# Brain training

**Drs Rafael Romero-Calderón** and **Chris Evans** discuss Project Brainstorm, an initiative which gives neuroscience undergraduates the opportunity to teach younger students about the brain. It was established by the former Director of the Brain Research Institute **Dr Arnold Scheibel** and expanded upon by **Dr Joseph Watson** in his capacity as Associate Director for Outreach


Dr Romero-Calderón


Dr Evans


Dr Scheibel


Dr Watson

**Can you explain what the Brain Research Institute (BRI) is, why it was set up and what its overarching goals are?**

**AS:** In 1950, the field of neuroscience was much more limited. Dr Horace 'Tid' Magoun, with Dr Giuseppe Moruzzi, had just described the ascending reticular formation; having previously demonstrated the control of the reticular formation over downstream motor activity with Dr Ruth Rhines. Magoun's move to the University of California, Los Angeles (UCLA) was widely noted, and attracted a number of other researchers. His dream of a research institute devoted entirely to the brain was another draw, as was the creation of a graduate teaching programme. In 1959, Magoun founded the BRI on the UCLA campus.

BRI's overarching goal has been to foster and improve multidisciplinary collaborations. Advances in areas such as Parkinson's, Huntington's and Alzheimer's diseases are contributing to UCLA's emergence as a leader in translating basic neuroscience research into clinical and technological applications.

**CE:** In the coming years, BRI's efforts will focus on six areas of neuroscience: learning and memory; neurogenetics; neural repair; addiction research; neuroimaging/cognition; and synapses, cells and circuits. UCLA's strength in these areas comes from multidisciplinary efforts to understand the nervous system at multiple levels with diverse technologies.

**How does Project Brainstorm fit into this work?**

**CE:** The BRI's mission is to: increase understanding of how the brain works, develops and responds to experience, injury and disease; help make UCLA the preeminent centre for translating basic knowledge into medical interventions and new technologies; and promote neuroscience education at all levels. Project Brainstorm is an important part of our educational mission.

**How did this initiative come to exist in its current incarnation – as a formal course offered to neuroscience students at UCLA?**

**RRC:** In 2005, while a doctoral student, I served as Science Student Coordinator for the Center for Community Learning at UCLA, which involved tutoring science undergraduates in internships outside UCLA. The Director of the Center suggested that, as a neuroscience graduate, I should develop an internship specifically for neuroscience undergraduates. I therefore contacted Dr Joseph Watson, then Vice-Chair of the Undergraduate Neuroscience Interdepartmental Program, who told me about the Project Brainstorm initiative and how it might be reinvented into a more formal course. Together with Dr Elizabeth O'Hare (also a neuroscience graduate student at the time), we came up with a working syllabus and the Project Brainstorm course was born.

**What are the key characteristics of the teaching programme offered by Project Brainstorm?**

**RRC:** The premise behind Project Brainstorm was to generate interest in science at the K-12 level (ages four-19), as well as give college students some exposure to teaching in the real world. All students benefit – school children will find science more interesting and real than in their textbooks, while college undergraduates get to apply the knowledge they acquire in their classes in a professional setting. Project Brainstorm is an ideal teaching programme since it requires students to teach other students, allowing all of them to learn something valuable.

**The brain is undoubtedly one of the most complex and poorly understood parts of the human body. As such, how do the Project's activities remain understandable and stimulating for younger students?**

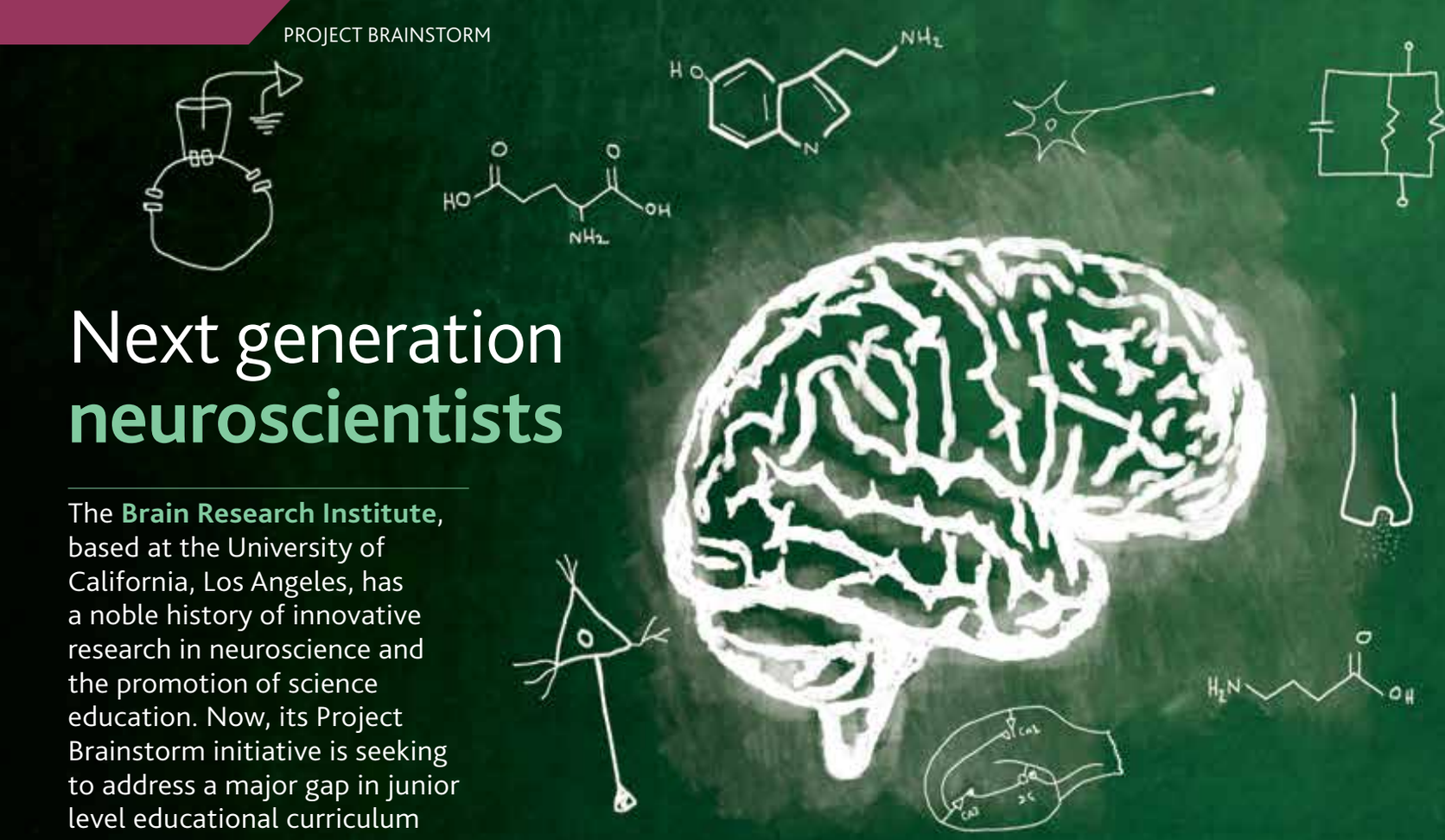
**RRC:** We make sure that we always focus on the basic concepts. As immensely complex as the brain is, it also seems to follow some basic rules, and these are the ones we focus on during our class visits. We avoid the details in an attempt to help students understand basic brain anatomy and physiology without confusing them. We also make ample use of didactic materials, like models, images, movies and activities, to make the brain much more relatable to the students.

**Are there any other scientific disciplines that you envisage this teaching model being applied to?**

**RRC:** In theory, any discipline – not just scientific – can use our model to engage students. All that is required is a breakdown of basic concepts and some hands-on activities that allow students to practise their newfound knowledge. Although Project Brainstorm was relatively easy to start, there is no reason that researchers and pedagogues in any field cannot apply our teaching strategy.

**What do you see for the future of Project Brainstorm?**

**CE&RRC:** Possibly the engagement of a larger group of students using virtual and online interactive presentations that are developed by UCLA students. We would also like to see other universities adopt similar programmes so that an even wider array of school children can be impacted.



# Next generation neuroscientists

The **Brain Research Institute**, based at the University of California, Los Angeles, has a noble history of innovative research in neuroscience and the promotion of science education. Now, its Project Brainstorm initiative is seeking to address a major gap in junior level educational curriculum

**THE BRAIN REMAINS** the most mysterious organ in the human body. The term 'neuroscience' was not coined until after World War II, and it is only since then that the field has seen any significant progress. One person at the forefront of neurological research during those early days was Dr Horace 'Tid' Magoun, who founded the world-renowned Brain Research Institute (BRI) at University of California, Los Angeles (UCLA).

To this day, the BRI remains at the cutting-edge of neurological research, embracing all aspects of basic neuroscience and accelerating the movement of ideas into real therapeutic applications. A major focus is the fostering of new and exciting collaborations between researchers at UCLA. "The strength of neuroscience here is due in no small part to the number of faculty members with an interest in the subject," explains Dr Rafael Romero-Calderón, Joint Coordinator of Project Brainstorm, an innovative educational programme with the objective of capturing young students' imaginations and fuelling an early interest in neuroscience.

> "Project Brainstorm has been a source of great fun for me and the UCLA Neuroscience students. I think it is really healthy to get the students off campus, away from the classroom and their smart phones, and interacting as a team with other schools and the broader community. In many ways, this is what we all need to do more often as neuroscientists"
> - **Dr Joseph Watson**

The diversity of faculty skills is indeed striking, with BRI faculty members appointed in 27 different departments across the University, from disciplines as varied as engineering, chemistry and psychiatry. However, while it is certainly one of its greatest strengths, pushing the boundaries of neuroscience research is not the only goal of the BRI. The Institute is also committed to furthering the teaching and academic study of neuroscience, a subject which is barely addressed in the overwhelming majority of K-12 school curriculums worldwide. Hence, the BRI developed Project Brainstorm.

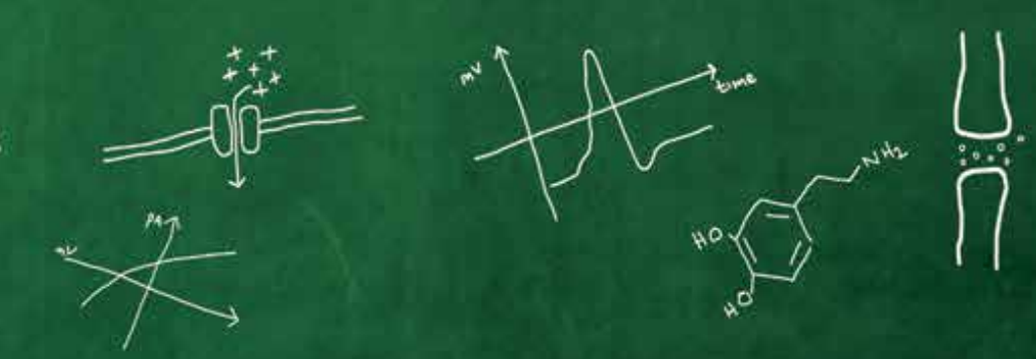
## ORIGINS OF PROJECT BRAINSTORM

The idea for Project Brainstorm originated in the early 1990s in the form of the Special Achievement Rewards for College Scholars (SPARCS) programme. It was developed by Dr Arnold (Arne) Scheibel, who was Director of the BRI at the time, and Ms Norma Bowles of the Achievement Rewards for College Scientists (ARCS) Foundation. Based on a similar model implemented at University of California, Berkeley by Dr Marian Diamond (for students of anatomy, including neuroanatomy), the SPARCS programme had the primary aim of providing students from kindergarten to 12th grade with material that could be used for teaching. Scheibel himself describes the initial stages of the SPARCS programme: "In the early days, I trained the students in a few basic teaching techniques. Soon the more experienced groups were teaching the incoming teacher candidates and the process quickly became self-renewing." The early 1990s was a time when funding was particularly stretched at the BRI, so the SPARCS programme offered an ideal cost-effective programme enrichment opportunity for current graduate students in the BRI, as well as an aid to inspire the younger generation.

## THE PROJECT'S GOALS

Project Brainstorm, under its current curriculum and incarnation, was developed in 2006 by Romero-Calderón, then a doctoral neuroscience student at UCLA. The distinction Project Brainstorm is keen to make from more traditional courses, similar to the SPARCS programme before it, considers students' exposure to practical activities and applications to be of utmost importance. Romero-Calderón explains: "Science education is slowly evolving into a more engaging and meaningful experience for students as we collectively realise that knowing facts is not the same as understanding them." Project Brainstorm tries to make science relevant to students by focusing on simple concepts and then allowing the students to develop their understanding by undertaking hands-on activities.

Another key objective that has been carried from the SPARCS programme over to Project Brainstorm is the focus on generating interest in neuroscience in school children. Science courses at the junior school level have traditionally remained centred on a core range of subjects, which have not changed a great deal in many decades. It is very rare for areas such as neuroscience to be introduced to students at this level, and as a result by the time they reach college age many are not even aware that this could be an area of interest. Neuroscience should be viewed as equally important to conventional school science subjects. A key goal is therefore




to address this shortcoming and inspire young minds to learn more about the brain. Ultimately, the team behind the Project hopes that this will drive more undergraduates to enter neuroscience research themselves in the future.

## EVERYONE'S A WINNER

While Project Brainstorm is not the only outreach programme of its kind that is currently in operation, there are many distinct aspects of the programme that make it unique. One crucial advantage is the targeting of young students and the exposure they receive to a fascinating area of science that they otherwise may never have encountered. They also gain important lessons for their daily lives such as the dangers of concussion and abused drugs from the perspective of neuroscience. Unlike other outreach programmes, which require students to visit specific educational institutions to attend courses, the Project takes the more proactive approach of visiting schools themselves, with a particular focus on disadvantaged areas.

Project Brainstorm is also of great benefit to undergraduate student participants. Not only do they gain the invaluable experience of passing on their own knowledge, but they also participate in a form of communication similar to that found in research spheres. "If we look at research laboratories, we find that although there is a well-defined 'chain of command', there is also a very fluid exchange of ideas up and down the chain," explains Romero-Calderón. "In a sense we could say that Project Brainstorm borrows from this latter model to facilitate communication between students."

PROJECT BRAINSTORM STUDENTS

Finally, both the BRI and the wider neuroscience field are set to benefit from these activities. By instilling a genuine passion for the subject in students at an age when their imaginations and aspirations are still without limit, Project Brainstorm hopes to inspire the next generation to join a discipline that continues to grow, evolve and surprise. After all, there is still so much to be discovered.

## BRI OUTREACH ACTIVITIES

The Brain Research Institute (BRI)'s educational and community science outreach programmes are not limited to Project Brainstorm

### Interaxon

Founded in 2006 by Shanna Fang, one of the first undergraduate students to complete the Project Brainstorm course, Interaxon is another educational outreach group affiliated with the BRI. The primary focus of this initiative is to help schools in disadvantaged Los Angeles areas which have difficulty funding the sciences.

### BRI Summer Undergraduate Research Experience (BRI-SURE)

BRI sponsors this summer undergraduate research experience pathway programme, which provides an opportunity for students to undertake an eight-to-10 week period of research, supervised by faculty mentors and working with cutting-edge facilities. The best participants are chosen based on academic achievement, leadership and also a strong commitment to diversity – seeking out students from either underrepresented or economically disadvantaged backgrounds.

### Neurocamp

This outreach programme engages local high school students in a centralised lab setting to learn about the fundamentals of neuroscience and basic laboratory techniques. Conducted in multiple one-week modules, the research groups explore the latest tools in brain imaging, neuroanatomy and molecular neurobiology.

## INTELLIGENCE

### PROJECT BRAINSTORM: USING NEUROSCIENCE TO CONNECT COLLEGE STUDENTS WITH LOCAL SCHOOLS AND K-12 STUDENTS

#### OBJECTIVES

- To provide a community outreach education service that gives K-12 students a firm grounding in neuroscience
- To give undergraduate neuroscience students the opportunity to try their hand at teaching and engaging young people

#### PARTNERS

All K-12 schools in the greater Los Angeles area

#### FUNDING

The Brain Research Institute
University of California, Los Angeles (UCLA)

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**RAFAEL ROMERO-CALDERÓN** is a Lecturer in the Department of Molecular, Cell and Developmental Biology at UCLA where he teaches research-orientated courses for the Biomedical Research Minor, a programme designed to prepare young undergraduate students for the transition to graduate and/or medical school.

**CHRISTOPHER EVANS** is Director of the UCLA Brain Research Institute and the Stefan Hatos Professor and Director of the Hatos Center for Neuropharmacology in the Semel Institute. He is also Director of The Center for Opioid Receptors and Drugs of Abuse (CSORDA), a centre funded by the National Institutes of Health (NIH).

**ARNOLD (Arne) SCHEIBEL** served as Acting Director of the UCLA Brain Research Institute from 1987-90 and Director from 1990-95. His research, stemming from his interests in both psychiatry and the neural underpinnings of behaviour, has revolved around the structural and functional basis of cognition and action.

**JOSEPH WATSON** received his PhD from the Department of Chemistry and Biochemistry at UCLA in 1985 and went on to pursue a postdoctoral fellowship in molecular biology at The Scripps Research Institute in La Jolla, California. He returned to UCLA in 1989 as a member of the Intellectual and Developmental Disabilities Research Center and the Department of Psychiatry & Biobehavioral Sciences, David Geffen School of Medicine, UCLA.

Brain Research Institute