Note by Note: A New Revolution in Cooking

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Note by Note cooking is an application of Molecular Gastronomy. It was first proposed in 1994 by French Physical Chemist and Molecular Gastronomy Co-founder, Hervé This. Traditional foods are not used to make dishes but pure compounds or mixtures of pure compounds. In doing so the potential for the creation of new foods is enormous. Hervé This estimates through mathematical calculation that it is possible to create in the region of 1,000 to the power of 10 (or 10^{30}) new recipes, and this is without factoring in compound concentrations. The chef has to design the various parts of the dish, the colours, tastes, odours, temperatures, trigeminal stimulation, consistency and nutritional aspects.

Chefs at the Cordon Bleu school in Paris served the first Note by Note meal in 2010 and since then continue to do so each year. Other countries are creating dishes including in Ireland where students from the Molecular Gastronomy modules, taught at the School of Culinary Arts and Food Technology (DIT), have done so since 2013. Following entry to the popular Note by Note competition in Paris in 2014 and in 2015, the DIT students have demonstrated that they are producing award winning dishes by gaining first prize in each of those years, in the student category. Note by Note dishes are also being created as part of Ph.D. research in DIT.

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What is it?

Note by Note cooking is an application of Molecular Gastronomy. Dishes are made entirely from pure compounds or mixtures of pure compounds. No meat, fish, fruits or vegetables are used in the recipes. The aim is not to re-create foods which already exist but to create new foods and potentially new flavours. The shapes, colours, textures, consistency, odours, temperatures and trigeminal stimulation can all be designed by the chef (This, 2013).

History and Development

Note by Note cooking was first proposed by Hervé This in 1994 (Kurti and This-Benckhard, 1994). Since that time famous chefs, such as the three star Michelin chef Pierre Gagnaire, have used this type of cooking to develop dishes and Note by Note meals are being served each year by chefs and students at Le Cordon Bleu, Paris (Ashley, 2013). A Note by Note programme has been launched by Copenhagen Hospitality College (Ball, 2015). Culinary colleges in other countries such as Portugal and Ireland (DIT, 2014) are also actively using Note by Note cooking. In Ireland, the School of Culinary Arts and Food Technology, at the Dublin Institute of Technology (D.I.T.), have incorporated Note by Note cooking into the curriculum of undergraduate and postgraduate modules in Molecular Gastronomy.

Note by Note cooking and Culinary Education and Research at the D.I.T.

The practice of Note by Note cooking is very useful in culinary education as it stimulates creativity by getting students to 'think outside the box'. To be successful the student must engage with Science and Technology as well as Culinary Arts. According to This (2013; 2014a) chemistry (including flavour chemistry), physics, toxicology, nutrition, food safety, culinary arts and technology are integral to Note by Note cooking.

Initially students (undergraduate and postgraduate; Culinary Arts and Food Science) can find it difficult to grasp the concept of creating a new dish or a food from scratch. The idea of not using traditional ingredients is alien for most. Students begin by researching generally regarded as safe (GRAS) pure compounds and mixtures and they source trusted information on maximum permitted levels of food grade chemicals in final dishes/drinks/food products. They are then ready to develop recipes, order pure compounds or known mixtures of pure compounds and carry out trials. Sensory attributes are optimised by varying concentrations of pure flavour and pure colour compounds. Individual pure flavour compounds can be combined to create new flavours. Texture and consistency are optimised through comparison of the properties of suitable pure compounds and through structuring of the new food (This, 2014; Aguilera, 2013).

The effect of processing and the processing conditions are also important e.g. pH, cooking times and temperatures, pressure (siphons) and mixing.

Figure 1: Culinary Arts and Food Science students taking the intermediate module in Molecular Gastronomy in DIT and creating new dishes and drinks using Note by Note cooking.

The 12 week undergraduate and postgraduate modules in Molecular Gastronomy are taught through team teaching by a culinary scientist and a culinary artist. Scientific theory classes are followed by experimental kitchen classes. Initially in 2009 only students from the B.A. in Culinary Arts programme took the intermediate module. These students have previously studied modules in Culinary Science and Technology, Nutrition and also Food Product Development. In 2012, for the first time undergraduate students from Food Science programmes and undergraduate students from the Culinary Arts programme enrolled together on the intermediate Molecular Gastronomy module. The class dynamic allows the food science and culinary arts students to learn from each other. This also happens at the taught Masters postgraduate level where there is a mixed student population in the Advanced Molecular Gastronomy module. However the experience, knowledge and skills of the individual student also play a role. For example, sometimes students have had work placement experience in Michelin star restaurants such as The Fat Duck restaurant in England, others have scientific qualifications and culinary experience and others vice versa. Some have many years of

experience working as chefs and have built up expertise in detecting flavours even at low levels. As there is often so much diversity in the classroom one question which arose in D.I.T. was, "could Note by Note cooking be successfully carried out both at undergraduate and postgraduate levels?" The hypothesis was tested by giving an undergraduate class a Note by Note assignment (see examples 2a and 2b below). The answer proved to be 'yes' as one of the undergraduate students received first prize in the student category of the International Note by Note competition in Paris and his recipe was published in an article in New Scientist magazine (Thomson, 2014). The following year a taught Masters student also gained first prize in the student category at the next International Note by Note competition. This student had culinary work experience and had studied some science and also culinary innovation. So it proves when using Note by Note cooking to stimulate creativity among students, the level of study is not the only factor of importance but also their prior knowledge and skills as well as the new theoretical knowledge and practical skills that they learn from the team teachers and from each other in the classroom.

Note by Note cooking will also be used at Ph.D level in a research project which has recently commenced in the D.I.T.: Novel food products containing functional food compounds from plant material will be developed for the consumer.

Examples of Note by Note dishes and a drink created in D.I.T.

To date over forty Note by Note dishes and drinks have been created at the Dublin Institute of Technology. Some examples of these are presented below.

Example 1: Bubble n'Fizz

The dish was created in 2013 by a postgraduate student of the Advanced Molecular Gastronomy module. This was the first year that Note by Note cooking was included in the curriculum. Elements of the dish included liquorice mousse, sorbet, lemon sherbet, blood orange jelly, display garnish (white and violet teardrops and violet spiral on top of the mousse). All parts of the dish were created from pure compounds or mixtures of pure compounds. While the foods created were familiar to a consumer, the focus of the assignment was to experiment with textures ranging from soft to hard. Typical ingredients included pure sugars, gums, flavour compounds, colour compounds, acids. Processing equipment such as a thermomix, a pacojet and a siphon were used.

Figure 2: Bubble n'Fizz created by Linda Hayes. Mentored by Róisín Burke and Pauline Danaher

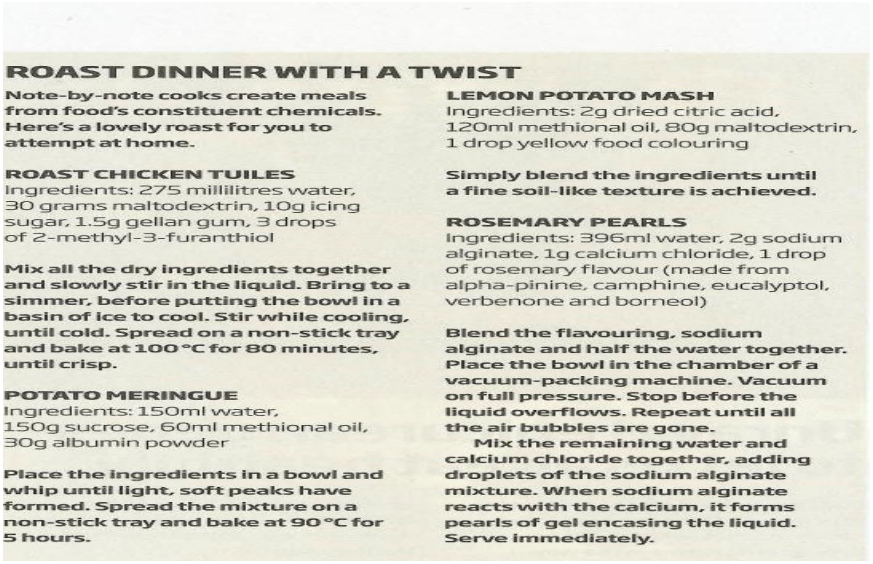
Examples 2a: Roast Dinner with a Twist and 2b: English Tea with a Twist both incorporating Methional

In January 2014 undergraduate students of the intermediate module in Molecular Gastronomy were given an assignment brief which matched the requirements of the second International Note by Note Cooking competition to be held in Paris in May of that year. They had to produce between one to three note by note dishes and/or drinks incorporating the pure compound Methional. It is an organic compound having the general formula $CH_3SCH_2CH_2CHO$. When pure it is a colourless liquid with a strong odour of cooked potatoes with bacon notes. It can occur when potatoes are cooked but also during tea production. It is made from an amino acid called methionine (This, 2014b).

In both of the examples shown the students used familiar names to describe a new dish and a new drink. This was to counteract neophobia.

Figure 3: Roast Dinner with a Twist created by Ciarán Doyle (DIT, final year student of the BA in Culinary Arts). Mentored by Róisín Burke and Pauline Danaher

As noted by Thomson (2014) there were 73 entries to the competition and Ciarán Doyle's dish (Figs 3 &4) won first prize in the student category. The aim was to create a new dish with a name that sounded familiar to the consumer and which contained the pure compound Methional. Other pure compounds in the recipe included gellan gum, flavour compounds 2-methyl-3-furanthiol (chicken taste) and verbone and borneol (Rosemary). The meal consisted of roast chicken tuiles with rosemary pearls, a lemon mash and a potato meringue.



ROAST DINNER WITH A TWIST

Note-by-note cooks create meals from food's constituent chemicals. Here's a lovely roast for you to attempt at home.

ROAST CHICKEN TUILES
Ingredients: 275 millilitres water, 30 grams maltodextrin, 10g icing sugar, 1.5g gellan gum, 3 drops of 2-methyl-3-furanthiol

Mix all the dry ingredients together and slowly stir in the liquid. Bring to a simmer, before putting the bowl in a basin of ice to cool. Stir while cooling, until cold. Spread on a non-stick tray and bake at 100 °C for 80 minutes, until crisp.

POTATO MERINGUE
Ingredients: 150ml water, 150g sucrose, 60ml methional oil, 30g albumin powder

Place the ingredients in a bowl and whip until light, soft peaks have formed. Spread the mixture on a non-stick tray and bake at 90 °C for 5 hours.

LEMON POTATO MASH
Ingredients: 2g dried citric acid, 120ml methional oil, 80g maltodextrin, 1 drop yellow food colouring

Simply blend the ingredients until a fine soil-like texture is achieved.

ROSEMARY PEARLS
Ingredients: 396ml water, 2g sodium alginate, 1g calcium chloride, 1 drop of rosemary flavour (made from alpha-pinine, camphine, eucalyptol, verbenone and borneol)

Blend the flavouring, sodium alginate and half the water together. Place the bowl in the chamber of a vacuum-packing machine. Vacuum on full pressure. Stop before the liquid overflows. Repeat until all the air bubbles are gone.

Mix the remaining water and calcium chloride together, adding droplets of the sodium alginate mixture. When sodium alginate reacts with the calcium, it forms pearls of gel encasing the liquid. Serve immediately.

Figure 4: Roast Dinner with a Twist (Source: Thomson, 2014)

and

Figure 5: English Tea with a twist created by Martin Schreiber (visiting Food Science Erasmus exchange student from Wageningen University, The Netherlands).

Another student, Martin Schreiber, used the idea of English Tea but by applying the Note by Note concept he literally turned it on its head and created a new drink. The recipe consisted of three parts: the milk in the form of pearls made with ingredients such as xanthan gum, calcium lactate, sugar, colour and flavouring compounds; the tuille made from glucose powder and water; the tea foam made with Methional, milk protein and tea flavour compounds. Equipment such as a siphon and alginate bath were used.

Example 3: The Forest Floor and Coconut, Milk and Mint

Most recently the student brief was according to the requirements of the fourth international Note by Note contest (June, 2016). It was required to make between one to three dishes, incorporating cellulose and/or its derivatives as well as compounds with a trigeminal effect. The dishes created by Sophie Dalton , graduate of the B.A. in Culinary Arts, DIT, have been selected to represent the students of the Advanced Molecular Gastronomy module.

Figure 6: The Forest Floor containing Methylcellulose by Sophie Dalton (Postgraduate student of the Advanced Molecular Gastronomy module, DIT). Mentored by Róisín Burke and Pauline Danaher. Image: S. Dalton (2016)

Figure 7: Coconut, Milk and Mint containing Methylcellulose and Menthol by Sophie Dalton. Mentored by Róisín Burke and Pauline Danaher. Image: S. Dalton (2016)

Conclusion

Note by Note cooking offers enormous possibilities for the creation of new food dishes/products and drinks. It is also a very useful educational tool both for students of culinary arts and of food science both at undergraduate and postgraduate levels. Students have to ‘think outside the box’ and apply their knowledge of chemistry (including flavour chemistry), physics, toxicology, nutrition, food safety, culinary arts and technology. Team teaching and a mix of students from food science and culinary arts with a diverse knowledge and skills set are important factors. As part of Ph.D research, Note by Note cooking should help to advance knowledge and contribute to creativity and innovation of new food products.

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