Delicious biophysics

Christophe Lavelle
CNRS & National Museum of Natural History, Paris, France

Contact: lavelle@mnhn.fr
Let’s start with some definitions

Molecular gastronomy: scientific discipline dedicated to the study of physical and chemical processes that occur during cooking and eating.


"Molecular" (??) cooking

"Cooking, without ceasing to be an art, will become scientifical and subject its formulas, too often empirical, to a method and a precision that will leave nothing to chance."
Georges Auguste Escoffier, *Guide culinaire*, 1907

Molecular cooking: cooking style favoring the renewal of cooking techniques (potentially inspired by the results of molecular gastronomy investigations).

This is molecular gastronomy
This is (molecular?) cooking
The (first) goals of molecular gastronomy

- gathering and scientific investigation of culinary precisions
- modeling of cooking practices
- introduction of new tools, methods and ingredients in cooking practice
- invention of new dishes


---

*Livre de cuisine de Tante Colette*, Paris 1905

**Stewed pears**

Take a dozen medium size *pears*, peel them and put them in one by one in cold water. Then melt at low heat in a pan 125 grams of *sugar* cubes with a little water; when the sugar is melted, add the pears, sprinkle them with lemon juice if you want the pears stay white; if you prefer them red, do not add lemon juice, but *cook* in a pan of tinned copper.
It’s all about physics, chemistry and biology

**cooking**

**eating**

- **solid**
- **liquid**
- **gas**
## Mixing ingredients (to make sauces)

<table>
<thead>
<tr>
<th>Line dispersed in column</th>
<th>Gaz (G)</th>
<th>Liquid (O ou W)</th>
<th>Solid (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaz (G)</td>
<td>Gaz</td>
<td>Liquid aerosol</td>
<td>Solid aerosol</td>
</tr>
<tr>
<td></td>
<td>G/G</td>
<td>W/G ou O/G</td>
<td>S/G</td>
</tr>
<tr>
<td>Liquid (O ou W)</td>
<td>Foam</td>
<td>Emulsion</td>
<td>Suspension</td>
</tr>
<tr>
<td></td>
<td>G/W or G/O</td>
<td>W/O ou O/W</td>
<td>S/W ou S/O</td>
</tr>
<tr>
<td>Solid (S)</td>
<td>Solid foam</td>
<td>Gel</td>
<td>Solid suspension</td>
</tr>
<tr>
<td></td>
<td>G/S</td>
<td>W/S ou O/S</td>
<td>S1/S2</td>
</tr>
</tbody>
</table>

Cooking ingredients (to modify their texture, color, taste)

- White just set but looks ghastly and breaks as soon as you touch it. Useless.
- The perfect egg to put on toast. White soft but good. A quick dip in simmering water will make it look traditional.
- Yolk fully set but very creamy. White firmer.
- The perfect yolk to roll into sheets. Whites not as nice as 65.
- Yolk more granular.
- Hard boiled.
- Yolk creamy but not set—it acts like a sauce. White firmer.
- Our favorite white—firm not rubbery. Doesn’t crack well. Yolk malleable.
- Yolk developing granularity but still soft. Will break when rolled in sheets.
- Yolk fully granular and starting to turn green. Smells of sulfur.

© J. Honvault

Christmas (soon) and crystals
Don't forget the drinks

Liger-Belair G. 2014. L'odysée d'une bulle de champagne. *In Science Culinaire (dir C Lavelle), Belin*
"The discovery of a new dish does more for the happiness of mankind than the discovery of a star."
Jean-Anthelme Brillat-Savarin, Physiologie du Goût, 1825