14:05-14:25
Foodomics 2.0
Wim Van Creikinge
Ghent University
^[now][transl|comput]ational[epi]genomic$
Lab for Bioinformatics and computational genomics

30 “genome hackers”
mostly engineers (statistics)

scientists, technicians, geneticists, clinicians

dewpal/aerolis

>100 people
Hardware/software engineers, mathematicians, molecular biologists
Math

Computer Science

Theoretical Biology

Informatics

Bioinformatics

Discovery Informatics

Computational Biology

(Molecular) Biology

\[^{\text{now}}[^{\text{transl}}[^{\text{comput}}[^{\text{ational}}[^{\text{epi}}[^{\text{genomic}}]}}$
"a discipline that studies the Food and Nutrition domains through the application and integration of advanced -omics technologies to improve consumer's well-being, health, and knowledge".
“The future is already here,... it’s just not evenly distributed.”

William Gibson, Futurist | Cyber-Visionary
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Foodomics 2.0

• Genetics
  • Nutrigenomics
  • Examples

• Epigenetics
  • Nutri-epigenetics
  • Examples

• Metagenomics
  • Nutri-metagenomics
  • Examples

• Foodomics 3.0
  • Technology
  • Big Data / AI
5 years ago ...

Wobblebase develops apps that allow the user to manage and explore his or her own genome. The apps aid in the interpretation of those variations/mutations with the highest probability of having a phenotype. In order to make this more tangible we allow the user to 3D print his own protein sets.

Team

- Personalized Proteins
  Geert Troosters, Bioinformatician and app developer
  Peter Schotte, Senior scientist with biotech experience
  Wim Van Ciereinge, Bioinformatician and entrepreneur

- Website
Consumer Genomics Market Expanding Rapidly

Source: 1) https://www.technologyreview.com/s/610233/2017-was-the-year-consumer-dna-testing-blew-up/; 2) Illumina @ JP Morgan Healthcare 2018
What can Consumer Genetic Testing Offer?

Categories of tests offered by DTC companies.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of companies</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ancestry</td>
<td>74</td>
<td>30%</td>
</tr>
<tr>
<td>Athletic</td>
<td>38</td>
<td>15%</td>
</tr>
<tr>
<td>Child talent</td>
<td>4</td>
<td>2%</td>
</tr>
<tr>
<td>Matchmaking</td>
<td>3</td>
<td>1%</td>
</tr>
<tr>
<td>Surrupetitious</td>
<td>34</td>
<td>14%</td>
</tr>
<tr>
<td>Nutrigenetic</td>
<td>74</td>
<td>30%</td>
</tr>
<tr>
<td>Non-legal paternity</td>
<td>88</td>
<td>36%</td>
</tr>
<tr>
<td>Legal paternity</td>
<td>83</td>
<td>34%</td>
</tr>
<tr>
<td>Genetic relatedness</td>
<td>92</td>
<td>37%</td>
</tr>
<tr>
<td>Carrier</td>
<td>27</td>
<td>11%</td>
</tr>
<tr>
<td>Only health testing</td>
<td>31</td>
<td>13%</td>
</tr>
<tr>
<td>Total companies analyzed</td>
<td>246</td>
<td></td>
</tr>
</tbody>
</table>

Source: https://www.sciencedirect.com/science/article/pii/S2212066116300011
Wobblebase’s mission is to bridge the gap between consumers and medical professionals to leverage genetic information to its fullest potential.
Use camera to identify Pill
Get “Insert” from database
Get pharmacogenomics SNPs
Check your SNPs
AR / Report
Use barcode to identify product

Get ingredients

Check your SNPs against ingredients
- Sensitivities
  - eg peanut
  - allergens
- Metabolic compatibility

AR / Report
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Relative importance of (Epi)genetics (i)
Relative importance of (Epi)genetics (ii)

- Epigenetics enables to reuse one genome for many different purposes
- Epigenetics driving etiology of many human diseases
Relative importance of (Epi)genetics (iii)

- Actionability* and integration of intrinsic with environmental signals
Phyto-oestrogens

- **Structure – natural products are**
  - α- en β-receptors
  - Epigenetic modifier ?

- base structure isoflavones
- 8-prenylnaringinine (PN)
- 17-β-estradiol.
Method

MCF-7 cellen
ER+

MDA-MB-231 cellen
ER-
Data analysis

- 450K Beadchip array (Illumina)
- Dose-response curves with active compound (8-PN)
Exploratory analysis of the human breast DNA methylation profile upon soymilk exposure

Louis Coussément\textsuperscript{1}, Selin Bolca\textsuperscript{1}, Wim Van Crietkine\textsuperscript{1,2,3}, Geert Trooskens\textsuperscript{1}, Klaas Mensaert\textsuperscript{1}, Katrien Poels\textsuperscript{1}, Nathalie Roche\textsuperscript{5}, Phillip Blondeel\textsuperscript{5}, Lode Godderis\textsuperscript{4}, Herman Depypere\textsuperscript{5} & Tim De Meyer\textsuperscript{1,2,3}

Upon soy consumption, isoflavone metabolites attain bioactive concentrations in breast tissue possibly affecting health. Though \textit{in vitro} epigenetic activity of soy metabolites has been described, the \textit{in vivo} impact on the epigenome is largely unknown. Therefore, in this case-control study, the breast glandular tissue DNA methylome was explored in women undergoing an aesthetic breast reduction. After a run-in phase, 10 generally healthy Belgian or Dutch women received soymilk for 5 days. MethylCap-seq methylation profiles were compared with those of 10 matched controls. Isoflavones and their microbial metabolites were quantified in urine, serum, and glandular breast tissue (liquid chromatography-mass spectrometry) and 17\beta-estradiol in glandular breast tissue (immunoassay). Global DNA methylation levels were obtained for 6 cases and 5 controls using liquid chromatography-mass spectrometry. Although lower MethylCap-seq coverages were observed, mass spectrometry results and computational LINE-1 methylation analysis did not provide evidence supporting global methylation alterations upon treatment. At a false discovery rate of 0.05, no differentially methylated loci were identified. Moreover, a set of previously identified loci was specifically tested, but earlier reported results could not be validated. In conclusion, after a 5-day soymilk treatment, no major general epigenetic reprogramming in breast tissue could be found in this exploratory study.
Fermented Soy

Active metabolite Equol

Equol: natural agonist ER-beta receptor

anti-proliferation and anti-inflammatory effect
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We Are More Bacteria Than Human

• Healthy adult harbors ~100 trillion bacteria in gut alone (10x the number of human cells we possess)
• Communal gut microbial genome (microbiome) is ~150 times larger than human genome
• Reasonable to view microbiome as an organ
• Is dominated by 4 large groups of bacteria: Actinobacteria, Bacteroidetes, Firmicutes, Proteobacteria
Biodesign Challenge
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Minima
The elementary biology lab
SAY BIG DATA
ONE MORE TIME
Figure 2

The diagram illustrates the relationship between flour, fat, and egg in various baked goods. The points on the graph represent different recipes, with symbols indicating the type of dish:

- Bread
- Scones
- Sweet biscuits
- Pastry
- Drop scones
- Yorkshire pudding
- Pancakes
- Sponge
- Cake

The numbers next to the points correspond to specific ingredient ratios. The graph is a ternary plot, with flour on the top, fat along the left, and egg along the bottom. The ratios are shown in percentages, with 0% on one side and 100% on the other.
A SURVEY OF FOOD RECOMMENDERS

A PREPRINT

Carl Anderson
Weight Watchers International
New York, USA
carl.anderson@weightwatchers.com

September 18, 2018

ABSTRACT

Everyone eats. However, people don’t always know what to eat. They need a little help and inspiration. Consequently, a number of apps, services, and programs have developed recommenders around food. These cover food, meal, recipe, and restaurant recommendations, which are the most common use cases, but also other areas such as substitute ingredients, menus, and diets. The latter is especially important in the area of health and wellness where users have more specific dietary needs and goals.

In this survey, we review the food recommender literature. We cover the types of systems in terms of their goals and what they are recommending, the datasets and signals that they use to train models, the technical approaches and model types used, as well as some of the system constraints.

Keywords: Personalization · Food recommendation · Recommendation systems · Collaborative filtering · Content-based recommenders · Expert systems
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Keywords: Personalization · Food recommendation · Recommendation systems · Collaborative filtering · Content-based recommenders · Expert systems
The Science behind Foodpairing®

Foodpairing is a scientific method to identify which foods & drinks go well together. To understand why ingredients match it’s important to know how humans perceive flavour.
"a discipline that studies the Food and Nutrition domains through the application and integration of advanced -omics technologies to improve consumer's well-being, health, and knowledge."