RUNNING HEAD: MOLECULAR GASTRONOMY & HAUTE CUISINE

Assessing the long-term impact of the molecular gastronomy movement on haute cuisine

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ABSTRACT

There is widespread agreement that what some of the most innovative chefs have been doing over the last quarter century or so in the west deserves a name that highlights how things have moved on in the kitchens and dining rooms from the *nouvelle cuisine* movement. However, what no one can seem to agree on is what name should be given to this movement. The scientists and press have been keen to label it as the science of 'molecular gastronomy'. However, many of the top chefs, after in some cases initially embracing the idea, have distanced themselves from that moniker. In their pronouncements and interviews, the latter have been keen to stress that while they are interested in the findings of scientific research, what they do is better conceptualized as the art and craft of cooking. Many of the top chefs have been inspired by the results of the scientific research much as they are inspired by what is happening in many other fields of endeavour, from painting to jazz etc. Given that it is mostly not what the chefs do, it becomes increasingly unclear whether 'molecular gastronomy' is itself anything more than a 'glorified' sub-discipline of food science. We believe, along with several other commentators, that the most appropriate name for what distinguishes contemporary culinary practice is what can be labelled 'experimental cooking'. It is defined as much by its innovativeness, its novelty, its creativity, and by the way in which it engages with the diner's intellect and emotions (with the diner's brain in other words), as with their gut.

KEYWORDS: MOLECULAR GASTRONOMY; HAUTE CUISINE; FOOD SCIENCE; EXPERIMENTAL COOKING; MODERNIST CUISINE; COOKING MOVEMENTS.

Introduction

What no one seems to doubt is that the world of haute cuisine has changed dramatically in the west over the last quarter century or so (e.g., Adria, Blumenthal, Keller, & McGee, 2006; Rayner, 2006). It certainly feels like we have come a long way from the nouvelle cuisine movement that emerged in France at the end of the 1960s (with French chefs taking culinary inspiration from the Japanese *Kaiseki* cuisine, both their cooking techniques as well as the latter's food aesthetic), reaching its apogee in the late 1980s (e.g., Gillespie, 1994; Revel, 1985; Spence & Piqueras-Fiszman, 2014; though see Beaugé, 1999; Rambourg, 2010, pp. 139-156, and pp. 283-299, for a slightly different take on the nouvelle cuisine movement). The chefs who have been at the forefront of this new wave are commonly thought to include Ferran Adrià in Spain, Heston Blumenthal in the UK, Pierre Gagnaire in France, and Thomas Keller in The States.[1] Behind them, innumerable other younger chefs, many trained in the formers' kitchens, René Redzepi (Denmark, but trained in ElBulli), Andoni Luis Aduriz (Spain, but also trained in ElBulli), Grant Achatz (a product of the Culinary Institute of America), Wylie Dufresne, and Sat Bains in the UK (Edwards-Stuart, 2012), to name but a few, followed closely in their culinary footsteps, while all-the-while continuing to innovate in the kitchen, and perhaps, more importantly, in the dining room (see Spence, 2017, for a review).

The public, perhaps led by the popular press, refer to this movement as 'molecular gastronomy' (though see Blanck, 2007).[2] And, for a while, at least, some of the chefs were happy to be so labelled. According to the British food critic and writer, Jay Rayner (2004): *"Blumenthal has a massive puppyish enthusiasm for what has become known as molecular gastronomy."* However, before long, dissent started to ferment amongst the very top tier of chefs (e.g., see Adrià, n.d.; Adria, Blumenthal, Keller, & McGee, 2006). The latter increasingly started to distance themselves (sometimes quite vociferously) from the label 'molecular gastronomy', arguing that the term sounded elitist, and did not accurately describe what distinguished their food. They were, after all, just chefs, and what they did was 'just cooking.' Ferran Adrià (n.d.), for instance states clearly that: *"I claim to be merely a cook; and everything that we do at elBulli as cooking"*. By 2006, at least according to one newspaper headline, Heston Blumenthal had decided that *'Molecular gastronomy is dead'* (Rayner, 2006). Part of the problem here

[1] Other chefs who were there at the beginning also include Raymond Blanc, Christian Conticini, Jean-Pierre Philippe, Fritz Blank, Elizabeth Thomas, Shirley Corriher.

[2] Note that there was something of a confusion in the popular press between molecular (and physical gastronomy) and "molecular cooking" and "molecular cuisine" (see Burke, This, & Kelly, 2016).

seems to have revolved around correctly assigning credit for culinary innovation, and part reflects a more fundamental disconnect between the scientific method that the scientists wanted to instill in those chefs practicing 'molecular gastronomy', and the innovative, experimental, but also artistic and intuitive practices of the top chefs themselves.

All that being said, we are left us with two pressing questions: On the one hand, what exactly is molecular gastronomy if not the name for the movement that has transformed gastronomy in recent decades?[3] And separately, how exactly should we refer to that movement, the one that everyone seems to agree is upon us, but which everyone nowadays seems to have their own name for. Should we call it 'molecular cuisine' (Adrià, n.d.; Cassi, 2004, 2011), 'modernist cuisine' (Myhrvold, Young, & Bilet, 2011), 'molecular cooking' (Youssef, 2013), 'experimental cooking' (Steingarten, 2012), or something else entirely. Now this might seem like nothing more than *'flogging a dead horse'* (see Mouritsen & Risbo, 2013, p. 1),[4] nothing more than merely a tedious terminological dispute: *"Who cares what name we give the movement just as long as everyone agrees what we are talking about?"* some might be tempted to say. However, as has been repeatedly noted in the history of science, failure to agree on terms, and what, exactly, they stand for, or mean, can lead to all manner of problems that are more than merely terminological (see Stein, Burr, Costantinides, Laurienti, Meredith, Perrault, et al., 2010), on this theme). Getting the terminology right, and fixing the definitions is, we believe, therefore an important endeavour. At present, we only seem to have confusion; different terms being used by different people to refer to the same or perhaps to different things. Indeed, one might actually wonder whether there is anything that unifies what the top chefs are doing currently. Or might it be that gastronomy is perhaps moving in multiple different directions simultaneously. If so, perhaps we should be talking of multiple culinary movements, and not just one. In this review, therefore, we track the history of molecular gastronomy, assessing its impact on haute cuisine. We review what the scientists appear to mean by the term, and summarize the problems that some important chefs seem to have with it, and hence why the latter certainly do not believe it captures the full range of what they do. Thereafter, we briefly evaluate the various other terms that have been put forward over the last decade or so in its place. We end-up sympathetic to Heston Blumenthal's suggestion that '*Molecular*

[3] According to the announcement posters of the *1992 International Workshop on Molecular & Physical Gastronomy* (IWMPG), the term 'molecular gastronomy' was, from the very beginning, defined as a scientific activity.

[4] Though note that Mouritsen and Risbo (2013) manage to mangle the idiom when they write: *"This is not the place to flog that old horse."*

gastronomy is dead' (Rayner, 2006). To our way of thinking, the term becomes essentially meaningless as soon as one detaches it from what the famous contemporary chefs actually do. Indeed, it is hard to see how what is left differs from traditional food science, albeit with a subtle change of emphasis. Given that the latter discipline has been around for close on a century now there seems little need to change the name, at least not for any reason other than for 'marketing purposes' (cf. Adrià, n.d.; Cousins, O'Gorman, & Stierand, 2010; Field & Smith, 2001).

Ultimately, we concur with Jeffrey Steingarten and Harold McGee that the most appropriate name for the current culinary movement would appear to be something like 'experimental cooking' (see Steingarten, 2012). However, given the recent history in this area, we should perhaps not hold out too much hope that this label will prove to be any less controversial than any of the others that have gone before. Nevertheless, trying to force agreement on what exactly characterizes contemporary culinary practice, e.g., as distinct from what went on before, would seem like a worthwhile pursuit, and far more important than merely the flogging of a dead horse, as some have been tempted to suggest.

What is molecular gastronomy?

Consult the writings of the physical and behavioural scientists with an interest in cuisine and one typically finds definitions of molecular gastronomy along the lines of *'a scientific approach to cooking'*. For instance, just take the definition that appears in a 2012 article in the *Journal of Culinary Science & Technology*, suggesting that molecular gastronomy is *'the application of science to cooking'* (Edwards-Stuart, 2012, p. 97). While such a definition may strike some (including one of the reviewer's of this article) as being a little too imprecise, it is worth noting that Dr. Rachel Edwards-Stuart is a scientist with a university degree in biochemistry and vocational chef qualifications from Paris (training with Hervé This). She went on to complete her PhD at the University of Nottingham (UK), in one of the first formal collaborations between a Food Science department and a star chef, in this case, the inimitable Heston Blumenthal. The collaboration was announced back in 2005, the year after the latter had first been awarded his third Michelin star, at the *Fat Duck* restaurant in Bray (see Rayner, 2004).

Elsewhere, in a 2010 article from Peter Barham, a physicist from the University of Bristol, working together with colleagues from the Department of Food Science at the University of

Copenhagen that appeared in *Chemical Reviews*, one comes across the following: "*We take a broad view of Molecular Gastronomy and argue it should be considered as the scientific study of why some food tastes terrible, some is mediocre, some good, and occasionally some absolutely delicious. We want to understand what it is that makes one dish delicious and another not, whether it be the choice of ingredients and how they were grown, the manner in which the food was cooked and presented, or the environment in which it was served. All will play their own roles, and there are valid scientific enquiries to be made to elucidate the extent to which they each affect the final result, but chemistry lies at the heart of all these diverse disciplines.*" (Barham, Skibsted, Bredie, Bom Frøst, Møller, Risbo, Snitkjær, & Mortensen, 2010, p. 2315). Along similar lines, early on, one finds Harold McGee (1984) talking of "*the scientific study of deliciousness*", while, more recently, Roosth (2013, p. 4), a professor in the History of Science at Harvard University rather than practitioner it should be noted, described molecular gastronomy as: "*a food movement whose practitioners – chemists who study food and chefs who apply their results – define as the application of the scientific method and laboratory apparatuses [sic] to further cooking*."[5]

Is molecular gastronomy anything more than glorified food science?

While such definitions are themselves reasonably clear,[6] the problem is that they immediately raise the further question of whether molecular gastronomy is actually anything more than a glorified name for (what chef's do when they use) food science (cf. Barham et al., 2010). We suspect that there is more to molecular gastronomy than that; though, in order to illustrate why, we will first need to be absolutely clear on what, exactly, food science is. Here, we are happy to defer to a couple of well-established definitions that one finds in the literature. The first, provided by Dennis Heldman (2006, p. 11), former Director of the Institute of Food Technologists, states that food science is: "*the discipline in which the engineering, biological,*

[5] Two other things that are widely associated, at least in the public's mind, with molecular gastronomy are bits of kit that look like they belong in the science laboratory (think liquid nitrogen and the rotary evaporator), and the use of unusual ingredients with chemical-sounding names, like sodium alginate and xantham gum. However, it is important to note that while the kit and the chemicals are sometimes/often used by those chefs whose names have been linked most closely to molecular gastronomy, these should not be thought of constituting part of the definition of what lies at the heart of this particular culinary movement, a point stressed by Edwards-Stuart (2012) in her review paper.

[6] Though one has to question Barham et al.'s (2010, p. 2315) bizarre claim that *'chemistry lies at the heart of all these diverse disciplines'* when talking about the impact of the atmosphere/environment on dining. This would seem rather the remit of experimental/environmental psychology.

and physical sciences are used to study the nature of foods, the causes of deterioration, the principles underlying food processing, and the improvement of foods for the consuming public." Meanwhile, according to the fifth edition of the *Food Science* textbook, the discipline can be defined simply as: *"the application of basic sciences and engineering to study the physical, chemical, and biochemical nature of foods and the principles of food processing"* (Potter & Hotchkiss, 1998, p. 1).

What is striking about these definitions is the emphasis on the physical sciences, and the lack of engagement with the behavioural or psychological sciences. The focus of the applied research in food science (or perhaps, better said, food technology), in other words, is squarely on the delivery and analysis of the food itself, not on the subsequent perception of that food substrate by the consumer/diner. As mentioned initially by McGee (1984), and thereafter by Barham et al. (2010), the focus of molecular gastronomy, by contrast, is on a better understanding the science of 'deliciousness'. Deliciousness may well depend on the formulation of the food (that is the food science part) but ultimately it is a matter of perception. Clearly, issues of presentation, appearance, description, branding, labelling, pricing, etc. also exert a major influence over the way in which people perceive and respond to food and drink products, and hence why these topics are of such interest to the so-called molecular gastronomy chefs. They are certainly not, however, traditionally considered within the remit of food science. Instead, one normally finds such research in the fields of food marketing, sensory science, and/or latterly experimental psychology/cognitive neuroscience (e.g., Barham et al., 2010, p. 2355; Spence, 2015; Spence & Piqueras-Fiszman, 2014). Here, one might also want to point to the short-lived interdisciplinary journal *Flavour* (co-edited by Peter Barham) as one of the places where such research was, for a while at least, published (https://flavourjournal.biomedcentral.com/). This, then, is one of the ways in which molecular gastronomy might be thought to differ from food science, it draws on a much broader range of scientific disciplines in order to answer a somewhat different empirical question, one that is related to the perception of food (i.e., its perceived 'deliciousness') and not just to its formulation.

However, beyond this difference in scope, or focus, there are also a few other salient differences in emphasis that have been stressed previously (e.g., by Barham et al., 2010, p. 2316; Edwards-Stuart, 2012): First, food science, and perhaps more frequently food technology, research tends to be conducted by large food companies rather than by chefs (and their teams) working away in restaurant research kitchens. Second, and perhaps as a result, food science/technology

research tends to be focused more on large-scale food production and issues of food preservation/safety. Molecular gastronomy, by contrast, is much more focused on the presentation and thereafter on the perception of the foods so created by the diner. Scalability and food preservation are typically of little interest to the molecular gastronomy chef excepting perhaps when considering whether to serve diners the results of their latest adventure in fermentation.[7]

A third important factor here, highlighted by Rachel Edwards-Stuart in her 2012 article, when describing her own experience between Michelin-starred restaurant research kitchen and university lab, that one of the problems/challenges for her when trying to operate at the interface between food science and restaurant kitchen was the sometimes dramatically differing timelines. Conducting thorough scientific research typically means that answers are delivered long after the research kitchen has passed the deadline for delivering the perfected dish/technical solution to the restaurant. Here, it is also worth pointing out that the majority of the research kitchens that are attached to successful restaurants are there primarily to research and develop new dishes for the restaurant, rather than researching issues because of their intrinsic scientific relevance/interest. The Nordic Food Lab associated with the *Noma* restaurant in Copenhagen is a good example of a food lab run by chefs that is focused more on academic research. The research kitchen at the *Fat Duck* restaurant would have been another good example, though apparently it closed down recently. The Alicia Foundation in Spain, linked to the chef Ferran Adrià have also been involved in basic research (e.g., Casas, León, Jovell, Gómez, Corvitto, Blanco, et al., 2012; Piqueras-Fiszman, Alcaide, Roura, & Spence, 2012).

As has already been mentioned, a number of those chefs whose names are popularly associated with the molecular gastronomy movement have themselves sometimes been involved in scientific research. Heston Blumenthal's name, for instance, has appeared in the author list of a number of peer-reviewed academic research papers over the years (e.g., see Oruna-Concha, Methven, Blumenthal, Young, & Mottram, 2007; Mottram, Spence, Shankar, & Blumenthal, 2011; Yeomans, Chambers, Blumenthal, & Blake, 2008). Similarly, chef Andoni Luis Aduriz and his team from *Mugaritz* over in San Sebastian have published fundamental research in the field of gastronomy and food science (e.g., Aduriz, Vergara, Lasa, Oliva, & Perisé, 2012;

[7] This is certainly the case for the *Faviken* restaurant in Sweden given that they only serve foods from the local area and so need to preserve many of their ingredients for use during the winter months (see Nilsson & Kroon, 2012).

Arboleya, García-Quiroga, Lasa, Oliva, & Luis-Aduriz, 2014; Arboleya, Olabarrieta, Luis-Aduriz, Lasa, Vergara, Sanmartín, Iturriaga, Duch, & de Marañón, 2008).[8] Your present authors have also been engaged in an active ongoing scientific research collaboration spanning the fields of gastronomy and gastrophysics over recent years too (e.g., see Spence, Wang, & Youssef, 2017; Spence & Youssef, 2016; Velasco, Michel, Youssef, Gamez, Cheok, & Spence, 2016; Youssef, Juravle, Youssef, Woods, & Spence, 2015; Youssef, Sanchez, Woods, & Spence, 2018; Youssef, Youssef, Juravle, & Spence, 2017). It is, though, worth noting that this scientific research is rarely what people (and especially the press) reference when talking/thinking about the molecular gastronomy movement.

When thinking about high-end chefs adopting a scientific approach to gastronomy one should certainly also mention chefs such as George Pralus of *Restaurant Troisgros*, in Roanne, France. He is considered to be one of the first chefs to incorporate sous-vide cooking into commercial kitchen back in 1974.[9] Thereafter, French chef Pierre Gagnaire has, since the 1980s, been working with scientists such as Hervé This. Gagnaire is a key figure here credited with taking a more scientific and methodical approach towards cooking processes (e.g., This & Gagnaire, 2010).

Science as inspiration or research method in molecular gastronomy?

What is common to both molecular gastronomy and food science, then, at least according to the scientists with an interest in gastronomy/haute cuisine, is that they share the same rigorous approach to addressing food-related research questions using the scientific method (or a scientific approach). However, it can be argued that there is actually a much more fundamental disconnect here between the high-end chefs on the one hand and the scientists with an interest in gastronomy on the other. Indeed, according to our way of thinking, the key question is really one of whether the results of food science (or innovations in food technology), behavioural science, or for that matter, any other kind of science are being used merely as a source of inspiration for culinary creativity in the restaurant research kitchen, and/or, as the

[8] Not to mention setting-up the *International Journal of Gastronomy & Food Science*.

[9] Note that the technique itself was first introduced in the 1960s in Swiss hospitals to improve the sterilization of food (see Baldwin, 2012; Spence & Piqueras-Fiszman, 2014). While the technique is now one of those associated with molecular gastronomy, it is also a technique that some commentators believe is overused (Coren, 2014).

scientists/commentators would have us believe, are the molecular gastronomy chefs actually adopting the scientific method (or approach)?

The former relationship (i.e., science as source of inspiration) is hinted at when Roosth (2013, p. 4) talks of: *'chemists who study foods and chefs who apply their results'*. Applying their results, note, not adopting their methods, or approach. Meanwhile, Barham et al. (2010, p. 2315) state that: *"The term Molecular Gastronomy has gained a lot of popularity over the last few years, largely because some chefs have started to label their cooking style as Molecular Gastronomy (MG) and claimed to be bringing scientific principles into the kitchen."* Once again, it is unclear whether, by the final phrase *'bringing scientific principles into the kitchen'*, the authors have in mind bringing the scientific findings into the kitchen, or the scientific method itself. These are two quite different things.

It is, though, striking how, in pretty much every one of the definitions quoted above, the claim is made that molecular gastronomy involves the use of the scientific method itself, and not just the use of the findings of that scientific research as a source of culinary inspiration: Edwards-Stuart (2012, p. 97), for instance, talks of *'the application of science'*; Barham et al. (2010, p. 2315) state that: *'there are verified scientific enquiries to be made'*; McGee (1984) talks of: *'the scientific study of deliciousness'*; and, finally, Roosth (2013, p. 4) points to: *'the application of the scientific method'*. Elsewhere, one finds French physical chemist Hervé This, titling one of his articles: *'Molecular gastronomy is a scientific activity'* (This, 2012). He repeated the suggestion the following year with a paper title that begins *'Molecular gastronomy is a scientific discipline'* (This, 2013). As such, there really can be little doubting how the scientists see matters.[10] (Though one might wonder whether the terms 'activity', 'method', and 'discipline' are synonymous.)

If, however, rather than focusing on what the scientists and cultural commentators write, one instead takes a closer look at what the chefs themselves have to say about their relationship to science, then a very different picture soon starts to emerge. In fact, read the statements and interviews with the likes of Ferran Adrià and Heston Blumenthal – internationally famous chefs whose names have been indelibly linked, by the popular press at least, with the emergence of molecular gastronomy – and it is clear that they retain, at best, an ambivalent relationship to science, to the scientific method, and even to the field of 'molecular gastronomy' itself

[10] At a workshop held back in 2004, Thorvald Pedersen, came up with the following definition: *'The science of choosing, preparing and eating good food'* (see Pedersen et al., 2006, p. 613).

(whatever the latter might stand for). It might be argued that they mostly just treat the results of the scientific method as inspiration for their own creative/artistic practice, but little more than that (i.e., they don't themselves consider what they do a scientific discipline/method/or activity). Note how, if this reading of their position is correct, then the results of the scientific research, be that research in food science (e.g., Potter & Hotchkiss, 1998), neurogastronomy (Shepherd, 2006, 2012; though see also Spence, 2012),[11] computational gastronomy (Ahn & Ahnert, 2013; Ahn, Ahnert, Bagrow, & Barabási, 2011; Ahnert, 2013), or gastrophysics (Spence, 2017),[12] are no different, at least as sources of inspiration for the chefs, than are the results/ideas to be found in many other fields (e.g., of artistic endeavour). Adria, Blumenthal, Keller, and McGee (2006) highlight the point when, in their *Statement on the 'new cookery'*, they say that: "*The act of eating engages all the senses as well as the mind. Preparing and serving food could therefore be the most complex and comprehensive of the performing arts. To explore the full expressive potential of food and cooking, we collaborate with scientists, from food chemists to psychologists, with artisans and artists (from all walks of the performing arts), architects, designers, industrial engineers.*"

Indeed, read the chef's coffee table gastroporn books, and/or the published interviews promoting them, and one finds renowned high-end chefs talking of their inspiration coming from such diverse sources as modern jazz (Massimo Bottura; see Anonymous, 2014b), history (Blumenthal's restaurant *Dinner by Heston* is inspired by historical British food; see also Blumenthal, 2013), the visual arts (Grant Achatz's famous table dessert is influenced by, and has been compared with, abstract expressionism; see van Ooijen, 2017),[13] fiction (see Gerard, 2009), or even architecture (thinking back to Câreme's fabulous food pastry structures from a couple of centuries ago; Câreme, 1828; see also Horwitz & Singley, 2004). One can perhaps see hints of this eclectic approach to culinary inspiration in the collection of short scientific articles that one finds at the end of *The Big Fat Duck Cookbook* (Blumenthal, 2008). There are entries from cognitive neuroscientists (e.g., Prof. Francis McGlone), perfumiers (Francois Benzi, 2008, of *Firmenich*), chemists working in flavour and fragrance houses (e.g., Tony Blake, then also at *Firmenich*), etc.

[11] And its follow-on 'neuro-enology' (Shepherd, 2015).

[12] No matter how you define it (see Mouritsen, 2012; Mouritsen & Risbo, 2013, 2015; Parker, 2004; Viglis, 2013).

[13] Of course, inspiration can flow in the opposite direction too (see Lesser, 2018).

Chefs, be they of the molecular gastronomy persuasion, or otherwise, are obviously perfectly entitled to take their inspiration from wherever they see fit. Being innovative, after all, is hard work! North American chef Grant Achatz captures this when he says: *"People like to think the creative process is romantic. The artist drifts to sleep at night, to be awakened by the subliminal echoes of his or her next brilliant idea. The truth, for me at least, is that creativity is primarily the result of hard work and study."* (quoted in van Ooijen, 2017). But note that one can take one's inspiration from the results of scientific research without necessarily having to make any commitment whatsoever to adopting the scientific method (or adopting a scientific approach) oneself on a day-to-day basis! This distinction, as we will see, turns out to be crucial.

On the growing popularity of the scientific approach to cooking

What is not in doubt here is that the scientific approach to cooking/cuisine has become hugely popular over recent years. And this rise in popularity has definitely overlapped with the rise of those chefs like Ferran Adrià and Heston Blumenthal whose names have been linked most closely with molecular gastronomy movement. The number of books published in recent years with 'science' or 'scientific' in the title (or if not there, at least infused in the contents), certainly attests to this changing emphasis (see Aduriz, 2014; Barham, 2001; Bouzari, 2016; Lopez-Alt, 2015; This, 2005, 2009a; Vega, Ubbink, & van der Linden, 2012, for just a few). However, it is worth noting that the scientific approach to cooking appears to cut across the so-called molecular gastronomy and home/commercial chefs. In other words, one is seemingly just as likely to find the scientific approach to cuisine being taught in culinary school (Edwards-Stewart, 2012), evening classes (see Sarıoğlana, 2014), physics class (Parker, 2004), or in a popular cookery book (see Barham, 2001; Bouzari, 2016; Lopez-Alt, 2015), as one is to find it in the kitchens of the molecular gastronomy chef these days (e.g., Aduriz, 2014; Youssef, 2013; see also Aguilera, 2018; van der Linden, McClements, & Ubbink, 2008).

A key figure in fostering the public's, not to mention the chef's, growing interest in the science to cooking is, of course, Harold McGee. The latter has written several hugely influential books, *On food and cooking* (McGee, 1984/2004), *The curious cook* (McGee, 1990), as well as an occasional column in *The New York Times* (e.g., McGee, 2008) where he has explored kitchen folklore (old wife's tales) scientifically. For instance, he famously discredited the suggestion that one should brown meat in a pan before placing it in the oven (to seal in the juices). He has also written, and experimented, on the science of using copper bowls for whipping egg whites

in an article appearing in the top science journal *Nature* (see McGee, Long, & Briggs, 1984). This scientist and writer certainly influenced Blumenthal's unique style of cooking (e.g., in early dishes where, for example, duck legs were being cooked at low temperatures for up to 60 hrs, while his triple cooked chips were still being perfected; see Rayner, 2004). The two have, in fact, remained good friends.

It certainly seems fair to say, then, that the rise of molecular gastronomy movement has made people (in general) more interested in the science of the kitchen (Edwards-Stuart, 2012; see also https://www.seas.harvard.edu/news-events/publications/features/cooking-as-practical-science). And science in the kitchen, or edible experiments certainly has broad appeal when trying to encourage young people to get interested in sciences like physics and chemistry (e.g., see Parker, 2004). Once again, though, saying that the rise of molecular gastronomy has encouraged widespread interest in the science of food/of the kitchen is not at all the same thing as saying that molecular gastronomy is itself a scientific activity/discipline (as, for instance, claimed in the titles of This's, 2012 and 2013 articles that we came across earlier). Before closing this section, it is also important to mention the work of *The International Centre for Molecular Gastronomy AgroParisTech-INRA* (see http://www2.agroparistech.fr/The-International-Centre-for.html). This centre has also been actively pursuing the promotion of the Molecular Gastronomy agenda through the organization of workshops, sabbatical placements, seminars, etc.

On the rise of chefs and 'non-food scientists'[14] interested in a scientific approach to cuisine/gastronomy

At this point, it is perhaps helpful to trace the history of interaction between high-end cooks and non-food scientists interested in gastronomy. Barham et al. (2010, pp. 2353-2354) dates the origins of the modern science of molecular gastronomy to the 1969 Royal Institution Friday Evening Discourse, entitled *'The Physicist in the Kitchen'*, given by Oxford University's Prof. Nicholas Kurti (1908-1998; see Kurti, 1969). On that occasion, the Hungarian-born low temperature physicist demonstrated the principal of 'inside-out' baking using a microwave

[14] One needs this rather cumbersome label to distinguish the hobby scientist interested in gastronomy from the professional food scientists/technologists who have been around, working for the food industry, for many decades (see Crocker, 1945, 1950; Farrell, Wagner, Peterson, & MacKinney, 1954, for early work).

oven[15] to make an inverted Baked Alaska that was hot on the inside and cold on the outside.[16] In hindsight, though, one might point to a blurring of boundaries here between technology (the recently-introduced microwave oven) and science. Kurti captured the view of many when he was once quoted as saying: *"However it seemed to me that, while scientists on the whole enjoy good food and are often expert cooks, they shy away from a serious application of their profession in the kitchen. Could it be that they do not regard cooking as sufficiently dignified to deserve research effort using scientific techniques and methods?"* (Kurti, 1988).[17]

Going much further back, of course, one should probably also mention Count Rumford who in 1794 wrote a 400-page treatise, entitled '*On the construction of kitchen fireplaces and kitchen utensils together with remarks and observations relating to the various processes of cookery and proposals for improving the most useful art.'* (see Pedersen, Meyer, Nursten, & Redzepi, 2006).[18] Another early example of a famous scientist interested in cooking is Justus Von Liebig. This German chemist developed a manufacturing process for beef extracts and founded a company that later trademarked the Oxo brand beef bouillon cube (see Judel, 2003).[19] And beyond these, there are a number of other less well-known examples including Papin (1681), Lavoisier (This, Méric, & Cazor, 2006), Accum (1820), Kellogg (1893), and de Pomiane (1922, 1940).

Opportunities for interaction between non-food scientists interested in cuisine and high-end chefs include a famous Escoffier Foundation event held in Biarritz in the mid-1990s where both Ferran Adrià and Harold McGee were present (with both subsequently referencing this particular meeting; Adrià, n.d.; McGee, 2014). Thereafter, most famous/influential, were probably the series of *International Workshops on Molecular Gastronomy* arranged by Hervé This-Benckhard (as he was known then) and Nicholas Kurti in Erice, Sicily (see Weiss,

[15] Hard though it is to imagine today, the microwave oven must have seemed like a pretty exotic space-aged kitchen appliance back at the end of the 1960's (see Belasco, 2006, p. 237; Gallawa, 2001). According to Barham et al. (2010), the microwave likely never became a central tool of the molecular gastronomy movement because of the uneven way in which it tends to cook food, not to mention the low maximum temperature that is achievable (c. 100˚C).

[16] Note that Kurti is also popularly, and most probably correctly, said to have introduced the term 'molecular gastronomy', though Hervé This also claims to have introduced the term in 1993 (see This, 2013).

[17] Kurti was famously also quoted as saying: *"I think it is a sad reflection on our society that while we can and do measure the temperature in the atmosphere of the planet Venus we do not know what goes on inside our soufflés."* (as quoted in Porter, 1988, p. xvii).

[18] Rumford is also famous for founding the Royal Institution in London. In fact, it was on the 170th anniversary of its founding that Kurti was invited to give his most popular lecture.

[19] Von Liebig is also credited with starting the myth that searing meal seals in the juices.

2001).[20] These meetings attracted a mixed audience of about 40 participants, that included cooks, food writers, and scientists. According to Pedersen et al. (2006, p. 612), the list of meetings was as follows (note, once again, the emphasis on the food science end of cooking):[21]

International Workshops on Molecular Gastronomy

- International School of Molecular and Physical Gastronomy (1992).
- International School of Molecular and Physical Gastronomy (1995). 'Sauces or dishes made from them'
- International School of Molecular and Physical Gastronomy (1997). 'Cooking'
- International School of Molecular and Physical Gastronomy (1999). 'Flavours, how to get them, how to distribute them, how to keep them'
- International School of Molecular and Physical Gastronomy (2001). 'Textures of foods: how to create them
- 'International workshop on Molecular Gastronomy 'Nicholas Kurti' (2004). 'Interaction of food and liquids'

Among the now globally-famous chefs who passed through were Adrià and Blumenthal, along with regular attendance from scientists such as Harold McGee, Tony Blake, Nicholas Kurti, and meeting organizer, Hervé This. When things went well, the chefs might come away with inspiration for their latest culinary creations, or a solution to their kitchen problems. At the same time, the physical scientists could engage their curiosity, help solve culinary technical problems, and feel themselves to be generally useful (see McGee, 1999, for the report from one of the attendees about the fascinating demonstrations and other goings-on).[22]

In Spain, meetings serving a similar function, though with a more pronounced involvement from the regional food companies, and a broader range of academic speakers, have been organized every other year in San Sebastian, Spain under the title *Diálogos de cocina*

[20] In fact, while rarely credited, it was Elizabeth Cawdry Thomas, a cookery teacher, who was once married to a physicist, studied at Le Cordon Bleu in London, and ran a cooking school in Berkeley, California, actually first came up with the idea for the Science and Gastronomy workshop in Erice (see http://www.sallybernstein.com/about/thomas.htm),

[21] As McGee (1999, p. 17) notes: *"The agenda is to analyse and help advance the fine art of cooking as it is practised in domestic and restaurant kitchens."*

[22] This is what, today, one might be tempted to call 'impact!' (see also Kurti & This-Benckhard, 1994a, b).

(www.dialogosdecocina.com/). The first of these meeting was held around the same time as the original series of Erice meetings stopped (note that IWMPG never stopped; in fact, the last one was held in 2016. Since 2014, the meetings have been held in Paris and organized by the AgroParisTech-Inra International Centre for Molecular Gastronomy; see http://www2.agroparistech.fr/The-International-Workshops-on.html). In fact, look closely, and it is easy to see how nowadays there are more venues for chefs and scientists to meet and share their ideas than ever before, including at the Danish MAD events (https://www.madfeed.co/event/), not to mention the long-running Oxford Food Symposium (https://www.oxfordsymposium.org.uk/).

Interim summary

Thus far, we have tried to establish that the scientists believe molecular gastronomy to be a scientific discipline/approach to addressing question about the deliciousness of food. By contrast, we have hinted that a number of the top chefs themselves seem instead to treat the science more as inspiration for their culinary creativity than anything else. What we have also stressed is that it is not that the chefs do not engage in science, some of them most certainly do (as we have seen). Our point is rather that scientific research does not seem to be what most people have in mind when talking about the culinary movement that is currently upon us, which seems qualitatively different from the *nouvelle cuisine* movement that came before, and which (wrongly, many people would say) is often referred to as 'molecular gastronomy'. Furthermore, we have also attempted to stress how the rise of molecular gastronomy has overlapped with, and may even have been partially responsible for, fanning the flames of public interest in the science of cooking. But, at most, molecular gastronomy, provides just one of many sources of inspiration for the contemporary chef.

Science as source of inspiration

Take the following quote: "*Adrià – whose Michelin 3-star rated restaurant has been regarded as one of the finest in the world — discussed the creative process at elBulli, where the entire staff is involved in the creation of one-of-a-kind food dishes that sometimes involve what has been described as "molecular gastronomy"* (quote from https://steinhardt.nyu.edu/site/ataglance/2011/03/ferran_adria_talks_creativity_.html). Note

that the suggestion here is that the culinary team sometimes use molecular gastronomy, but what made this flagship restaurant so special cannot be captured simply by describing it as molecular gastronomy.

Indeed, in one undated statement, Ferran Adrià (n.d.) was keen to stress that his approach to cuisine was much more intuitive, and only loosely tied to science. What is more, he also points out that his link to science occurred only after he became famous for dishes such as the spherified green olive. As he puts it: *"Just to set the record straight: up until 2003, after at least fifteen years of innovation….our contact with the scientific world had been sporadic."* Later in the same piece he describes drawing up a: *"Synthesis of our cuisine: 23 points to define what we do. One of the things it brought home to us is that the role of research or science, while important, was limited to just one of the 23 points. Cooking is much more than that…"* That said, in the same opinion piece, Adrià also details the subsequent publication of his *Scientific and Gastronomic Lexicon* together with scientist Pere Castells as an attempt to bridge the gap between science and gastronomy.[23] The point, then, is not that there is no place for scientific inspiration, and for the use of findings derived using the scientific method in what distinguishes what the top chefs have been doing, but rather that it should be seen as co-existing with, and not defining, their approach. As Adrià puts it: *"I must be blunt: I think that what we have here is a marketing operation and the public should not be tricked into believing that molecular cuisine is a cooking style."*

Many of the chefs then argue that science is merely incidental to, or a very small part of, what they do. This certainly fits with our own experience in kitchens, according to which culinary innovation is not yet – and, who knows, may never be – a scientific process. Currently, after all, no one can yet guarantee that some new dish or other will taste good to the target diners (or consumers). The scientists may wish that this were the case, they may even be confident that in the near-future it will be,[24] but as of yet, it remains at least as much of an art (or perhaps craft; see Roosth, 2013) as a science.[25] Along similar lines, Number 7 of the *10 Principles of Modernist Cuisine* states that "*Science and technology are sources that can be tapped to enable*

[23] The latter appearing in English as *Modern gastronomy A to Z: A scientific and gastronomic lexicon* by Alícia & elBullitaller in 2006.

[24] This aspiration is hinted at by the following quote from Barham et al. (2010, p. 2361): *"It may even become possible to give some quantitative measure of just how delicious particular dish will be to a particular individual."*

[25] Harold McGee (1999, p. 17) made much the same point when he noted in a *News and Views* article in *Nature*: *"What's in a taste? Chemists can isolate the components of flavours, and biologists have begun to explain how our bodies enjoy them, but cookery will remain more art than science for a while yet."*

new culinary inventions, but they are a means to an end rather than the final goal." (http://modernistcuisine.com/about-modernist-cuisine/principles/).

Finally here, back in 2006, Adria of *El Bulli*, Heston Blumenthal of the *Fat Duck*, Thomas Keller of the *French Laundry* and *Per Se* together with writer Harold McGee were very clear on the need to distinguish what they do from molecular gastronomy. In particular, they state: *"Similarly, the disciplines of food chemistry and food technology are valuable sources of information and ideas for all cooks. Even the most straightforward traditional preparation can be strengthened by an understanding of its ingredients and methods, and chemists have been helping cooks for hundreds of years. The fashionable term "molecular gastronomy" was introduced relatively recently, in 1992, to name a particular academic workshop for scientists and chefs on the basic food chemistry of traditional dishes. That workshop did not influence our approach, and the term "molecular gastronomy" does not describe our cooking, or indeed any style of cooking."*[26]

Given the above, it should be clear that the chefs treat science (and that includes molecular gastronomy, or food science) primarily as a source of inspiration, and they are absolutely clear on the fact that they are not, and do not want to be, constrained by the scientific method.

Experimental cuisine and culinary innovation

As one might expect of the great food critic and food writer, Jeffrey Steingarten, he was, we believe, absolutely spot on when he said of the food at *elbulli*: "*There is nothing strictly scientific about it. Harold McGee prefers the phrase experimental cuisine. I like that term, too, because it is inclusive, and I believe that it implies a systematic series of hypotheses and trials. The techniques for separating the tomato and shaving the cauliflower were as far as I could tell unprecedented – but not quintessentially scientific. Both (the tomato and the cauliflower dishes) depend on the close observation of natural forms, the province of either biologists or painters and engravers."* (Steingarten, 2012). Adrià (n.d.) makes much the same point when he states that: *"…we have never ascribed any scientific origin to our creations, which have*

[26] Note that others have dated the origins of the term to 1988 when Hervé This together with Nicholas Kurti introduced 'molecular and physical gastronomy' as a scientific discipline (Kurti & This-Benckhard, 1994a), with the title being abbreviated to 'molecular gastronomy' in 1998 (see Burke et al., 2016; This, 2009b).

come about from a purely culinary quest: observation and curiosity have been part and parcel of our activity, in my case for almost a quarter of a century."

Similarly, Pedersen et al. (2006, p. 611), when describing the approach they saw emerging from the interface between physical and chemical sciences and hate cuisine fostered by the Erice workshop, state that: *"Inspiration for creating novel flavours and sensorily attractive foods and meals is nowadays increasingly sought at the interface between science and the art of cooking. … senior chemists and renowned Michelin-starred awarded Danish cooks were brought together to discuss and illustrate with real samples how chefs and flavour scientists can cooperate in a constructive way by creating ever more satisfying sensory experiences, based both on artistic and scientific skills".*

What the contemporary chefs are doing in their kitchens and dining rooms is undoubtedly innovative and would appear to be so distinctively different from *nouvelle cuisine*, in that it takes culinary inspiration not just from *Kaiseki* cuisine but from a far broader range of disciplines to create innovate in the kitchen and to deliver it in the dining room.[27] Clearly, while such an approach may sometimes build on the results of scientific experimentation, it does not fundamentally rely on the scientific method or approach to deliver the hard-won culinary innovation that Achatz was quoted talking about earlier.

Why not simply change the name?

Given the palpable tension between scientists claiming that molecular gastronomy is a scientific discipline (a sub-discipline of food science), and given some scientists (wrongly) being credited by the press with responsibility for some of the culinary creations coming out of the top kitchens (cf. Presenza, Abbate, Casali, & Perano, 2017), the obvious irritation felt by some chefs becomes easier to understand. Ferran Adrià, for one, can barely withhold his disdain when he says of certain of the scientists associated with the term 'molecular gastronomy', that one can count the number of interested/cooperating chefs on the fingers of one hand![28] Given that 'molecular gastronomy' is not the correct name for what makes what

[27] Indeed innovation was one the key pillars of Adria et al.'s (2006) 'Statement on new cooking', stress innovation, where their third pillar begins: *"3. We embrace innovation - new ingredients, techniques, appliances, information, and ideas - whenever it can make a real contribution to our cooking.*

[28] *"Strangely enough, while molecular gastronomy gave its inventors a name, contacts with chefs could be counted on the fingers of one hand."* (Adrià, n.d.).

the top chefs do distinctive from what went before should we just change the name? Would the problem here be solved by such a simple move?

We are certainly not the first to suggest such a move. As Arboleya et al. (2008, p. 267) put it: *"There is, however, a real concern within the culinary community as to whether the term "molecular gastronomy" should be redefined or not. Gastronomy is the study of relationship between culture and food and molecular gastronomy does not really cover these aspects. Furthermore, the public tend to be skeptical* [sic] *with this name as it sounds highly elitist, complicated, and unsafe. If one of the big issues between the interactions of scientific and cooking communities is communication, we believe that this name does not really help to achieve that goal. One step forward would be to consider the modification of the name "molecular gastronomy" into an easier and more representative one. In any case, the most important thing for us is that collaboration between both communities should be encouraged irrespective of whatever name this is to go by."* Chef Heston Blumenthal has gone further still suggesting that: *"Molecular gastronomy is dead"*. This, the first part of the title of an article appearing in the *Observer Food Monthly* magazine in 2006 (see Rayner, 2006). That being said, opinions on the matter clearly differ with other distinguished Spanish researchers practitioners recently arguing in print that molecular gastronomy is thriving in Spain, both amongst chefs and companies (see García-Segovia, Garrido, Vercet Tormo, Arboleya, Fiszman Dal Santo, Martínez Monzó, Laguarda, Palacios, & Ruiz, 2014).

As we saw earlier, other names that have been given to try and capture what is distinctive about what so many contemporary chefs have been doing include 'molecular cuisine' (Adrià, n.d.), 'modernist cuisine' (Myhrvold et al., 2011), 'molecular cooking' (Youssef, 2013), and 'experimental cooking' (Steingarten, 2012). As we have made clear already, though, our preference is to side with McGee and Steingarten's choice of the term 'experimental cooking'. However, as should by now be clear, the friction between the chefs and the scientists will likely not be addressed simply by renaming what the chefs do. This is because what is at stake is really a question of what is/are defining features of the movement, and separating what the scientists are interested in promoting from what the chefs actually seem to be interested in.

Is there more to 'molecular gastronomy' than merely glorified food science?

While changing the name will address some of the chefs' concerns, like the focus on the 'molecular' which sounds complicated according to Blumenthal, and the to-some elitist

559 sounding ‘gastronomy’ (see Rayner, 2006), what it won’t do is get at the heart of the issue,
560 namely whether the scientific method is intrinsic to what goes on in those restaurants that are
561 commonly referred to practicing molecular gastronomy. That leaves us, then, with the question
562 of whether molecular gastronomy is sufficiently distinctive to deserve a name of its own, or
563 whether instead people should accept that what is left, once the chefs have left the party, is
564 merely a glorified sub-branch of food science, and little more.

565

566 **Real-world decision-making is often based on gut feel**

567 Chefs, just like many others real-world decision makers, often end up basing their important
568 decisions on gut-feel, or in this case the trained taster’s palate, or brain, rather than on the basis
569 of scientific research when making important commercial decisions,[29] as when deciding
570 whether to put a new dish on the tasting menu. The problem here is that while science, or the
571 scientists, are tempted to promise that it is going to deliver the answer, how can one ever be
572 absolutely sure that it will. When science promises, those whose careers are on the line in
573 gastronomy, marketing, or any other field for that matter, typically regress to gut feel. You can
574 perhaps understand why when oftentimes the guaranteed solution of the scientists fails to
575 deliver. As a case in point, consider only the science of food pairing. Top chefs, like many
576 others, initially jumped on the flavour pairing bandwagon. However, they, as well as many
577 others soon realized that what professed to be a scientific method to discover unusual
578 combinations of ingredients that would work well together flavourwise, because of the
579 molecules they share in common, ultimately turned out to be nothing more than a neat way of
580 generating new possible combinations (with no guarantee of success; see Spence et al., 2017,
581 for a review).

582 No wonder then, that the chefs soon realised that they had been misled by the promise of a
583 guaranteed solution and that they would ultimately decide whether the combination worked or
584 not. Indeed, despite Heston Blumenthal’s initial enthusiasm, the chef soon recognized the
585 short-comings of the flavour pairing approach: *“Looking back at my younger self I’m almost*
586 *embarrassed at my bumptious enthusiasm, not least because I now know that a molecule*
587 *database is neither a shortcut to successful flavor combining nor a failsafe way of doing it. Any*
588 *foodstuff is made up of thousands of different molecules, that two ingredients have a compound*

[29] Though, of course, sometimes the latter happens to fall in line with the former.

in common is a slender justification for compatibility. If I'd known then what I know now, I would probably never have tried this method of flavor pairing: there are simply too many reasons for it not to work. As it was, in my naivety I just got stuck in." (Blumenthal, 2010, p. 45).

The following exchange between the food critic and writer Jay Rayner (2004) and chef Heston Blumenthal is perhaps illustrative here of how decisions actually get made in the top kitchens: *"All well and good, I say, but chemistry can't make things taste nice. 'No,' he says, 'it can't. I detach myself from that when I put the food in my mouth.' And that's what makes the Fat Duck work. It's not the science; it's the dishes, which prove that the appliance of those principles by someone with extraordinary taste makes a difference."* In other words, the chef's palate, and hence their gut feel, tend to win out every time. As Blumenthal said in the same interview: *"Everything has to come down to "does it taste good?" If it doesn't taste good it doesn't go on the menu."* That being said, it is important to note that the subjective nature of deliciousness means that there can be no guarantee that just because one person likes a dish, others will necessarily follow in terms of their assessment.

As such, it should perhaps come as little surprise to find that the chefs prefer to rely on gut-instinct, on the conviction of their palates, when making the call about whether the dish goes on the menu or not. Chefs are perhaps no different in this regard that the marketing manager who have also been reported to rely more on 'gut feel' than (i.e., in their case), neuromarketing, as they apparently have always done (Blakeman, 2017). For reference, according to one online survey of a little over 1000 marketers conducted back in 2014, 49% reported "trusting my gut" when it came to deciding where to invest their marketing budgets (see Anonymous, 2014a). And the marketers are by no means exceptional in this regard: According to psychologist Gerd Gigerenzer "*I've worked with large companies and asked decision makers how often they base an important professional decision on that gut feeling. In the companies I've worked with, which are large international companies, about 50% of all decisions are at the end a gut decision."* (quoted in Fox, 2014). Thus, even if the scientists are to be believed, that still does not necessarily mean that the chef, nor any other kind of manager would necessarily take their findings/recommendations on board anyway. In this regard, the more artistic, inspired approach of the chefs is no different from what one finds in many other areas.

<u>There is more to contemporary cuisine than merely the search for deliciousness</u>

Finally, here, it is worth highlighting the fact that while some creative chefs undoubtedly do agree with the suggested importance of deliciousness to their art, not all do. As an example of a Michelin-starred chef adopting the latter position, just take Spaniard Andoni Luis Aduriz, who had the following to say a few years ago: *"You know, I went to cooking school decades ago, and there they taught me how to make delicious food. It's not my goal to make delicious food anymore. I want to make interesting food."* (quoted in Ulla, 2012). To the extent that this view is representative, 'the science of deliciousness' that we came across earlier (Barham et al., 2010; McGee, 1984) would really not seem to capture all of what has been going on in the top kitchens in recent years because: 1) as has been suggested already, it is not a science; and 2) not all of the chefs are primarily, or only, interested in deliciousness. Indeed, their *'Statement on the new cooking'*, Adria et al. (2006) emphasize the importance of deliciousness, but also stress that what they are after goes beyond merely delicious food to include those dishes that the diner will find 'stimulating'. They say: *"We do not pursue novelty for its own sake. We may use modern thickeners, sugar substitutes, enzymes, liquid nitrogen, sous-vide, dehydration, and other nontraditional means, but these do not define our cooking. They are a few of the many tools that we are fortunate to have available as we strive to make delicious and stimulating dishes."* What is also interesting to note about their statement is that they hardly mention science, or the scientific method, once!

Finally, here, the fourth of the *10 Principles of Modernist Cuisine* (http://modernistcuisine.com/about-modernist-cuisine/principles/) makes a similar point: *"Diners have expectations—some explicit, some implicit – of what sort of food is possible. Surprising them with food that defies their expectations is another way to engage them intellectually. This includes putting familiar flavors in unfamiliar forms of the converse."* At the same time as engaging the intellect, however, the authors end-up stressing the fundamental need for chefs to: *"always strive to produce the most delicious, technically exquisite food"*.

Ultimately, therefore, it can be argued that the new cuisine is defined as much by its innovativeness, its novelty, its creativity, and by the way in which it engages with the diner's intellect and emotions (with the diner's brain in other words), as much as with their gut, and with the search for deliciousness.

Social and sustainable cuisine

While there is a sense in which experimental cooking was made possible by global food security, the one thing to note about many of the more recent statements that have appeared on the topic of cuisine, such as *The New Nordic Food Manifesto* (http://www.norden.org/en/theme/ny-nordisk-mad/the-new-nordic-food-manifesto), the *Lima Declaration: Open Letter to the Chef of Tomorrow* (https://www.theworlds50best.com/blog/Events/-lima-declaration-open-letter-to-the-chefs-of-tomorrow.html), or even the *10 Principles of Modernist Cuisine* (http://modernistcuisine.com/about-modernist-cuisine/principles/) is the increasing stress on food sustainability, be it local sourcing, or foraging, of ingredients, earnest attempts to reduce food miles, or concerted attempts to reduce food waste in the kitchen. It is, we would be tempted to suggest, how chefs position themselves in response to such growing concerns around food sustainability that will mark out what comes next from the kitchen, as much as anything else the top chefs manage to do (see King, 2018; https://www.unric.org/en/latest-un-buzz/30598-is-sustainability-the-next-stage-of-gastronomy). Solving such global problems will likely require a highly-innovative approach and, as such, we are hopeful that many of today's chefs, those who have been practicing experimental cooking, molecular gastronomy, call it what you will, will be well-placed to face the challenges ahead full-on.

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