Rainbows teaching us of diversity in our (molecular) world

Inaugural lecture/Oratie

Prof Wesley Richard Browne

Rainbows teaching us of diversity in our (molecular) world

Leden van het College van Bestuur, zeer geachte aanwezigen.

Ik ga het in mijn oratie vandaag hebben over mijn visie van de toekomst van mijn vakgebied. Maar ik moet het ook hebben over begrippen zo als diversiteit en inclusiviteit met betrekking tot mijn vakgebied en onderwijs en onderzoek in het algemeen.

Nu begin alweer een paar moeilijke punten. Eerst, moet ik zelf een duidelijk beeld hebben over wat mijn vakgebied eigenlijk is –'wat is mijn ding'.

Maar wij komen zo terug op dit punt want ik heb een taal probleem.

Door mijn oratie in het Nederlands uit te spreken, sluit ik het merendeel van de gasten uit. Mijn andere optie is dat ik mijn moedertaal – Engels – gebruik maar dan sluit ik bijna iedereen uit behalve mijn zus, die gelukkig aanwezig is, en andere gasten die uit Ierland komen. Dus om zo inclusief mogelijk te blijven kies ik voor versimpeld Engels als de tal van vandaag – dus spreek ik wat langzamer, eenvoudiger, en maak meer gebruik van mijn lippen dan normaal voor mij is.

Schiet niet op de pianist; ik doe mijn best.

Members of the Board of the University, distinguished guests

In my inaugural lecture today, I will express my vision for the future of my research discipline. However, I will also discuss the impact of aspects such as diversity and inclusivity in relation to my discipline, and education and research more broadly.

I face immediately a few difficult points. First, I have to have myself a clear view on what my discipline actually is – what is my 'thing'.

I will come back to that point later as I have a more immediate language problem to deal with.

By delivering my inaugural lecture in Dutch, I by default exclude the majority of guests attending today. My other option is that I use my native language – English – however by doing so I will exclude almost everyone, bar my sister, whom fortunately is present today, and the other guests that are from Ireland. Therefore, in order to be as inclusive as possible, I instead choose simplified English as the language of the day – specifically I will speak slower, simpler, and make more use of my lips than is normal for me. I will do my best to be understood by everyone.

Dear guests, Dear colleagues,

In the macroscopic world we can observe our surroundings using the five senses, touch, taste, smell, sight and hearing. Which of these do you consider the most important?

Could you imagine living in a world without any one of them? There are many that have no choice in this, but on my short cycle to and from work every day it is clear that there are many that choose to use the minimum necessary to observe their surroundings, for example they don't seem to need to use sight as that can be devoted to aap-ing and/or sound since they can devote that to listening to lady GaGa's greatest hits with their noise cancelling (headphones).

But they seem to get on ok without use of these senses, since of course they can always rely on their sense of touch to recognise a lamppost or taste when the encounter a pavement.

It is natural I guess that no matter what capabilities are at our disposal, we tend to focus on using the minimum necessary to do a job, which, if it works most of the time, is fine. Good enough. Indeed, if it works and we are comfortable with using a subset of the senses at our disposal then the one we use most, quickly becomes 'the best'.

It is natural that we subconsciously choose to limit diversity in the tools we use – it makes life simpler, easier, albeit maybe also a bit duller.

It is only natural to do this. But why?

Indeed the best tool or the best person for the job should always be chosen, no?

I argue no. I argue that the mantra of the 'the best' is false. I argue that 'the best' is only ever subject and by seeking the best, we miss the point completely. I argue that we should chose diversity.

Diversity continues to be, often, a contentious point in many aspects of the modern world but its importance, especially to science cannot be overstated. Diversity is not something that we have to achieve, a goal, but is at every level essential to scientific progress and hence should be integral to how we teach, learn and carry out research.

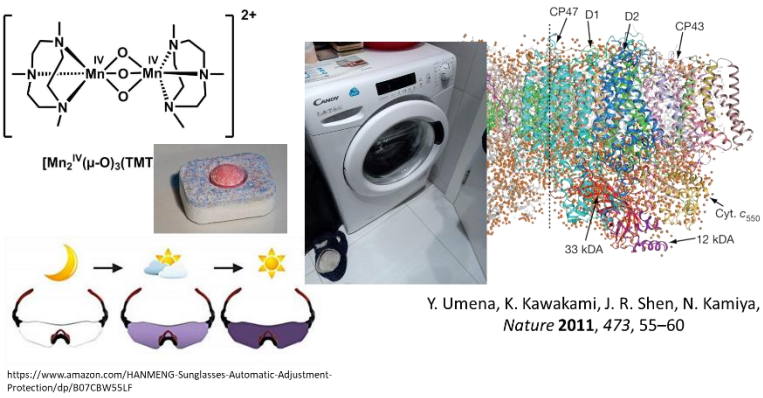
The question of course is how we do this.

Actually this is really two questions: the first is why do we focus on the best techniques the best tools for the job and why as scientists do we ignore diversity so easily but convince ourselves otherwise.

Sensing in the molecular world

Today I will speak to you about what in Dutch is called my 'vakgebied'. My world. And what I see as its future and the challenges we set out to face in that future.

In my world, the molecular world, our goal is to seek to understand every increasing complexity and the mechanisms by which molecular systems work, be they industrial catalysts, enzymes (natures factories) or react sunglasses, and to understand, we must observe these systems as they work.



Our molecular senses move far beyond those we use in the macroscopic world, beyond the colours of the rainbow that we see with and the vibrations of air that bring us sound.

Nature gifts science the entire electromagnetic spectrum and a diversity of interactions with matter which we can use to sense the world around us. It gifts us also touch 'stickiness' that we call chromatography (scheikunde or separation science) and sound (for example piezoelectrics) with which we can feel and hear the world around us. But, as in the macroscopic world, in our day to day lives, we scientists, we are also of course people, seem to tend to limit our attention to only one and sometimes to two of the best of our molecular 'senses'.

Vakgebied!

The Dutch term Vakgebied is loosely translated as discipline in English. But it is not quite that. Indeed the term scientific discipline has become an taboo word in the Netherlands as it seems to conflict with the concept of interdisciplinary research that is being pushed so hard by funding agencies and universities in part in the name of diversity.

A better translation of Vakgebied is 'your thing', your USP – unique selling point, what you are (defined, of course, by what you have achieved rather that what you do).

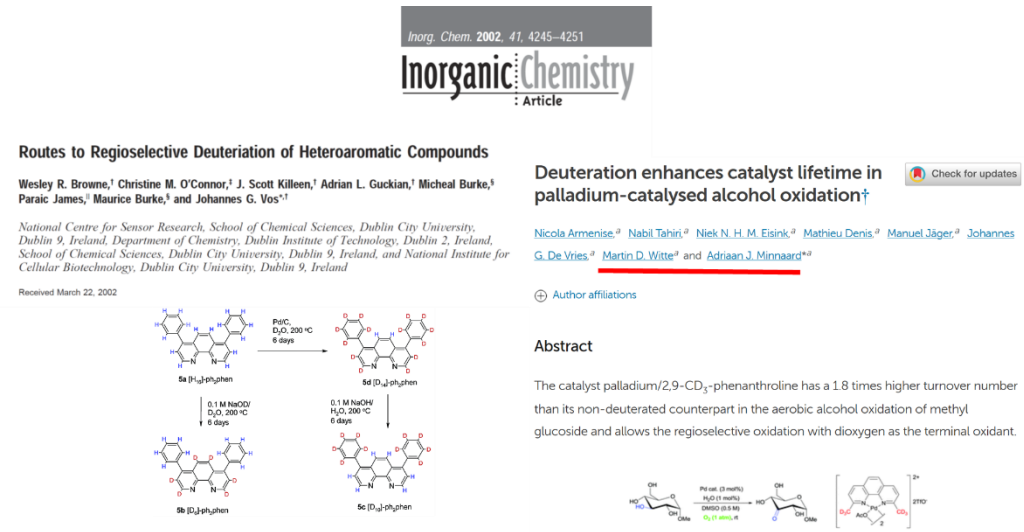
The term Vakgebied in the Dutch context is something I have never been comfortable with. I guess it is because I am not quite sure what I am, what is my 'thing', what am I about; however one puts it. Basically where do I fit in.

I am proud to be a member of the Stratingh Institute for Chemistry. So I must be a chemist or at least I am for chemistry. I chair the research unit Molecular Inorganic Chemistry.

At its simplest, I guess that I am an inorganic chemist. I don't think my promotor would disagree – but unfortunately those words 'inorganic chemist' create a box and I am pretty sure I spend most of my time out of that box despite the best efforts of some to put me back I my box occasionally.

You could argue that in the end your scientific publications can easily be used to define you – i.e. defined by what you have achieved.

Well consider this. One of my first first-author papers, which was submitted to journal inorganic chemistry came back with positive reviews but also a comment that there was no actual inorganic chemistry in the paper. Well that was in fact true, but the results and subject were certainly useful to the readers of the journal, the inorganic chemistry community.



The fact that it would later be useful to my colleagues doing organic chemistry was something that did not occur to me at the time – because I was an inorganic chemist after all – but it did later make me doubt myself.

So which box do I fit in then?

To answer that I ask myself what do I do all day – well mostly paperwork so I must be a manager.

Ok maybe I have to rephrase my question: what do I like doing all day instead of paperwork?

Observing!

What does observing mean. We all do it. A parent does it intensely in the first weeks after a baby is born. As a teacher we observe how students change over the course of their education.

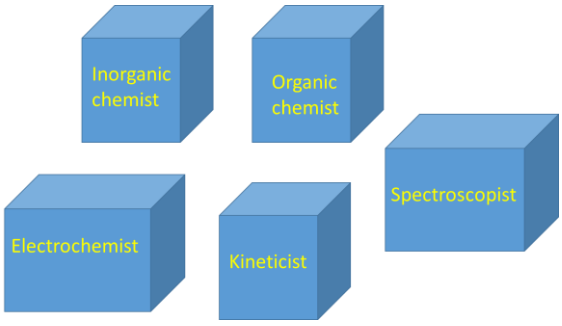
We all observe. But what does observing mean.

Observing is more than just sensing – 'seeing'. It is sensing over time. It is sensing how the state of a system, how something is, changes over time. Observing how things change is my 'thing'. To observe you have to 'see', and that makes me first and foremost a spectroscopist. I want to see more and more detail of the thing I am observing and make as much use of the EM spectrum as I can. In some people's eyes it means I like to play with lasers. That is true, I do.

But I have other senses available to me as well, electrochemistry for example, in which we use electrons, electricity and not light to observe the molecular world. That makes me an electrochemist.

As I said, I like to see how things change over time – how fast, how slow, how much , how little. I don't go into the lab to look at pretty pictures. I watch movies. This makes me a kineticist.

But I also like to make things and not only laser setups. I like to make new compounds. I think of the people over 40 in this room I am one of the very few whom has made a new organic compound in the last year with one's own hand – I am an organic chemist then. But don't tell my postdoc supervisor as he doesn't know that I could do that.

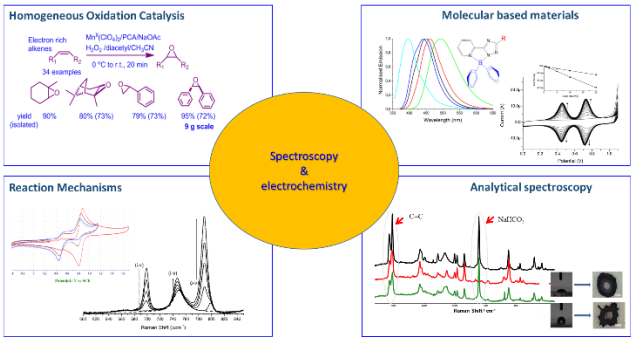


Yes in chemistry we have plenty of boxes but I don't seem to fit in any of them. And that is a bad thing because I want to belong to a group – fit in a box where I feel I belong, where I feel accepted. Doesn't everyone?

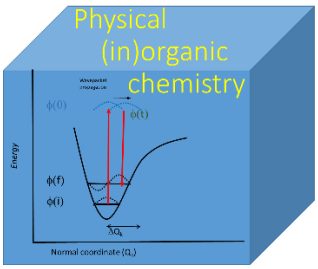
But I have never been comfortable in any of these boxes, Electrochemist, Kineticist, Spectroscopist, Organic chemist, Inorganic chemist. I am and always have been an outsider. But there is nothing stopping me from defining my own box I guess – my own discipline, vakgebeid.

Of course I have this problem of defining who I am regularly when I introduce myself during lectures at other universities so I will say now what I always say.

My group is busy with many areas of chemistry, analytical methods, functional organic materials ‘switches’, transition metal catalysis, reaction mechanisms.



I do spectroscopy and electrochemistry to work out how things work. My box is Physical (In)Organic Chemistry.



Not really the catchiest name for a box I guess.

Ok I have defined my box so I should be happy. But I am also subject to the laws of quantum mechanics and as such, as I am sure my Dean a theoretical physicist would appreciate, no matter how high the barrier to ‘leaking’ out of my box is – I inevitably will.

Indeed my first publication of 2019 was in dentistry.


CLINICAL ORAL IMPLANTS RESEARCH WILEY

Phase transformation and fracture load of stock and CAD/CAM-customized zirconia abutments after 1 year of clinical function

I can assure you that doesn’t make me a dentist though.

So what is my thing? What is my accomplishment? I was asked that last week by a colleague. I have to admit I had never really thought about it. An advice given to me over 20 years ago by an old Dutch professor was that to be successful in the future, one has to forget one’s past success. He was right, a high H-index, high citation number do not make new science. Track record is important, but as the English say, you can read yesterday’s news after you have finished your fish and chips.

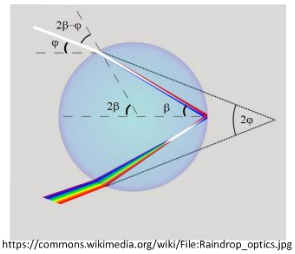
But it did make me think.

So what is my thing.

To paraphrase a coke cola add from the 1970s (before my time I might add), I’d like to teach the world to see.

The focus of my group's research is on mechanism – how things happen; why they happen and how we can use that understanding to predict the effect of changes to conditions is primarily fundamental. First and foremost, we want to understand.

I have no intention that any research we do or do in the future will be done because it is 'useful'; that it will lead to intellectual property; that it will be worth something. The only good reason to study the behaviour of compounds in reactions and the properties of materials is to learn something new; to advance the body scientific; to challenge students to not only apply now routine methods to study reactions and materials but to innovate in both how information is gathered and to learn to 'let the data speak'



https://commons.wikimedia.org/wiki/File:Raindrop_optics.jpg

On the screen, what do you see? Why do you see it? What can one learn from the observation.

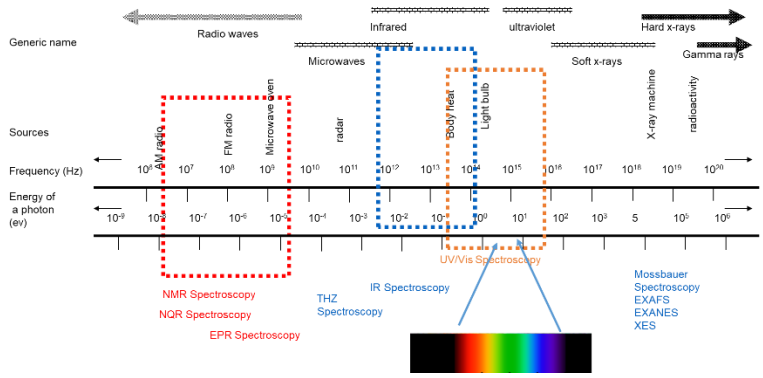
Light (the late morning sun low on the horizon) shines through raindrops which act like miniature ball lenses (glass beads) and undergoes dispersion to greater or lesser extent depending on the wavelength (colour) and reflects back almost towards the direction the sunlight comes, in this case, by me.

The observation of a rainbow can be explained by physics but what extra information can be gleaned from this spectroscopic observation. What does the rainbow actually tell us if we let it speak? What can we do with this information.

Well, I live on the south of the city and have to cycle to the Zernike complex in the North of the city and it is the morning. Observation of the rainbow means that it is raining to the north of my position – the information can be interpreted. I can expect that I will get wet on my journey to my office.

I want to spend a few moments considering rainbows in more detail and what they mean, to me, to you and to others. The rainbow, aside from being a natural phenomenon, has meaning projected upon it. As an Irishman the rainbow first and foremost means one thing. It is not that it is raining – in Ireland it is always raining so we don't need a rainbow to tell us that! To an Irishman a rainbow is hope, the hope that if you can follow it to its end you will find a pot of gold guarded by a leprechaun.

As a scientist, the rainbow shows diversity. It reminds us that even when all you see is just white, that you should not assume there is no hidden diversity. But even when we see that diversity, when we see the colours that make up the rainbow, we are using just one of our senses. As a scientist we can use many more senses to see the true diversity, and utility, in white.



De toekomst (the future)

A few minutes ago I stated that I have no intention that any of the work we do to understand mechanisms will have an application or is 'useful'. But of course there is no reason that what we do cannot be useful or have an application that we had not intended. As I said my group is busy with many different areas of science including a program, together with several large companies and colleagues in Groningen and around the Netherlands, several of whom are here today. With such a large program and a diverse club of scientists it must be a ground breaking exciting topic. I have to tell you the project is as exciting as watching paint dry.

And now I am going to say something which puts me in a particular box – the nerd box.

Watching paint dry is amazingly interesting.

It is interesting because it is one of the hardest problems I have ever had the good fortune to work on.

It is interesting because we have had to throw every molecular sensing technique we have at the problem.

It is interesting because it has allowed a diverse group of students and industrial researchers to interact on a level playing field and learn to value each persons 'superpowers', whatever they are.

In the days of fast fashion and quick turnarounds, where we have to get a nature or a science paper accepted to be considered excellent researchers, it is a breath of fresh air to work on real problems that are not so sexy but are critically important to our day to day lives, our economic well being and the environment.

Yes paint drying is important, but so is your dishwasher, so are false teeth, so are epoxy resins, alkyd paints, making syn-diols. But again, these problems are interesting to me because the involve process, change – things have to happen for them to work. If something happens there is a mechanism by which it happens. These problems are interesting to me because they present hard problems. They force us to be diverse in both the team we build to address these problems as much as the breath of techniques we use to do so.

Indeed the study of mechanisms is fascinating because the problems are never really solved. There are projects running in my group that have entertained very many students (including me) over as much as 20 years. And they are still on going and since I have at least 25 more years of research to look forward to (well I hope I have) then I doubt my excitement for studying mechanisms will ever dim. I think I have found by box after all. I study mechanisms.

That is my thing.

And is that important?

Will any of the mechanisms I study lead to anything? I don't and can't know. But for sure the skills and experience in problem solving that studying them develops will be invaluable when the time comes. We will be prepared.

As I said earlier, in the macroscopic world we can observe our surroundings using the five senses. In the molecular world we have many, many, more with some of the best known techniques shown on the screen.

Could you imagine living in a world without any of them? Admittedly there are many present who have never used any of them but of course not everyone here is a scientist – some of you have real jobs. But to be serious, again there are many that have no choice in this – some methods are just too expensive, require too much resources to run. But let me rephrase the question. Which technique do you consider the most important? I realise that for some of you this is a bit of a moot point and for those of you that live in the real world, an irrelevant one. But for many of you the answer is obvious. It's the one you use most. The one you rely on. The one that gives you the best results that works for you. It's the best technique.

If we are honest with ourselves, even though most of us have a well-stocked toolbox in our garage or storage room at home, there is probably a flat head screwdriver sitting somewhere handy in your kitchen or living room. Why? Because for pretty much every job the screwdriver is either the most appropriate tool or can do the job reasonably conveniently even if there is a more appropriate tool lying unloved in the toolbox.

But this way of working, which we take too often in science, ultimately limits our ambition, our potential, it can hold back our progress in research and what is worse; we often never notice.

If we want to go as far as we can, if that truly is our ambition then we have to change our approach to research and instead of focusing on the best technique; the best being defined as the technique that is the most comfortable and solves our problems almost all of the time; we need to consciously chose for the techniques that we are not comfortable with, that we do not know so well, that is maybe not recognised as the best technique. We need to embrace diversity in our approach to research and embrace as wide a range of techniques as possible, we need to give every tool in our toolbox an equal chance.

Why? This approach seems to waste time and resources. It does not get us to our answer faster than simply using the best technique.

But we need to do this because it familiarises us with the abilities and opportunities each technique offers, brings to the table. We need to do this because when in our efforts to understand molecular systems, we will be aware and take advantage of the opportunities to explore those systems that are open to us. Of course this holds for people also – diversity is always better than the best.

But I want at this point to make a comment on inclusivity and opportunity also. As I mentioned, for many researchers, the choice of tool to use in their research is made on the basis of availability. They really only have a hammer and have no choice but to approach every problem as if it were a nail. In the earlier years for my group all we had was a hammer and a screwdriver and I am grateful for the open access to equipment and training provided by my colleagues both in Groningen and outside the Netherlands.

Over the 11 years since I was appointed as assistant professor in Groningen and indeed since I arrived in Groningen in 2003, it has been my good fortune to have the wholehearted support, if not always comprehension, of my colleagues in building our capacity in spectroscopy and electrochemistry. I am not yet done of course but we now have a very well stocked toolbox at our disposal.

However, I have the duty now to respect karma and to open our doors to others, and share not only access but also experience and to help train students from both other groups in Groningen and from Spain, France, Ireland, Denmark, China….well anywhere; To even out the playing field in regard to opportunity for students and in end it takes a village to raise a child. We now live in a global village.

My vision of my vakgebied for the future is bright. The search to understand mechanisms – how the molecular world works and to develop and expand but also to reinvent the techniques and methods to do this will in equal measure continue to be the focus of my passion for science because these are the playing fields on which to inspire generations of young talent to show their ‘True colours like a rainbow’ and to grow by embracing diversity and reach across disciplines in all aspects of life.

Tenslotte (to end)

Ik heb nu al ongeveer vijf en twintig minuten over de toekomst gesproken maar ik wil ook iets zeggen over het nu en het verleden.

Ik ben nu gelukkig. Ik ben nu gelukkiger dan ooit. Waarom is dat?

Ik ben gelukkig dat mijn zus nog bij ons is ondanks wat er is gebeurt in de afgelopen jaren.

Ik ben gelukkig dat ik een diverse groep van jonge toppers om mij heen heb.

Ik heb geluk dat de studenten in onze groep mij eerst als een vriend zien---- en daarna pas as docent en mentor.

Ik heb geluk dat onze groep zo divers is.

Ik heb geluk dat ik per ongeluk scheikunde gestudeert heb.

Ik heb geluk dat ik docenten had die altijd de lat hoog gelegd hebben.

Ik heb geluk dat ik docenten had die altijd achter mij stonden zonder voorwaarden te stellen of iets terug te vragen.

Ik heb geluk dat zij mij geleerd hebben dat steun en verwachtingen allebei nodig zijn in het opleiden van studenten –kennisoverdracht is alleen het begin van een opleiding. Het is veel meer werk dan dat.

Ik heb tuurlijk pech dat twee van mijn leermeesters, Paraic James en John McGarvey niet meer bij ons zijn.

Maar ik heb geluk dat ik nu de kans heb om studenten op te leiden en te begeleiden op de manier dat zij mij opgeleid hebben – om terug te geven wat zij mij geleerd hebben.

Ja, zeker. Ik ben gelukkig.

Ik heb geluk.

Ik heb gezegd.