Interview with Nicolas GIUSEPPONE

Nicolas Giuseppone defended his "European Label" PhD at the University of Paris XI-Orsay in 2000; at that time, he was working in Prof. H. B. Kagan's laboratory. His dissertation was related to the use of samarium diiodide in diastereoselective and enantioselective transformations. Dr. Giuseppone then moved to the Scripps Research Institute, in La Jolla, CA, as a postdoctoral associate in the group of Prof. K. C. Nicolaou. There he was involved in the first total synthesis of Diazonamide A, a highly potent antitumoral secondary metabolite presenting unique structural features. In 2002, he joined the laboratory of Prof. Jean-Marie Lehn in Strasbourg as a CNRS junior scientist and started working on dynamic combinatorial chemistry. He defended his Habilitation thesis in 2005 and became Full Professor of Chemistry in 2007 at the University of Strasbourg, after which he created the SAMS research group at the Institut Charles Sadron (ICS). In 2010 he was awarded a Starting Grant from the European Research Council (ERC), then became deputy director of the ICS in 2012. His current research interests focus on Supramolecular Chemistry and Systems Chemistry, more specifically for their implementation in soft-matter science.

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What made you opt for a career as a researcher? How would you define your job?

In fact, this came step by step, the first one definitely being my grandfather's contagious passion for science in general and for astronomy in particular. Since we spent nights together observing stars and days discussing about the physical meaning of space and time, I became fascinated by what might exist behind and beyond them. At the university I was quite interested in the complexity of biology during my early studies but finally, at the last moment, I turned to chemistry because I felt that acting on the diversity of matter could bring me plenty of freedom to create my own objects of studies. At this stage, a sense of art in chemical synthesis was a strong driving force for me.

This was confirmed during my Master's degree when I entered the old wooden laboratories and the library of the Ecole Normale Supérieure de Paris for the first time. Something in the air was magic and I knew at that precise moment that I had found my path.
I view my job as a permanent obsession to prove what I suspect from experiments, using the rules of scientific reasoning. This is an extremely demanding way of working but when I understand or find new phenomena, the hard moments vanish and only strong satisfaction remains.

We'd like to catch a glimpse of your daily activities. What is a typical day (or week) for you?

Well, this varies enormously from day to day and month to month; I share my time between several quite different activities. First, a lot of my time, is spent planning the research proper which includes raising funds (which means writing projects) and attracting good students when my applications are successful is a heavy part of the job. Then, the daily research itself with PhDs and Post-docs is another and very unpredictable part of the job, with many technical problems to solve at any point of the project and, believe me, this part is a never-ending story, but it is also here that the most exciting and unexpected things happen. When projects work, I might also come to publish my work, and this is again very demanding when I want to target good journals because I have to convince independent referees who judge my work usually as competitors. But this is what makes science progress and develop overall. Releasing my new findings in international conferences is also part of the work and I usually have to travel quite a lot for that. Finally, teaching at the University is another very important task which requires long periods of preparation prior to lectures. Besides, I also have to work for the scientific community by participating in many committees of evaluation, by referring manuscripts, by organizing conferences, and so on. If you include administrative duties and rules to follow, you can understand that I am usually kept more than busy and that a good part of my time consists in organizing all of it.

DYNANO brings together Research labs, an SME and two big companies. How do you view research-industry collaboration within the framework of the project?

This is a fantastic opportunity for all of us to progress because it creates a symbiosis with complementary expectations from the different partners. I come from academia, where we often want (or dream) at some point to make use of our findings. Ultimately we want to push our findings into the market, but we usually don't know much about the reality of this market and what is needed to go through. The gap between what we have found at the bench and what can be used by industry is very wide for many reasons.
This is something we usually don't realize because there aren't many bridges between the industrial and academic worlds. Companies look for new products and processes which can be more efficient but also more easily patented; it is mostly fundamental research that can bring such breaking technologies. However, companies are tied by time and money, and investing in something which might never reach industrial requirements is really risky. This is why being in contact with academics helps companies refresh their views on what is seen as established fields; it also provides opportunities in opening new ones. Combining these different views and objectives from these two cultures can open new and unexpected routes. Establishing such a synergistic network is a great asset of DYNANO. In addition, it is quite a unique environment for students involved in the program to be in contact with these two worlds; this can help them make their choices for the future and broaden their view of science and technology.

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The DYNANO project has been designed with a strong emphasis on interdisciplinary training. Interdisciplinary work implies integrating concepts from different disciplines: what do you expect from crossing traditional boundaries?

I expect the best from interdisciplinary research; but to succeed we have to be careful. Indeed, science has no boundaries— this is increasingly the case nowadays. This is especially the case in chemistry, which bridges the gap between physics and biology, and DYNANO is essentially based on chemistry. However, even though multidisciplinary concepts are powerful and attractive you cannot dispense with being a specialist in your very specific domain. The level in science is, by and large, too high and too technical to just look at things from far away and imagine that you will come up with a global and far-reaching breakthrough by, simply because time is limited and because you can get a deep understanding of only a very narrow piece of knowledge. The key is thus to be at the forefront of your specialty while keeping yourself very well informed about what is going on in other disciplines. But in order to do so, you need to meet people, take time to discuss issues, understand each other, and to find common interests. This is exactly what DYNANO is providing—a platform for discussions and trainings, in order to merge concepts and techniques brought by the best specialists in their fields. What is considered as interdisciplinary today might become a specialty in the near future, which will ideally be the outcome of some endeavors pursued in the network.

What advantage will DYNANO's interdisciplinary training give to the PhD students and post-doc researchers recruited?

This is the point where we come to the core meaning of DYNANO, which is above all a training network. Being educated in science with such a strong interdisciplinary environment is something I have not seen before. As mentioned before, the students will become aware of the concerns that people have in industry, in academia, in biology, in drug discovery, in physical-chemistry, in synthetic chemistry, in systems chemistry, and in materials science. This is unusual and very interesting. They will benefit from that context not only by attending regular meetings, but also by seizing the opportunity to work in other labs for a given period of time. This means that they will end up with a broader vision and a wider technical knowledge, in comparison to a more "classical" training. This is a strong asset for their development as future researchers, and obviously, on the spot , for getting positions on the market. On the other hand, the fact that these periods abroad are limited in time will ensure a balance between what should be brought by interdisciplinary studies and what should be pushed forward as a specific technical project over a maximum period of three years for a PhD. Finally, beyond the contents of their scientific projects, recruited researchers will have to adapt quickly to different working environments in different countries. This is another very powerful experience which will help them with their whole careers and lives.

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The new field of systems chemistry studies molecule networks: chemists can now investigate how interactions between members propagate through networks, allowing complex behaviors to emerge. Has this new field changed the way you work and envisage chemistry?

Yes. For me there is no doubt that this is the new frontier for chemistry, and it might be the ultimate step to bridge the gap with life science, although there is still a lot of work ahead. But we are now clearly integrating all the parameters of space and time in these chemical networks which allow emergence and self-organization processes. In fact, this domain of systems chemistry itself is founded on a multidisciplinary approach. People in mathematics were interested in networks back in the 18th century, namely networks by Leonard Euler, who originated the graph theory; other investigations in collective behaviors of complex networks came from very different domains such as sociology, computer science, and obviously biology with the mapping of gene and protein networks. The term "systems chemistry" itself is a parallel with systems biology, which attempts to decipher these networks from complex structures to their building blocks. Interestingly the chemical approach, has been conceived just from the opposite direction: how can we build complexity from simple components? Today we are lucky as chemists that people before us developed the synthetic and analytical tools to construct and analyze more and more complex mixtures which amount to systems chemistry. Along that road, the development of supramolecular chemistry in the past 50 years has been instrumental in opening the way for studying interactions between molecules. In that sense, systems chemistry is a continuation of supramolecular chemistry, but in multicomponent systems, and also a field in which supplementary cooperative effects act at the network level, depending on its topology and kinetic constraints. Furthermore, I believe that the question of the origin of life is a fine question to be addressed by systems chemists, because a cell is no more, but no less(!), than a self-organized network of small molecules and polymers which interact with one another to self-sustain and grow. I believe that this new field will also give birth to numerous findings and applications in materials science: the next generation of “smart” materials will certainly come from systems chemistry. It is always hazardous to try to predict the future of a nascent scientific field, because it is most likely you will come back to this interview twenty years from now and realize that everything you said was wrong… but I want to believe this will not be the case here.

Thank you Nicolas, and all the best for DYNANO.

ICS building

DYNANO in brief

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