Molecular Mechanics of the Cardiovascular System Lab at CNIC

Philosophy of work

Mission statement

We are a multidisciplinary team of scientists who investigate how mechanical forces determine muscle function at the molecular, cellular, tissue and organismal levels. Our motivation is to improve the understanding, diagnosis and treatment of cardiovascular and musculoskeletal diseases. At the same time, we train scientists, awake vocations in science and contribute to strengthen and disseminate the scientific culture.

Our laboratory was established in July 2014 to understand how the physiology of the heart is affected by protein mechanics. We explore how mutations in sarcomeric proteins cause cardiomyopathies. We study what makes a ventricle stiffer and more inefficient in conditions such as myocardial infarction. We are also interested in practical applications for our findings –for instance to develop biomaterials whose mechanical properties are regulated by the same mechanisms found in the heart. We take multidisciplinary approaches at the interphase between biology, physics, and chemistry. We do some programming in languages such as Igor for data acquisition and analysis, and we are also learning to develop our own instrumentation. One of our main strengths is to be able to study the mechanics of proteins using single-molecule force spectroscopy by Atomic Force Microscopy (AFM).

MAIN GOALS OF THE LABORATORY

- **Do exciting and solid science**. We love science and it is our pleasure to contribute to the global scientific enterprise. We want to generate new knowledge and publish high impact papers.

- **Training excellent scientists**. Most people in the laboratory stay for a limited amount of time ranging from a few weeks (undergrads) to several years (PhD students). We take pleasure in training and mentoring all of them so that they become an improved version of themselves by the time they leave.

- **Fundraising**. A fraction of the lab's time is devoted to apply to funding agencies to fund our experiments, pay salaries, go to conferences, etc. All people in the lab, particularly PhD students and postdocs, contribute to this effort and get trained in how to write competitive grant applications.

- **We are a team** and support each other's needs as much as we can. The success of any of us is the success of the whole group.

- **Have fun!** Our goals are challenging and require hard work – so we better have fun while achieving them. Working in a research lab is a privilege. Think about it, society supports us to do stuff with the potential to change textbooks and clinical practice –all of that while having a good time!

STRUCTURE OF THE LABORATORY

The structure of the laboratory is hierarchical in a way that has little to do with the kind of hierarchy that can be found in governments or the army. The group leader makes the important decisions and sets the overall goals of the laboratory, but scientific discussions are expected to

happen independently of rank and all members are supposed to show initiative. This is a list of the different positions in the lab:

- **Undergraduate and master students** rotate in the lab for periods ranging from several weeks (e.g. CICERONE summer program) to several months (Graduate Thesis, Master Thesis). Students at these levels are encouraged to learn as much as they can while developing small projects for which they can see progress through the duration of their stay. As an undergraduate or master student, don't assume that you have little to contribute to the lab. On the contrary, your input and expertise is very valued. Undergrads and master students are always supervised by more senior members of the lab. Master students may be invited to continue in the lab for their PhD always depending on availability of space and funding.

- **PhD students** are supposed to obtain their PhD in 4 years. Similar to undergraduate or master students, new PhD students generally need to be trained during their first months in the lab and are closely supervised by other senior members. Thesis projects are supervised by the group leader and potentially by senior postdocs or collaborators. PhD students are expected to secure their own fellowships (FPU, FPI, La Caixa, Boehringer, etc.). PhD projects are agreed by the student and the group leader. A good strategy is to develop projects where the expertise of the lab is combined with new approaches, experimental techniques, and/or topics. 1-2 short stays (2-6 months) at top international laboratories are encouraged. All PhD students are signed up to CNIC's predoctoral program, which provides a common framework for all CNIC's PhD students. An interesting feature of this program is that there is a Thesis Committee set up that includes the thesis supervisor, and two more members, one of them from outside CNIC. Also, CNIC's PhD students are granted 1,500€ that can be used for expenses such as short stays, attending to conferences or courses, printing their thesis, etc. If you have any doubt regarding PhD paper work or administrative issues ask current PhD students. We want all of our PhD students to be first authors in at least two papers in top international journals, and to be co-authors of other publications of the lab. PhD students usually write the first versions of their papers, which are then improved together with postdoctoral scientists and the group leader. At the end of the PhD period, students should be able to write very good papers, a skill that will be key for their careers. After graduation, students may continue in the lab for a limited time to finalize projects. A measure of our success training PhD students is given by the positions they take after graduation. We're especially proud if our students are offered postdoctoral positions at top international laboratories.

- **Postdoctoral scientists** join the lab after completing their PhD somewhere else. They may have additional postdoctoral experience in other labs. In the lab, postdoctoral scientists are trained in leadership skills to become independent scientists. Postdocs generally lead high risk/high gain research projects with little supervision of the group leader, supervise some of the junior members of the lab, write grant proposals and manuscripts, assist the group leader in management duties, etc. Depending on their career plans and availability of resources, postdocs can be supported to engage in new lines of research that can be taken with them when moving to an independent position somewhere else.

- **Technical personnel** are in charge of routine lab work to provide the lab with proteins, plasmids, etc., although they are also encouraged to participate in project design. Technical personnel also take care that consumables are available, equipment is working

properly, etc. The group leader prioritizes the tasks of technical personnel according to the global strategy of the laboratory. Having technical personnel as a support is a privilege for the lab –but can be detrimental for students if they fail to learn basic techniques such as buffer preparation, molecular biology techniques, protein purification, etc. Hence, students take care of most of their experimental needs, with occasional help from the technical personnel in agreement with the group leader.

- **The group leader** (Jorge) sets the overall goals of the laboratory, makes sure the laboratory works at full capacity, coordinates and supervises lab members, writes papers and grant proposals, designs research projects, disseminates results, hires new personnel, provides conflict management, teaches at undergraduate and masters programs, defends the interests of the laboratory, networks, reviews manuscripts and grant proposals, takes care of administrative duties, etc. Many of these chores make it difficult for Jorge to spend a lot of time at the bench. Still, Jorge's office door is almost always **open** for people to come in and discuss about science and other matters.

- Occasionally, we host **visiting scientists** as a result of collaboration with other laboratories or through specific programs of CNIC such as those targeting MD students and medical professionals (Res@CNIC and InvesMIR).

Technical personnel, PhD students and postdocs have scheduled meetings with Jorge every six weeks to plan and monitor specific objectives, but everyone can reach out for him at almost anytime to discuss scientific matters and doubts if needed. Members of the lab also have the support of Angel Ciprés (scientific manager in charge of accounting, bureaucracy, grant calls, hiring rules) and of several departments of CNIC (IT, management, facilities...).

ORGANIZATION OF WORK

Scientific activity has very little in common with an average nine-to-five, Monday-to-Friday job in industry or in an office. Developing high-quality research is very competitive and requires hard work. Advantages of such a commitment are that we are passionate about what we do, that we interact with fantastic people who are as passionate as we are, and that there is quite a lot of flexibility regarding work hours. In the lab, we support **flexible work schedule** regarding time-off and holidays always complying with CNIC's regulations (https://www.cnic.es/en/carreers/working-cnic). We spend a lot of time developing our projects so having flexible work hours make it possible to take care about other aspects of our personal lives. The only limitation to our flexible schedule comes from the fact that we are a team working together, meaning that as a general rule, **everyone is expected to be around from 10 am to 4 pm**. It's up to the lab members whether they want to complete needed work early in the mornings, in the evenings, at night and/or during the weekends, provided that progress is made in their projects. Also, if people are under the supervision of or collaborating with other members of the lab, they of course have to adapt their working hours. Holiday periods are agreed with Jorge and, if possible, planned several weeks in advance to minimize impact in submission of grants, publications of papers, thesis work, etc. In general, 2-3 short vacation periods are preferred over a single, very long vacation.

SEMINARS

Attendance to scientific seminars is encouraged. The official language for seminars is English. This is a list of the type of seminars at CNIC.

- Our **weekly lab meetings** (aka journal club). Exciting research papers, which may be unrelated to our primary research interests, are presented by a member of the group. Once

every 4-6 months students and postdocs present the progress of their projects. All presentations and discussions are held on English, although other laboratory matters are discussed in Spanish (as long as everyone present is fluent in Spanish).

- **CNIC seminars**: Mondays at 12 pm. These seminars are given by leading international scientists and CNIC's group leaders.
- **Area Seminars**. Tuesdays, **Wednesdays (Cell Biology and Development, our area, at 12:30 pm)**, Fridays. Students and postdocs belonging to the different areas present their projects here. Members of the lab make their best to attend all seminars on Wednesdays.
- Other thematic seminars are usually held on Thursdays or Fridays, such as the Mechanobiology seminars, co-organized by Jorge, which attract a bunch of scientists from the Madrid research area.

FEEDBACK, CRITICAL THINKING AND DISCUSSION

These three elements are central to the advancement of science. In the lab, they are encouraged, appreciated and taught. We learn from feedback we receive from other members of the lab, from colleagues, from reviewers, etc. We are thankful when people take the time to provide feedback to our work. Our lab members are encouraged to provide feedback to others as much as possible (by the way, feedback on this document is highly appreciated!). Critical thinking is key to engaging in fruitful scientific discussions, the engine that powers science. We teach our trainees not to be afraid to challenge other people's results or analyses in seminars and conferences, and to be ready to accept and discuss challenges made to their work –and to improve if necessary.

LANGUAGE

We use English in our notebooks, figures, reports, protocols, etc. Papers in journal club meetings are presented also in English. We use Spanish in conversations only if all participating people are fluent, otherwise we switch to English.

LAB NOTEBOOKS

The general idea is: "**All experimental results should be documented in a way that can be accessed by any member of the lab at any time**". We use electronic notebooks, which are great since they can be accessed from any computer in CNIC (or via VPN connection), they allow simultaneous editing by different people, they are backed-up by CNIC's IT department, and copies can be kept by members when leaving upon agreement with Jorge. Some people also have a personal paper notebook to take notes, outline experiments, etc. This hard copy notebook does not replace the electronic notebook.