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**From Molecular Gastronomy to Molecular Architecture:
Reflections towards a new architectural praxis**

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The relationship between architecture and research has been barely discussed and by making use of critical reading this paper proposes to investigate how other disciplines started to use Research and Development (R&D) as part of their creative processes. In particular it explores how gastronomy has unfolded new R&D paths through the revolutionary work of three leading chefs: Ferran Adria, Rene Redzepi and Grant Achatz, illustrating the deep impact that the use of R&D had in this field and how it helped to transform it globally. By making parallels with these two disciplines, architecture and gastronomy, we hope to open up for new possibilities and alternative visions of architecture particularly those focusing at a new architectural praxis as well as at a computational and sustainable level.

Key words: R&D / Architecture / Molecular Gastronomy / Contemporary Culture

The control of trade routes and the spice-producing regions were among the reasons for Portuguese and Spanish maritime expeditions during the XIV and XV centuries. Royal Courts of Europe would give a significant amount of money to have access to the exotic spices from the Moluccas Islands in the Pacific Ocean. However, the price to be paid by the Venice Republic, which dominated the spice routes through the Mediterranean and the Silk Route was too high. New venture capitalists thrilled with the profits that the selling of spices in Europe could give, started to invest in naval construction and maritime technology based in state of the art knowledge about cosmology and cartography. In this way the existing Venetian-Muslim monopoly of the Levante trade in spices would be replaced by a Portuguese monopoly exercised via the sea route round the Cape of Good Hope ⁱ. But was probably from Venice that the biggest innovation in the food industry came to the forefront. Marco Polo a merchant from the Venetian Republic whose travels are recorded in *Il Milione* ⁱⁱ, learned about trading whilst his father and uncle, Niccolò and Maffeo, traveled through Asia. The three of them embarked on an epic journey through Asia, returning after 24 years to Venice, probably bringing the knowledge of new food procedures and products from the Orient. One of this was the *pasta* (Fig.1).

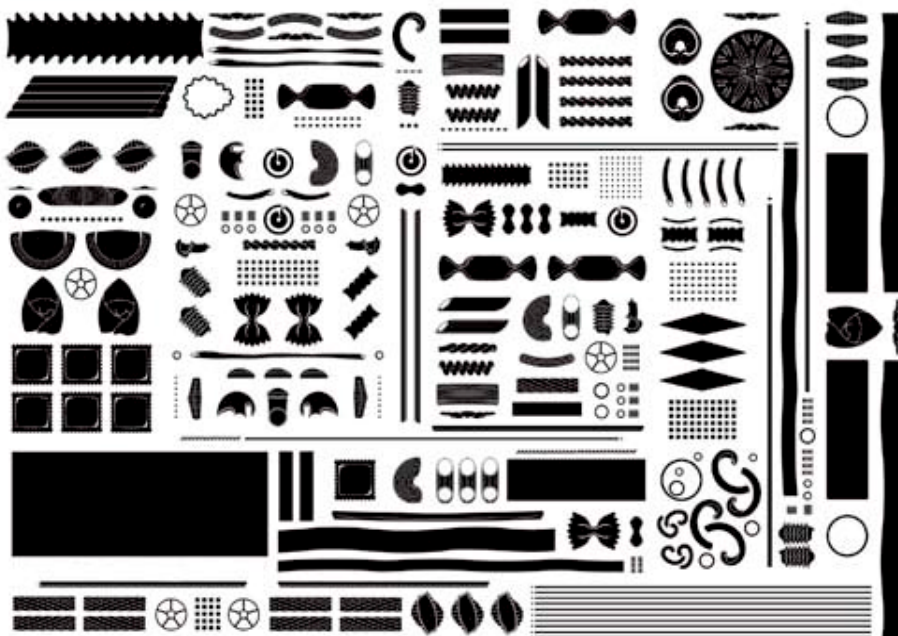


Fig.1. Different Pasta Typologies.

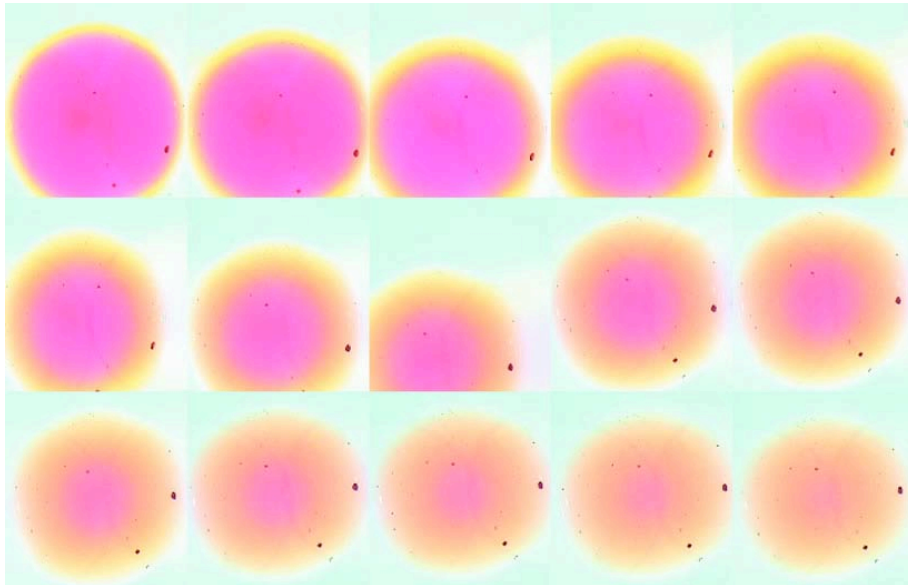


Fig.2. Electronic Microscopy image of caviar.

The matter of addressing research in architecture (at a molecular level) with a systematic basis started with the Irish physicist John Desmond Bernal (1901-1971) on his remarkable book, *The World, the Flesh and the Devil*. Written and published when Bernal was 28 years old, it shows a concern for environmental issues on a global scale, ideas about the development of new materials through the possibilities of changing the molecule level of materials. Bernal says:

*The physical discoveries of the last twenty-five years must find their application in the world of action – a process which has hardly begun, but the nature of which can easily be seen. It should lead to a development of new materials and new processes in which physics, chemistry and mechanics will be intractably fused. The stage should be reached in materials when they can be produced not merely as modifications of what nature has given us [...] but will be made to specifications of a molecular architecture. Already we know all varieties of atoms; we are beginning to know the forces that bind them together; soon we shall be putting them together in a way to suit our own purposes.*ⁱⁱⁱ

This astonishing view of atomic procedures, later called nanotechnology^{iv}, which would allow the creation of new materials and structures, reflects Bernal's vision and reputation as a physicist. By 1929 he is appointed to the Chair of Physics at the Birkbeck College, University of London, conducting pioneer research in X-Ray

Crystallography, which led him to become a leading figure in molecular biology and genetics. It was indeed Bernal who first brought architecture into the field of research, relating it with science. In 1937 at the age of 36, Bernal published his first article in the *RIBA Journal*. In this article he pointed out:

The academic architect and the academic scientist were poles apart. The result has been unhappy for both sides. The essential superficiality that marked the decay of architecture in the nineteenth century and still marks school architecture today is due to a preoccupation with the appearance rather than structure or function.^v

Despite major advances in the field of applied research in the building sciences particularly after the Second World War,^{vi} the architecture discourse remained mainly associated to an ideological strand and its experimental focus never received the required development of criticism.

Eating, like architecture is a multisensory experience, drawing on contrasts to texture, temperature, visual appearance and sound, as well as on our memories. In architecture there is a long tradition, local materials, cultural contexts but also the notion of belonging to a place and the need to innovate. Like Charles Eastman stated, "The ethic of modern design is to take human activities as given, without constraints, and to create an environment which maximally supports them". As it happens in gastronomy, the quest for authenticity without neglecting tradition and the need to push further the boundaries of the discipline place Architecture and Gastronomy in an interesting common ground. Both rely heavily upon the creative process and in technology but their affiliation with the practices of R&D have not always been well defined.

Accordingly to the Organization for Economic Co-operation and Development (OECD), the activity of R&D comprise creative work undertaken on an systematic base to increase the gathering of knowledge in order to devise new applications for the society.^{vii} R&D cover thus at least three activities: **i)** basic research, experimental or theoretical undertaken primarily to acquire new data of the underlying phenomena (without any particular application or use in view); **ii)** applied research, undertaken in order to acquire new knowledge, however directed foremost towards a specific practical aim or objective; **iii)** experimental development drawing on existing knowledge, which is directed to producing new concepts, products or devices. Within this general characterization how can we

chart R&D in architecture and gastronomy? What distinguishes leading architectural practices from leading cuisine practices? What distinguishes the use of scientific knowledge in their work? If R&D is related to economic growth, in a worldwide economic perspective, Europe is still deficient in terms of competitiveness, and entrepreneurship if compared with other major regions in the global society. Achievement is increasingly being determined by the ability of companies and individuals to be innovative. When it comes to innovation, the EU is ranking behind its international competitors, notably the United States and Japan. One of the motives is that since the 1990s major new players have emerged in science and technology, notably in Asia. The result is an increasingly global context where science, technology and patent applications are more widely distributed throughout the world. Almost 80% of researchers work outside the EU and 75% of gross domestic expenditure on R&D (GERD) is executed in other world regions.^{viii}

Very few architectural offices make explicit their R&D units. Probably because it is neither a common practice or just for the reason that architects are too much concern with the praxis of designing and less with the larger range of possibilities that the same praxis of design allows. However, examples from haut cuisine practices suggest that the separation of the activities of R&D from the daily-life core business have been helpful in broadening the scope of the profession. Relating haut cuisine to “Molecular Gastronomy” which stands for the efficient and methodological study to explain culinary phenomena was never intended to evolve within the kitchen. However Modern cuisine has in recent years blown through the boundaries of the culinary arts and indeed a scientific approach to understand the physics and chemist of cuisine started to be used. This revolutionized the way how cuisine was conceived and understood. Borrowing techniques from the laboratory, pioneering chefs at world renowned restaurants such as the Catalan Ferran Adrià at *eIBulli*, (Barcelona) the American Grant Achatz at *Alinea*, (Chicago), Danish René Redzepi at *Noma*, (Copenhagen), and British Heston Blumenthal at *The Fat Duck*, (Berkshire)^{ix} have been investigating haute cuisine using it as a starting point for new conceptual models but also to achieve healthier food and to explore in depth the potential of the relationship between science, creativity and gastronomy.

This new approach started gradually in 1994 at *eIBulli* when Ferran Adrià thought of constituting a team devoted to creativity that could generate new concepts and new techniques. By 1996 Adrià was convinced that “creativity, surprise and

innovation would be the driven forces” for his new infrastructure: the *eIBullitaller*.^x Nine years later, Adrià took part in an exhibition at the Centre Pompidou in Paris and starts to receive widely public attention. He is also the first chef invited to display his creations at *Documenta 2007* one of the most innovative contemporary art events, held in Kassel, Germany. In 2010 The Harvard School of Engineering and Applied Sciences (SEAS) in the USA and the Alícia Foundation (Spain) developed a General Education science course, “Science and Cooking: From Haute Cuisine to the Science of Soft Matter” (Fig.3). The course uses food and cooking to explicate fundamental principles in applied physics and engineering and Adrià is one of the Keynote speakers. The aim is probably twofold; by one hand it is an excellent way in which science is made public so as to make it intelligible, and on the other hand, to display the principles of research for innovative cooking^{xi}.

Could architects take a similar position enabling the audience to understand their creative process? How they use science as a creative and technological source? How cutting edge architectural practices illustrate their work with the use of cellular automata, genetic algorithms or by designing advanced evolutionary systems for urban design?^{xii} How they convey collaborative partnerships with external R&D Labs for digital fabrication and new materials assessments and for innovative high-rise structures ^{xiii}?



Fig.3. Ferran Adrià with the Alicia Foundation at a Conference about Science and Cooking at Harvard University, Cambridge, USA. December 2010.

What relates these haut-cuisine practices is their truly commitment to R&D activities in order to gain a deeper understanding on the use of science related to cooking technology. This was the seed in 1994 for Adrià setting up the *eIBulliWorkshop*: a new concept in the profession, which gradually spread throughout the haute cuisine world, making increasing demands for on-going creativity. Two years later, in response to the need to professionalize the creative process, a new team was constituted devoted exclusively to innovation. This led to *eIBullitaller*, a place to provide new ideas for the restaurant, open all year round, it employs twelve professionals organized in different teams with an annual investment of 250,000 €^{xiv}. The latest development was the incorporation of a scientific department into the Taller, since scientific processes involved in cooking were the basis for its evolution. Just like in R&D labs, of the some 5,000 culinary experiments conducted in the workshop, about 125 recipes were finally incorporated into the following year's menu.

The success of this practices led in 2003 to the collaboration with the chemical scientist Pere Castells, resulting in the setting up of the *Alicia Foundation*, a research centre focusing on technological innovation in kitchen science and the dissemination of gastronomic heritage where scientists and chefs carry out research into cooking and eating habits. As a result they published a *Scientific and Gastronomic Lexicon*,^{xv} a tool designed to bridge the gap between these two worlds. "Molecular Cuisine" was originally called molecular gastronomy when in the early the 80s, a few scientists interested in gastronomy included Nicholas Kurti and Harold McGee began to study the physical and chemical processes that occurred in a kitchen. Regarding this experience Pere Castells says: "It is also important to remember that we are not investigating haute cuisine, but using it as a starting point to promote the possibilities for cooking for social applications: hospital menus, children's menus, healthier fried food, special menus for diabetics, that is our great aim and what we are working towards."^{xvi}

Rene Redzepi, the chef of restaurant *Noma*^{xvii}, worked at *eIBulli* during the 1999 season and in 2004 in Copenhagen founded with gastronomic entrepreneur Claus Meyer, *Noma* and the Nordic Food Lab (Fig.4) a non-profit organization, based on donations guaranteeing a three year operation period, which purpose is to scientifically explore the new Nordic Cuisine and disseminating results from this exploration. What does it mean to do search on local products on different ways of fermentation, on looking to the heritage of food and propose recombination of it in news mediums? Interestingly *Noma* and the NFoodLab were invited to an EU

Parliament session to discuss innovation,^{xviii} showing that innovative R&D on the gastronomy could lead policy makers at political level.

Also Grant Achatz chef, who inaugurated *Alinea* in 2005, had an *e/Bulli* epiphany after his four days period at the restaurant mentioning that Ferran Adrià with his pencils and notes, looked more of an architect or theatre director than a chef. In the UK, Heston Blumenthal, works with chemists to invent techniques to draw out the essence of flavors, to discover which foods awaken similar receptors among our 10,000 taste buds. Increasingly this meant seeking out new ways to harmoniously stimulate all of the senses during the eating experience. He has research and a development kitchen since 2004 with 46 chefs for a 42 cover table, which function as a laboratory just opposite the main building of *The Fat Duck*.

Architecture does not offer such a rich and well-organized body of experiments related to the various outputs of the profession. Much more problem-solved oriented and working at a various scales, architecture is lacking the opportunities to explore new always of reinventing the professional praxis. There are excellent architectural practices with long tradition on multidisciplinary participation, but these also occur in large-scale firms, which contrast with the smaller organization of the mentioned haut cuisine cases. Ghery Technologies an offspring of Frank Ghery Partners, Herzog & Meuron Office or the Renzo Piano Foundation, could illustrate this path. Moreover, The Office for Metropolitan Architecture (OMA) founded in 1975 by Rem Koolhaas, Elia and Zoe Zenghelis and Madelon Vriesendorp, probably best embodies the concept of two practices within a unified vision of Architecture related to R&D. A forerunner practice for contemporary architecture, urbanism, and cultural analysis founded the company's research-based "think tank", AMO to operate in areas beyond the common boundaries of architecture and urbanism such as media, politics, sociology, technology, energy, fashion, publishing and graphic design (Fig.5). This is a multidisciplinary process that will nurture the proper practice of architecture expanding the possibilities of traditional intervention.

Architecture can only survive as architecture in its physical and central diversity and not as a vehicle for an ideology of some kind. It is the materiality of architecture that paradoxically conveys thoughts and ideas therefore able to be conceived freely. Also architecture lives and survives because of its beauty, because it seduces, as Rem Koolhaas stated: "Unless we break our dependency

on the real and recognized architecture as a way of thinking about all issues, from the most political to the most practical, liberate ourselves from eternity to speculate about compelling and immediate new issues, such as poverty, the disappearance of nature, architecture will maybe not make the year two-thousand-fifty.”^{xix}

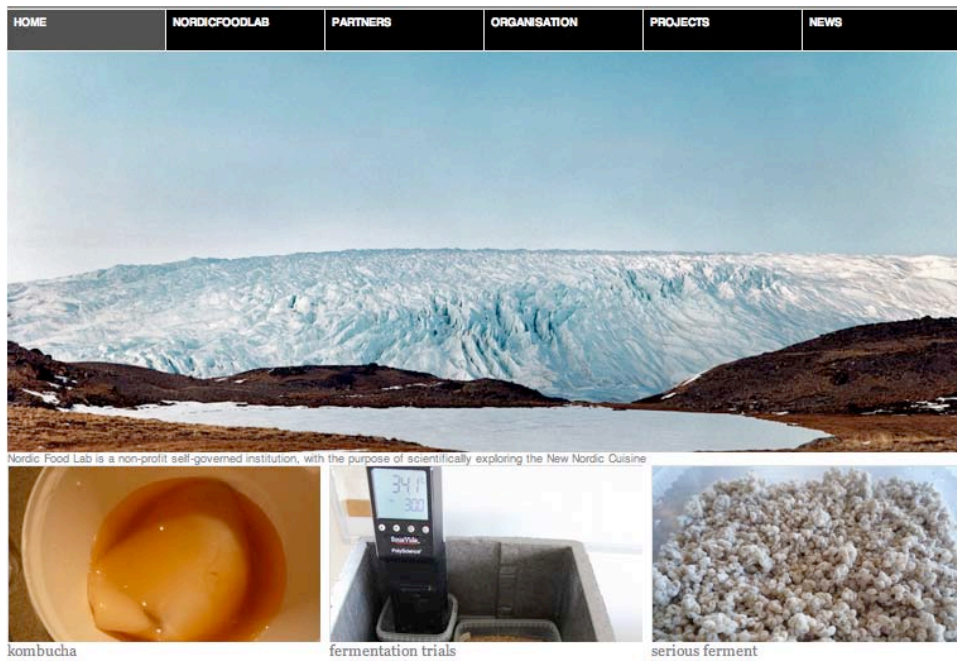


Fig.4. Nordic Food Lab (København), Research Center.



Fig. 5. AMO (Rotterdam), OMA’s Research Think Thank.

But one common ground to these two disciplines and to investigative approaches towards sustainable high-rise buildings lay in a better use of organic matter, either for creative cooking and research or to envision new energy processes. Phytoplankton (Fig.6), and Algae fuel might be an alternative to fossil fuel. Also Algae can produce up to 300 times more oil per acre than conventional crops and grown on land vertically, that is not suitable for other established crops.^{xx}

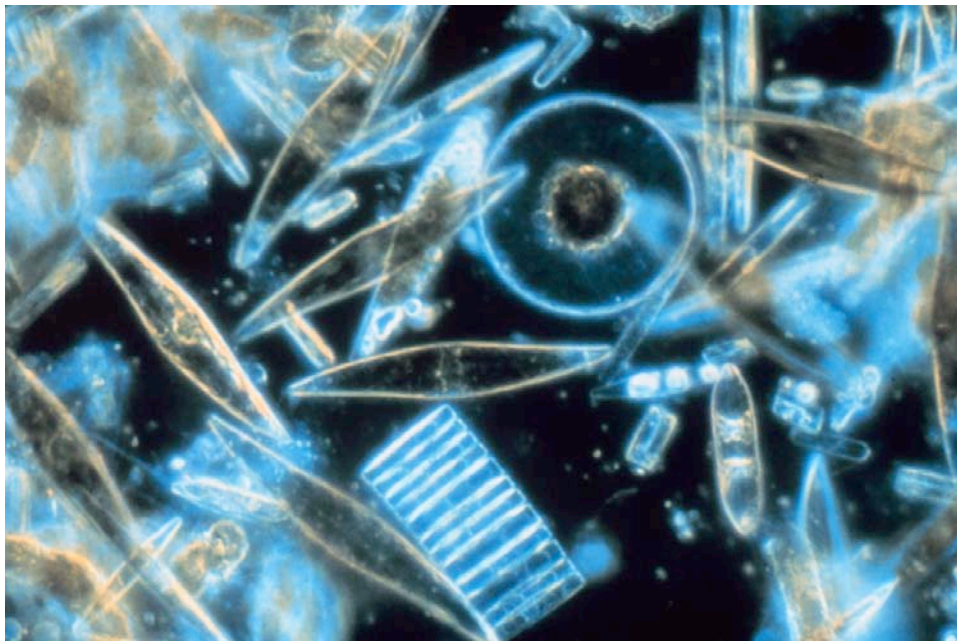


Fig. 6. Molecular image of Phytoplankton.

To conclude, haut cuisine practices are creating and developing highly sophisticated labs to disseminate new knowledge but also showing a deep concern for the reinterpretation of food heritage at an innovative scale. Paradigmatically *eIBulli*, is closing an astonishingly successful practice to open a foundation dedicated to pursue creativity and R&D activities within the gastronomy profession. A Lab for gastronomic creativity with awarded scholarships within a framework of synergy with other disciplines such as design, art and creative communication. Could architectural offices adapt their practices to educational and R&D foundations? Couldn't these same successful offices open low cost branches to operate in different cultural contexts and geographical latitudes answering more profoundly to fundamental social needs?

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- Fig.4. Nordic Food Lab (København), Research Center © 2011
- Fig.5. AMO (Rotterdam), OMA's Research Think Thank © 2011
- Fig.6. Molecular image of Phytoplankton.

Notes:

ⁱ **Boxer**, C.R. (1969). *The Portuguese Seaborne Empire 1415-1825*. Exeter: CARCANET.p:37.

ⁱⁱ **Polo**, Marco. (1974). *Il Milione*. Novara: EDIPEM.

ⁱⁱⁱ **Bernal**, D.J. (1969). *The World, the Flesh and the Devil. An Enquiry into the Future of the Three Enemies of the Rational Soul*. London: Indiana University Press. [1st. edition, 1929],p:5.

^{iv} This account of nanotechnology precedes in 30 years Richard Feynman's famous talk, "There is enough Room at the Bottom" given on December 29th 1959 at the annual meeting of the American Physical Society at the California Institute of Technology [Caltech] and first published in the February 1960 issue of Caltech's *Engineering and Science*.

^v **Bernal**, J. (1937). "Architecture and Science," *RIBA Journal*. Vol. 44. p:805-12.

^{vi} See: **Rocha**, Altino João Magalhães. *Architecture theory, 1960-1980: Emergence of a Computational Perspective*. MIT Thesis Arch 2004 Ph.D.

^{vii} OECD Factbook 2008: Economic, Environmental and Social Statistics

^{viii} A more research-intensive and integrated European Research Area Science, Technology and Competitiveness key figures report 2008/2009. EUFerran

^{ix} Criteria to choose chefs was also based on those who received a three Michelin star.

eIBulli was

^x **Adrià**, F.A., Soler, J., & Adrià, A. (2006). *eIBulli 94-97*. London: Ecco. p.271

^{xi} The Royal Institute of British Architects launched 'Design Bites', a series of talks and tours linking eating and drinking with cutting edge design where the chef Heston Blumenthal, from *The Fat Duck* is one of the speakers. June 2011.

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^{xiv} **Planellas, Marcel., Svejenova, Silviya.** (2007). "Case: Creativity: Ferran Adrià". Paper presented at the ExpoManagement on 24 May, 2006 in Madrid. ESADE.p.6.

^{xv} **Adrià, Ferran., McGee, Harold** (2009). *Modern gastronomy A to Z: a scientific and gastronomic lexicon*. London: Taylor and Francis.

^{xvi} "This is not molecular cooking. This is science and cooking". Interviewed by Dímpel Soto. Universitat Autònoma de Barcelona, 2011.

^{xvii} Considered the Best Restaurant in the World in 2011. San Pelegrino List.

^{xviii} EU Agencies. The Way Ahead. 2011

^{xix} Rem Koolhaas. Pritzker Price Cerimony Acceptance Speech. 2000.

^{xx} See *Oilgae Report* at: www.oilgae.com. Last accessed June 2011.