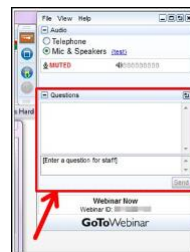
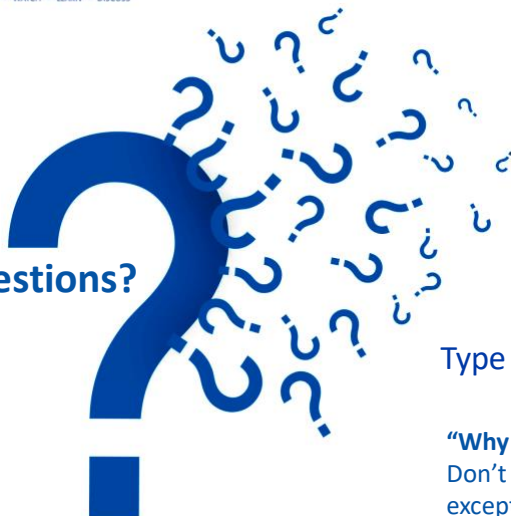




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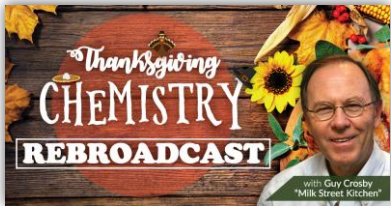


“From a chemist's and cook's perspective, this webinar was very informative. Understanding how cooking temperatures and brining impact turkey meat's outcome as well as how the type of potato used will affect mashed potatoes will help me to improve thanksgiving dinner for my family. Really enjoyed this!”

Fan of the Week

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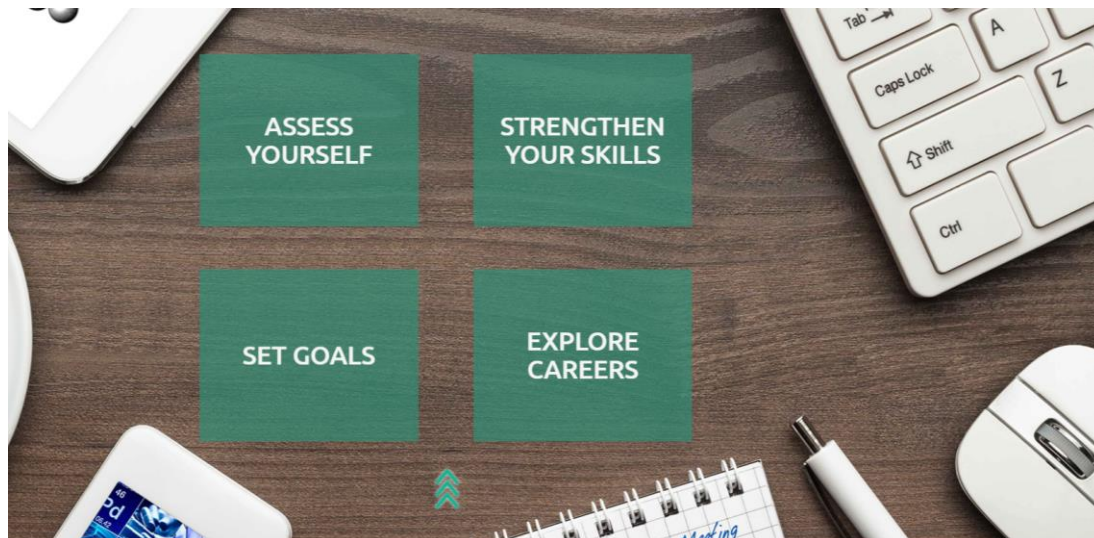


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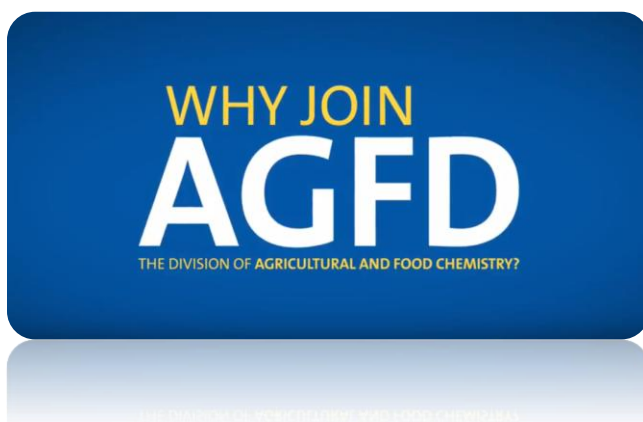
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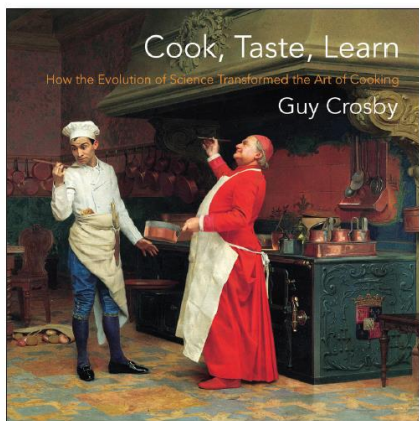
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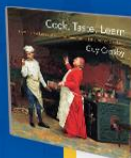
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 Editor, Milk Street Kitchen

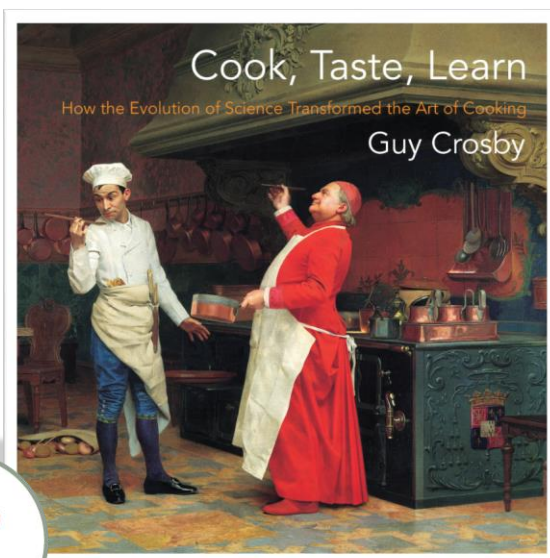
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Only Humans Cook Their Food!

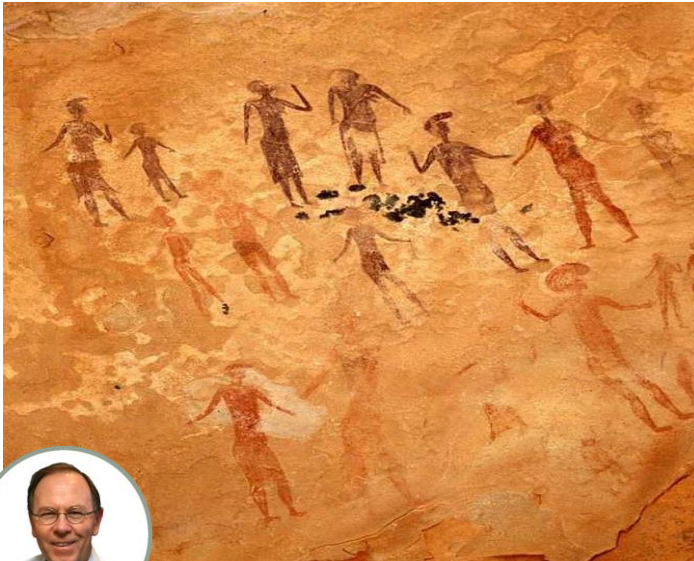


- **Richard Wrangham – Fire first used to cook food almost 2 million Years ago**

- **Cooking must have had a profound influence on the evolution of humans**



Homo Erectus...The First Cooks



- Cooking provided more nutrients, energy, and social interaction

- Cooking Made Bigger Brains

- By 200,000 YA Human brain increased by 60%



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The Evolution of Agriculture



- Agriculture evolved 10,000 Years ago

- Seven independent regions of the World: Nicolai Vavilov 1930s

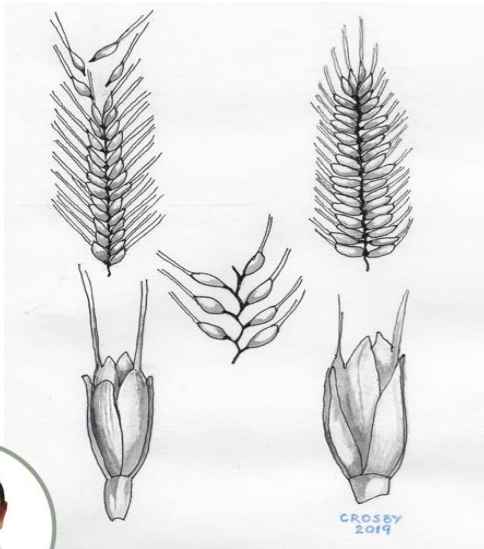
- Enough food harvested in 3 weeks to last a year



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The Greatest Technological Advance



- **Agriculture the single greatest technological advance of all time**
- **Permanent settlements established**
- **Within 7,000 years population grew from 3 MM to 100 MM**



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Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT



20

How many basic tastes are there?

- Four
- Five
- Six
- Seven
- None of the above

** If your answer differs greatly from the choices above tell us in the chat!*

Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT



ANSWER

- Four
- Five
- **Six** (Sweet, Salty, Sour, Bitter, Umami, Fat)
- Seven
- None of the above

** If your answer differs greatly from the choices above tell us in the chat!*

The Art of Cooking Begins:

Clay Ovens for baking 7000 YA



Chinese clay cooking vessel 3500 YA



Akkadian Tablets 3750 YA



Chinese Cooking Contributions



- Chinese produce Iron from iron ore 2700-2500 YA
- First cast iron wok created during Han Dynasty 2200-1800 YA
- First noodles from millet 4000 YA

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Faux Science is King



- 2600 to 2300 YA Greek philosophers believe all matter composed of air, fire, earth, water
- Properties of matter are interchangeable
- Alchemy in search of gold is born
- Little real science discovered until 1600s



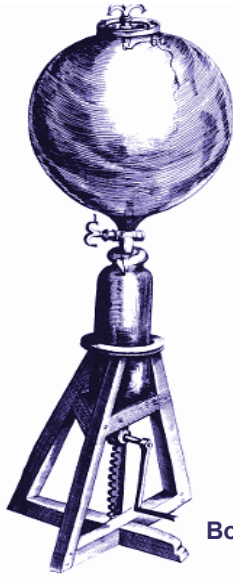
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The Evolution of Modern Science



- **Robert Boyle Destroyed Aristotle's Concept of the Elements in 1661**
- **Boyle proved fire was a process of combustion rather than an element**
- **The evolution of modern science begins**



Boyle's vacuum pump

Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT



Which method of cooking meat makes it juicier?

- Braising
- Roasting
- Either
- Neither



** If your answer differs greatly from the choices above tell us in the chat!*

Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT



Which method of cooking meat makes it juicier?

Measure	Braised*	Roasted
Total cooking loss	29.6%	28.2%
Evaporation	20.0%	5.6%
Drip loss	9.6%	22.6%

Eye of the round beef cooked to internal temperature of 158°F (70 °C) in 325°F (163 °C) oven

** Braised in water*

J Food Science 39 (1974): 18-21

** If your answer differs greatly from the choices above tell us in the chat!*

The Pressure Cooker is Invented



- Based on Boyle's Law, Denis Papin develops the "Pressure Cooker" in 1679

Portrait von Denis Papin, 1689



The Law of Conservation of Matter



- Lavoisier proves Oxygen is required for combustion in 1777
- Develops The Law of Conservation of Matter
- Lavoisier tragically executed by the guillotine in 1794



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Combustion and Heat Understood



- Until 1798 scientists believed heat was a weightless fluid substance called “caloric”
- Benjamin Thompson proved heat was a form of mechanical energy
- Combustion and heat were finally understood
- One of Thompson’s many inventions was the precursor of sous vide cooking in 1799



Benjamin Thompson painted by Gainsborough in 1783

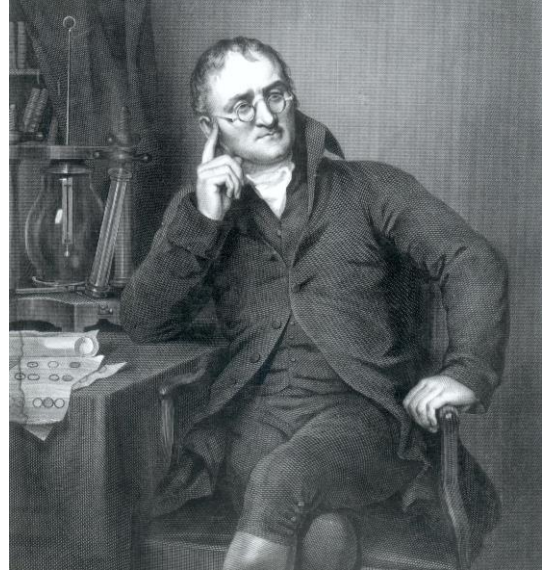
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The Art of Cooking and the Science of Atoms



- Atomic Theory (1805)
- John Dalton – meteorologist
- Greatest advance in science
- Understand food and cooking at the molecular level
 - *“The essence of science: ask an impertinent question and you are on the way to the pertinent answer”*
 - Jacob Bronowski (1973)



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Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT



Which is hotter at 74°C?

- Water
- Olive Oil
- They are the same

** If your answer differs greatly from the choices above tell us in the chat!*

Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT



Olive oil



Water

Water is “hotter”. Heat capacity of water ~ 2X olive oil.

At 74°C water contains 2x more heat energy as olive oil

** If your answer differs greatly from the choices above tell us in the chat!*

The First Celebrity Chef

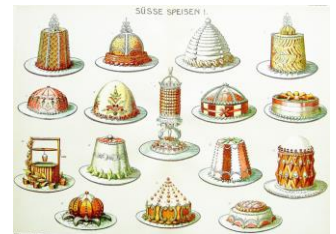


Chef Marie-Antoine Carême

- “King of Chefs” creator of nouvelle cuisine, or modern French cooking in 1810s-30s
- The first ‘celebrity chef’
- His exquisite cuisine was based on science.



Escoffier: *“The fundamental principles of the science [of cooking], which we owe to Carême, will last as long as cooking itself.”*



Healthy Diet Cooking



Emma Kellogg
forges a new
path in cooking
science:

*How to cook
food to provide a
healthy diet -
1892*



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“The Browning Reaction”



John Edward Hodge – 1953

- USDA Chemist
- Turned the world of flavor chemistry upside down
- Maillard-Hodge Reaction



Dehydrated Foods, Chemistry of Browning Reactions in Model Systems

J. E. Hodge

Cite this: *J. Agric. Food Chem.* 1953, 1, 15, 928-943
Publication Date: October 1, 1953

<https://doi.org/10.1021/jf60015a004>

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Modern Instrumental Analysis



- **Modern instrumental analysis in the 20th Century makes it possible to understand food and cooking at the molecular level**
- **How are flavor and texture created?**
- **What happens to nutrients when food is cooked?**



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Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT



Does The Maillard-Hodge Reaction proceed faster at:

- pH 5
- pH 7
- pH 9
- pH does not affect the speed
- The speed is the same for pH 5,7, and 9

** If your answer differs greatly from the choices above tell us in the chat!*

Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT



Does The Maillard-Hodge Reaction proceed faster at:

About 500 times faster at **pH 9** than at pH 5.

That's why cookies made with baking soda are darker brown in color.



** If your answer differs greatly from the choices above tell us in the chat!*

Cooking Affects Nutrients



Impact of cooking methods on nutrients in broccoli

<u>Nutrient</u>	<u>Steam</u>	<u>Boil</u>	<u>Fry</u>
Carotenoids	+32%	+19%	-67%
Polyphenols	-73%	-38%	-60%
Vitamin C	-48%	-32%	-87%
Glucosinolates	+30%	-59%	-84%

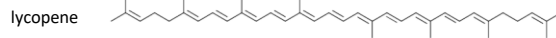
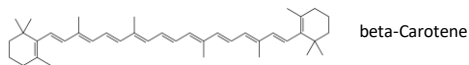


Carotenoids Protect Long-Term Health



Low-intake of carotenoids associated with:

- Macular degeneration
- All-cause mortality
- Cognitive decline
- Cardiovascular disease
- High blood pressure
- Various types of Cancer
- Inflammation
- Reduced immune function



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Cooking Releases Lycopene in Tomatoes



- Lycopene is a powerful antioxidant (10X Vitamin E)
- Absorption of lycopene from tomato sauce ~ 4X from fresh
- Cooking sauce with olive oil increases absorption by 80%
- 2 - 3 servings of sauce / week reduces risk of Prostrate Cancer by 35% - 56%

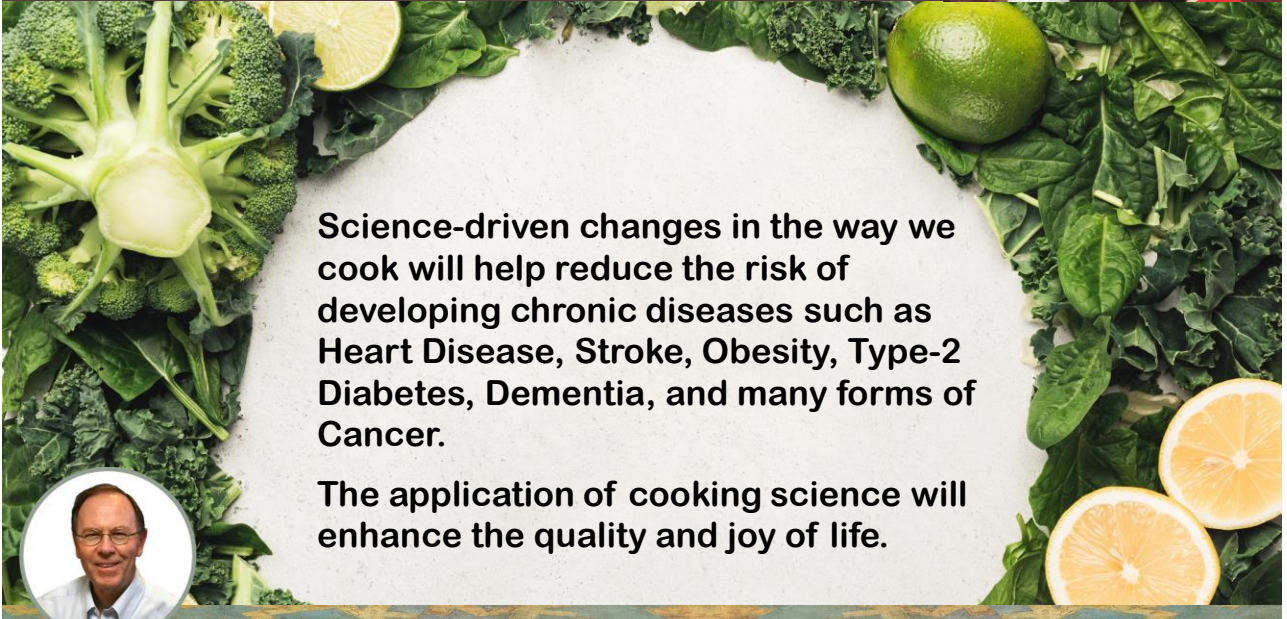
• Carotenoids also reduce risk of Colorectal and Pancreatic Cancers, and Coronary Heart Disease



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The Future of Cooking Science



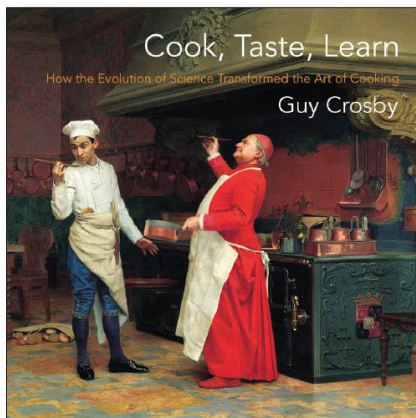
Science-driven changes in the way we cook will help reduce the risk of developing chronic diseases such as Heart Disease, Stroke, Obesity, Type-2 Diabetes, Dementia, and many forms of Cancer.

The application of cooking science will enhance the quality and joy of life.

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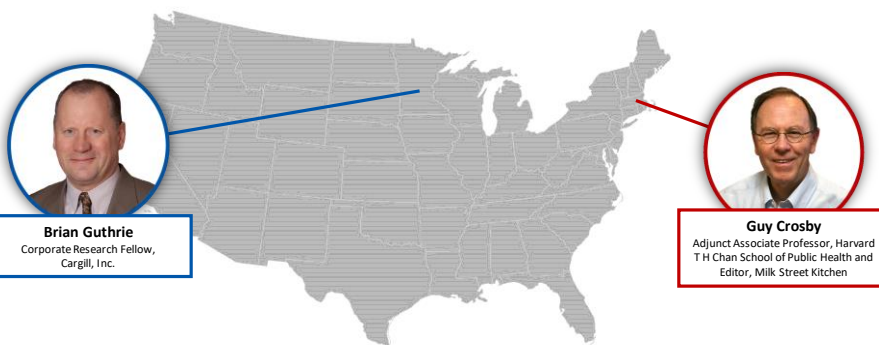
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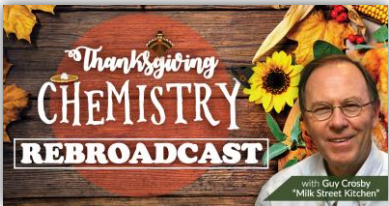
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Fan of the Week

Jennifer Jenner,
MA Dept. of Public Health



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