# Teaching cooking through chemistry

## (and not the other way round)

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# A little context

Latecomers to gastronomy

- Early retirement
- Then studied cuisine
- ...then food science
- ...now applied chemistry
- We cook and we teach

# From the kitchen to the lab

**Six basic principles of food science, according to the Culinary Institute of America (CIA, 2011)**

1. Caramelization
2. Maillard reactions
3. Gelatinization
4. Denaturation
5. Coagulation
6. Emulsification

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# Chef 2 Chef

The emphasis currently seems to be on **teaching science through cooking**

- MOOCs (edX, Coursera, etc.)
- Part II of HMG

Our goal is, paraphrasing K. López-Alt, to teach **Better cooking through science**, **chef to chef**

# Current state - Ecuador

- 67% of Universities,
- 32% of Technical colleges,
- A few Schools,

...that teach gastronomy include food science in their curriculum.

Food chemistry, bromatology, art and science, food science and conservation, food physical chemistry are names for the subject.

# Teaching and blogging

- **Food physical chemistry** for culinary students - university
- **Basic science training** for culinary instructors - professional association
- **Sci-cook** communication - web
  [chefs.ec](chefs.ec)
  [etilmercurio.cl](etilmercurio.cl)
  [comer.me](comer.me)

ACE
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## Toda la Cocina es Molecular

POR ACE / EN 5 MAYO, 2021 / EN ARTÍCULO, MAGAZINE

La -quizá mal llamada- cocina molecular ya tuvo su momento de gloria, y dejó tras sus excesos una serie de técnicas muy interesantes y nuevos conocimientos. Sin embargo, quizá su mayor aporte fue el de acercar a los cocineros a las ciencias.

Hace más de treinta años comenzaba la gastronomía molecular, liderada por el físico Nicholas Kurti y el químico Hervé This. Ellos propusieron investigar los

# Our students

- Highly motivated, mostly with little or no science background from high school
- Pandemic conditions:
  kitchen = lab (scale+thermometer)
- Varying socio economic scenarios

# Motivating and approachable

Provide students and instructors with a toolkit

- Applies science
- Genuinely useful
- Simple equipment and ingredients
- Inexpensive
- Fun/magical

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# Seminars

Since 2016: Ecuador, Chile
Universities, Technical colleges

- Scientific method
- Why preparations work
- Relevant examples
- Hands-on
  - For “salty cooks” tuiles, spherification, foams
  - For pastry cooks, soufflé

# Class

For the 1st. semester class, introductory concepts on:

- Transformation
- 4 food molecules
  Water, Lipids, Carbohydrates, Proteins
- Perception
- Dispersions
  Emulsions, foams, gels
- Enzymes and fermentation
- Additives
- Food pairing

# Examples: molecules

- Water
  - Finishing salt
  - Coffee stirrers/fondant
- Lipids
  - Fire oil
  - Ganache
- Carbohydrates
  - Derivative sauces (roux + read Escoffier)
  - Turkish delights
- Proteins
  - Ceviche
  - Lemon foam

# Examples: dispersions

- Emulsions
  - Mayonnaise
  - Geoffroys (milk, egg white, aquafaba)
- Foams
  - Swiss meringue
- Gels
  - Turkish delights
  - Gummies
- Combinations
  - Chantilly chocolate

# Examples: others

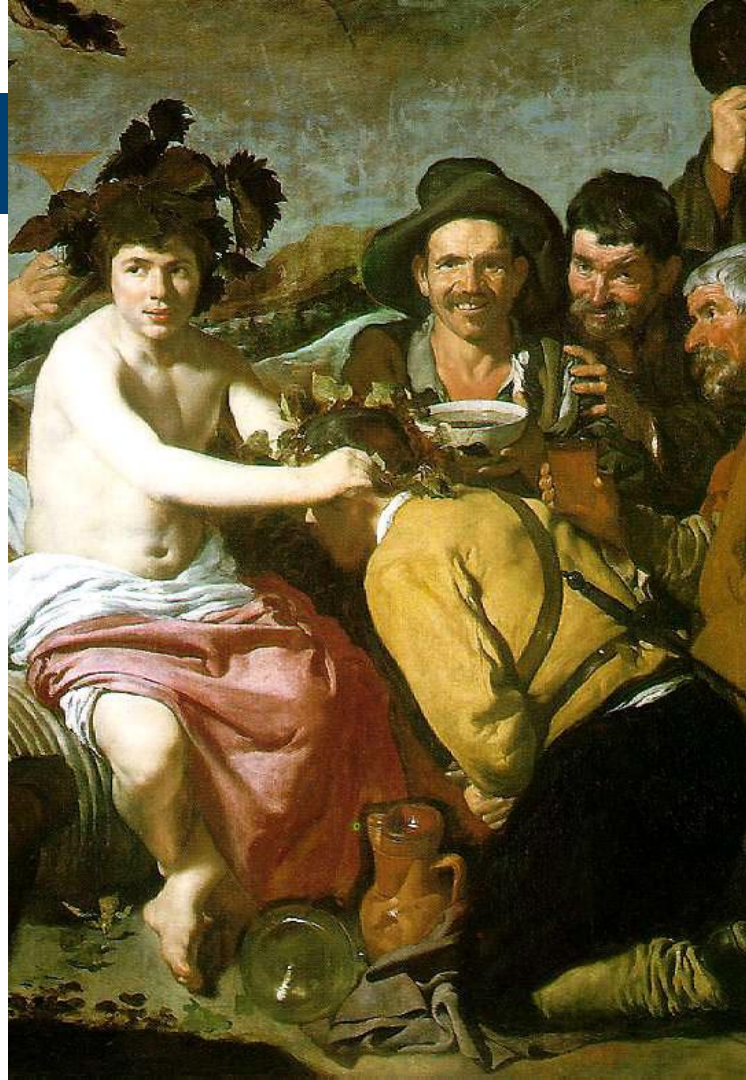
- Perception
  - Basic sensory evaluation (chips)
- Enzymes
  - Milk gel (ginger juice)
  - Non-browning bananas
- Fermentation
  - Yogurt
  - Pickles
- Food pairing
  - Strawberry/cilantro
  - Cauliflower/cocoa

# Appreciation

Likert scale 1=useless to 7=very useful

**6.59±0.74 (n=41)**

- Know the origins
- Improves technique
- Reduces stress
- Fosters creativity
- Anticipate results
- Problem solving
- Reinforces intuition



# Next steps

- Re-visit science toward the end of the study program - requested
- Ecuadorian examples for all hands-on activity - WIP
- Integrate sustainability - requested

# Next steps

- **Water** - traditional ice-cream (*helados de paila*)
- **Lipids** - *mapahuira* (black lard)
- **Carbohydrate** - *melcocha* (sweets)
- **Protein** - regional ceviche variations
- **Emulsions** - Tamarillo-chile condiment (*ají de tomate de árbol*)
- **Foams** - *espumilla* (guava-stabilized, hand beaten meringue)
- **Gels/enzymes** - rennet custard
- **Fermentation** - *Chicha de jora* (malted maize beer)
- **Food pairing** - Traditional cuisine pairings

# Conclusions

- Science-backed cooking is well received and garners interest
- Simple, approachable and inexpensive are vital
- Continuity is desirable

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# References


Culinary Institute of America (Ed.). (2011). *The professional chef (9th ed)*. John Wiley & Sons.

Lertsch, M. (2014). *Texture: A Hydrocolloid Recipe Collection*.

McGee, H. (2004). *On food and cooking: The science and lore of the kitchen (Completely rev. and updated)*. Scribner.

Ministerio de Turismo del Ecuador (2012). *Ecuador culinario: Saberes y Sabores*. AI Digital

Mouritsen, O. G., & Styrbæk, K. (2017). *Mouthfeel: How texture makes taste* (M. Johansen, Trans.). Columbia University Press.

Myhrvold, N., Young, C., Bilet, M., & Smith, R. M. (2011). *Modernist cuisine: The art and science of cooking* (1st ed). Cooking Lab.

Spence, C. (2017) *Gastrophysics: The New Science of Eating*. Viking

This, H., & DeBevoise, M. (2012). *Molecular gastronomy: exploring the science of flavor*. Columbia University Press.

Vásquez-Moreno, R. (2015). *Ashanga cocina morlaca*. Universidad de Cuenca


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