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Q & A

Laurent Blanchoin

Laurent Blanchoin graduated in cell and molecular biology from the University of Paris VI in 1996 after working with Marie-France Carlier. He then pursued his postdoctoral work with Tom Pollard, first at Johns Hopkins Medical School in Baltimore and then at the Salk Institute for Biological Studies in La Jolla. In 2001, he was awarded a young investigator grant to start his own group at the Cell & Plant Physiology Laboratory in Grenoble, where he began investigating molecular mechanisms controlling actin cytoskeleton dynamics using a combination of biochemical, biophysical and theoretical approaches. In 2009, together with Manuel Théry, he created the Cytomorpho Lab in the Nanobiology Campus in Grenoble, where he is trying to connect in vitro *biophysical approaches with cell biology to establish the rules directing cytoskeleton organization during morphogenesis. An important part of the effort in their lab is to develop original technological tools that can be used at the molecular and cellular levels, thus helping to bridge these different levels of complexity.*

How or when did you decide to move to science? I never had a big career plan. After my baccalaureate, I went to university because I did not know exactly what to do and in France this is a classical choice. My first three years at university, in fact, I was more interested in sports (running) than science. Maybe because of the way biology was taught at the University in Toulouse, science was not so appealing. What actually got me interested in science was working in a lab. I did a 6 month rotation in the early 90s in a small startup company and every day I was exposed to a stimulating intellectual challenge, from the design of new experiments to the use of new technological tools. Working in a lab felt rapidly like home to me. But after my master's degree, I had to stop for a year to do my military service. Coming back from this unique experiment, I was really motivated to start a PhD, but it was very difficult to find a position after this break. I was really lucky because the Carlier lab in Gif-sur-Yvette was looking for a PhD student with my profile to work on the biophysics of the acto-myosin system. At the time, I did not know that this choice to work on the cytoskeleton would have such a huge impact on my carrier. Even after 20 years, I am still fascinated by the challenge of understanding cytoskeleton organization.

After your PhD how did you decide where to go for your postdoc? At the end of my PhD, the Carlier lab started to work on actin-based motility using *Listeria monocytogenes* as a model system. I was then and am still now really excited by the challenge of understanding how the cytoskeleton can generate a force. You also have to realize that, even if I am not that old, we did not have access to the Internet at the time. I had my first e-mail account at the end of my PhD. So I was using the current content to follow the scientific developments on this topic. And I really enjoyed the quantitative cell biology from the Pollard lab. Specifically, his classic paper from 1986 where he used electron microscopy to determine the rate constant of actin at the end of the filament. In addition to how elegantly the experiment was designed, I was very impressed because Tom is the only author on the paper. Once again, I was lucky that Tom had a position available in his lab for me just after my PhD, so I moved to Johns Hopkins Medical School in Baltimore and afterwards to California at the Salk Institute when he became the Salk president. It was an amazing time, both at the scientific level because during this period (5 years) the entire actin field was really creative and some major discoveries — including the mechanism of actin nucleation and branched actin network formation together with the reconstitution of actin-based motility — were made, but also at the personal level. In addition to working with Tom, I had the chance to interact with amazing young scientists in the lab who are now well-established professors.

Any advice for young PhD students? I think the first question that they should ask for themselves is: how much effort am I ready to put into science? I think for most of us science is not a job but a passion. So we are ready to accept a lot of frustration to achieve this passion, including failed experiments, grant success rates below 10%, rejected papers, unjustified criticisms

at conferences or meetings by colleagues… But the pay-off is every day when you come to the lab, you feel that a new challenge is in front of you and this is very exciting. In some ways, I find in science what I experienced as a competitive runner. You train very hard, which is sometimes painful, but the challenge to beat your best time is what takes all the pain away.

How has your job changed since you started? Actually, when I was a student or a postdoc I did not realize how lucky I was to be able to do science without worrying about anything else. Now as a PI, this is the opposite; an important part of my job is to take care of everything in addition to the science. I often compare my job to the head of a small company where I need to make sure the money is OK, the equipment is running and the people in the lab are happy on a day-to-day basis. This part of the job nobody really teaches you. And with the economic crisis, running a lab is not easy because the money is tight. But I should admit, I really enjoy interacting with the people in my group and seeing them growing and moving away is really rewarding, but it is also sad when they leave.

I also changed my way of doing science. Early in my career as PI, I tried to limit the risk by addressing a question limited to the biophysics of the actin system. Then, our work became more interdisciplinary with important contributions from computational biology or modeling. Now, we are expanding our lab towards systems biology where we use a combination of technological tools that we developed in the lab — imaging-based assays *in vitro* and in living cells, as well as biochemistry and biophysics together with theory and modeling.

If you could do it over, would you pursue the same research career? Yes, I would choose the same career with the same scientific questions but I would try early on to expand my knowledge in physics, mathematics and chemistry. Our field is truly interdisciplinary and I spend more and more time interacting with our collaborators using mathematical and biophysical modeling that provide the tools necessary to formalize the concepts developed in the lab. Having a strong background in these disciplines would definitely help me to enjoy interacting with these colleagues even more.

What are you doing outside science? I have a family with two kids, 5 and 10 years old, and my wife is also a scientist. But we try — and it is not always easy — to have time outside science for the kids. As a big commitment, we decided to travel together as a family for four weeks every year. Last year we went to Indonesia, this year we are going to Vietnam and Cambodia. This is a fantastic time, because all the family is discovering a new way to live and every day for four weeks is a new adventure. When we come back from such a trip, in addition to having seen some fantastic place, we realize how easy life is in France.

How do you see the future of your field? There is no doubt that technological development is an important aspect of what drives the cytoskeleton field in particular, and cell biology in general. For example, until 2001, it was almost impossible to follow a single actin filament growing *in vitro*. And the first time I saw a direct visualization of an actin filament under a TIRF microscope, I knew that the actin field would not be the same. And in the past 10 years the new discoveries made based on the use of this technique to study cytoskeleton dynamics have been unmatched. In addition to improving imaging technology and analysis, labs are developing microfluidics, microfabrication, surface patterning, and force measurement tools that allow us to ask new questions about the physics of the cytoskeleton and its relevance for its organization and cellular function. This is true not only at the molecular level *in vitro*, but also at the cellular level where the field of mechanobiology really benefits from new technological tools.

We see also the appearance of optogenetics, which allows us to locally and rapidly manipulate the cell, limiting the possibility for the system to adapt to a perturbation. Proteins in general, and molecular motors in particular, can also be manipulated by light, allowing them to change step size or directionality. By doing so, we can really start to dissect how molecular properties correlate with a cellular response. I truly believe that this is one of the major challenges in biology, we have a good understanding of how molecules work, we know their cellular localization, but it is very difficult to translate a molecular mechanism to a cellular response and even more difficult if we consider the multicellar or tissue level.

Where do you see room for improvement in science? I think, as scientists, we should realize that our duty is to share our discoveries as quickly as possible. In most cases, because we are afraid of competition or not to be the first to publish a result, we hide our findings until the last moment. This tactic is obvious at meetings where the amount of unpublished data presented is decreasing. I remember a meeting last year where a postdoc showed a result on a poster and would not tell anybody how he did his experiment. I understand the importance of the publication for a career but to move the science faster it is really a limitation. I am not against competition — I think it is good because you are often better when you compete with somebody for a goal — but we should be able to communicate better, at least at meetings or conferences. In that sense, Gordon Conferences are in general very good because it is mandatory if you give a talk to present unpublished results and I truly believe that should be a general rule instead of an exception.

This is also why I see joint grants between different PIs as a very good way to have experts working together. I had the chance in 2009–2010 to have my friend Enrique De La Cruz, professor at Yale, come for a year's sabbatical in my lab. It was just fantastic to have him around and we exchanged so many ideas that we rapidly made some important breakthroughs. In that sense, having a joint lab with Manuel Théry also helps a lot. I do not think I want to go back to being the sole PI of my group because we learn so much from each other that the science is not only more fun but definitely more efficient.

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