RESIDENTIAL REQUIREMENTS
DESCRIPTION OF THE TEACHING AND SCIENTIFIC STRUCTURES AVAILABLE TO STUDENTS

SISSA offers post-graduate teaching and research opportunities in the departments of Physics, Mathematics and Neurosciences, in a shared campus in via Bonomea n.265, Trieste. The School boasts a spectacular setting above the city, overlooking the Adriatic sea and surrounded by a park of 100,000 square meters. Other facilities are located in Via Beirut, Trieste, on the sea-front; these house inter-institutional research and teaching facilities and the important Ulysses cluster.

The School provides students with 17 teaching classrooms (total surface area 1,053.97 m²), 72 laboratories (total surface area 1,977.28 m²), a technical structure to support research activities, an interdisciplinary library (total surface area 672.00 m²) and a main lecture theatre (total surface area 990.30 m²) which is used for institutional events and performances.

Students of the same year share offices, to create friendships and share ideas, but have individual workstations to allow them access to IT support they may need to develop their research.

As for the lecture rooms, SISSA has 12 dedicated to educational activities, a twin room “the Cinema” which can be opened up for larger classes, meetings, assemblies and such like, a spacious meeting room and council room used for meetings held by the Director, and two further meeting rooms in the library which are open to anyone in SISSA.

All rooms are equipped with audio-visual equipment for video conferencing, and with a touchscreen panel to control audio, video, lights, screens and motorised curtains to aid users to create the perfect conditions for their activities.

Almost all lecture rooms are also equipped with two traditional sliding slate blackboards. The rooms are designed and equipped to accommodate:
- seminars and conferences held in a traditional manner;
- seminars, conferences, and lectures which require audio-video support, the use of computers and network connection for access to recorded or digitalised documents, and to distributed applications for work with cloud computing.
- interactive online work sessions for teleworking, distance learning, videoconferencing and teleconferencing;
- transmission of scientific programs from files stored on special servers;
- presentation of activities in collaboration with external partners such as companies or research bodies, public administration offices etc.

The twin lecture room located on level +1, is identified by the signs St. 128 and St. 129, and is colloquially referred to as the "Cinema". The joining of the 2 rooms creates one long rectangular room, with 18 rows of six chairs. The audio-visual equipment has been adapted to suit the increased capacity of the room, therefore as well as the main central screen, it has four lateral monitors for the reproduction of the same video signal which is projected in the central screen, when it is used as a single lecture room.
The main **meeting room** has 40-50 seats arranged in a horseshoe shape. The audio-visual systems are similar to those present in the lecture rooms, with the addition of microphones, loudspeakers and cameras connected with the LIFESIZE 200 series video conference system. The tables are equipped with hidden turrets for connecting VGA and video composite sources, data network and electric sockets.

The **council room** has 20 seats around an oval table and is mainly used for periodic meetings of the Academic Senate and the School's Board of Directors. Like the main meeting room, it is equipped with turrets for connecting VGA and video composite sources, data network and electric sockets.

The **main lecture theatre** has a capacity of around 500 seats, with a raised stage. It is equipped with a high brightness video projector and a motorised screen, as well as with three motorised video cameras positioned to cover the entire room: one near the projector, one near the projection screen and one on the wall to the right-hand side. The auditorium was built to have good acoustics and is equipped with two wireless microphones: one handheld microphone and one levalier jacket microphone. There are also five "stem" type microphones: one positioned on the bookrest and four positioned on the table on stage. The projection screen can be accessed from each of these five positions by connecting a source (laptop or other). There is also the possibility of projecting from a source located above in the control cubicle, from where the lights, video and audio sources are also controlled. The main lecture theatre is also equipped with devices capable of transmitting events in streaming and recording them simultaneously. The lecture theatre has a system for simultaneous translation as well as two cabins for interpreters.

The **meeting rooms in the library** are equipped with a ceiling-mounted video projector and a motorised screen.

As for the School's **research laboratories**, the following experimental facilities are available:

**PhD course in Cognitive Neuroscience**
- prof.ssa Bueti TIME AND SPACE PERCEPTION LAB
- prof Crepaldi LANGUAGE READING AND ABSTRACT COGNITION LAB
- prof. Diamond TACTILE PERCEPTION AND LEARNING LAB
- dott. Mathys ILAB - INFERENCE, LEARNING AND ACTION IN THE BRAIN
- prof.ssa Rumiati SOCIAL AND COGNITIVE INTEGRATIVE NEUROSCIENCE LAB
- prof. Treves LIMBO - LIMINAR INVESTIGATIONS IN MEMORY AND BRAIN ORGANIZATION
- prof Zoccolan VISUAL NEUROSCIENCE LAB

**PhD course in Neurobiology**
- prof.ssa Ballerini NEURON PHYSIOLOGY AND TECHNOLOGY LAB
- dott. Giugliano NEURONAL DYNAMICS LAB
- prof. Heppenstall MOLECULAR PHYSIOLOGY OF SOMATOSANSATION LAB
- prof.ssa Menini OLFACTORY TRANSDUCTION LAB
- dott. Taccola APPLIED NEUROPHYSIOLOGY AND NEUROPHARMACOLOGY LAB
- prof. Torre LABORATORY OF SENSORY TRANSDUCTION

**PhD Course in Functional and Structural Genomics**
- prof. Gustincich LABORATORY OF NEUROGENOMICS
- prof. Legname LABORATORY OF PRION BIOLOGY
In addition to the experimental facilities named above, in early 2016, a new Advanced Mechatronics Laboratory, LAMA FVG, was opened at the Scientific campus of the University of Udine. This laboratory was funded by the Ministry of Education, University and Research (MIUR) and the FVG Region, and is a result of the collaboration between SISSA and the Universities of Trieste and Udine. The Lama FVG is a centre of excellence for industrial innovation and cutting-edge research in frontier technology sectors, dedicated to technological development and advanced training based on new synergies between academia and industry. Thanks to its impressive technological equipment, the laboratory aims to become a reference point for excellency in 3-D printing of metal objects, advanced robotics and the digital transformation of production systems in the Alpe-Adria Region.

Finally, SISSA, together with the International Center for Theoretical Physics, hosts one of the largest High Performance Computing facilities in Italy, named Ulysses. The HPC cluster comprises more than 4000 cores based on the most up-to-date technology. Ulysses is hosted in a new data center dedicated to HPC with a new and scalable air-conditioning system, electrical power distribution and UPS support. The cluster is based on IBM Dataplex dx360 M4 servers made with 224 nodes and 4480 cores. The servers are equipped with Intel processors Xeon E5-2680 v2 with 10 cores and 20 threads. The total RAM of the cluster is 12TB with 2GB per core for most of the nodes, 8GB per core for 24 nodes and 16GB per core for 8 special nodes. Eight nodes are also equipped with 2 GPU Nvidia Tesla each. An Infiniband QDR (40Gbit/s) network provides the interconnection between the nodes.

Recently, thanks to funding from the FVG Region, a new partition has been added consisting of 88 nodes, 11 of which are equipped with 2 Nvidia Pascal P100 GPUs. The HP Proliant XL170r and XL190r servers are equipped with Intel Xeon E5-2698 V4 processors with 16 cores each. The storage is a DataDirect Network 12000 with 350TB of disk space and max capacity of 6.7PB. An upgrade is being carried out to provide more technologically advanced storage with greater data storage capacity. The filesystem used is Lustre.

The new data center is located in the Miramare building (via Beirut 2/4) and has about 100 square meters. The project was developed considering the possibility of expanding the computational resources in the future. The reference level is the TIER II of the UPTIME Institute. According to these specifications, we have redundant UPS units and cooling systems. Special attention has been given to the electrical efficiency and scalability.
The cooling system is based on 7 VERTIV CRV35RA units together with the external condenser units. These provide high capacity cooling (35KW of cooling power each) and efficient energy consumption. They are able to control air temperature, humidity and air filtration in the surrounding racks.

Given the high density of computational nodes, the front of the two rows of racks, which form a cold aisle, are confined to an island. This avoids the use of a raised floor ensuring high cooling efficiency.

Ulysses uses a customized Linux distribution called SISSA Linux built using the available public source, in RPM format, of the Enterprise RedHat distribution. SISSA’s Linux distribution has been modified to satisfy the needs of its scientific community. This distribution is also used on the Linux workstations in SISSA, and many packages related to the cluster have been added to make it a suitable distribution also for a HPC cluster.

Ulysses allows scientists, SMEs and industries to gain direct experience in a production environment and to explore characteristics and configurations of a HPC cluster. The HPC system also provides a number of nodes with accelerators explicitly dedicated to advanced research and industry projects. The in-house facilities are complemented by state-of-the-art facilities available worldwide to computational research groups involved in the Master course in High Performance Computing (MHPC). The experimental HPC facilities are also available through a European research program which involves local companies and scientific research institutions.

In 2019 a project was financed with the aim of turning Italy into the home of one of the supercomputers that will make up the European network for 'supercomputing'. This is the result of a partnership agreement between MIUR, Cineca, INFN and SISSA. The project is part of EU actions aimed at diffusing the access to high performance computing as a driver of growth and innovation. Part of the project’s infrastructure, foresees the hosting of a pre-exascale class supercomputer, with a computing power of more than 250 petaflops, at the Tecnopolo in Bologna. The Italian Ministry of Education, University and Research (MIUR) has funded the implementation of the project for a total of 120 million euros, distributed over seven years (2019-2025), while another 120 million euros will be provided by the European Commission, for a total investment of approximately 240 million euros.

To provide guidance and support to the experimental research activities, the School has a technical unit with ten members of staff. The coordinator of the unit is of upper managerial level (EP), assisted by seven staff members of category D and two other technicians of category C. The technical staff is able to offer users with an excellent quality of services thanks to the high professionalism of the members of staff themselves. Three members of staff have obtained a PhD or are graduates in Neuroscience, Genomics and Philosophy, and are therefore able to share their own research experience and competencies with students. The other five members of category D staff are mainly graduates in Biological Sciences and one has also gained a second degree in Pharmacy. This is to say that the lab technicians have been actively involved in scientific projects themselves and some of them are co-authors of scientific publications.
The technical staff welcome students to the laboratories and familiarise them with specifications of the equipment and facilities. Technical and scientific assistance is given to students, both in the choice of the most suitable experimental approach for a certain procedure, and guidance provided about scientific and technical correctness, without forgetting health and safety regulations.

The technical support unit is based within the Neuroscience Area, where most of the experimental activities take place, but assistance is also provided for the experimental activities which are carried out by the Mathematics Area. The PhD courses which have access to the services and instrumentation managed by the technical unit are the following: Structural and Functional Genomics, Neurobiology, Cognitive Neuroscience and the PhD course in Mathematics, Models and Applications Analysis.

The Technical unit provides various specialist and experimental facilities which include the following:

**Cell culture services and facilities:**
- three laboratories which provide the equipment necessary for carrying out experimental activities using cell cultures and an automatic cryogenic storage system for the preservation of cell lines and biological samples.

The management of cell culture services and facilities is carried out by two members of staff dealing with:
- training and user support regarding the use of equipment present in cell culture facilities;
- maintenance checks and management of the specific equipment for cell cultures;
- cell lines cryopreservation management;
- preparation of culture media;
- preparation of primary cultures;
- preparation of organotypic cultures;
- education and support in cell biology, primary and organotypical culture techniques.

**Molecular biology services and structures:**

the molecular biology laboratories and related equipment are all concentrated on one floor. These laboratories are equipped with a cold chamber, fume cupboards, PCR instruments, Real-Time PCR Detection Systems, a PCR ELISA reader, Western blot and agarose gel acquisition systems, floor and bench centrifuges, orbiting incubators, static incubators/ovens, a complete system of GeneChip Microarray (Affymetrix), a vacuum concentrator system with centrifuge and other small equipment.

The management of services and facilities for molecular biology is carried out by two members of staff dealing with:
- training and user support for the use of the equipment present in the molecular biology lab;
- maintenance checks and management of the specific equipment for molecular biology;
- management of consumables and reagents used by the different research groups in the molecular biology laboratories;
- genotyping service;
- analysis of microarray data;
- education and support in molecular biology techniques.

**Histology and microscopy facilities and services:**

- two laboratories equipped with a fume cupboard, peristaltic pumps, a stereotaxic instrument, a microtome freezer and two cryostats. The specialist microscopy facilities include two laboratories equipped with three confocal microscopy systems (one Leica and two Nikon, one of which is a brand new Nikon AR1) fluorescence microscopes with acquisition systems (Leica and Zeiss), one microdissection laser capture system (Palm Microlaser System + Zeiss). The 3D Volocity image analysis software (PerkinElmer) is available for the analysis of the images.

The management of molecular biology services and equipment is carried out by one member of staff that deals with:
- training and user support for the use of histology and microscopy equipment;
- maintenance checks and management of histology apparatus and microscopes;
- training and support in histological and immunohistochemical techniques;
- training and support in the use of software for image acquisition and image processing.

**Glassware washing and sterilisation service:** the spaces dedicated to washing and sterilisation are equipped with two automatic glassware washers, two autoclave sterilisers, one forced ventilation oven and one automatic system for the preparation of Petri dishes with autoclave.

The management of services and structures of molecular biology is carried out in rotation, by three members of staff that deal with:
- maintenance checks and management of the glassware washing and sterilisation equipment;
- washing, drying and sterilisation of the glass tools used in the laboratories;
- preparation and sterilisation of solutions, culture media and bacteria plates.

**Storeroom service and management of consumables for general use:** the storeroom for consumables used by all research groups (such as test-tubes, pipettes, plate tips, filters, etc.) is located within the laboratory area. A separate laboratory houses the refrigerators and freezers where reagent aliquots, cell culture solutions, secondary antibodies and fluorochromes are stored and distributed to laboratory users. Students and researchers can access the storerooms according to specific opening times. Three members of staff, on a rotary shift, run the storerooms and deal with:
- distribution of consumables;
- management of the storeroom and stock control;
- management of the secondary antibodies and fluorochromes bank.
**Electronic and mechanical workshop:** the workshop is equipped with a numerical control milling machine, a manual milling machine and numerous small electronic and mechanical instruments. The workshop management is carried out by one member of staff that deals with:
- maintenance of experimental set-ups for electrophysiology;
- design and construction of electronic devices;
- inspection and repair of laboratory equipment;
- mechanical work and carpentry.

**Services and facilities of the Mechatronics laboratory:** this laboratory is divided into two sections with complementary activities and competencies: the first one deals with the design and implementation of control software and development of electronic media for experimental tests; the second one deals with the design and construction of mechanical and structural components for the development of experiment set-ups.

The management of the services and facilities of the mechatronic laboratory is carried out by two members of staff that deal with:
- design of experiment set-ups;
- design and construction of electronic circuits;
- support in mathematical and physical analysis for the development of experiment set-ups;
- training and support in electronic and electrophysiological techniques;
- CAD and CAM design;
- rapid prototyping with 3D and CNC tools;
- training and support in CAD/CAM programming techniques.

**Planning and management of the purchases for the Neuroscience Area (Scientific Buyer):** the activities of the scientific buyer are carried out by one member of staff who deals with:
- support in planning/rationalising purchases and assessment of needs;
- market research and identification of specific resources for the Neuroscience area;
- intermediation between users and the School’s Purchasing office;
- support to the Scientific Secretariat for the registration of delivery documents.

**Other services and shared equipment:**
- three water purification systems (one in each floor of the laboratories);
- three ice machines (one in each floor of the laboratories);
- a room and two specific cabinets for storing flammable substances;
- five chemical cabinets;
- eight ultra-low temperature freezers (-80°C) in the labs from the fourth to the seventh floor.
- one cold chamber and many refrigerators (+4°C) and standard freezers (-20°C).

**Planned purchases of new strategic apparatus:** the instruments listed below are the next planned purchases of the laboratories, some have already been ordered, and some are expected to be purchased in the next two years:
- microfabrication system of complex 3D structures through a two-photon polymerisation process (2pp direct laser writing);
- cyto-fluorometer with cellular separator FACS (Fluorescence Activated Cell Sorting);
- digital PCR system for the quantification of nucleic acids.
**Animal housing service:** SISSA has a central housing area for mice (several lines of transgenic mice are housed), rats and amphibians. There is another room where experimental animals are housed and a quarantine room (the total number of animals is about 3000). The animal housing activities are managed by a specialised external company with four members of staff to take care of the animals and their environment.

**Courses and technical training:** the laboratory technicians hold theoretical and practical training sessions, concerning experimental techniques and procedures, rules of use and correct lab behaviour. They also provide students with an explanation about how the various apparatus and equipment function. These lessons are mainly aimed at first-year students and are normally timetabled at the beginning of each academic year. The topics covered by the courses held in the academic year 2018/2019 for a total of 36 hours were as follows:

- basic techniques in cell cultures;
- primary cultures: dissociated and organotypic cultures;
- basic microscopy techniques;
- basic fluorescence techniques;
- immunofluorescence;
- introduction to image analysis;
- introduction to electronics

The School’s **library** collection includes approximately 34,900 books of which approx. 15,000 are in a digital format. Currently SISSA offers e-books from the following publishers:

- SIAM (Society for Industrial and Applied Mathematics)
- Springer mathematics and statistics archive: 1940-2004
- “Lecture notes in mathematics” (Springer): from 2008-2019 (under the Springer magazine contract)
- “Lecture notes in physics” (Springer): from 2008-2019 (under the Springer magazine contract)
- Oxford Scholarship Online: Neuroscience, Mathematics, Physics: (2010-2018)

As for **academic journals**, there are subscriptions to about 100 paper journals and further subscription packages to electronic journals from the following publishers:

- Springer
- Wiley
- Elsevier (up to 2018)
- American Chemical Society
- Cell Press (a selection of journals)
- American Institute of Physics
- Oxford University Press (scientific journals)
- American Association for the Advancement of Science (Science)
- Nature (17 electronic journals with archive)
- Institute of Physics (IOP)
- American Psychological Association journals (“Psycharticles”)
- JSTOR (mathematics and statistics journal collection - archive)
- High Energy Physics journals from different publishing houses: SCOAP3
- Bibliographic databases: Scopus, Web of Science (WOS), MathSciNet, PsychArticles.
- A collection of journals of the American Mathematical Society
- SIAM (six journals)
- American Psychological Association (a series of journals)
- Cambridge University Press journals
- Neuroreport (Lippincott Williams & Wilkins)
- Neuromedicine (Future medicine)

In addition to its collection of academic books and research journals, the School Library adheres to a system called “Portico” for the long-term preservation of the subscribed electronic journals. It also manages the School's institutional archive (SISSA Digital Library-IRIS with 7,513 articles, 1,820 theses, 649 records of conference proceedings, 271 book chapters, 43 books and 19 patents), archives the SISSA preprints in the SISSA Preprint Archive and provides the following services:
- cataloguing (to search paper books and journals as well as e-books),
- joint search through the SISSA “Discovery Service”;
- document delivery;
- interlibrary loans;
- book and journal purchases on request;
- assignment of SISSA preprint numbers;
- management of publication costs for the whole school and consultancy in bibliographic research (Scopus and WOS) and in the insertion of scientific works by SISSA authors in the SISSA Digital Library. In collaboration with the Universities of Udine and Trieste, the library deals with the management of UNITYFVG, a shared archive between the three regional research institutions for the management of anti-plagiarism software for theses.

Documents and explanatory texts uploaded in the SUA_Scuole database are available on the Quality page of SISSA website, in the section relative to accreditation: https://www.sissa.it/cevs