SHORT REPORT

Names of organisers: Rebeca Aldunate, John Ewer, Carlos Oliva, and Jimena Sierralta

Title of Event: "Small brains, big ideas" Practical Course

Location: Santiago and Las Cruces, CHILE

Date: October 18-28, 2024

1. GENERAL SUMMARY

The "Small Brains, Big Ideas" practical course was offered for the seventh time October 18-28, 2024. The primary objective of the course is to expose students from Latin America to the use of invertebrate preparations for basic and applied research in neurosciences and biomedicine.

The course included (see Course Program):

- Lectures covering basic and also specialized knowledge about the use, genetics, development, physiology, and behavior, of these model organisms.
- Laboratory exercises with *Drosophila*, *C. elegans*, and bees
- Presentations by the students during which they talked about their research. For this they were asked to present a single slide that summarized their interests and work. We also asked them to bring a 3-5 minute video so we could learn about their country, university, colleagues, etc. These videos are great fun and serve to get to know the students and to "break the ice". Three-4 students presented every day.
- Faculty research talks.

The course was organized by Dr. Jimena Sierralta (University of Chile, Santiago, Chile), Dr. Rebeca Aldunate (University Santo Tomás, Santiago, Chile), Dr. Carlos Oliva (Pontificia Universidad Católica de Chile, Santiago Chile), and Dr. John Ewer (University of Valparaíso, Valparaíso, Chile). The course started in Santiago with a general lecture followed by several practical sessions during which the students were able to see *Drosophila* bearing various genetic markers as well as preparations of *Drosophila* and *C. elegans* stained with or expressing different labels; two days were devoted to these activities, which also included a lecture on ethics in science. As we have done starting in 2016, all other course activities took place at the Marine Station of the Universidad Católica, at Las Cruces (Estación Costera de Investigaciones Marinas UC, ECIM). This is really a great location to hold the course as we have complete control over the use of the lab spaces and are not restricted in terms of the scheduling. It is also a beautiful location with large lab and lecture spaces (see photos, below), which also contributes to making the course a much more pleasant experience. It also provides a "retreat environment" that fosters interactions between students and between students and faculty because students and faculty are always together, including during meal

The course has a permanent website (https://smallbrains.org/) where we post information on past courses, in order to create a more permanent "critical mass" associated with the course as well as with the use of these models.

Faculty

Faculty (including organizers) included (5) from Chile, (3) from Argentina, (1) from Uruguay, (2) from UK of which (1) participated remotely, (2) from France of which (1) participated remotely, and (3) from USA, of which (2) participated remotely (one of whom was scheduled to come but was unable to come because his visa did not arrive on time). We had (2) teaching assistants (one from UK, one from Chile). It is very satisfying to us to see that over the years the number

of faculty from Latin America has increased steadily, reflecting the increased use of these invertebrate model systems, to which we hope we have contributed by offering this course on a regular basis for the last 14 years.

Cancellations

This year 3 faculty cancelled their participation at the last minute: Claire Benard and Travis Thomson were unable to come due to illness; in the case of Travis Thomson, he suggested that Peter M'Angale from his lab replace him, but Peter was ultimately unable to attend because his visa did not arrive in time (he is Kenyan so required a visa to enter Chile). Rachel Parkinson was also unable to come because of visa problems. In this case she was replaced by Fernando Locatelli; Fernando was truly was excellent and is from Argentina, thereby increasing the proportion of faculty from Latin America.

Students

Selection process

The call for applications was posted on the course site (https://smallbrains.org/), the website of the center of Dr. Ewer (www.cinv.cl), as well as on the website of the Chilean Society for Cell Biology (www.sbcch.cl), the Chilean Neuroscience Society (www.socneurociencia.cl), and sent to colleagues throughout Latin America as well as to former students of the course. The application process is done entirely online on the course website. Applicants were asked to submit a letter of interest and a *Curriculum vitae*, and to arrange to have a letter of recommendation sent directly to the e-mail address associated with the course (sbbiplus@gmail.com). We specifically asked the reference to comment on the applicant's proficiency in English, as the course is done entirely in English. When selecting the applicants we paid close attention to the extent to which taking the course would be useful to their current research or to their immediate future career plans. For example: Had they recently started using one of these models for their research? Were they especially isolated at their institution in terms of lacking the necessary expertise close by? Were they looking to incorporate the use of one of these models in their current research or in their immediate future? etc. Applications were ranked separately by the course co-directors, followed by a meeting where we discussed the applications and reached a consensus on which applicants to accept.

Selected students

This year we received 97 applications (55 women, ~57%). Of these, 74 were from Latin American countries and 23 were from non-Latin American countries. We were pleased to learn that several of this year's applicants had applied through recommendations of previous alumni. None of the applicants from non-Latin American countries were accepted, mainly because their interests and/or background was not relevant to the course (and several applications were incomplete). Of the 74 applicants from Latin America we selected 29 students (18 women, 11 men); of these one male student was not able to attend due to illness. The final 28 accepted students came from the following countries: Chile (9), Argentina (8), Brazil (7), Uruguay (2), Colombia (2). Students requesting funding to help defray their travel expenses were provided with travel fellowships (up to €300-500 depending on location).

2- LECTURES, LABS, AND SCIENTIFIC HIGHLIGHTS

The course included a large number of lab exercises in neuroscience, ranging from the cellular to the behavioral (see Course Program). Most of the labs have been vetted in previous offerings of the course and worked very well, even though some are quite challenging.

Given its current prominence in Neuroscience research, an area that we expanded this year was "connectomics" (in 2022 we only included a research talk on this subject). This topic was covered in a lecture by Dr. Maria Fernández and in a practical session that she directed during

which students learned how to navigate the relevant online databases, find their "favorite neuron", and identify its pre- and post-synaptic partners.

A completely new section devoted to instrumentation was added this year. It consisted of a long lecture/discussion led by André Maia and Bruno van Swinderen. It was then followed by 2 entire afternoons during which students learnt: a) How to use a 3D printer and either design or modify existing designs to build specific setups b) How to set up a system to track and analyze animal locomotion. c) How to use Arduinos, and the Bonsai and DeepLabCut open source software to build electronic devices and quantify behavior. It is clear that this addition was greatly valued and is something we will definitely offer again in the future.

Finally, given the tremendous increase in the availability of DNA and RNA sequences, we again included a session on sequence and "big data" analyses. This year we did not include a session on the use of the open-source "Galaxy" platform, a web-based genome analysis tool, because our experience from the 2 previous offerings of the course is that it is quite difficult to master in such a short amount of time and is not of direct utility to the vast majority of the students. Instead, we focused on basic bioinformatic tools and on approaches used for single cell RNA analyses, so the students would have some basic understanding of these methods.

As we did in 2022, remote lectures were again included this year. They were offered by Angela Giangrande (University of Strasbourg, Strasbourg, France), Carolina Rezával (University of Birmingham, UK), and Daniel Kronauer (Rockefeller University, USA). Of particular interest was the lecture by Daniel Kronauer, as his recent work applying CRISPR/Cas9 technology on ants shows that this organism is becoming a very useful model to study the mechanisms underlying complex behaviors. Daniel said he would be happy to attend the course in the future and offer to run a specific practical session using his ants. This is definitively an offer that we will consider for the future.

3- STUDENT EVALUATIONS

Unlike previous years, this year we did not ask students to complete an evaluation because we did not want to overload them with evaluations (they will already be asked to complete the EMBO as well as the IBRO evaluations). We look forward to receiving the results of these surveys.

4- EXPENSES AND FUNDING SOURCES

The total cost of the course was approximately USD83,000 (See Budget). Funding was generously provided by a number of agencies and institutions. We are extremely grateful for all their support, without which this course would not have been possible. We are especially grateful to EMBO for their contribution of €35,000 (+ €6,500 in travel grants), to IBRO (International Brain Research Organization; €15,000), to ISN (International Society for Neurochemistry; USD11,200), to the UMass Chan Medical School (USD 10,000), and to The Company of Biologists; (£2,000). Several companies generously loaned dissecting and compound microscopes. The list of all sponsors is included in the course website (see http://smallbrains.org/sponsors/) as well as on all the posters.

5- LOOKING AHEAD

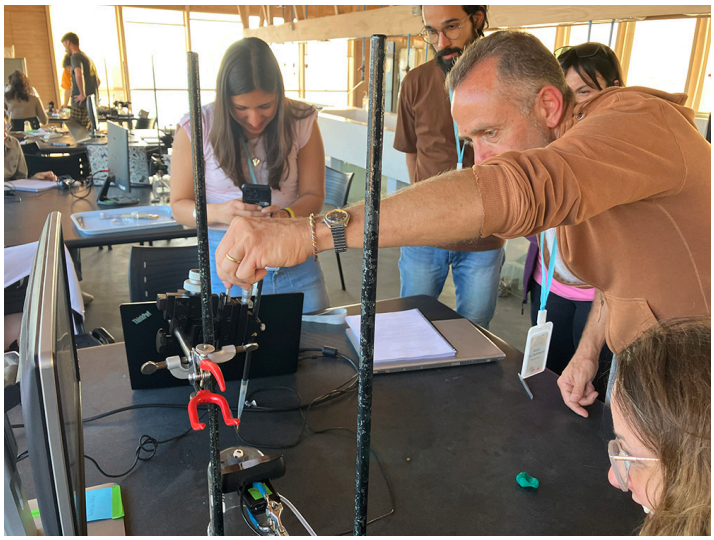
This course has now been offered seven times and has matured into a successful practical course, which we feel confident we'll be able to repeat every two years for the foreseeable future. The course includes a core of loyal faculty who are willing to share their knowledge and enthusiasm, and to teach and lead labs that are interesting and tried and tested in this course. In addition, we have always invited new faculty to introduce other topics, some of which have

now become incorporated into the course. Carrying out most of the course at the Marine station (EICM) has greatly improved it and we hope to be able to continue using it in the future.

This practical course involves faculty who are good communicators and are willing to participate in long and intensive days of lectures and practical sessions. Importantly, they are also willing to leave their normal academic life and, for many of them, travel to the other side of the world to participate in this course. Thus, the invited faculty are real heroes, and we are so very grateful for their selfless participation. In terms of faculty, some have participated in the course since its inception, whereas others have been recruited in subsequent years. Based on the success of the “Instrumentation” section of the course, we will definitely include in future offerings faculty who are experts in building equipment using cheap components and relying on open source resources. And as mentioned above, we will also consider incorporating ants as a model organism for this course.

Ours is the only course available in Latin America that teaches the theory and practice on how to use these powerful invertebrate models. We feel strongly that these models deserve a more prominent position in Latin American research because they are very powerful experimental systems and are comparatively cheap, and should therefore be very attractive to this region of the world where funding for science is quite limited. In the 14 years we have offered this course we have contributed to building a critical mass of researchers using these systems, as shown by the fact that we are accepting students who are doing research with alumni of the course. And the reputation of the course is growing: we receive very good applications, and continue to receive applications from countries that were not represented in the past. Thus, we feel that this course fills an important void, and we wholeheartedly hope that we can continue to offer it for the foreseeable future. Unlike similar courses offered in the Northern hemisphere (e.g., practical courses offered by Cold Spring Harbor Laboratories, USA) student attendance to our course is almost entirely free and funded by the course itself, which also offers those who need it a substantial travel subsidy. This makes the course quite expensive. Yet, funding for research in Latin American countries is such that most students would not be able to attend if they had to cover the full cost of attending this course. Thus, the survival of this course depends critically on being able to finance the course through grants. We hope we can continue securing this funding in the future.

Course location. View from ECIM (Estación Costera de Investigaciones Marinas Universidad Católica), Las Cruces, where most of the course was held.



Labs: Bruno van Swinderen helping set up an insect locomotion tracking system ("instrumentation" sessions). The tethered fly is on a white styrofoam ball suspended by a stream of air, directly below Bruno's hand.

Course participants: Students and most of the faculty and teaching assistants of the 2024 course. Photo taken at the ECIM marine station.

Friday October 18 (Santiago)

9:15-10:00	Welcome
10:00-10:45	Introduction to invertebrate models
10:45-11:00	*Break*
11:00-13:00	Plan of course
	Bioethics lecture/discussion, John Ewer
	Drosophila / *C. elegans* demonstrations
13:00-14:30	*Lunch*
14:30-19:00	*Drosophila* / *C. elegans* demonstrations
	Microscopy I (lab)

Saturday October 19 (Santiago)

8:30-10:45	Microscopy II (lab)
10:45-11:00	Break
11:00-13:00	Microscopy III (lab)
	Presentacion Galenica (Juan Pablo Sagal)
13:00-14:30	Lunch
14:30-19:00	Microscopy IV (lab)
19:00	Bus to Las Cruces

Sunday October 20 (Las Cruces)

8:30-10:00	Basis of work with bees, Fernando Locatelli, Agustin Lara
10:00-10:45	Fernando Locatelli research talk
10:45-11:00	*Break*
11:00-13:00	Lab: *C. elegans* 1A/ Bees B
13:00-14:30	*Lunch*
14:30-18:00	Lab: *C. elegans* 1A/ Bees B
18:00-19:00	Student presentations

Monday October 21 (Las Cruces)

8:30-9:15	*C. elegans* behavior Diego Rayes
9:15-10:00	Peter M'Angale research talk
10:00-10:45	Social evolution and behavior of ants, Daniel Kronauer (remote talk)
10:45-11:00	*Break*
11:00-13:00	Lab: *C. elegans* 1B/ Bees A
13:00-14:30	*Lunch*
14:30-18:00	Lab: *C. elegans* 1B/ Bees A
18:00-19:00	Student presentations

Tuesday October 22 (Las Cruces)

8:30-9:15	*Drosophila* genetics B (John Ewer)
9:15-10:00	*Drosophila* courtship, Carolina Rezaval (remote lecture)
10:00-10:45	Lab: *Drosophila* courtship A / *C. elegans* 2B
10:45-11:00	*Break*
11:00-13:00	Lab: *Drosophila* courtship A / *C. elegans* 2B
13:00-14:30	*Lunch*
14:30-18:00	Lab: *Drosophila* courtship B / *C. elegans* 2A
18:00-19:00	Student presentations

Wednesday October 23 (Las Cruces)

8:30-9:15	*Drosophila* glia/immune system Angela Giangrande (remote lecture)
9:15-10:00	Genetic screens in *Drosophila*, John Ewer
10:00-10:45	María Fernández research talk
10:45-11:00	*Break*
11:00-13:00	Connectomics (María Fernández)
13:00-14:30	*Lunch*
14:30-	Free afternoon

Thursday October 24 (Las Cruces)

8:30-9:15	*Drosophila* CNS, Carlos Oliva
9:15-10:00	Discussion of *C. elegans* results
10:00-10:45	*Drosophila* learning/memory, Scott Waddell
10:45-11:00	*Break*
11:00-1:00	Lab: *Drosophila* learning A / *Drosophila* CNS B
13:00-14:30	*Lunch*
14:30-18:00	Lab: *Drosophila* learning A / *Drosophila* CNS B
	Lab: Viewing of *Drosophila* preparations
18:00-19:00	Student presentations

Friday October 25 (Las Cruces)

8:30-10:00	Instrumentation (theory/resources) / Andre Maia & Bruno van Swinderen
10:00-10:45	Bioinformatics (theory)
10:45-11:00	*Break*
11:00-13:00	Lab: *Drosophila* learning B / *Drosophila* CNS A
13:00-14:30	*Lunch*
14:30-18:00	Lab: *Drosophila* learning B / *Drosophila* CNS A
	Lab: Viewing of *Drosophila* preparations
18:00-19:00	Student presentations

Saturday October 26 (Las Cruces)

8:30-9:15	Bassem Hassan research talk
9:15-10:00	Scott Waddell research talk
10:00-10:45	Lab: Bioinformatics (practical)
10:45-11:00	*Break*
11:15-13:00	Lab: Bioinformatics (practical)
13:00-14:30	*Lunch*
14:30-18:00	Instrumentation lab / Andre Maia, Bruno van Swinderen & Agustin Lara
18:00-19:00	Student presentations

Sunday October 27 (Las Cruces)

8:30-9:15	Bruno van Swinderen research talk
9:15-10:00	Mark Alkema research talk
10:00-10:45	Discussion of *C. elegans* results
10:45-11:00	*Break*
11:15-13:00	Discussion of *C. elegans* results
	Circadian rhythms lecture / analyses of results, María Fernández
13:00-14:30	*Lunch*
14:30-18:00	Instrumentation lab / Andre Maia, Bruno van Swinderen & Agustin Lara
18:00-19:00	Student presentations

Monday October 28 (Las Cruces)

10:00-12:00	General discussion, prizes, etc
12:00-13:30	*Early lunch*
13:30	Bus departs for airport and Santiago

Small brains, big ideas Practical course

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small brains
BIG IDEAS

ISN
International Society
for Neurochemistry

Budget

1. **Contact details:**

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2. **Title of School:** "Small Brain Big Ideas" (website: http://smallbrains.org/)

3. **Itemized budget**

Expenses	
Local travel (Chile: Santiago-Marine Station-Santiago for students and local faculty)	USD 621
International flights	USD 25,500
Airport shuttles (for travelers from abroad; to Santiago or to Marine Station)	USD 2,226
Local travel (Santiago-Marine Station -Santiago)	USD 4,544
Student travel grants (non-Chilean students only)	USD 9,630
Total food (breakfast, lunch, dinner)	USD 20,068
Housing (students and faculty)	USD 5,273
Marine station use (auditorium, lab spaces, computer room)	USD 4,649
Lab supplies	USD 3,531
Total other costs (accounting, printing, miscellaneous)	USD 7,458
Total expenses	**USD 83,500**
Funding obtained	
EMBO	USD 37,500
EMBO student travel grants	USD 7,000
IBRO	USD 16,000
ISN	USD11,200
UMass Chan Medical School	USD 10,000
Company of Biologists	USD 1,800
Total funding secured	**USD 83,500**

In total we secured USD83,500 for the course.
The sources and amounts include:
- EMBO: USD37,500 (€35,000) for the course with an additional USD7,000 (€6,500) allocated for travel grants.
- IBRO: USD16,000 (€15,000)
- ISN: USD11,200
- UMass Chan Medical School is one of the founding institutions of this course and will support it with US$10,000 for the 2024 version (confirmed)
- The Company of Biologists (GBP2,00).

We are very grateful for these contributions, without which we would be unable to offer this course.