

The Development of Molecular Gastronomy as a Subject Discipline at The Dublin Institute of Technology

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Molecular gastronomy is the study of the physical and chemical culinary transformations that occur during preparation, cooking and consumption. Molecular gastronomy differs from food science as the social, artistic and technical components of culinary and gastronomic phenomena are explored. At the Dublin Institute of Technology (DIT) the aim of developing molecular gastronomy modules is to use them as a tool to teach scientific principles to those who work in the Culinary Arts. Students and graduates can then apply their knowledge to develop and create novel dishes and food products. Scientific principles are taught, explained and demonstrated in the kitchen environment, in scientific laboratories and through the use of information technology such as Echo360 which is a lecture capture software system. Molecular gastronomy modules have been written and validated at levels 6 (basic), 8 (intermediate) and 9 (advanced) in accordance with the Irish National Framework of Qualifications. In addition a Ph.D (level 10) is currently being conducted in the subject area of molecular gastronomy. The School of Culinary Arts and Technology together with partners in AgroParisTech and The University of Naples will contribute to a transverse module in molecular gastronomy which is part of the Erasmus Mundus Master's in Food Innovation and Product Design. The module will be launched by Dr. Hervé This (Co-founder of molecular gastronomy) in Paris in September 2012. The pedagogical developments in molecular gastronomy in DIT are unique to Ireland.

Keywords: Molecular gastronomy, Education, Communication, Food Product Development

Introduction

Molecular gastronomy, originally called ‘molecular and physical gastronomy’, was founded as an academic discipline, in 1988, by French chemist Dr. Hervé This and Hungarian physics professor Nicholas Kurti (Kroger, 2006). Kurti’s interest in applying scientific knowledge to culinary problems dated from at least 1969, when he gave a talk at the Royal Institution in London entitled ‘The Physicist in the Kitchen’, at which, he amazed the audience by using the recently invented microwave oven to make a ‘reverse Baked Alaska’ (Kurti and Kurti, 1988). Hervé This’s experimentation with recipes and his introduction to Nicholas Kurti led them to create a food discipline which was eventually called ‘molecular gastronomy’. They wanted to include all aspects of food-knowledge, enjoyment, nutrition and preparation and chose “gastronomy” as defined by Brillat-Savarin (1825) to convey these concepts. Each wanted to incorporate parts of their own background into the title. This suggested ‘molecular gastronomy’ Kurti wanted ‘molecular and physical gastronomy’. After Kurti’s death in 1998 the name was shortened to molecular gastronomy. In 1984 Harold McGee published his book *On Food and Cooking* (McGee, 2004) and proposed that ‘science can make cooking more interesting by connecting it with the basic workings of the natural world’. In 1998 a number of creative chefs started experimenting with the incorporation of ingredients and techniques normally used in mass food production in order to arrive at previously unattainable culinary creations. This ‘new cooking’ trend required a knowledge of chemical reactions and physico-chemical phenomena in food, and specialist tools. The tools needed meant the housewife could never mimic these recipes as equipment like high-speed homogenisation and flash freezers were required (Vega and Ubbink, 2008:373)

Molecular gastronomy lends itself well to the collaboration between chefs and food scientists and one such collaboration was the INICON project funded by the European Union (INICON, 2012). The goals of the project were to modernise gastronomy and cooking using

natural ingredients and innovative technologies. Restaurants such as Au Crocodile, el Bulli, The Fat Duck and Grashoff as well as a number of research and educational institutes were involved. The end result was a web site, www.inicon.net, which defines terms used in molecular gastronomy, provides a manual on molecular gastronomy as well as information tools and a handy kitchen apparatus with superior emulsifying performance. Of the top 50 restaurants in the world (San Pellegrino, 2010), the top 3 for the last number of years have been associated with molecular gastronomy.

Culinology® /Culinary Science

In the United States the concept of Culinology®—the blending of culinary arts and food science was introduced in 1996 by the Research Chefs Association (Cheng *et al.*, 2011). The term *Culinology* was coined by Winston Riley, former president and a founder of the Research Chefs Association (RCA), to describe and formalize the fusion of two disciplines—culinary arts and food technology. It recognized the birth and evolution of a critical new expertise in the food industry—the ability to efficiently and economically manufacture restaurant-quality convenience foods that actually look and taste like food served in a restaurant (Cousminer, 1999). The essence of Culinology® is found in the rigorous knowledge, aesthetic, and experimental sensory expressions that scholars and practitioners develop, as well as the emotional excitement, love, fun, and theatre experienced while engaging with the study of the culinary field. Thus, culinary science is not only “science for catering students” or the “applications of scientific principles” in a culinary context. The discipline is much larger. It revolves around the need to know how to ensure food is safe from farm to fork and to know what constitutes healthy, and not merely profitable, meals. (Hegarty, 2005)

Culinology® or Culinary Science is taught on many college programmes around the world. In the United States the Research Chefs Association (RCA) has approved fourteen Culinology undergraduate degree programmes. Each offers unique features and advantages for prospective students (RCA, 2012). Some programmes are offered at a single university, while others are offered through a partnership by two neighbouring schools. These partnering models allow students to transfer their culinary coursework to nearby institutions where they can continue their studies in Culinology and earn their undergraduate degree in the field. Just recently the RCA approved a Bachelor of Science in Culinology® at Taylor's University, Kuala Lumpur, Malaysia.

Culinary Science in DIT

According to Danaher (2012) on the 29th of May 1996 the School of Culinary Arts and Food Technology adopted a strategy to develop an undergraduate B.A. in Culinary Arts. The core principle of this strategy was to promote a change in direction for culinary arts education in Ireland that would ensure its future development (Hegarty, 2004). One of the pillars of the B. A. is Life Sciences comprising modules in Food Safety, Culinary Science and Technology, Nutrition and Occupational Health and Safety. The Programme is reviewed every five years and the life science pillar is regularly updated. In addition to core modules in culinary science, students can also choose specialist optional science based modules e.g. in molecular gastronomy.

Molecular Gastronomy Education Programmes

Van Der Linden *et al*, (2008) note that molecular gastronomy provides an excellent opportunity for improved communication and understanding between artists, scientists, students and the general public. They discuss courses that relate science with gastronomy for example those which are taught in The Netherlands and Denmark. In France the Institut

National de la Recherche Agronomique (INRA) has a molecular gastronomy group in AgroParisTech (IAGMG) which is involved in educational activities from primary school to university level and also for broader audiences (This, 2011).

Molecular Gastronomy Modules in DIT

Following a visit to a seminar “When Chefs meet Scientists” at a conference in Paris in 2007 Dr. Róisín Burke, a culinary scientist lecturing in the School of Culinary Arts, discovered the possibilities that molecular gastronomy had to offer for teaching science to culinary arts students in DIT (Kidd, 2012). In 2009 she developed an intermediate level module in molecular gastronomy as an option for fourth year BA Culinary Arts students (DIT, 2011a). It was the first of its kind in Ireland. Since 2009 two more modules have been validated by DIT, a basic module (DIT, 2011b) and an advanced module (DIT, 2011c). The basic molecular gastronomy module is running on a DIT Springboard programme for people who have lost their jobs and wish to upskill. The advanced module which is at Master’s level is available as an option for students who have studied culinary science at undergraduate level. Some units of this module will form part of a transverse module which will run on the Erasmus Mundus M.Sc. programme in Food Innovation and Product Design (FIPDes). DIT are partners on the programme with AgroParisTech (APT), University of Naples (UNINA) and Lund University (Burke, 2011). The FIPDes programme launched at the end of August 2011. In 2012–2013 some of the participants will elect to take a transverse module in molecular gastronomy. The module will be taught between AgroParisTech (Dr. Hervé This), DIT (Dr. Róisín Burke), Teagasc (Dr. Juan Valverde), and the University of Naples (Professor Vincenzo Fogliano).

Figure 1 outlines the educational levels of molecular gastronomy available in the School of Culinary Arts, DIT. Teaching methods on the molecular gastronomy modules include team

teaching with food scientists, chefs, and culinary scientists. Theoretical classes are underpinned by laboratory and kitchen classes. Information technologies such as Echo360 and WimbaCLASSROOM for higher and further education will be used particularly for the Level 9 transverse module. Echo360 is a lecture software combining the instruction, the visuals, the video and the lecturer into a seamless environment that can be viewed anywhere, anytime by all students (Echo360, 2012). Wimba is a live, virtual classroom that includes audio, video, application sharing and content display. Its pedagogical design and ease-of-use ensure that educators and students engage as if they were meeting face-to-face (Wimba, 2012).

Molecular Gastronomy in DIT

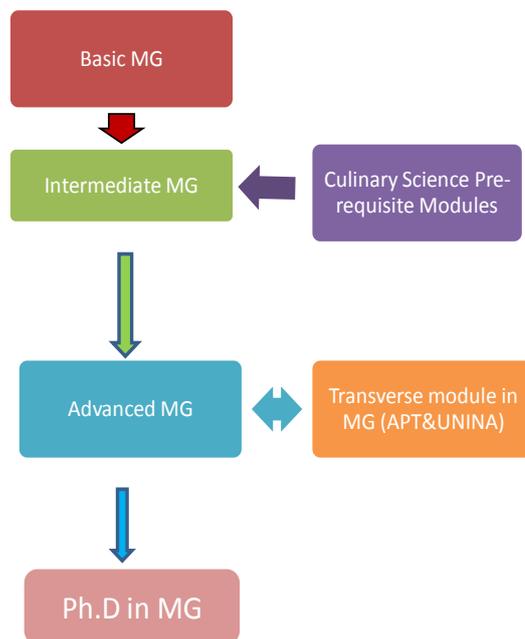


Figure 1. Molecular Gastronomy modules and Ph.D in The School of Culinary Arts and Food Technology, DIT.

Module Learning Outcomes

Fundamental Molecular Gastronomy (Level 6)	Intermediate Molecular Gastronomy (Level 8)	Advanced Molecular Gastronomy (Level 9)
<ul style="list-style-type: none">• Demonstrate know-how and skills in the science of food which is prepared in the kitchen.• Apply knowledge and skills when developing food products.• Work in an organised manner as part of a team in the kitchen.• Evaluate and learn from feedback in lectures and practicals.• Reflect on and discuss information received in class relating to Molecular Gastronomy.	<ul style="list-style-type: none">• Demonstrate the application of scientific and gastronomic knowledge and skills.• Apply concepts, theories and analysis in the development of novel recipes, dishes and food and beverage products.	<ul style="list-style-type: none">• Critically evaluate the fundamental scientific and gastronomic theories of Molecular Gastronomy.• Produce a novel and innovative dish/cocktail using ingredients and techniques associated with Molecular Gastronomy.• Develop new skills to a high level including novel techniques

Figure 2. The Learning Outcomes of the DIT modules in Molecular Gastronomy.

The learning outcomes for each of the modules are displayed in Figure 2. They are written in accordance with the framework specified by the National Qualifications Authority of Ireland (NQAI, 2012)

Van Der Linden *et al* (2008) state that the future of molecular gastronomy depends on communication of scientific investigation to fellow scientists, chefs (basic concepts and recommendations) and the general public who can then appreciate the importance of food and its preparation in the overall quality of life. DIT students who successfully meet the learning outcomes of the molecular gastronomy modules will be able to communicate to scientists, chefs and the general public (Figure 3).

Application of Molecular Gastronomy in DIT

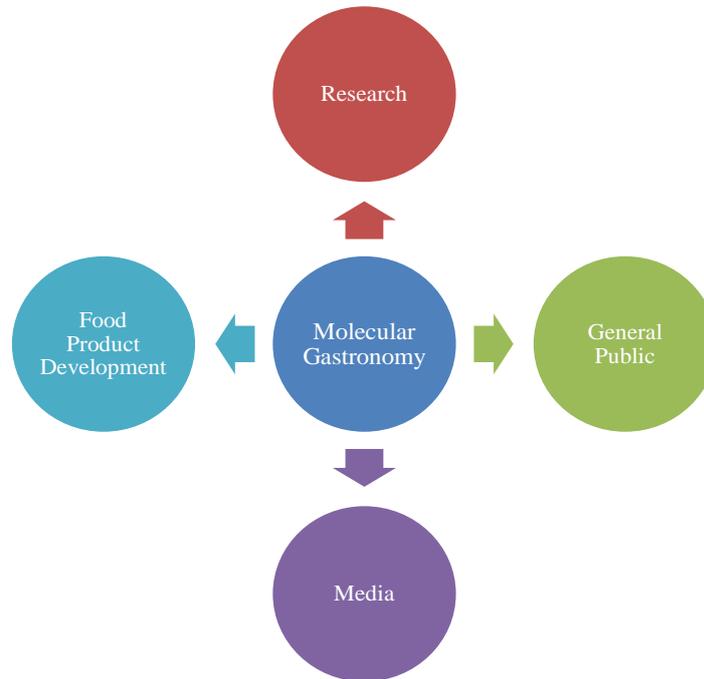


Figure 3. Applications of knowledge from the Molecular Gastronomy modules which are taught in The School of Culinary Arts and Food Technology

Molecular Gastronomy Research in DIT

The first ever Ph.D in molecular gastronomy in Ireland is being funded in DIT through an ABBEST scholarship (ABBEST, 2006). Results of studies have been presented at the Research Chefs Association conferences in Atlanta (2011) and San Antonio (2012) and a number of scientific papers are being submitted to scientific journals (Traynor *et al.*, 2011; Traynor *et al.*, 2012).

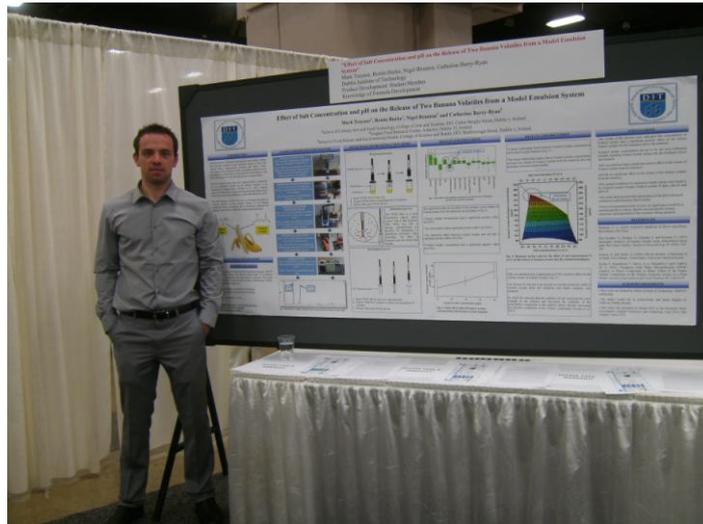


Figure 4. Mark Traynor, presenting findings from his Ph.D study at the Research Chefs Association Conference in San Antonio, Texas, in March 2012.

As Dublin is the ‘City of Science’ for 2012 a dissemination event is being organised in July to showcase food science and molecular gastronomy research activities. DIT is one of the partners in this event along with Bord Bia (The Irish Food Board), Teagasc (Food Research) and University College Dublin (UCD). The School of Culinary Arts (lead by Dr. Róisín Burke and Ms. Pauline Danaher) and The School of Food Science and Environmental Health (lead by Dr. Catherine Barry-Ryan) will present short lectures, showcase food products, including functional foods, and have live demonstrations of molecular cuisine. The event is aimed at city of science attendees.

Communicating Molecular Gastronomy to Chefs and the General Public Through Competitions and Public Demonstrations

Students from the intermediate module in molecular gastronomy have in 2011 and 2012 created dishes according to the themes of the prestigious ‘Science, Arts and Cuisine’ competition in France. The competition is overseen by the co-founder of molecular gastronomy, Dr. Hervé This. In 2011 the DIT students came second out of 10 groups and in

2012 they have reached the finals. A student has been selected to present his 'seaweed-themed' dishes at the competition in Nantes, France on May 24th, 2012.

During April 2012 culinary arts staff, students and graduates presented a 'molecular cuisine' meal to members of the general public. Under the guidance of culinary arts lecturer, Pauline Danaher, the meal was prepared using molecular cuisine ingredients and techniques and served at the 'Edible' exhibition in The Science Gallery, Trinity College Dublin, Ireland. Former culinary arts students David Smith and Seán Meehan explained to the audience what each course represented and how it was made.



Figure 5: Members of the general public at 'Edible' waiting to be served the 'molecular cuisine' meal.

Communication of Molecular Gastronomy to chefs and the general public through the Media

The molecular gastronomy teaching team have also contributed to and featured in the BBC's 'Great British Menu' which was aired on BBC2 on May 2nd 2012 (Great British Menu, 2012). A basil foam was developed for one of the dishes of Northern Ireland chef, Chris Fearon.

Molecular Gastronomy and Food Product Development

Students who take the optional modules in molecular gastronomy can apply their scientific knowledge and culinary skills to produce novel and innovative food dishes/products in the food service or food manufacturing industries.

Conclusion

In DIT molecular gastronomy is firmly established as a growing discipline from basic undergraduate to advanced Ph.D level. Graduates are disseminating and applying their educational knowledge to produce novel and innovative dishes and food products which consumers can enjoy. The general public can learn about the science of producing quality food through enjoyable meal experiences such as that at the 'Edible' exhibition. Competitions stimulate students to actively develop exciting and creative dishes/products. Results of molecular gastronomy research is being disseminated through scientific literature and the media adding to the body of knowledge and ensuring continued food innovation.

References

ABBEST (2006). *Ireland: ABBEST PhD Research Scholarships at Dublin Institute of Technology*. Available at: <http://www.scholarshipnetinfo/Ireland-abbest>. [Accessed on 11 May 2012]

Brillat-Savarin, J.-A., (1825) *Physiologie du Goût ou Meditations de Gastronomic Transcendante; ouvrage theorique, historique et al l'ordre du jour, dediè aux Gastronomes parisiens, par un Professor, member de plusieurs societies litteraires et savants*, Paris: Flammarion.

Burke, R. (2011). The EU Erasmus Mundus Program: The Master's Degree in Food Innovation and Product Design (Partners: Dublin Institute of Technology, AgroParisTech, University of Naples and University of Lund). *Journal of Culinary Science & Technology*, 9(2): 66–70.

Cheng, M., Ogbeide, G-C. A and Hamouz, F.L. (2011). The Development of Culinary Arts and Food Science into a New Academic Discipline-Culinology®, *Journal of Culinary Science & Technology*, 9(1): 17-26.

Cousminer, J. (1999). *Practicing Culinology. Food Product Design*. Available at: <http://www.foodproductdesign.com/articles/1999/01/practicing-culinology.aspx> [Accessed on 11 May 2012]

Danaher, P. (2012). *An Investigation of the Current Course Content in Hot Kitchen Modules on the BA (Hons) in Culinary Arts at the Dublin Institute of Technology; A Survey of the Attitudes of Stakeholders to the Adequacy of the Hot Kitchen Modules*. Unpublished M.Sc. Thesis. Dublin Institute of Technology.

DIT (2011a). *Coursewise*. Available at: <http://www.lttc.ie/coursewise/module/8870/>
[Accessed on 11 May 2012]

DIT (2011b). *Coursewise*. Available at: <http://www.lttc.ie/coursewise/module/9704/>
[Accessed on 11 May 2012]

DIT (2011c). *Postgraduate programmes*. Available at :
<http://www.dit.ie/study/postgraduate/programmes/dt414dt415mscinculinaryinnovation/#d.en.599> [Accessed on 11 May 2012]

Echo360. (2012). *Beyond Lecture Capture: Blended Learning with Echo360*. Available at:
<http://echo360.com/blended> [Accessed on 10 May 2012]

Great British Menu Episode 17 (2012) [TV Programme] BBC, BBC2, 2 May 2012 18.30

Hegarty, J. (2004). *Standing the Heat*. New York, The Haworth Press.

Hegarty, J. (2005). Developing “subject fields” in culinary arts, science, and gastronomy. *Journal of Culinary Science & Technology*, 4(1): 5–13.

INICON (2012). *Research for more quality of life*. Available at: <http://www.ttz-bremerhaven.de/en/main-research-interests/food/research-projects/893-inicon.html> [Accessed on 11 May 2012].

Kidd, C. (2012). Molecular Gastronomy. *Science Spin*, 52: 10-11.

Kroger, M. (2006): What's All This We Hear about Molecular Gastronomy? *Comprehensive reviews in Food Science and Food Safety*, 5: 48-50.

Kurti, N. and Kurti, G. (1988). *But the crackling is superb: An Anthology on Food and Drink by Fellows and Foreign Members of the Royal Society*, Oxford, Institute of Physics.

McGee, H. (2004). *On Food and Cooking, The Science and Lore of the Kitchen*, (2nd ed.). New York:Scribner.

NQAI (2012). *National Framework of Qualification*. Available at: <http://www.nqai.ie> [Accessed on 11 May 2012]

RCA (2012). *Develop A Degree Program*. Available at: <http://www.culinology.com/culinology-degree-programs> [Accessed 11 May 2012]

San Pellegrino (2010). *The World's 50 Best Restaurants*. Available at: <http://www.theworlds50best.com/> [Accessed on 24 October 2010].

This, H. (2011). Molecular Gastronomy in France. *Journal of Culinary Science and Technology*, 9 (3):140-149.

Traynor, M., Burke, R., Frías, J. and Barry-Ryan, C. (2011). *Influence of soy lecithin, xanthan gum and sunflower oil concentrations on the formation and stability of an oil-in-water emulsion*, March, Atlanta, GA: Paper presented at the Annual Research Chefs Association Conference.

Traynor, M., Burke, R., Brunton, N. and Barry-Ryan, C. (2012). *Effect of salt concentration and pH on the release of two banana volatiles from a model emulsion system*. March, San Antonio ,Tx: Paper presented at the Annual Research Chefs Association Conference.

Van Der Linden, E., McClements, D.J. and Ubbink, J. (2008). Molecular Gastronomy: a food fad or an interface for science-based cooking? *Food Biophysics*, 3:246-54.

Vega, C. and Ubbink, J., (2008). Molecular gastronomy: a food fad or science supporting innovative cuisine? *Trends in Food Science & Technology*, 19: 372-382.

Wimba (2012). *Wimba classroom for higher education*. Available at: <http://www.wimba.com/solutions> [Accessed on 11 May 2012]