

From Cutting-Edge Engineering to Social Science Studies

Doing Research in Switzerland

Experiences of U.S. and Canadian Researchers

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Cover Image: "Aerosolization Assessment During Ear Surgery" by Lukas Anschuetz, University Hospital of Bern - Inselspital

During the COVID-19 pandemic, special attention has been paid to aerosols and the airborne spread of infectious diseases. Healthcare workers in particular are at high risk of disease transmission. We aimed to investigate aerosolisation patterns of surgical procedures related to middle ear surgery. The spread of aerosols and droplets was visualised using fluorescence and showed that the surgeon and operating room staff are at high risk of transmission of airborne disease. The picture shows a surgeon performing a mastoidectomy on an anatomical specimen using an operating microscope. The middle ear and mastoid air cell system had previously been injected with fluorescein. The droplets and aerosols were visualised under ultraviolet light, and fluorescein deposition on the surgical table was quantified at the end of the procedure. Note the large amount of fluorescein in the air and on the experimental table, indicating the high potential for transmission of airborne diseases. Credit: Lukas Anschuetz via the SNSF Scientific Image Competition

Forewords



Ambassador's Foreword

"Bringing together young, talented researchers opens up the path for unlimited opportunities in international collaborations."

Switzerland's competitive and innovative economy is a result of the combination of an excellent educational landscape, generous public funding for research and development, and heavy R&D investment by the private sector. This unique fusion is why Switzerland consistently leads international rankings such as the Global Competitiveness Report and the Global Innovation Index. Scientific excellence is further fueled by international cooperation and exchange.

When it comes to research and innovation, Switzerland has a very special relationship with the United States, which remains one of our most important and closest partners. In this brochure, you will have the chance to discover Switzerland as a research destination through the eyes of young American and Canadian scholars who have conducted research at Swiss universities. Their fields range from neuroeconomics to virtual reality, from traffic emissions to the fabrication of brain implants. Collectively, these projects and their authors reflect the true creativity and diversity of our research landscape and bilateral cooperation.

At the Embassy of Switzerland, we promote exchange among young researchers and we strongly believe in connecting bright minds at an early age.

Jacques Pitteloud
Ambassador of Switzerland
to the United States of America



State Secretary's Foreword

"Science and research thrive on international cooperation and exchange. Only then can excellent solutions emerge."

Education, research and innovation are of key importance to Switzerland. They serve as the basis for individual well-being, social cohesion and economic success. Against this backdrop, universities and research institutions in Switzerland are concerned with digital transformation, sustainable development, climate and energy, migration and other pressing issues. At the same time, we are well aware that the questions that arise are too big for us to tackle on our own. Science and research thrive on international cooperation and exchange. Only then can excellent solutions emerge.

The ThinkSwiss scholarship program and the Fulbright-Swiss Government Excellence Scholarships are effective instruments in linking young U.S. and Canadian talent with those at Swiss universities and their members. The experiences that these talented young people had during their stays in Switzerland are extremely positive - as their statements show. In this fertile academic environment, they made exciting contributions that serve the globalized knowledge community. Seen in this light, scholarship holders are ambassadors in their home countries for Switzerland as a cosmopolitan, competitive center for creative ideas and industry. Hopefully, they will stay in contact with the country throughout their lives.

Martina Hirayama
State Secretary, State Secretariat for Education,
Research and Innovation (SERI)

Switzerland at a Glance

Key Figures:

Surface area:
15,940 sq mi;
Population: 8.5
million inhabitants
(2019); **National
languages:**
German, French,
Italian, and
Romansh; **GDP:**
USD 703 billion
(2019); **Per capita
GDP:** USD 81'994
(2019)

**Almost 55% of
Ph.D. students in
Switzerland are
foreign nationals.**

Culturally Diverse

Located in the heart of Europe, Switzerland is a culturally diverse country with four national languages: German, French, Italian, and Romansh. Switzerland has 26 cantons (comparable to U.S. states or Canadian provinces). Swiss cantons are relatively autonomous, which also contributes to their cultural diversity. Most cantons are German-speaking; the second-most-spoken language is French. Additionally, English is widely spoken in Switzerland, especially in business, research, and education environments.

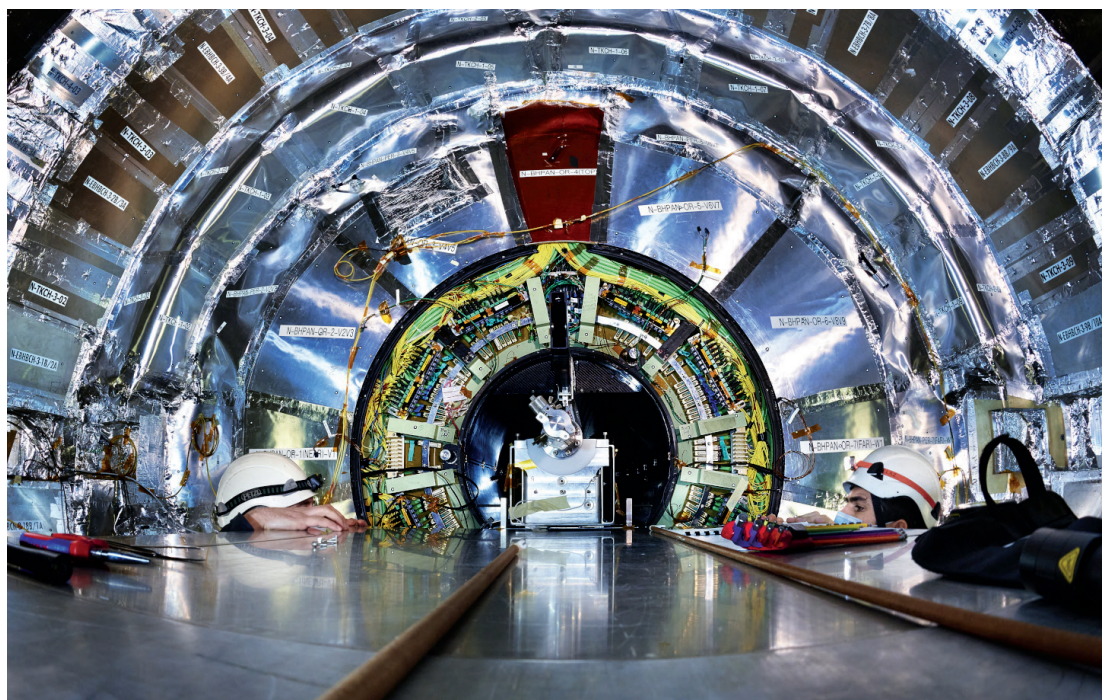
Knowledge-Based

Switzerland has a knowledge-based economy. Its strong educational system and favorable conditions for the private sector drive scientific advances and innovation. As in the U.S., public expenditure makes up about one third of all research and development investment. Over two-thirds of all research in Switzerland is funded by the private sector. For its small size, Switzerland has a remarkable scientific output:

- › In relation to its population, Switzerland publishes the most scientific papers worldwide.
- › Scientific papers from Switzerland have the 3rd highest citation numbers worldwide.
- › Switzerland's scientific impact is particularly high in the fields of physics, chemistry, earth sciences, agriculture, biology, and environmental sciences.

Well Connected

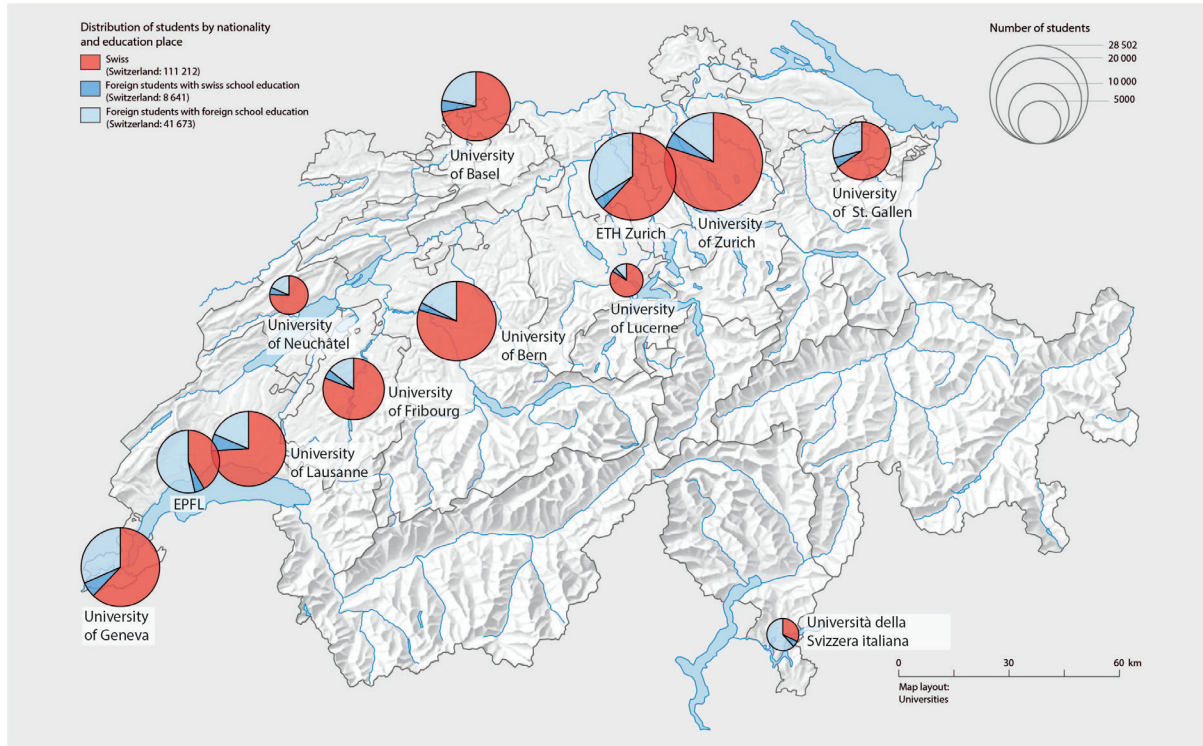
Switzerland is well connected in the global research landscape and a member of many international research institutions and organizations including the European Space Agency (ESA) and the European Organization for Nuclear Research (CERN), which are located in France and Switzerland, respectively. Switzerland has close ties to the European Union that allow Swiss scientists to fully participate in European research programs. Swiss higher education has a strong international appeal: around a quarter of all students in Switzerland are foreign nationals.



People at work on the CMS detector open during the Long Shutdown 1 of the Large Hadron Collider and CERN's other accelerators.
Credit: CERN

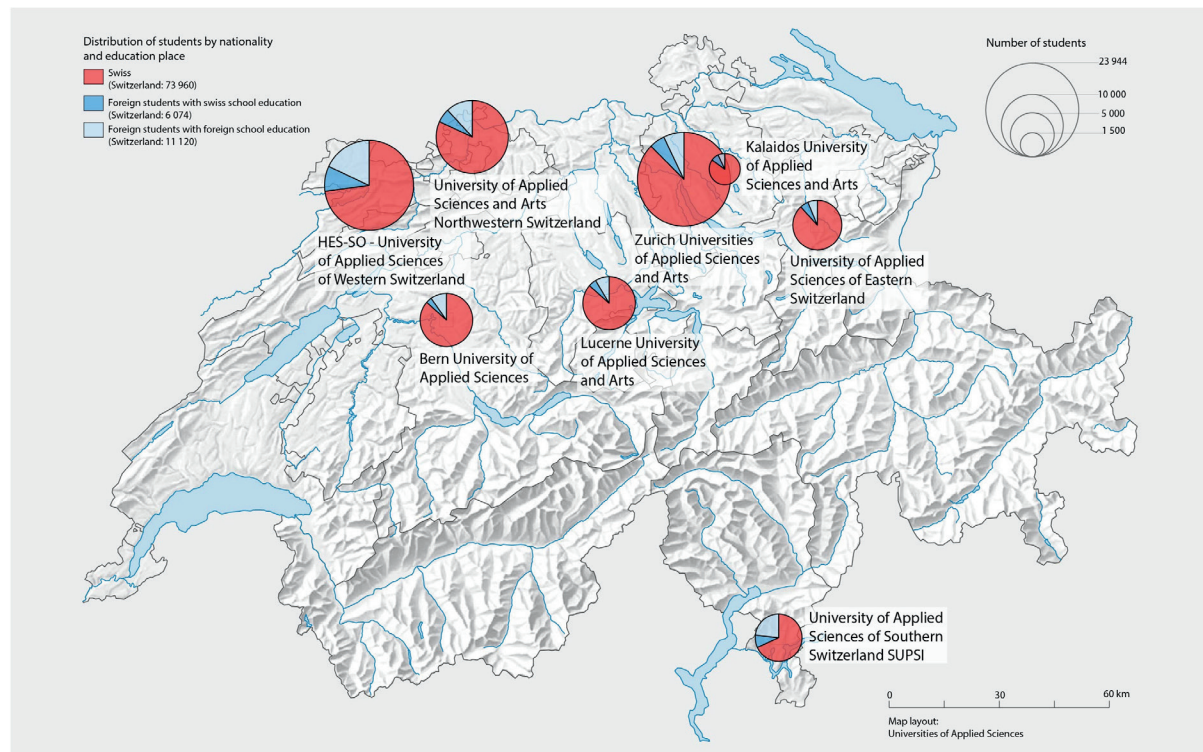
Switzerland's Higher Education Landscape

Share of students at universities and federal institutes of technology by nationality and educational background



Source: Swiss Federal Statistical Office 2021

Share of students at universities of applied sciences by nationality and educational background



Source: Swiss Federal Statistical Office 2021

Higher Education and Research in Switzerland

Switzerland is a hub for excellent education, science, and innovation. It has outstanding universities with numerous programs, many world-class public research institutions, and a thriving private sector which encourages research and development. Higher education in Switzerland comprises universities, universities of applied sciences, and universities of teacher education. These institutions offer first-rate educational opportunities in diverse fields of study and they usually conduct research in an English-speaking environment. Swiss higher education follows the tiered study model of bachelor's and master's degrees. The universities also award PhD degrees. Swiss higher education is largely publicly funded.

See where Swiss universities are currently ranked in international ranking lists: www.universityrankings.ch.

Universities

Switzerland has ten cantonal universities and two Federal Institutes of Technology. The two Federal Institutes of Technology are based in Zurich (ETH) and Lausanne (EPFL). Additionally, there are four affiliated research institutes within the Federal Institutes of Technology domain: the Paul Scherrer Institute (PSI), which is a research institute for natural sciences and technology that runs several particle accelerators, the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL), the Swiss Institute for Materials Science and Technology (EMPA), and the Swiss Federal Institute of Aquatic Science and Technology (EAWAG). Swiss universities offer a diverse range of high-quality study options in all disciplines and fields of study. Many of them figure prominently in international university rankings. In 2019, the majority of Swiss universities were ranked among the top 200 in the Times World University Rankings.

Browse through www.swissuniversity.ch to find more information about Switzerland's higher education landscape.

Universities of Applied Sciences (UAS)

The universities of applied sciences focus mainly on applied research and development to serve the needs of the private sector, the cultural sector and the public sector. They enable the transfer of knowledge between research laboratories and the market. In so doing, they form an important link to the innovation chain. They are based in multiple locations and offer studies in a variety of fields such as:

- › Design
- › Architecture, Building Engineering and Planning
- › Economics
- › Sports
- › Music, Theater, and Fine Arts
- › Agriculture and Forestry
- › Chemistry and Life Sciences
- › Applied Psychology
- › Engineering and Information Technology
- › Applied Linguistics
- › Social Work and Health

Universities of Teacher Education

Switzerland also has more than a dozen universities of teacher education with multiple locations in most cantons (comparable to U.S. states or Canadian provinces). The universities of teacher education combine practical training with applied research. They work closely with universities and universities of applied sciences and some of them are integrated into those institutions, which is why they do not appear on the maps as individual institutions.

Other Research Institutions

Switzerland also has a few specialized higher education institutions such as the Graduate Institute of International and Development Studies in Geneva and Swiss conservatories (some of which are integrated into UAS). A great deal of research is also conducted outside the higher education realm. Switzerland has a number of research institutions of national interest, for example, the Swiss Tropical and Public Health Institute and the Swiss Centre for Applied Human Toxicology. Furthermore, the Swiss National Science Foundation (SNSF) is Switzerland's foremost funding organization for basic research. Science-based innovation is promoted by the federal innovation agency Innosuisse.

Find out more about the Swiss National Science Foundation at www.snsf.ch and Innosuisse at www.innosuisse.ch.

Scholarships

There are several scholarships which offer financial support to U.S. and Canadian students interested in going to Switzerland for their studies or to do research. Most Swiss universities also have student exchange programs with U.S. universities and some of them offer their own scholarships to international students. The most prominent Swiss research scholarships for North American students are ThinkSwiss and the Swiss Government Excellence Scholarships, which are open to students of all fields. ThinkSwiss has supported young researchers since 2007 and Swiss Government Excellence Scholarships have been available to U.S. researchers since as far back as 1961. Both programs are funded by the Swiss State Secretariat for Education, Research and Innovation (SERI).



ThinkSwiss

ThinkSwiss is a scholarship program managed by the Science Office at the Embassy of Switzerland in Washington, D.C., that offers research scholarships and summer school travel grants to students from U.S. and Canadian universities.

Find out more about ThinkSwiss at www.thinkswiss.org.

Research scholarships offer financial support to students who wish to spend up to three months at a Swiss institution of higher education for a research internship. Summer school scholarships provide travel grants to students participating in selected Swiss summer schools. ThinkSwiss scholarships are open to students of all fields and all degrees as long as they have completed their sophomore year of undergraduate studies. The Embassy of Switzerland in Ottawa, Canada strongly supports the program and offers information for students from Canada. Presence Switzerland (PRS) also supports the program by organizing an annual 2-day trip for ThinkSwiss awardees.

Swiss Government Excellence Scholarships

Swiss Government Excellence Scholarships fund research stays for six to twelve months. For U.S. students and artists, the Swiss government, the U.S. Fulbright program and the Institute of International Education (IIE) collaborate to offer merit-based scholarships. These Fulbright-Swiss Government Excellence scholarships are offered by the Swiss government through the Federal Commission for Scholarships for Foreign Students (FCS), also known as ESKAS (*Eidgenössische Stipendienkommission für ausländische Studierende*) or CFBE (*Commission fédérale des bourses pour étudiants étrangers*).

Find out more about Fulbright-Swiss Government Excellence Scholarships at <https://us.fulbrightonline.org> and www.sbf.admin.ch/scholarships_eng.

The research scholarships are open to researchers at all degree levels and in any discipline. Art scholarships are open to art students wishing to pursue an initial master's degree in Switzerland. They are awarded for study at any Swiss conservatory or university of applied sciences. Swiss Government Excellence Scholarships are not available to Canadian students at this time.

Experiences of Young Researchers

Visit our website to read about the most recent ThinkSwiss scholars: www.thinkswiss.org.

A research stay in Switzerland allows young scientists to become engaged in a diverse research community and to establish an international network. The ThinkSwiss and Fulbright-Swiss Government Excellence Scholarships also allow students at undergraduate level the opportunity to do research with leading experts. That exposure is a great starting point for a future academic career.

The following portraits of past awardees provide an insight into the range of possibilities and the merits of doing research in Switzerland. Their experiences range from patent filings for a cutting-edge innovation to a saxophonist finding his place in classical music. Many of the past awardees continued their studies as graduate and PhD students, which led them to successful careers in and outside academia.



High Altitude Research Station Jungfrauoch at an altitude of 3450 m above sea level.
Credit: Jungfrau.ch

Computational Biology

Mechanics and Physics Behind Cellular Growth of Lungs



Alay hiking in the Swiss Alps
Credit: Alay Shah

Alay Shah

2019 ThinkSwiss Research Scholarship Awardee
(as an undergraduate student)

ETH Zurich (Federal Institute of Technology Zurich)

"I am incredibly thankful for the ThinkSwiss Research Scholarship, which exposed me to the plethora of research and cultural opportunities in Switzerland!"

In Dr. Dagmar Iber's lab at ETH Zurich, I had the opportunity to participate in a research project that combined high-end imaging approaches and computational modeling to define basic developmental mechanisms of the lung. The group had recently developed a protocol to image the development of mouse organs. I was able to assist the postdoc, Dr. Aleksandra Sapala, in processing the resulting large datasets using an innovative computational modeling tool called MorphoGraphX, and analyze the cellular dynamics and mechanical forces during lung branching morphogenesis. Furthermore, I was able to learn and familiarize myself with R programming to integrate and visualize data for a final presentation to the lab team at the end of my internship.

Ultimately, my imaging was utilized in a research publication for the lab group in bioRxiv. Through this amazing research experience, I was able to enhance my skills in image analysis and computational modeling and learn about the physics behind cellular growth of lungs. Working at ETH Zurich in Dr. Iber's lab exposed me to the most pressing challenges and issues in the field of animal organogenesis. This learning opportunity was crucial for improving my image processing and computational modeling skills, which are translatable to many other fields of research, and helped prepare me for graduate school.

I currently work in pharmaceuticals at Bristol Myers Squibb as a bioprocessing associate in cancer cell therapy. After my industry work experience, I hope to pursue graduate school and continue to be a leader in driving innovation in the healthcare field. I am incredibly thankful for the ThinkSwiss Research Scholarship, which exposed me to the plethora of research and cultural opportunities in Switzerland! This internship in an international research environment helped me both to learn the most important aspects of being a scientist, and to share a universal and multicultural passion for combining engineering and biology to advance medicine.

Basal side of lung epithelium
and segmentation with
MorphoGraphX
Credit: Alay Shah



Social Sciences

Preparing Young People to Job Hop



Alex speaking about her research experience at a TEDx talk in Nevada
Credit: Chris Holloman

Alexandra Ellison

2015 ThinkSwiss Research Scholarship Awardee
(as a graduate student)

University of Basel

"I couldn't have predicted that my research trip to Basel would have been of any use or interest in Nevada."



Alex with her family on the Simplon Pass
Credit: Alexandra Ellison

My research in Switzerland revolved around understanding the Swiss dual education system. I began to see very clear connections with and applications to the growing manufacturing industry in my home state. I also received some words of warning from experts in Switzerland about one-sided curriculum change, which can result when a large company begins to mold the educational standards to meet their own needs.

My research focused on the politics, policies, and strategies behind dual education in comparison to the U.S. model. During my meetings with administrators and a collection of interviews with the private sector, I began an internal debate, comparing the value of purely academic endeavors to preparation for the trades. I considered the appropriate balance of the two, the value of a 4-year bachelor degree, the level of respect given to individuals in the trades, and the best way to prepare young people to pivot and be flexible in a fast-paced and ever-changing world.

I began my research thinking that vocational education was limiting, but later learned that 70% of young people in Switzerland who choose to pursue vocational education are in fact better prepared to pivot and "job hop" in the future. Switzerland has figured out a way to allow multiple learning pathways without limiting students' opportunities or future earning potential.

In January 2016, I gave a talk at TEDx University of Nevada entitled "Educating the Next Generation of Job Hoppers." In this talk, I discussed my research

in Switzerland and what the United States could gain from a better appreciation for and application of a similar *Dualbildungssystem*.

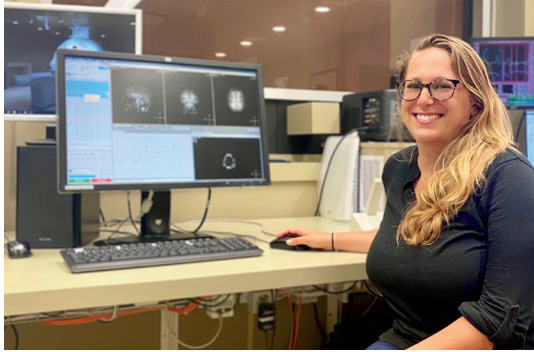
Inspired by my research in Switzerland, I helped launch a rural vocational education job shadowing experience, which I modeled after the Schnupperlehre in Switzerland. I was so impressed with the Swiss emphasis on exposure and experience before asking students to choose a career. In my private counseling practice, I regularly encourage students to seek out job shadows, as I've found this kind of context brings some relief to students who have anxieties about what awaits them after school.

In 2019, I published "Go Your Own Way: 7 Student-Centered Paths to the Best College Experience," in which I highlight my research in Switzerland. My expertise was also solicited in a collaboration for a new university textbook titled "Leading Schools with Social, Emotional, and Academic Development" (SEAD), published in 2021 by IGI Global, where I wrote a chapter called "A More Mindful Approach to College and Career Counseling." Currently, I am working on a new book project which addresses the power of aptitudes in our search for "fit" in our vocations, especially as the nature of work is continuously changing. The insights gained throughout my research in Switzerland continue to significantly influence my written and applied work.

Watch Alexandra's TEDx talk on YouTube: www.youtube.com/user/tedx-talks.

Neuroeconomics

Researching Human Decision Making



Anna working at the Neuroeconomics lab
Credit: Nick Sidorenko

Anna Giarantana

2019-2020 Fulbright-Swiss Government Excellence
Research Scholarship Awardee
(as a PhD student)

University of Zurich

“On a personal level, living and working in Switzerland broadened my worldview and allowed me insight into the importance of working within the international science community.”

Imagine you have been lost for days in the mountains. On your right, you see what looks to be a small village, which would surely have food and water. On your left, you see the glimmer of what may be a long-lost medieval treasure. You can only pick one direction; do you go to the right or the left? The decision you make will be the result of several different inputs that are neurological, psychological, or economical in nature. The junction of these disciplines is where we find the emerging field of Neuroeconomics, the study of how humans make decisions. The University of Zurich has established the Zurich Center for Neuroeconomics, an unparalleled world-class center researching human decision-making.

At the Zurich Center for Neuroeconomics, I studied the question of how schizotypal personality traits in the general population affect visual and reward decision-making in the brain. Working in collaboration with schizophrenia researchers at the University of Geneva, we developed novel behavioral experiments aimed at determining how well individuals were able to adapt to a range of both visual and reward tasks. The object discrimination task that I was responsible for creating and implementing was the first of its kind to show that humans are able to adapt to a range, not only in basic visual processing, but also in higher order visual processing. Using this novel task to investigate deficits in adaptive coding across the schizophrenia spectrum allowed us insight into the disease process in a way that had previously never been studied. Our data collection is still ongoing, but we hope to have results to report within the year. We anticipate that if we

find a canonical deficit in adaptive coding across the schizophrenia spectrum, we will have learned more about how the disease process works and identified a new target for potential therapies in the future.

My time working at the Zurich Center for Neuroeconomics was pivotal in my development as a scientist and as an MD-PhD student. I return to Rutgers Robert Wood Johnson Medical School to complete my medical degree with a much richer understanding of human decision-making and a knowledge of how to develop and implement tasks to study important research questions, using both behavioral and neuroimaging methods. On a personal level, living and working in Switzerland broadened my worldview and allowed me insight into the importance of working within the international science community. I plan to sustain the ties I made during my time in Switzerland, both personally and professionally, and hope to utilize all I have learned to make a positive impact in the future.



Credit: Anna Giarantana

Urban and Regional Planning

Road Traffic Emissions in Southern Switzerland



Credit: Benjamin VanGessel

Benjamin VanGessel

2013 ThinkSwiss Research Scholarship Awardee
(as a graduate student)

Università della Svizzera italiana

“As an extension of this experience, I continue to tackle environmental issues at the U.S. Environmental Protection Agency.”

In Europe, emissions from road transportation are growing, whereas emission trends remain steady or are decreasing for other sectors. Additionally, road traffic is a major source of air pollution that poses significant human health risks. As a participant in the ThinkSwiss program, I sought to identify potential mitigation strategies to reduce emissions from the on-road transportation sector in Switzerland.

Hosted by the Università della Svizzera italiana (USI) in Lugano, my research largely focused on air quality concerns in Switzerland’s southern canton of Ticino. I examined air quality concerns, developed projections of future emissions from the transportation sector, and identified potential mitigation strategies. Both particulate matter and ozone-monitored readings in the valleys of Ticino were shown to be elevated well above the Swiss national average. The increased levels are related in part to topographic and meteorological conditions, but are largely a product of increasing regional traffic volumes.

For this research, I examined macro trends of the Swiss on-road transportation sector including vehicle ownership, vehicle miles traveled, vehicle type sales, fuel expenditure, and energy and greenhouse gas intensity of travel. I developed long-range projections on a cantonal level using a sketch model based on the U.S. Environmental Protection Agency’s Motor Vehicle Emissions Simulator. Long-term macroeconomic and behavioral trends in Switzerland indicated that, without intervention, air quality issues will worsen both within the Canton of

Ticino and nationally. Furthermore, private vehicle use accounts for nearly 32% of Switzerland’s annual greenhouse gas emissions and is projected to grow. Reducing emissions requires a policy mix that addresses three areas. First, introducing a pollution price on certain fuels could begin to capture the externalities of transportation. Second, other efforts to promote lower emissions vehicles and fuels, such as electric vehicles, could tap into Switzerland’s already robust investment in clean energy generation. Lastly, travel efficiency measures, such as road pricing, could be employed to reduce overall transportation demand.

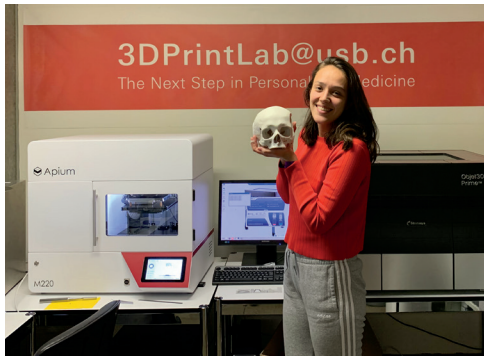
This experience and research aligns with my career path. I currently work at the U.S. Environmental Protection Agency’s Office of Transportation and Air Quality (OTAQ). In this position, I provide technical assistance to state and local transportation agencies across the United States to assess and develop interventions to reduce transportation-related pollution and greenhouse gas emissions.



Traffic in the Swiss Canton of Ticino. Credit: Haya831

Biomedical Engineering

3D Printing Implants at the Point of Care



Cemile holding a 3D-printed skull
Credit: Cemile Basgul

Cemile Basgul

2020 ThinkSwiss Research Scholarship Awardee
(as a PhD candidate)

University Hospital Basel

“ThinkSwiss provided me with an unforgettable research experience through joint institutes and an interdisciplinary research environment across hospital, university, and industry.”

I received the ThinkSwiss scholarship for my research in 3D printing of orthopedic implants at a chaotic moment, in the midst of the COVID-19 lockdown. While trying to finish my PhD as the pandemic was going on and with all the travel restrictions in place at the time, I was not sure how my planned research trip would work. However, thanks to the ThinkSwiss program, which helped and supported me through my journey, the research trip was not only made possible, but proved to be unforgettable.

I spent two months working at the 3D Print Lab at the University Hospital of Basel with Dr. Florian Thieringer, a craniomaxillofacial surgeon, and his team. They have been investigating the use of PEEK (polyetheretherketone) for cranial implants with a medical 3D printer located at the 3D Print Lab.

After four years of research experience in this area, I developed a mathematical model that predicts the interlayer strength of 3D-printed PEEK depending on the printing conditions. This model helps to improve the 3D-printed implants' strength by optimizing different parameters. It is vital to ensure the mechanical stability of 3D-printed implants to be able to produce patient-specific implants in hospitals. For the last part of my thesis and PhD, I planned to validate this model and collect temperature measurements during 3D printing. The University of Basel's biomedical engineering team generously provided me with an infrared camera for my thermal data collection.

The outcome of this research was recently published in *Additive Manufacturing* by Elsevier, one of the most influential journals on 3D printing. In addition, the collaboration between the 3D Print Lab through Dr. Thieringer, and the Implant Research Center (IRC), through my advisor, Dr. Kurtz, led to a fruitful review article on 3D-printed high-temperature polymer implants and implant applications that has likewise been published.

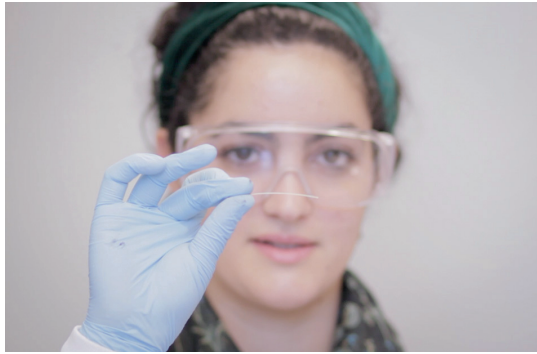
ThinkSwiss provided me with an unforgettable research experience through joint institutes and an interdisciplinary research environment across hospital, university, and industry. I was able to collect the final data to complete my five-year PhD with two first-author papers generated by this grant. I successfully defended my PhD and graduated in March 2021 after a few months of completing my dissertation. I look forward to exploring my options in 3D printing medicine in the future.



Selfie before watching a surgery using 3D-printed implants.
Credit: Cemile Basgul

Neural Engineering

Fabricating Brain Implants



Christina holding a flexible multifunctional fiber for neural depth probes
Credit: Melanie Gonick

Christina Myra Tringides

2015-2016 Fulbright- Swiss Government Excellence Research Scholarship awardee (after her undergraduate studies)
EPFL (Federal Institute of Technology Lausanne)

“My stay in Switzerland provided me with a new lens into the world of neural engineering.”

Neural engineering involves the fabrication of implants that can provide therapeutic relief, characterization, and potential treatment for a variety of neurological disorders such as Parkinson’s disease, epilepsy, or blindness. The engineered devices interface with the nervous system (brain, spinal cord, nerves) by providing electrical and/or chemical stimulation.

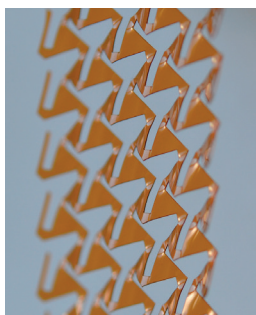
Through my Fulbright/Swiss Government Excellence scholarship, I spent a year at the École Polytechnique Fédérale de Lausanne (EPFL) in the research group of Stéphanie Lacour. I worked on the design, characterization, and fabrication of a surface electrode array that could record from difficult-to-access regions of the brain. One of the first projects to which I contributed was to increase the number of electrically active sites, using a method that was both reliable and scalable. Our new technique allowed for close to a 100% yield of functional electrodes, compared to previous yields of around 60%.

My second contribution was to the development of an alternative technique for fabricating softer neural implants with conductive tracks of various materials. After months of optimizing the fabrication steps, we had our first proof-of-concept of this inherently stretchable device and were able to completely characterize the technology.

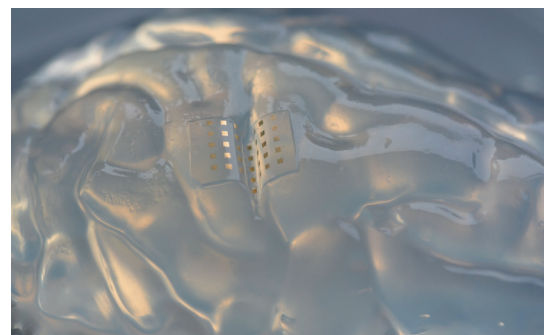
Since then, we have gotten a license for testing the two technologies that I worked on in larger mammals. With the second project, other generations of students in the group have further developed and translated the technology to various neuro-

logical applications. In addition to the publication of two scientific papers, of which I am co-author, we filed for a patent for the alternative stretchable technology. Further, I fell in love with these surface electrode arrays and began a PhD at Harvard University, where I have continued to develop next-generation implants. I recently published a paper on a brand-new materials toolbox, and class of devices, and collaborated with the Lacour lab to validate the technology.

My stay in Switzerland provided me with a new lens into the world of neural engineering, and allowed me to learn microfabrication techniques, in addition to recognizing the limitations of existing materials/protocols to fabricate arrays. I have continued to maintain collaborations with the lab that taught me so much during my Fulbright/Swiss Government Excellence scholarship. Professor Lacour was (and remains) a fantastic mentor, and has continued to provide technical advice throughout my PhD as well as feedback on the academic track that I hope to pursue.



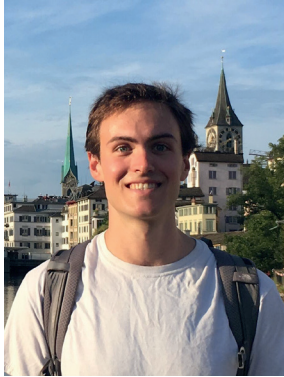
New technology that enables stretchability in non- or minimally-stretchable materials
Credit: Nicolas Vachicouras



‘Jello’ agarose brain model with a grid
Credit: Christina Myra Tringides at LSBI EPFL

Electrical Engineering

Developing Next Generation Systems for Electric Transportation



Credit: Grayson Zulauf

Grayson Zulauf

2019 ThinkSwiss Research Scholarship Awardee
(as a PhD candidate)

ETH Zurich (Federal Institute of Technology Zurich)

“The ThinkSwiss experience opened my eyes to a different set of tradeoffs, research directions, and challenges.”

Power electronics are ubiquitous to our modern, electrified economy, yet remain largely unknown to the public. They are the “brick” that charges your phone and laptop, the key to integrating solar and wind power into the grid, and the foundation of both electric vehicles and cloud computing. In short, every single electric device, in some way, relies on the efficiency, size, and reliability of power electronics, the focus of Johann Kolar’s Power Electronic Systems (PES) lab at ETH Zurich.

Over the summer, we were able to lay the foundation for five papers and counting that have since been published. My work focused on improving the efficiency of power supplies for data centers (which are expected to consume 20% of the world’s electricity by 2030), the physical properties and limitations of next-generation materials for power semiconductors (including gallium nitride and silicon carbide), and pushing the boundaries of power conversion for solar inverters and electric vehicle motors. These papers have already garnered widespread attention in academia and industry and have been featured as the “Most Popular” papers in industry-leading journals.

The ThinkSwiss experience was, without exaggeration, transformative for my research and subsequent career. My home lab at Stanford University, Prof. Juan Rivas’ SUPER-Lab, is building power electronics for future applications that are 5-10 years away from industrial adoption, while Prof. Kolar’s PES Lab is more focused on power electronics with applications today. This opened my eyes to a different set of tradeoffs, research directions,

and challenges than I had been exposed to previously, growing my horizons. Some of the insights led to my current role as CEO / co-founder of Resonant Link, a company bringing wireless charging to mission-critical applications like medical devices and electric vehicles. Our frameworks, strategies, and applications would have been entirely different without the time I spent at ETH Zurich that was enabled by ThinkSwiss.



Hiking in the Swiss Alps
Credit: Grayson Zulauf

Biology

Genetic Diversity Across Space and Time



Mark holding an indigo snake
Credit: Nick Cairns

Mark Szenteczki

2014 ThinkSwiss Summer School Scholarship Awardee
(as an undergraduate student)

University of Lausanne

“While the species I’ve studied have varied over the years, one element that connects them all is Switzerland.”

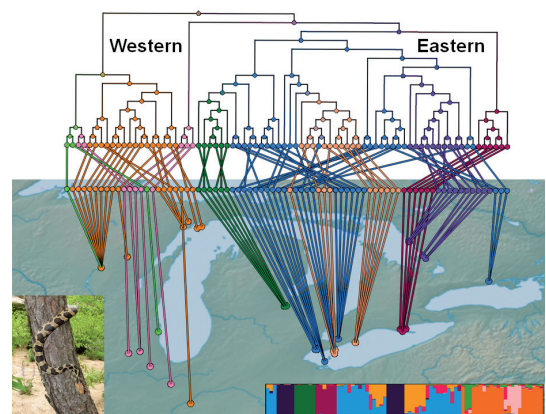
Few things excite me as much as influences on genetic diversity across space and time, and the current pace of technological innovation. As a field biologist with a penchant for overly technical solutions to questions in ecology and evolution, I am lucky to have been able to combine these interests.

Much of my research has involved Switzerland—and it all started with a ThinkSwiss travel grant for the summer undergraduate research program at the University of Lausanne (UNIL). While at UNIL, I researched North American snakes (specifically, eastern and western fox snakes) using leading-edge Swiss research facilities. I was given the opportunity to use next-generation sequencing technologies to reconstruct the evolutionary and demographic histories of fox snakes from the Great Lakes region of Canada and the United States. I produced a restriction site-associated DNA sequencing (RADseq) library, which allowed us to survey genetic variations across over 20,000 loci. This high-resolution overview of the distribution of fox snake genetic diversity revealed that the eastern and western lineages are likely two distinct species.

This project funded by ThinkSwiss had a major impact on my research career – I later returned to Switzerland thanks to a UNIL Master’s grant, and am still in Switzerland nearly six years later! During my MSc and PhD, we have studied the genetics underlying diverse interactions between microbes, insects, and plants. Currently, I am in the final year of my PhD research on *Arum maculatum* pollina-

tion at the University of Neuchâtel, funded by the Swiss National Science Foundation.

Thanks to world class facilities, excellent support, and an incredible environment both in and out of the lab, we now have a better understanding of the genomics of diverse organisms, ranging from microorganisms to snakes. These data will ultimately allow us to better protect their genetic diversity and adaptive potentials in a changing world.



Evolutionary relationships between fox snakes (top), and the distribution of their genetic diversity across Canada and the U.S. (bottom)

Credit: Mark Szenteczki

Design

Emotional Investment in Virtual Reality



Credit: Rebecca Goodine

Rebecca Goodine

2016 ThinkSwiss Research Scholarship Awardee
(as an undergraduate student)

Zurich University of the Arts

“If anything from this experience is certain, it is that I have grown: academically, personally, and culturally.”

While attending Zurich University of the Arts, I was involved in research looking at emotional investment in the context of played virtual reality (VR) experiences. I held playtesting sessions where I asked my participants to play the VR game “Sightline: The Chair,” during which I asked them questions about their in-game perceptions.

These questions centered on two key topics, emotion and bodily sensation, in order to investigate my hypothesis that VR embodiment could elicit emotion in ways unique to that medium. I then attempted to codify these answers across participants to see where common thematic areas occurred in their verbal answers. My small sample size did not yield enough data to make significant quantitative predictions or statistical observations; however, I did find some qualitative areas of commonality, such as a reported uncomfortableness when the in-game avatar did not match the player’s real life body, which is certainly an area I am interested in considering with future larger-scale research.

My interest in this particular project, and in games studies in general, stems from my wish to understand why and how video games can make us feel the way we do. From a young age I was drawn toward games, and today I believe that the wholly engrossing “magic” which I saw in them is something that can be refined to help a variety of individuals, such as those with emotional or mood disorders.

I am extremely grateful to ThinkSwiss and my hosts, Zurich University of the Arts and Dr. Beat Suter, for this opportunity to explore my research

interests, an opportunity which has since proven to be an invaluable source of inspiration personally. In fact, I think a combination of working in the lab, being exposed to a multitude of fantastic thinkers, and being given the tools and freedom to work on my interests are what collectively inspired me to later apply to a graduate program.

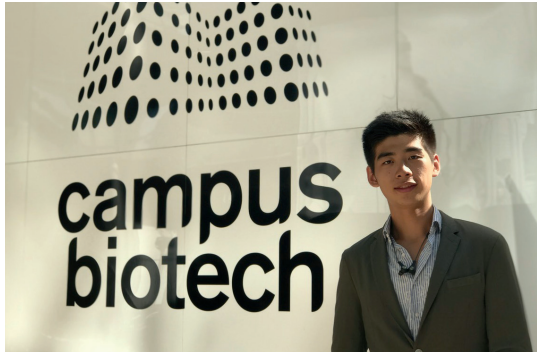
I completed my Master of Design degree from Concordia University in 2020, with a thesis project titled “ColorFull: A Research-Creation Game for Wellness Reflection”. The project began with a series of three participatory design workshops. This in turn helped build a physical card-based drawing game, wherein group discussion and sharing promoted individual reflection on the user’s own conceptions of wellness. From testing this work, I created a set of best practices useful for future emotional and/or wellness game designers.



Rebecca using “Birdly”, a VR flight simulator
Credit: Olga Brykina

Computational Neurobiology

Cognitive Workload of Drone Pilots



Credit: Thomas Qilong Xin

Thomas Qilong Xin

2018 ThinkSwiss Research Scholarship Awardee
(as an undergraduate student)

EPFL (Federal Institute of Technology Lausanne)

“I sincerely believe that such an experience in Swiss universities, with an emphasis on collaboration and opportunities to learn about cutting-edge technology, is a great way to develop one’s skill as a successful scientist.”

In the summer of 2018, supported by ThinkSwiss, I had the incredible opportunity of an internship at the Defitech Chair in Brain-Machine Interface (CNBI) laboratory at Campus Biotech of the EPFL. My project was to optimize a machine learning algorithm used to detect in real-time, from electroencephalogram (EEG) recordings, which are recordings of brain activity, pilots’ workload during symbolic control of drones. This project was part of a larger study aimed at improving the semi-automation of drones designed for air-dropping resources for disaster relief. Specifically, I worked on modeling the “normal” background EEG activity of the subjects, i.e., the constant backdrop of activity that is necessary for default human activity, as opposed to the more intense modulation of attention when controlling drones. The project was exciting as it used biologically-informed knowledge to improve the performance of the brain-machine interface. Furthermore, the potential impact of this research was also quite impactful.

During my internship, I was able to work independently on both data collection and algorithm design. For data collection, I learned how to deploy high-density EEG recordings, set up flight simulators, and examine EEG recordings in real-time for quality control. These skills proved to be invaluable for my later research using EEG. More importantly, I worked on integrating current research on the EEG background activity into the classification algorithm. I received a lot of helpful guidance from my PhD student supervisor, who trained me to conduct data collection in the protocol throughout my internship. The principal investigator and the lab’s

research scientist also helped me develop a clear timeline and benchmark for my project. Though not directly relevant to my project, other members provided me with invaluable feedback whenever I ran into an issue. In fact, the lab had a designated coffee break every day, where we would share all the problems and progress of our research in a spontaneous context. For instance, one PhD student at the lab, a very experienced programmer, taught me how to write clean and efficient code, a skill that has proven to be beneficial even to this day.

Overall, my internship in Switzerland benefited me tremendously as a researcher. In terms of techniques, EEG data analysis has been a continuous theme throughout my undergraduate thesis and my current graduate study. Moreover, thanks to my internship, I learned how to manage my project effectively and communicate with others in a collaborative environment. I believe these skills are equally, if not more, important, for a career in research or industry. I am thankful that ThinkSwiss supported my research internship. I sincerely believe that such an experience at Swiss universities, with an emphasis on collaboration and opportunities to learn about cutting-edge technology, is a great way to develop one’s skills as a successful scientist.

Music

Classical Saxophone



Credit: Uday Singh

Uday Singh

2020-2021 Fulbright-Swiss Government Excellence
Research Scholarship Awardee
(as a graduate student)
Zurich University of the Arts

“I always found myself surrounded by creative and unique projects that aimed to go far beyond the standard classical music performance format.”

Although the genres of classical music and popular music once used to overlap, that is not the case anymore. Over the course of the last century, classical music has instead fallen to the wayside as first jazz music and eventually rock and other popular genres became the primary listening choice for most. However, instead of attempting to adapt in order to maintain relevance to the truths of modern society, the establishment in the classical music industry have generally chosen to stick primarily to their core repertoire in what seems to be a blind hope that the tides will turn back in their favor and the masterworks of the 19th and early 20th century will continue to live on. However as a classical saxophonist, this has always seemed like a missed opportunity to me.

As the saxophone was patented only in 1846 and was not widely adopted into classical music until much later, much of its repertoire falls into the category of “new music”. While this means that saxophonists cannot typically find performance opportunities with standard symphony orchestras, as most other instrumentalists are able to do, it also means that we are able to focus extensively on what I consider to be a very engaging and exciting branch of music.

While in Zurich as a Fulbright recipient, I studied with Professor Lars Mlekusch at the Zurich University of the Arts (ZHdK). Professor Mlekusch has been a strong advocate for new music for the last two decades, both as a saxophonist and as a conductor. His students are known for their commitment to artistic integrity in addition to their

enterprising nature. This combination of skills enables them to set themselves apart in the fractured music industry we have today.

As a part of the class at ZHdK I always found myself surrounded by creative and unique projects that aimed to go far beyond the standard classical music performance format. I found this to be a fantastic way to push our instrument further into the spotlight and to generate new artistic concepts to share with new audiences. I truly believe that pursuing this type of work with new music is the best way to bring classical music back into relevance with the next generation of listeners. I look forward to implementing the tools I gained during my time in Zurich in my performance and pedagogy practices in the future.



Credit: Caroline Minjolle

Listen and watch the recording Uday made in Zürich: www.youtube.com/watch?v=O2BeUCUJ0_U



Uday performing live in Zurich
Credit: Lars Mlekusch

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