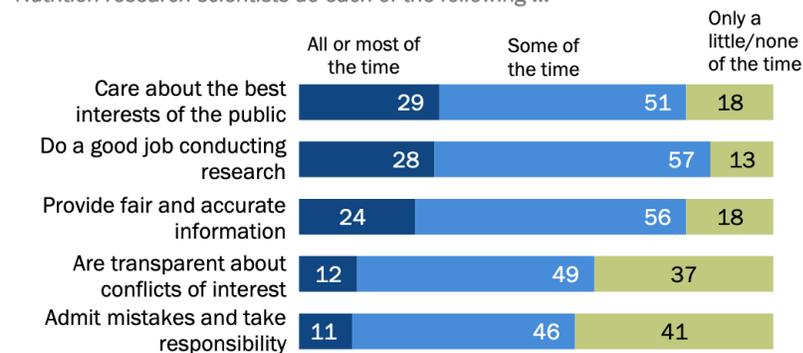
## The Role of Evidence and Public Trust in Achieving New Expectations

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

% of U.S. adults who say the following about nutrition research scientists



Nutrition research scientists do each of the following ...



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"

PEW RESEARCH CENTER



The American Journal of  
**CLINICAL NUTRITION**



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Volume 109, Issue 1  
January 2019

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

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.](#)



A close-up photograph of several golden wheat stalks with long, thin awns, set against a bright, slightly hazy blue sky. The wheat is in sharp focus in the foreground, while the background is softly blurred.

**We've done it before.**



**FOOD**

**PEOPLE**



**ENVIRONMENT**

**ECONOMICS**



**We must do it again.**

# Connect with the IHA

