Type them into questions box!

“Why am I muted?”
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Thank you and enjoy the show.

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Jennifer Jenner,
MA Dept. of Public Health

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Cook, Taste, Learn

How the Evolution of Science Transformed the Art of Cooking

“As a foodie myself I was delighted to see all suspicions confirmed in Cook, Taste, Learn—that advances in the culinary arts are commonly empowered by curious scientists who also happen to be hungry.”

—Neil deGrasse Tyson, American Museum of Natural History

“Cook, Taste, Learn entertains with a smorgasbord of curious facts, delightful explanations, and fun recipes. What is so special about olive oil? Why use one kind of potato for baking and another for boiling? How does one make scrambled eggs fluffy? Crosby’s history of cooking provides a riveting education for your inner chef.”

—Richard Wrangham, author of Catching Fire: How Cooking Made Us Human

http://cup.columbia.edu/book/cook-taste-learn/9780231192927

ACS Technical Division
Agricultural & Food Chemistry (AGFD)

COOK, TASTE, LEARN
How the Evolution of Science Transformed the Art of Cooking

Featuring his new book!

Guy Crosby
Harvard T.H. Chan School of Public Health
and Milk Street Kitchen

THIS ACS WEBINAR WILL BEGIN SHORTLY...
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%

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
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

Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT

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

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
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!
Which method of cooking meat makes it juicier?

<table>
<thead>
<tr>
<th>Measure</th>
<th>Braised*</th>
<th>Roasted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cooking loss</td>
<td>29.6%</td>
<td>28.2%</td>
</tr>
<tr>
<td>Evaporation</td>
<td>20.0%</td>
<td>5.6%</td>
</tr>
<tr>
<td>Drip loss</td>
<td>9.6%</td>
<td>22.6%</td>
</tr>
</tbody>
</table>

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


* 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

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
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)

---

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

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!

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**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

“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

https://pubs.acs.org/doi/10.1021/jf60015a004
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?

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!
**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**

<table>
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<th>Steam</th>
<th>Boil</th>
<th>Fry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carotenoids</td>
<td>+32%</td>
<td>+19%</td>
<td>-67%</td>
</tr>
<tr>
<td>Polyphenols</td>
<td>-73%</td>
<td>-38%</td>
<td>-60%</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>-48%</td>
<td>-32%</td>
<td>-87%</td>
</tr>
<tr>
<td>Glucosinolates</td>
<td>+30%</td>
<td>-59%</td>
<td>-84%</td>
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**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

![Carotenoids](image)

**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 Prostate Cancer by 35% - 56%
- Carotenoids also reduce risk of Colorectal and Pancreatic Cancers, and Coronary Heart Disease
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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