UCONN | UNIVERSITY OF CONNECTICUT

Connecticut **Institute** for **the Brain** and **Cognitive Sciences**

UCONN

CONNECTICUT INSTITUTE FOR THE BRAIN AND COGNITIVE SCIENCES

Annual Report, Year 5
2019-20

Contents:

EXECUTIVE SUMMARY (and main expenditure):

- 7 **seed grants** awarded, with PIs across 5 departments: $105K
- 5 **IBRAiN fellows** $101K
- 8 **Graduate fellowships** awarded, across 5 departments: $40K
- 16 **Undergraduate fellowships** awarded, across 3 departments: $27K
- 41 **External grant applications** (see Section 5) directly supported by IBACS, totaling $29.8M. $324K awarded so far, $13.5M pending
- **Laboratory and group support** (through direct funding, admin support, or funded GAs)**:** *Brain Imaging Research Center (BIRC)**;** Murine Behavioral Neurogenetics Facility (MBNF)*; *Cognitive Science Shared Electrophysiology labs (CSSERL)*; *Expression, Communication and Origin of Meaning group (ECOM); Logic Group*
- **Workshop support:** 9 sponsored workshops/meetings/conferences, including IBACS 2-day annual Meet-and-Speak, and virtual Meet-and-Speak on Computational Modeling and AI.

2. INSTITUTE MISSION

The mission of the **Connecticut Institute for the Brain and Cognitive Sciences** (CT IBACS) is to serve as both a beacon and incubator for research across the brain and cognitive sciences at UConn and beyond; promoting and supporting the interdisciplinary science of the mind and its realization in biological and artificial systems. It will enable new research and educational opportunities for graduate students, postdoctoral researchers, and faculty to extend their intellectual reach beyond traditional disciplinary boundaries, as well as enabling undergraduates to receive laboratory-based training in neuroscientific, behavioral, and theoretical research in the brain and cognitive sciences. It aims to provide the physical, financial, administrative, technical, intellectual, and educational infrastructure to enable UConn's extensive but distributed neuroscience and cognitive science community to realize its full potential for disciplinary and interdisciplinary innovation in the brain and cognitive sciences. The Institute was founded July 1st 2015, as a part of the University's Academic Plan.

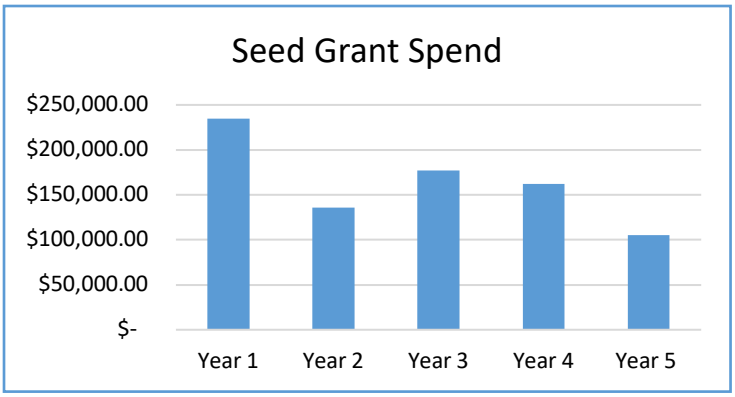
3. GOVERNANCE

The Institute is managed by a **Director** (Altmann, *Psych Sciences*) and two **Associate Directors** (Magnuson, *Psych Sciences*; Chamberlain, *UConn Health*). They meet with an **Executive Committee** of 10 other faculty drawn from 7 different departments (including Neuroscience at UConn Health, Farmington). The executive meets in person three times per year, although day-to-day issues are brought to their attention, and advice sought, via ad-hoc emails throughout the year. The Director and Associate Directors meet regularly during the semesters, and occasionally during the summer break.

A **UConn-internal Advisory Board** meets twice a year, advising on shorter- and longer-term issues of strategic importance, in respect of both Institute-internal matters and issues that may impact externally on the Institute. Throughout the year we solicit and receive advice from CLAS, the Offices of the Provost and the Vice President for Research, as well as the heads of the various departments we interact with (with particular support from Psychological Sciences).

4. INSTITUTE ACTIVITIES 2019/20

1. **Seed grants**: The Institute had two calls for seed grants (October 2019 and April 2020). We received 11 applications in total, of which 7 have been funded (approx. $105K). We received more letters of intent than applications, but on 3 occasions we advised against proceeding to a full proposal (the applications did not fit sufficiently well with the Institute's mission). All applications were reviewed by at least three reviewers drawn from the IBACS community. We avoid reviewers who are themselves applicants in the same round, although occasionally we will solicit advice from someone in this position, noting the conflict of interest. Overall, 5 out of 11 applications could be considered "cognitive", although the dollar amounts awarded are more evenly split between cognitive/behavioral and bench or animal neuroscience grants. We continue to monitor this closely. All awards are described on the IBACS website (ibacs.uconn.edu/research/). *A condition of award of a seed grant is that, in the event of a successful outcome (e.g. data suitable for publication or inclusion as pilot data in a grant) the PI will submit an application for external funding*. We track and follow-up each funded grant to ensure this condition is met. **Total amount awarded in AY/FY 19/20: $105,251**. See Appendix 2. Comparative data on seed grant expenditure across Years 1 to 5 of the Institute are shown below. This last year saw fewer grants funded, in part reflecting a need to balance the budget through to June 2021 (see budgetary sections below):

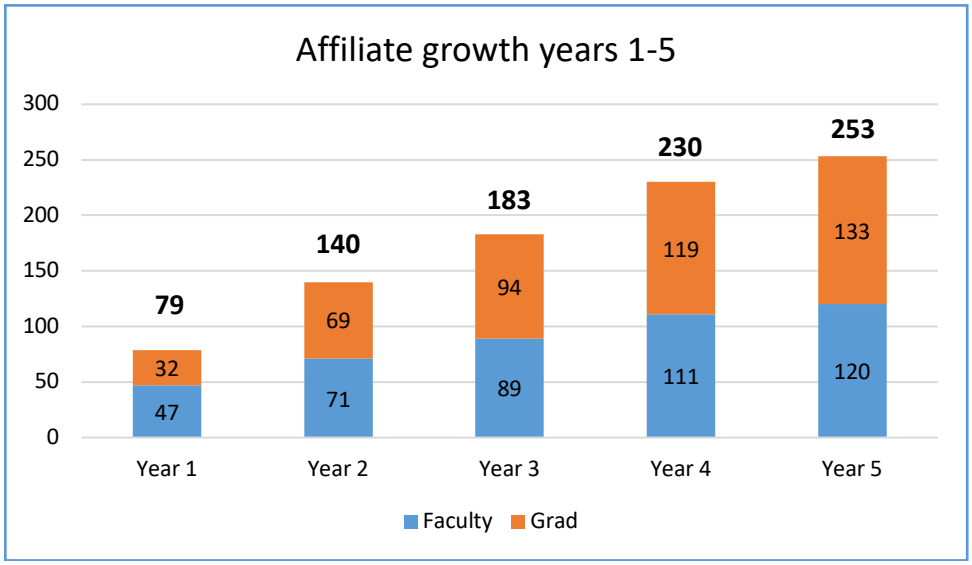


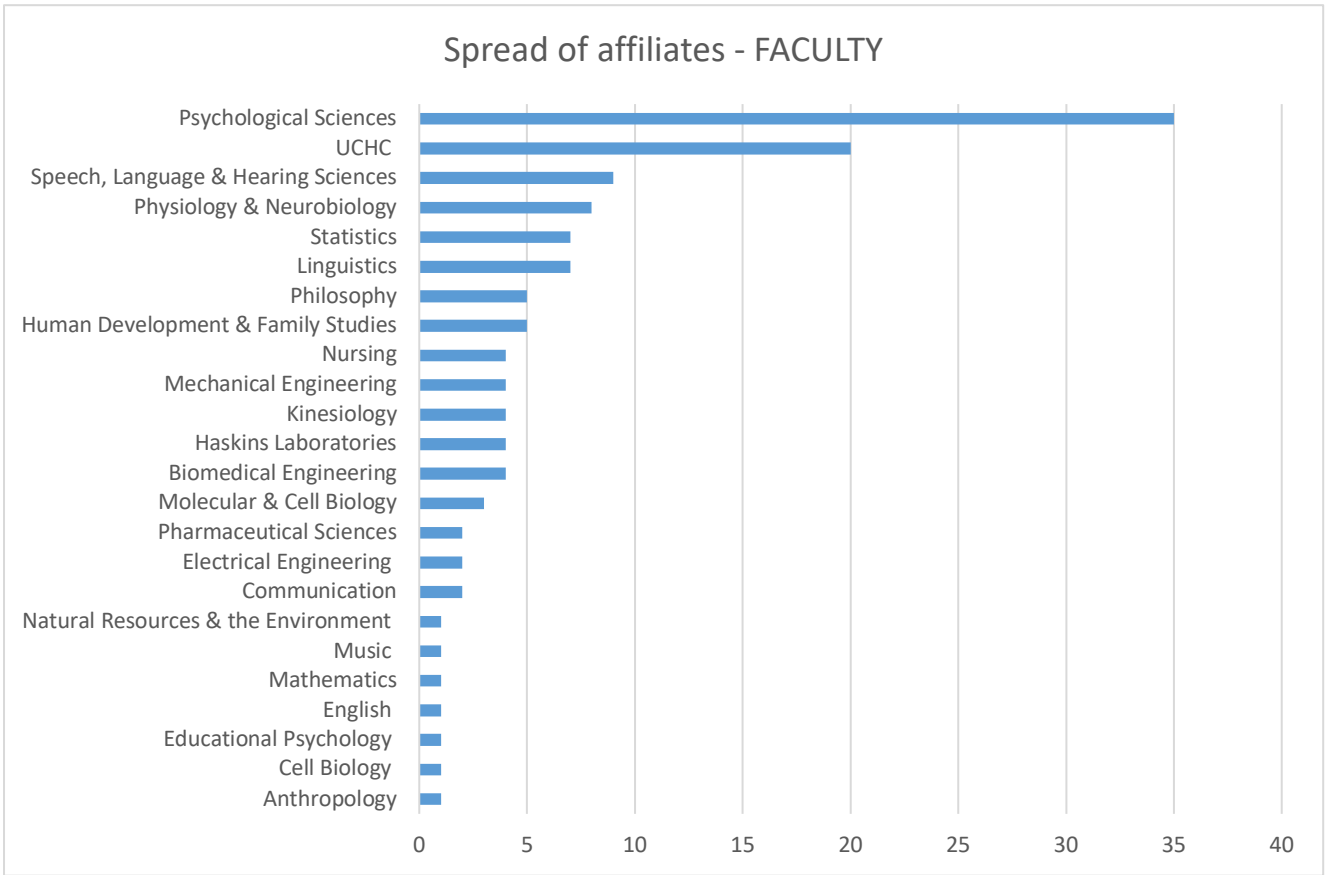
2. **Graduate Fellowships**: These pay up to $5,000 in summer funding to graduate students. *A condition of award is that students apply for a pre- or post-doctoral award (e.g. NRSA or GRF) in the Fall*. To this end, recipients take a 3-day grant-writing workshop hosted by the Institute (with various assignments across a 2-month period). This year was the 5th year of the workshop. For non-US citizens, their advisor had to commit to writing an application for external funding. We follow-up on each fellowship both to encourage and monitor such applications (see below for 2018 metrics). This year (Summer 2020), we funded **8 students, at a cost of $40,000.** Each student receives $2K upfront and $3K once the external grant application is in submittable form (to be signed off by the advisor, in principle during the summer, but by no later than March 1st of the following year). Funding decisions were made by a committee comprising the Director and Associate Directors (COIs were avoided by ensuring that no advisor scored their own student, and conflicts were registered and explicitly considered by non-conflicted members). We follow-up with each student and advisor to monitor progress on applications. See Appendix 3. Again, fewer fellowships were funded this year, reflecting our budgetary constraints through to June 2021.
3. **Undergraduate Fellowships**. The undergraduate fellowship scheme ran for a fourth year, managed by John Salamone, in conjunction with the Office of Undergraduate Research. The fellowships allow a student to work in an Institute affiliate's lab and provide up to $1,000 research expenses for semester fellowships, and a combination of $1,500 research expenses and $3,500 stipend for summer fellowships. We funded 13 semester and 3 summer fellowships in 2019/20 at a **total cost of $27,125**. See Appendix 4. Note that $200 of this amount is a travel award given to a previous undergraduate fellow who reached out to us because they were asked to present a poster at a large conference on the research project they completed with our award. We have received similar requests in the past, which has prompted us to create a new IBACS Travel Award program which will award up to 10 $500 fellowships to be used for conference travel expenses where data will be presented that was directly supported by IBACS. These awards will be made available to undergraduate and graduate students, as well as postdocs.
4. **IBRAiN Program**: 2019/20 was the third year of this program. This is a Research Assistantship paying five graduate students a stipend for 10 hours' assistance per week in BIRC ("IBRAiN" = "IBACS-BIRC Research Assistantships in Neuroimaging"). IBRAiN students are trained to assist with, and are themselves trained in, advanced specialized knowledge currently lacking in the labs of PI's who have sufficient knowledge to conceive of appropriate imaging studies but do not have the expertise to actually run a study and analyze the data. Each IBRAiN student receives a summer fellowship ($5,000), as well as MRI scan time, to work on their own neuroimaging project. The total cost of the program in FY19/20 was approximately **$100,600**. The recipients of the IBRAiN are listed in Appendix 5, and a summary report is included in Appendix 6. This year saw a reduction from 6 to 5 assistantships, reflecting the needs of BIRC as well as our own budgetary constraints. One outcome this year was a *Nature* publication (see Appendix 6).

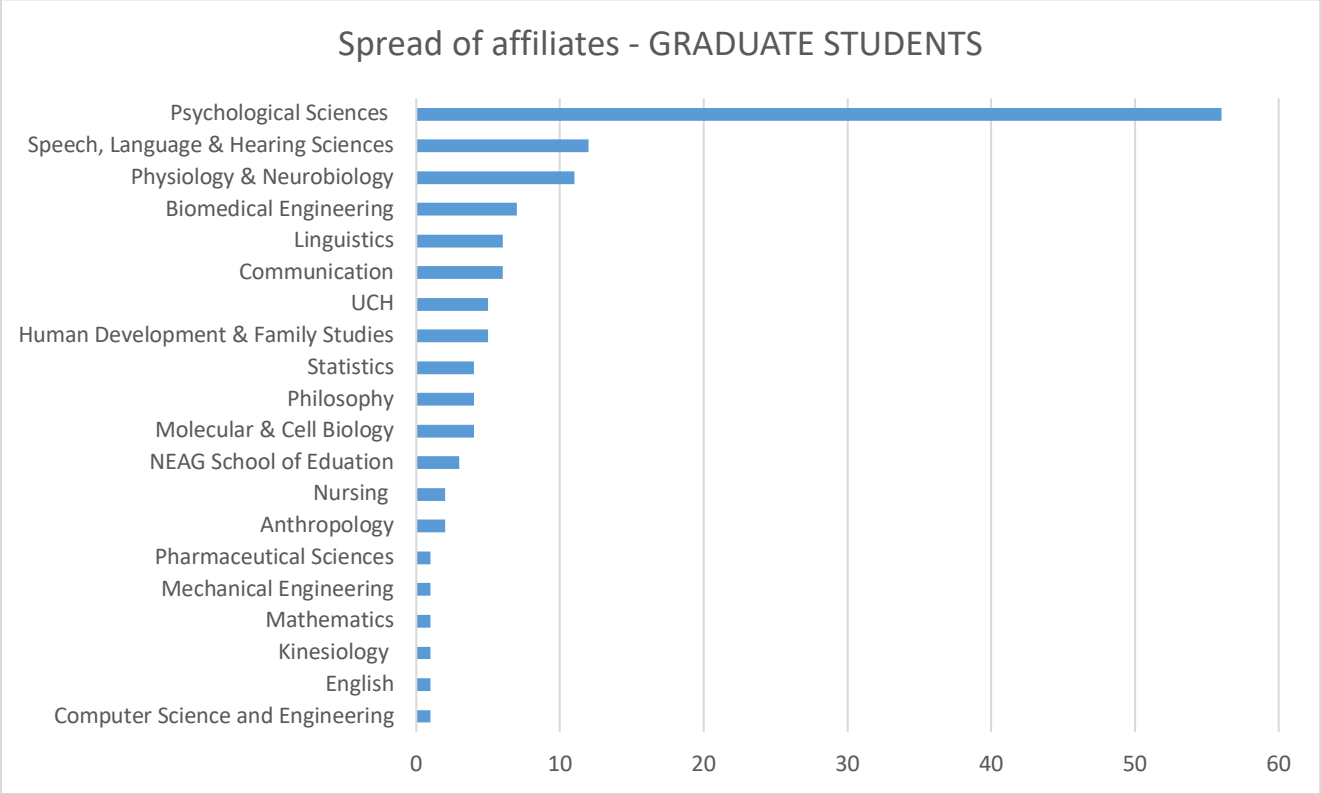
5. **Other Research Support during the past year (July 2019 – June 2020):**
   a. **Murine Behavioral Neurogenetics Facility** (MBNF)**:** In June 2018, MBNF became a subsidiary facility under the governance of IBACS. MBNF is managed by the current Director, Dr. Fitch. It was originally a Tier 2 facility funded by the University's Academic Plan. This year, we provided a block grant of $48K to MBNF to support Institute-funded and affiliated research with mouse models (linking cognitive behavior to neuroscience and genetics). A summary report and financial breakdown is included in Appendix 6C.
   b. **Cognitive Science Shared Electrophysiology Labs** (CSSERL): Lab manager (10 GA hours per week during the Spring semester). CSSERL supports the electrophysiological (EEG) research of faculty in SLHS, Linguistics, and Psychological Sciences. A summary report is included in Appendix 6B.
   c. **Brain Imaging Research Center (BIRC).** Aside from the IBRAiN program, Dr. Gitte Joergensen (the Director's lab manager / postdoc) spends a minimum of 12 hours per week on BIRC-related activities during the year, developing, maintaining, and helping write scripts for the in-scanner eye-tracking system. She also helps with EEG and works closely with Elisa Medeiros (MR Tech) on development and maintenance of other fMRI-based projects. A summary report of the BIRC IBRAiN Program is in Appendix 6A, and Joergensen's BIRC projects are described in Appendix 6E.
   d. **IBACS Lab Manager:** Dr. Joergensen is paid 2/3 IBACS 1/3 Yee Lab. Aside from her work in BIRC, and managing both the Yee Lab and the Altmann Lab, she also supports a number of non-BIRC collaborative projects under the auspices of IBACS. These are summarized in Appendix 6E.
   e. **Center on Aging, UConn Health.** IBACS and InCHIP together supported a research project on lower urinary tract symptoms (specifically, "bladder urgency") and cognitive modulation of the experience of urgency. This project was a collaboration between IBACS and the Center on Aging and The Institute for Collaboration on Health, Intervention, and Policy (InCHIP). This paid one $10K fellowship ($5K from each Institute) in each of 2017/18 and 2018/19 to a student on the Masters in Public Health. A hypothesis paper is about to be submitted (authors: Lee[1], Cavallari[2], Kuchel[3], Altmann[4], & Smith[3]; [1] Department of Public Health, Boston University; [2] Department of Public Health Sciences, UConn; [3] Center on Aging, UConn; [4] Institute for the Brain and Cognitive Sciences, UConn).
6. **Group Support during the past year (July 2019 – June 2020):**
   a. **Expression, Communication, and the Origins of Meaning (ECOM) Research Group** ($5,000). To support organization of the ECOM Spring Workshop and their speaker series. A summary of ECOM activities is included as Appendix 6D. IBACS also awarded ECOM a $7,000 grant for a three-day international interdisciplinary conference titled Expression, Language and Music (ELM) which was supposed to take place in May 2020. Due to COVID-19, it has been tentatively postponed to May 2021. See the ECOM report in Appendix 6D for more information on this conference.
   b. **UConn Logic Group** ($5,000). To support colloquia, visits, and other activities of the Logic Group – a group of logicians across the departments of Mathematics, Philosophy, and Linguistics.
   c. **Cognitive Science Program**. IBACS provides administrative assistance for the program (including managing meetings, the website, etc.). The Institute also provides financial assistance for jointly organized visiting speakers.
   d. **UCONN K.I.D.S**. This year, IBACS supported UCONN K.I.D.S. through continued support for the UConn server.

7. **Workshop and conference support**. The Institute supported 10 workshops/conferences: Neuroscience at Storrs; Language Fest; the InCHiP Lecture Series; Expression Language and Music (ELM) Conference; IBACS Meet & Speak; IBACS Grant Writing Workshop and the AI/Computational Modeling Meet & Speak. The Institute also supported several externally sponsored workshops such as NACCL-32 Conference; Brain Injury Alliance Conference (BIAC) and CUNY 2020, **Total outlay: $16,457.**
8. **Annual "Meet-and-Speak"**. IBACS holds an annual Meet & Speak event, but this year, it was unfortunately postponed until Fall of 2020 two weeks before the event due to COVID-19 concerns. At this event, faculty talks are provided from both Storrs and UConn Health (predominately recipients of IBACS seed grants), as well as presentations from Graduate Students (IBACS Summer Fellows and IBRAiN students). See Appendix 8 for the pending program. We are planning to hold the event over Zoom, rather than in-person, to facilitate participation in the context of social distancing.
9. IBACS partnered with UConn Health (Prof. David Steffens) to organize a 2nd **Brain Symposium** in September 2019 that brought together researchers from UConn Health in Farmington and UConn in Storrs. The symposium, intended to facilitate new collaborations, took place in Hartford, with 28 members of the Storrs community in attendance (and at least the same number from UConn Health). We hope to plan a third symposium in the Fall of 2020.
10. **IBACS External Application Review**. This internal review process continues to be organized by a small interdisciplinary group led by Jim Magnuson, and tasked with helping UConn investigators develop high quality grant proposals by offering a mechanism for "mock review" of in-development proposals, and facilitating mentoring in grant writing.
11. **Outreach and related activities**.
    - The Institute is in the process of publishing its fourth **Research Digest** edited by graduate students (Cara Hardy, Ben DeBari, and Charles Davis). This is similar to a "glossy brochure" and focused on the lifespan and relevance for public policy. 200 hard copies will be sent to a member of the state legislature, and copies will also provided to the UConn KIDS Research Recruitment Coordinator and were also made accessible across the Storrs campus. The Digests are available on the Institute website.
    - The Institute has identified **Advanced Placement Psychology Instructors** at high schools across Connecticut, and has created a listserv in which to share information with them such as the Brain Digest, advertisements of upcoming talks/colloquia, and recorded videos of colloquia of interest.
    - IBACS had coordinated its third **BIRC fieldtrip** with high school students studying Advanced Placement Psychology, however, it was cancelled due to COVID-19. The field trip will resume in May 2021. Students from E.O. Smith and Windham High Schools visit the Brain Imaging Research Center in May and are given tours of the MRI, EEG and TDCS facilities, accompanied by talks given by the IBRAiN students and BIRC's Associate Director, Roeland Hancock.
    - Dr. Tim Miller produced **six short scripted films** (2-3 minutes each) describing the research of six members of the Institute. These films were premiered at last year's Meet & Speak event on May 14th. They are available on the Institute's YouTube account as well as on the website. IBACS plans to continue its partnership with UConn Digital Media and Design to create more of these short films.
    - The Institute uses its website to celebrate the successes of the affiliated research community by placing various "**spotlights**" on the homepage that highlight and describe the activities of select faculty and student (graduate and undergraduate) Fellows.

12. **Affiliate membership**. The Institute has a total of 265 affiliates. Excluding the Director, 2 Associate Directors, and 9 Executive Committee members, we have 120 **affiliated faculty** and 133 **affiliated graduate students** from across 34 UConn departments. All are listed on the Institute website (photograph, research description). Affiliation is dependent on demonstrating research expertise relevant to the research mission of the Institute. We anticipate growing this number each year. Affiliation is a pre-requisite for applying for financial support from IBACS and enables us to track the impact of that support (see Section 5).







13. **Administrative support**. Crystal Mastrangelo joined us in October of 2018. This position had previously been supported 25% by Psychological Sciences; but IBACS assumed 100% of the cost in FY18/19. This position also provides support to the Cognitive Science undergraduate program (admin support and website management). As the Institute Coordinator, Crystal ensures that all the activities that have an annual cycle (seed grants, fellowships, Research Digest, etc) proceed to time, ensures that we know our budgetary situation on a weekly basis, and keeps the website and various databases (including those containing performance metrics) up to date. Crystal also manages our annual Meet-and-Speak, as well as various other activities throughout the year (including the workshops we support). She also provides support to the Director in respect of his other administrative duties within Psychological Sciences. Crystal's oversight of the Institute's finances identified vulnerabilities that we are now better prepared for (see Section 6: Going Forward). Other tasks included developing the Metrics Portal with UITS (for collecting performance metrics that contribute to Section 5, below), and managing the transition to online activities (e.g. the AI/Computational Modeling meeting held over Zoom).
14. **Space**. The Institute's physical focus consists of lab space in Arjona allocated by their respective departments to PIs Altmann, Hancock, Large, Magnuson, Yee (all Psychological Sciences), and Sprouse (Linguistics), and used also for teaching (the SLAC and Neurobiology of Language graduate programs). IBACS is hoping to update the older furniture in the lounge space to improve functionality and promote social distancing, and to purchase a conference webcam to enable distributed meet-ups (i.e different groups using Zoom or equivalent from different rooms).

15. **Educational Playcare Fellowship**. This fellowship provides up to 20 weeks of free, full-time daycare to IBACS-affiliated students, to be used within the first year of their child's life. It is intended to support students who become new parents during their graduate studies, and to facilitate their return to their studies/research. Two fellowships are available each year. They are made available through a generous gift from Educational Playcare. The first fellowship was awarded in April 2019 and two more were awarded this year in March of 2020. It consists of 10 weeks' free daycare provided by Educational Playcare, and a further 10 weeks of childcare paid for by IBACS (max. annual cost to IBACS: $6,400).

5. METRICS FOR EVALUATING INSTITUTE IMPACT: July 1st 2019 – June 30th 2020

The Institute's impact is twofold: in respect of the research ethos it is stimulating and in respect of more tangible outputs such as grant applications and publications. One of the core missions of the Institute is to foster new collaborative research initiatives, through facilitating dialog across traditional disciplinary boundaries. This is accomplished through activities such as the Meet-and-Speak, as well as through support of research groups that are themselves fostering such cross-disciplinary dialog. This contribution of the Institute to the University's research ethos is critical, and a primary motivation for the founding and continued operation of the Institute. However, because it is less quantifiable than the Institute's contribution to grant activity and publication and other outputs, we focus in this section on the latter, detailing metrics concerning grant activity, and publications. Last year, we rolled out a new web-based portal for affiliates to enter information about the IBACS support they have received or made use of, grant applications submitted, and scholarly products output. The portal was developed in conjunction with Jason Card at ITS. It has been made available to other Institutes and Centers for their own use now that it has been fully debugged and lessons have been learned from last year's trial. *Collecting metrics is imprecise, although we ensured that all faculty/graduate students who received funding responded and entered the requested information. All figures reported below are likely to under-estimate the true figures* (see Section 6). The Institute Director has taken part in a number of discussions on how our experience can help improve metric collection across the university, with several demos to representatives from the Provost's office, the OVPR, and to Deans and other Directors.

Since Inception: Since the Institute was founded in 2015, **it has supported 107 unique faculty** through seed grants, and their graduate and undergraduate students. **The Institute has supported 135 unique graduate and undergraduate students** through fellowships. IBACS has spent approximately $596k on student fellowships (e.g. IBRAiN program, Graduate RAs, graduate and undergraduate research fellowships), $855k on seed funding, $760k on group support and $159k on meeting support. These total approximately $2.4 million (approx. $475K per year).

Grant Activity FY19/20: We solicited from all Institute affiliates details of any grant submitted externally in this reporting period **which had been *directly* supported by IBACS seed funding** (affiliates were told that *"IBACS support includes: use of EEG/tDCS Lab (BIRC), seed grant funding, support from an IBRAiN Fellow or IBACS Grad/Undergrad Fellow, support from Joergensen lab manager, use of the CSSERL lab or Murine Facility, or use of IBACS External Application Review service (EAR)"*).

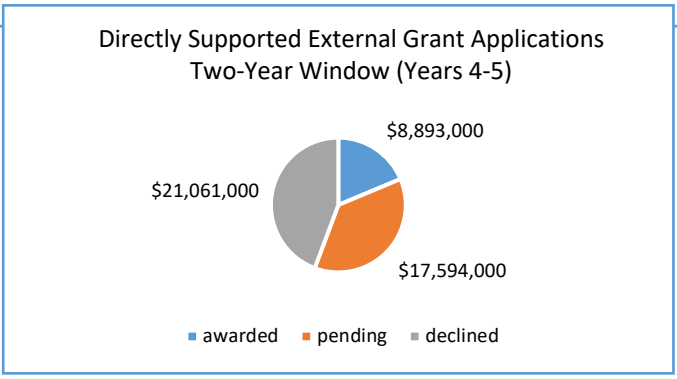
- Directly supported grants **applied for**: 41 grants totaling $29.8M (up from 35 last year)[1]
- Directly supported grants **awarded**: 3 grants totaling $324K; indirects $21K (down from 8 grants and $8.6M last year; indirects down from $1.1M)
- Directly supported grants still **pending**: 18 grants totaling approx. $13.5M; indirects $4.1M (up from 15 grants, up from $8.6M; indirects up from $1.5M)
- **grant hit rate** (# grants awarded as percent of # grants applied for): 7% (down from 23% last year)

Note 1: These numbers include 13 extramural graduate student applications.

As described in our previous Annual Report (FY18/19), we now also report aggregated data across a two-year window (the current year and the previous year). Going forward, this should give a more accurate view of the data that is less prone to yearly ups or downs due to the relatively small numbers involved (it only takes one large grant award, for example, to shift the numbers dramatically).

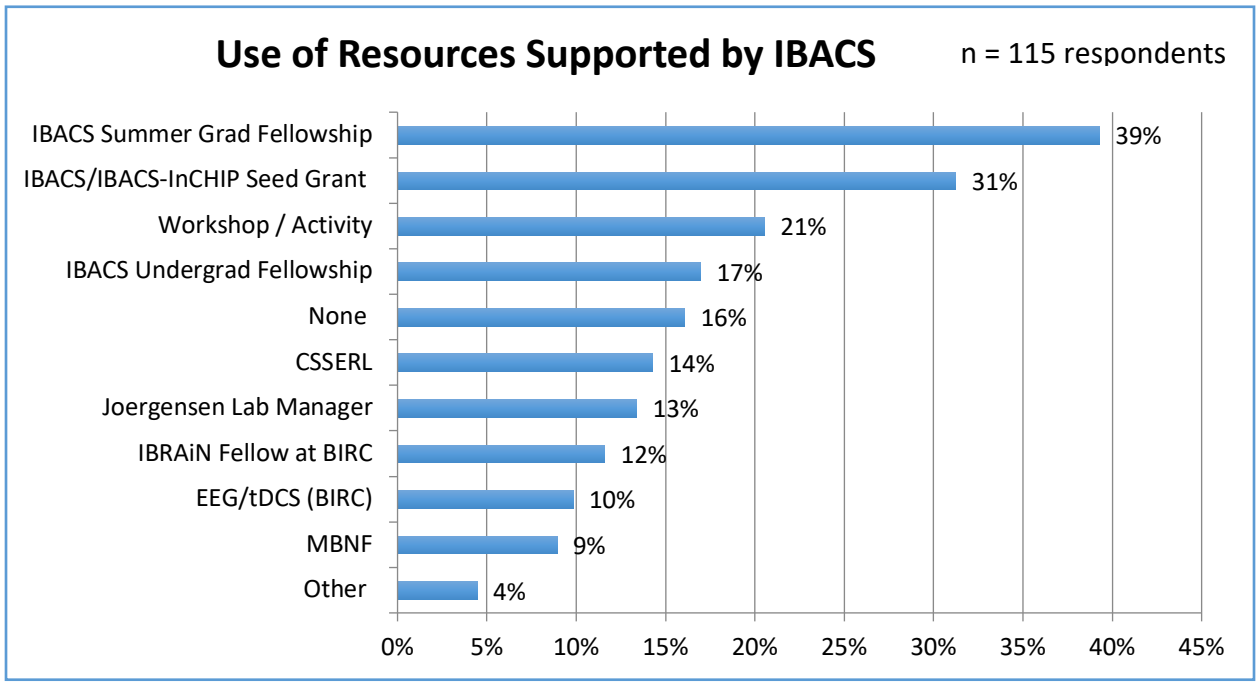
Two-Year Window – FY18/19 – FY19/20:

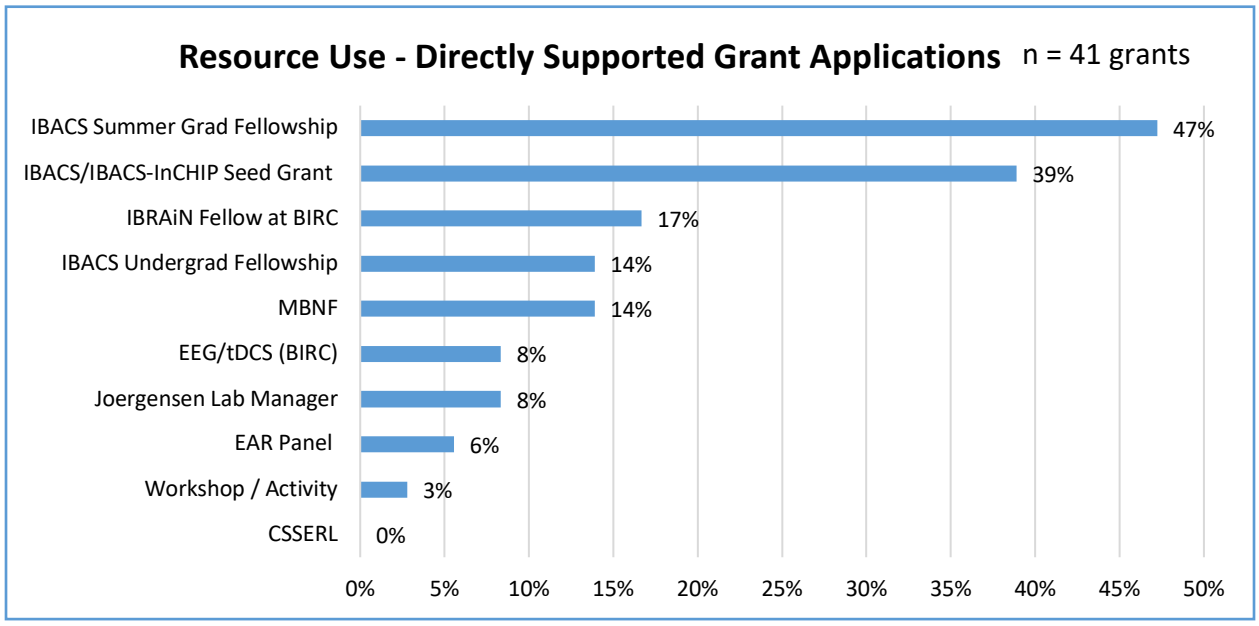
- Directly supported grants **applied for**: 64 grants totaling $48.4M
- Number of unique lead PIs who applied for grants: 36
- Directly supported grants **awarded**: 11 grants totaling $8.9M; indirects $1.2M
- Directly supported grants still **pending**: 21 grants totaling approx. $17.6M; indirects $4.3M
- **grant hit rate** (# grants awarded as percent of # grants applied for): 19%
- **$ hit rate** ($ amount of grants awarded as percent of $ amount applied for): 18%
- ***The bottom line****: The <u>total</u> Institute expenditure (incl. summer commitments) in this same period, for comparison against the $8.9M total and $1.2M indirects awarded so far, was $1.2M. <u>Note</u>: even assuming last year's $8.6M awarded grants was a maximum, and this year's $3.2K was a minimum, our averaged ROI is $7.4 for each $1.*

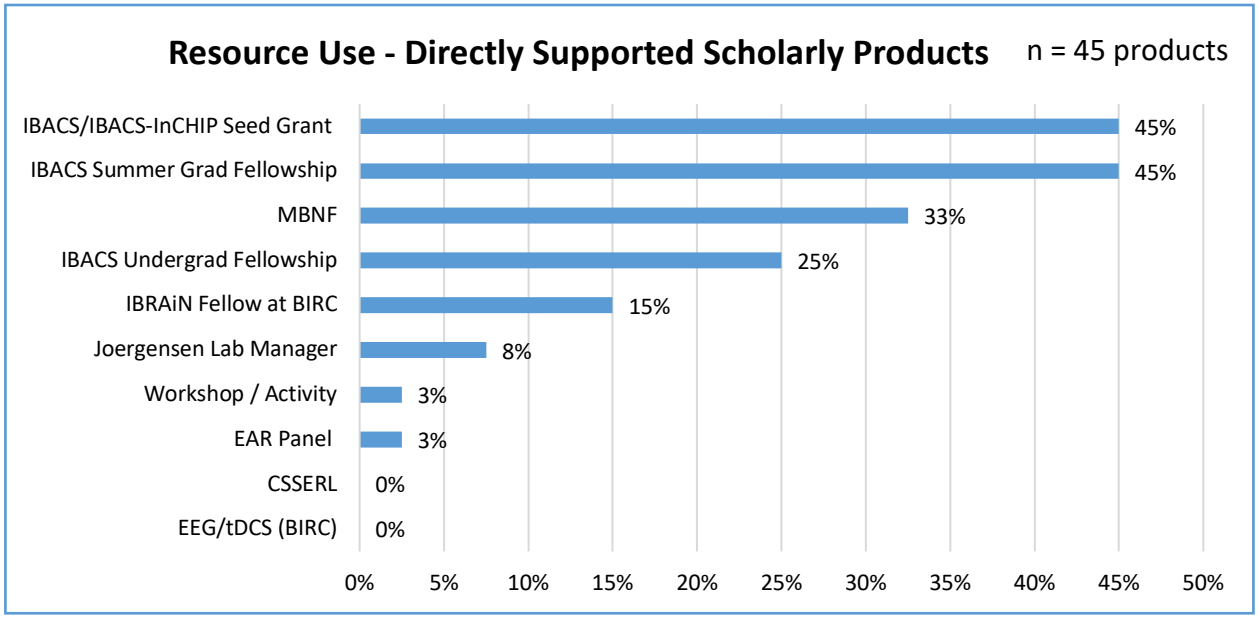


<u>Publications and other output:</u> In Appendix 7 we list publications by Institute affiliates in two categories – *Directly* supported and *indirectly* supported. Institute affiliates were given the following guidance: *if the Institute had funded work that was described or referred to in the published work, or had funded work that led, one way or another, to the published work, then that constituted "direct support"*. There were 30 such articles (20 published, 10 under review) identified **for the period 7/1/19–6/30/20**, and 16 conference presentations. If the work had been "inspired" by IBACS-related activities or the ethos that has been generated since the inception of the Institute, then that would constitute "indirect support" (65 manuscripts – 51 published or in press) and 11 conference proceedings).

Use of Resources Supported by IBACS: The figures below demonstrate the use of resources directly supported by the Institute, July 1st, 2019 to June 30th, 2020. The first figure shows the percentage of respondents who used our resources in their research overall. The second figure shows the percent usage of each resource for directly supported grant applications. The third figure shows the percent usage of each resource for directly supported scholarly outputs.







6. Going Forward: Challenges

Each year there are new challenges, some unforeseen, and some that are constant:

- **Continued Funding:** The Institute has a commitment for continued funding through FY 20/21 from the offices of: the Provost, the Vice President for Research, the School of Medicine, and the College of Liberal Arts and Sciences. Going forward, a major challenge will be to determine the Institute's funding model beyond FY21. We anticipate entering into discussions with the Provost's Office in the Fall of 2020, after our 5-year mark and as part of a 5-year review. Budgetary uncertainties due to the Covid-19 pandemic will undoubtedly color these discussions. Now more than ever, the University's resources need to be targeted as effectively as possible. The Institute is well-placed to meet that challenge, and to help target those resources in ways that will build sustainable research programs that will further establish UConn as a leading research university.
- **Projected Shortfall:** Each year, we roll over saved funds to cover core staff costs in the subsequent year, intending to do the same each year (providing a 1-year financial cushion – a reaction against possible budgetary uncertainty). Core staff currently consist of the Institute Coordinator and two thirds of the Director's lab manager who also serves BIRC and manages several IBACS research projects (see Appendix 6E). In FY19 we projected a $70K shortfall at the end of that year and a shortfall of approximately $77K by the end of FY20/21 (Year 6). Through operational savings that did not significantly impact on core activities we have ended FY19/20 without going into deficit (see Appendix 1), and following some budgetary adjustments we have reduced our projected shortfall at the end of Year 6 (FY20/21) to under $5,000. We note that stipend and fringe costs have increased, as has our contribution to the costs of the Institute Coordinator, while our annual operating budget has been unchanged since FY15/16.
- **Institute Growth**: As the Institute has grown, it has taken on new activities to better serve the community. For example, we recently started a small travel award for students to attend a conference at which they would present research that was directly supported by IBACS (these

will be evaluated on a rolling basis). New activities are also being considered that could be transformative in respect of allowing us to kickstart major, and sustainable, research programs at UConn, but these would require additional investment (e.g. to fund small research clusters consisting of a postdoc and one or two graduate students over a 3-yr period, supporting interdisciplinary and interdepartmental research collaborations among existing and new faculty). Growth has been limited in part because the Institute budget has remained static since FY15/16 while costs have increased (see above re. stipend and fringe costs, for example). Nonetheless, the Institute must continue to evolve to meet new challenges and opportunities.

- **Potential Summer School:** During the Fall of 2019, a number of small committees met to evaluate the feasibility and market for a Summer School, aimed at students, including high school students, and professionals. As a group, we narrowed the options down to one model and are currently seeking more details about it, as well as exploring how feasible it would be for IBACS to replicate the model. Any income from such an initiative would likely be small once costs are covered.
- **MBNF:** In FY18/19 the Institute took over the fiscal management of the MBNF. We have converted the lab manager position associated with the MBNF to a graduate assistantship. The challenge will be to keep the additional costs within our operating budget. We believe that the benefits of diverting funds towards the MBNF and what might be termed (animal) cognitive neurogenetics will outweigh the costs – the dividends are already apparent, as described in the MBNF report in Appendix 6C.
- **Graduate Fellowship Applications**: Only 47% of our 2018 graduate fellowship cohort submitted an external grant. In 2019 the figure was 44%. This year we reduced the number of fellows by 50% (to 8 fellowships from 16) to make them more competitive. We gave U.S. citizens $2k upfront and will give them another $3k once the external grant application is in submittable form (to be signed off by the advisor). We have already seen an uptick in applications for external fellowship funds and will continue to monitor this closely.
- **Unspent Seed Monies**: The Institute is continually monitoring the issue of unspent seed monies sitting in seed grant accounts. We have calculated that less than 10% of all seed awards are currently rolling over. We allow a one-year extension on the award automatically if needed, but once this year is over, we require a written explanation as to why an extension is necessary. Typical reasons for such requests include IRB approval delays and issues finding graduate students to take up the RA-ship required to complete the work. The Institute does recoup a small number of unspent funds each year. ** Note that we expect this percentage to go up as we transition into FY21 as COVID-19 has pushed back many of our ongoing seed grant projects due to the temporary halt of research at UConn.
- **Collecting Data Metrics**: Forty-five percent of our affiliates submitted information during this year's data collection exercise (down from 46% last year). We believe that the majority thought it was unnecessary to do so unless they had received direct support from the Institute this past year. We shall continue to monitor the low return rate. In addition, some users of IBACS facilities at BIRC/CSSERL/MBNF may have been unaware that their work is supported by us (one does not need direct funding from us to use these facilities). We used information about seed grant co-PIs, student advisors, and information on their users provided by BIRC/CSSERL/MBNF to identify directly-supported users who did not self-identify as such, and followed-up with individual emails requesting they provide the requested grants and outputs information at our online portal. Notwithstanding the challenge that this kind of data collection presents, *we believe that all members of the UConn community who received direct support from IBACS did submit information about grants and scholarly output.* However, an ongoing challenge is to ensure that researchers are aware of which facilities they have used, and who funds those facilities – the more a facility blends into the infrastructure, the less likely researchers will report

using the facility. A number of faculty who made use of the IBRAiN program, CSSERL, or Dr. Joergensen's lab management (to use eye-tracking equipment in the Altmann lab) reported that they had used no IBACS resource. In FY20/21 we shall institute a new mechanism for following-up in such cases.

- **Space:** We have two additional meeting rooms in Arjona, supported by CLAS, to complement the laboratory and teaching space already used there by PIs Altmann, Hancock, Large, Magnuson, Sprouse, Yee, and the SLAC and NBL graduate programs. We believe that the current activities continue to be a necessary first step towards building an environment in which a physical Institute could take shape, and we shall continue to work towards this long-term goal. While the Institute does now have an identity at UConn, having a physical focus that is specific to the Institute remains a longer-term goal, and the options for revenue generation that are under consideration may usefully impact on this goal. As a part of our 5-year internal review (feeding into our 5-year review by the Academic Centers and Institutes Review committee) we have identified a number of activities which will create a more vibrant focus within Arjona, as well as generating greater "community feel" among the different constituencies we support. These will roll out during FY20/21, and will include "First Friday" meetings either in Arjona or coordinated from Arjona (with social distancing and Zoom protocols in place), inspired by the AI/Computational Modeling Meet-and-Speak we organized May 2020 over Zoom (with over 90 individuals in attendance, excluding the 12 speakers).

IMPACT OF COVID-19

- **Research projects:** Due to COVID-19, some of the Institute's supported research projects will now be delayed well into the Fall 2020 semester. However, some PI's had already committed associated stipends to their GAs through the Spring semester before COVID-19 closed down research at UConn, so we anticipate a few graduate students still needing GA-ships in the Fall of 2020 to complete the research. We plan on setting aside some funds to help alleviate some of the financial burden these research delays will have on the projects we fund.
- **Going Virtual**: The Institute co-hosted a Meet & Speak event on AI and computational modeling with the School of Engineering on May 6th. We held this conference virtually over Zoom rather than postponing it to the Fall. The conference was a huge success and has already initiated cross-college discussions. However, this event made us realize that we could be putting more information on our website about the interests of our affiliates and that there is a clear desire and need to organize meet-ups to encourage further discussion and collaborations. We are also considering the creation of a forum on our webpage to help researchers find research groups to collaborate with. However, it will be a challenge to find the time to accomplish all of these ideas, as well as to make the events attractive to researchers. This will likely incur costs, such as catering (when we eventually resume in-person meetings). We are planning, as detailed above, a "First Friday" series, which will either be in-person or online, using the momentum from the AI/Computational Modelling meeting. Most likely it will begin online and transition to in-person as appropriate.
- **Space Renovation**: The Institute will need to renovate Arjona 339 to accommodate social distancing practices and to be more conducive to holding virtual meetings for the foreseeable future. These expenses include a large meeting table, a couch and chairs to allow 6 feet apart in the common kitchen area and a webcam and microphone for the monitor in this space to allow

for virtual meetings to occur (consumer webcams are too small to capture the larger rooms and the associated audio input).

- **Meeting/annual cycle changes:** Below is a list of all meetings and mechanisms IBACS has directly supported this past year, which have been impacted by COVID-19:
    - **Grant Writing Workshop:** IBACS has historically hosted this workshop in-person over the summer to assist our summer graduate fellows in writing external grant applications. We had to host this workshop virtually this year, and while we normally offer the workshop to more than just the IBACS graduate fellows, this year we limited attendance to just the fellows to make the online organization easier (it is an interactive workshop).
    - **High-School BIRC Field Trip**: IBACS facilitates an annual field trip in May with local high-school students enrolled in AP Psychology, Biology, or related classes to the Brain Imaging Research Center (BIRC) at UConn. This year, the field trip was cancelled due to the inability to reschedule in the near future (we could not reschedule for the Fall or Spring sessions as we always schedule the trip for when UConn is not in session and we can close BIRC for the day).
    - **Educational Playcare Fellowship**: IBACS awarded two fellowships this year, but one recipient has delayed their award until they feel it is safe to enroll their child back into daycare.
    - **Brain Digest:** The Institute's fourth digest focused on the lifespan and relevance for public policy will likely not be published until the end of Fall 2020 at the earliest. Our graduate student editors found it difficult to conduct interviews with faculty in the midst of the University adjusting to and accommodating online instruction, so many of those interviews are now occurring this summer.
    - **IBACS Meet & Speak:** The Institute has postponed its annual Meet & Speak into the Fall, so we will be rolling over funds to pay for two Meet & Speak events in FY21. We postponed the event in March to October as we were hopeful COVID would subside, but are currently exploring the possibility of holding the event virtually.
    - **Language Fest:** This event has been postponed from May 2020 to 2021 (date is yet to be determined).
    - **32nd North American Conference on Chinese Linguistics (NACCL-32):** This event has been postponed from April 2020 to September 2020.
    - **Expression, Language and Music Conference (ELM):** This event has been postponed from May 2020 to tentatively May 2021.
    - **33rd Annual CUNY Human Sentence Processing Conference:** This event was held virtually in March rather than in person.
    - **Brain Injury Alliance of Connecticut (BIAC) Annual Conference:** This event was virtually recorded rather than held in person in April.

7. BUDGET SUMMARY

The Appendix contains a summary of expenditure and commitments made. These figures may differ slightly from current account balances, due to unpaid commitments. We are grateful to Kane Lynch, CLAS Finance Director, for managing the Institute accounts and advising us on budgetary matters. To summarize income and expenditure:

Initial budget, July 1st 2019 – June 30th 2020:
- $350,000 from Tier 1 funding
- $214,210 Core Staff Carryover FY19
- $100,000 from VPR
- $110,000 from CLAS
- $50,000 from School of Medicine
- $56,387 misc rollover
- $618 recouped seed funds
- **$ 881,216 total**

Expenditure:
- **$556,720**

Commitments[1]:
- $314,495

TOTAL uncommitted to rollover into AY 2020/21:
- **$517**

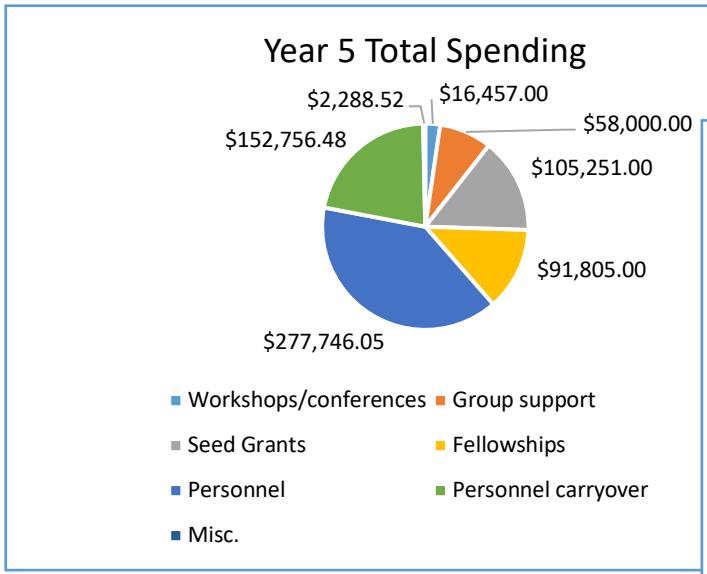
We anticipate for FY 2020/21 the following funding:

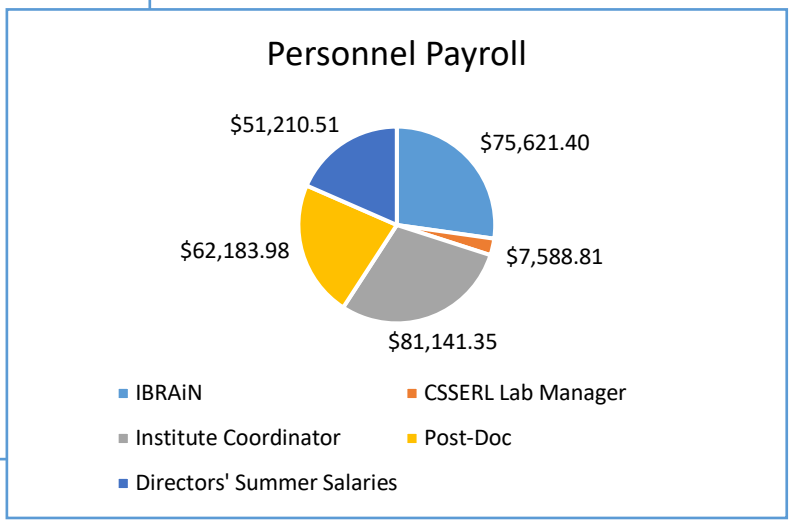
Provost's Office:	$350,000
OVPR:	$100,000
School of Medicine:	$50,000
CLAS:	$110,000
Rollover:	$98,239
TOTAL	**$868,424**

Notes

1. This includes $153K to be carried forward into FY20/21 to guarantee funds in FY20/21 for core staff: Admin Assistant (Mastrangelo), Lab Manager (Joergensen). Remaining commitments include reserved funds for 8 graduate fellowships and a seed grant that will not be paid out until FY21, IBACS Meet & Speak (was postponed due to COVID-19), Educational Playcare fellowship funds (two have been awarded this year, although one fellow is waiting to use it until it is safer to do so), summer salary for the grant writing instructor, and a number of computational modeling gatherings in Arjona aimed at fostering greater cross-college discourse and collaborations. The rest is committed to covering what was an anticipated deficit next year.

2. The Director receives two weeks' summer salary, and the Associate Directors receive one week each.





8. CASE STUDIES: INSTITUTE-SUPPORTED COLLABORATIONS

Here, we very briefly outline 2 case studies, and the impact of a 3rd.

1. CEDAR: Community Engagement in Deafness and Autism Research: The first case study concerns an initiative to establish the needs of the Deaf community and, specifically, the resources available to diagnose and support deaf individuals with autism spectrum disorder.
2. Transcranial Direct Current Stimulation and Cognitive Control: This second case study is more methods-oriented, focusing on a new initiative at UConn to explore the impact of neural stimulation on cognitive performance.
3. Educational Playcare Fellowship. We report an unsolicited email from a recipient of the fellowship which provides an example of how the Institute can have impact in unforeseen ways.

CEDAR: Community Engagement in Deafness and Autism Research. As is often the case in scientific research, where it ends up is not necessarily where it was anticipated to end up. Professors Coppola and Eigsti, from the programs of developmental and clinical psychology within the Department of Psychological Sciences, study the development of numerical and language abilities in deaf individuals and in individuals with autism spectrum disorder (ASD). They and their colleagues received a seed grant from IBACS to run a workshop to explore how to engage community members in the research that they and others carry out. If such research is to have societal impact (and even if not) it is ethically essential to include members of these communities and other stakeholders in the research.

The CEDAR workshop was held at Avery Point with over 100 attendees, including members of the Deaf community, individuals with ASD, their family or other carers, and service providers from both the public and private sectors. But what became clear very early on was that whereas there is reasonable provision of information for each of the two communities separately (e.g. information on care services, on specialist teaching, on best practice for improving literacy outcomes, etc.), there was no such provision for individuals with ASD *who are also deaf*. While the prevalence of ASD and deafness is low in absolute terms, the incidence of ASD in deaf children is estimated at 3 times higher than in the general population. Unsurprisingly there are significant obstacles to obtaining even basic services such as education and health for such individuals, and the workshop quickly turned to discussion of what would be needed to overcome such obstacles (although removing an obstacle is not the same as addressing the factors that put the obstacle there in the first place; the entire rationale for the workshop was to provide an environment in which attendees could listen to one another and learn about actual needs rather than the needs that one group might project onto another).

One immediate need that was identified was the lack of provision of testing – there is no clinical diagnostic of autism suitable for the Deaf. And there is no measure that distinguishes communicative deficits due to language deprivation (as is common in Deafness) and communicative deficits due to other factors. With this in mind, the workshop organizers sought additional funding, again from IBACS, to develop exactly such a measure. This project, led by Coppola's lab manager Kristin Walker intended to convert a standard measure for ASD, the "ADOS-2", into an instrument suitable for Deaf people in the US. As they started their research, they learned of a group at the University of York in the UK, led by child psychiatrist Dr Barry Wright, who have adapted the ADOS for deaf populations internationally, and who are working on a version in British Sign Language. That group had already done much of the heavy-lifting in respect of identifying items on the ADOS that were, or were not, appropriate for deaf people in general, regardless of their specific language. Wright's group have made their work available to Walker, and the next step will be to "translate" the ADOS into American Sign Language (ASL) and then apply for extra-mural funding from NIH to go out into the Deaf community to test as many individuals as possible

in order to generate standardized scores for the test against which individual scores in the clinical setting can be compared.

Coppola and Eigsti's work is an example of how research in the lab setting can inspire translational work and outreach with the potential for considerable clinical and societal impact on under-represented groups who lack the provisions that the rest of us take for granted.

Transcranial Direct Current Stimulation and Cognitive Control. Cognitive control is the ability to disregard irrelevant information while attending to what is relevant, given the task at hand (from ignoring the news commentary playing in the background, to quickly choosing the right tool on a cluttered workbench, to even more quickly choosing the right concept to articulate). It's a fundamental cognitive ability that receives much attention in the neurobiological literature, with recent claims that this ability can be enhanced through delivery of weak electrical currents (using the technique of "transcranial direct current stimulation", tDCS) to certain parts of the scalp. Dr. Eiling Yee received an IBACS seed grant to purchase a tDCS system in order to validate these recent claims.

After reviewing the literature, Yee has realized that these prior claims often relied on studies testing a small number of participants, and in which comparisons were made across groups of participants (one group getting the tDCS and another group not getting it), rather than within groups (i.e. the same participant getting tDCS in one condition and "sham" stimulation in another). Together with graduate student Hannah Morrow (funded on an NSF Graduate Research Fellowship), they sought to replicate some of the basic effects using a within-subject design. But they soon realized that the tests of cognitive control that many of these other studies had used had poor "test-retest reliability" – there was huge variation in individuals' performance on the tasks from, e.g., one session to another. Test-retest reliability is an important measure - imagine a tape measure that gave a different reading each time you measured the same window. Poor reliability means that with the typically small numbers of participants used in such studies, spurious effects (e.g. finding an effect of tDCS on cognitive control when in fact there was none) could easily arise. Yee and Morrow also discovered that many of these previous studies applied the current to areas of the scalp that modern "current modeling" techniques show are not quite the ones that would be predicted to cause the sought-after effects on cognitive control (i.e. the current was being applied to bits of the brain that are not involved in cognitive control).

The group recently identified a cognitive control task that does have good test-retest reliability, and they were about to test it in a within-subjects design, using the latest current modeling, when COVID-19 struck and the lab closed down. The research will start up again just as soon as it is safe to do so. But progress has been made, and thus far the work has contributed to two undergraduate honors' theses, one undergraduate senior thesis, and potentially, if the planned experiments pan out, to Morrow's PhD dissertation. The new tDCS lab (located in CSSERL on the 3rd floor of Arjona) will also support the work of Jamilah George, another student in Psychological Sciences who intends to use tDCS to stimulate the frontal regions of the brain as a means to understanding emotion regulation difficulties in individuals with obsessive compulsive disorder and/or posttraumatic stress disorder (related, tDCS has been used in other contexts to ameliorate the effects of depression). In the short to medium term, if the Morrow/Yee plans work out, the data will form the basis for an application to NIH to continue tDCS approaches into cognitive control and its role in conceptual activation, the primary topic of work in the Yee lab.

Educational Playcare (EPC) Fellowship. The fellowship is intended to support students who become new parents during their graduate studies, and to facilitate their return to their studies/research. The following email (reproduced with permission) illustrates how the impact of this fellowship is more than about facilitating the return of new parents to their research. The impact is as much personal as it is professional. We cannot quantify the impact of the fellowships and grants we award on the personal lives of the students and faculty that we support, and nor can we anticipate the nature of that impact.

> *I would like to express my sincere gratitude for the Educational Playcare Fellowship. When I applied for the fellowship, I had no idea that the world was going to turn upside down within a matter of months. The EPC Fellowship has been amazing in the way it has eased our minds and created space to strengthen our family. It provided some financial peace of mind as we faced the stay at home orders and my husband made plans for his next career steps. I chose to continue sending my son to EPC during that time because he is able to get the socialization and enrichment that would not be possible at home. Also, the caregivers in the Chickadee room had become like family to him and it was good to be able to provide him with the routine and caring faces that would give him a sense of normalcy during difficult times.*
>
> *As a result of being able to have my son at EPC, I was able to focus on helping my daughter with the end of her 5th grade year via School at Home. It was a good opportunity to witness her strengths and struggles. She was recently diagnosed with ADHD and we were able to work together to find strategies to help her organize her tasks and keep her focus and motivation through some of her more challenging subjects. We were also able to have some fun and some honest conversations together, so essential after the new baby, since she had been an only child for so long. I enjoyed being able to do my work alongside her each day, and in doing so, was able to keep largely on track to complete my doctoral work.*
>
> *With grateful hearts, from me and my family,*

The fellowship holder sent this email unsolicited. Thanks to the Fellowship, she remains on track to complete her doctoral dissertation in December 2020.

APPENDICES

1. Budget Summary
2. Recipients and topics of IBACS Seed Grants
3. Recipients of IBACS Graduate Summer Fellowships
4. Recipients of IBACS Undergraduate Research Fellowships
5. Recipients of IBRAiN Assistantships and IBACS-InCHIP Fellowships
6. Activity reports from: BIRC (IBRAiN program), CSSERL, MBNF, ECOM and IBACS lab manager
7. Publications describing IBACS-supported research
8. Meet and Speak Program (the original in-person program scheduled for the Fall – it will be modified to an online format to take place over Zoom).

APPENDIX 1

BUDGET SUMMARY

STARTING BUDGET	$881,216 (see Revenue entry below)	
Expenditure and Commitments		*notes*
meetings		
ELM Conference	$7,000	Meeting Postponed
NACCL-32 Conference	$2,000	Meeting Postponed
Neuroscience at Storrs	$300	
InCHIP Lecture Series	$1,000	
Brain Injury Alliance Conference	$1,500	Held Virtual
Language Fest	$3,000	Meeting Postponed
CUNY 2020	$1,500	Held Virtual
Grant-Writing Workshop	$157	Held Virtual
group support		
Murine Facility	$48,000	
ECOM	$5,000	
Logic Group	$5,000	
seed grants & fellowships		
Fall 19 & Spring 20 seed grants	$105,251	
Spring ’19 Fitch/Li seed grant	$25,000	
IBRAiN Summer 19 fellowships	$25,000	
Fellowship residual Summer 19	$11,000	
Grad fellowships Summer 20	$16,000	
UG fellowships	$27,125	
Educational Playcare fellowship	$6,680	
Brain Digest fellowships	$6,000	
misc.		
Misc. expenses[1]	$2,461	
personnel		
IBRAiN Fall 2019/Spring 2020	$75,621	
CSSERL Lab Manager	$7,589	
Core staff salary carryover	$152,756	
Admin & Postdoc (67%) – Core staff	$143,325	
Directors' summer salaries:	$51,211	

Total spend to date	**$576,720**
Total remaining commitments	**$303,978**
TOTAL uncommitted to rollover into FY20	**$517**

Revenue ($881,216)

$350,000	Provost
$214,210	Core Staff Rollover
$110,000	CLAS
$100,000	VPR
$50,000	School of Medicine
$56,387	Rollover Yr 4
$618	seed recoup

[1]Includes: facility and printer fees, Brain Digest copies, office supplies, in addition to Dropbox, Zoom, and Adobe Creative Cloud licenses/subscriptions.

APPENDIX 2

IBACS SEED GRANTS

Only the lead PI is listed, although in all cases there were one or more collaborators and Co-PIs. Details of each can be found at: http://ibacs.uconn.edu/research/

FALL 2019

Lead PI	Dept.	Title	Award Amount
Eric Levine	UCHC	Cellular effects of a common BDNF gene variant associated with altered cognition in humans	$24,808
Adrian Garcia-Sierra	SLHS	A Dynamic Duo: Interaction between referential context and bilingualism in sentence processing	$20,313
Sharon Casavant	NURS	Predicting Neurodevelopmental Outcomes of Preterm Infants Using Absolute Telomere Length	$5,075
Sandra Villata	LING & PSY	An empirical investigation of ungrammatical sentence processing	$2,300

SPRING 2020

Inge-Marie Eigsti	PSY	Adapting the Autism Diagnostic Observation Schedule (ADOS-2) to assess Deaf individuals who use American Sign Language (ASL)	$17,755
Ed Large	PSY	Synchronizing Movement and Sound: Model with Application to Motion Capture Data	$25,000
Dimitris Xygalatas	ANTH	Psychosocial effects of virtual social gatherings	$10,000

APPENDIX 3
GRADUATE SUMMER FELLOWSHIPS

Name	Department	Advisor
Crawford, Jeffrey	Psychological Sciences	Chi-Ming Chen
Parker, Ashley	Speech, Language & Hearing Sciences	Erika Skoe
Pedrick, Delaina	Biomedical Engineering	Monty Escabi
Quam, Madeline	Psychological Sciences	Marie Coppola
Raimondi, Gianna	Physiology & Neurobiology	Linnaea Ostroff
Sklenarik, Skyler	Psychological Sciences	Robert Astur
Wadams, Amanda	Speech, Language & Hearing Sciences	Jennifer Mozeiko
Zavez, Katherine	Statistics	Ofer Harel

APPENDIX 4

IBACS UNDERGRADUATE RESEARCH FELLOWSHIPS

Name	Department	Advisor
Anam, Aditi	Psychological Sciences	Etan Markus
Cleri, Alexis	Psychological Sciences	Marie Coppola
Eskander, Veronica	Physiology & Neurobiology	Anastasios Tzingounis
Grubb, Samantha	Psychological Sciences	James Magnuson
Harris-Starling, Cheyenne	Psychological Sciences	Eiling Yee
Hebert, Caroline	Psychological Sciences	James Magnuson
Hu, Qingli	Psychological Sciences	Etan Markus
Lopez, Joel	Pharmaceutical Sciences	Gregory Sartor
Mishra, Akriti	Psychological Sciences	Marie Coppola
Morgan, Kerry	Genetics & Genome Sciences	James Li
Nanez, Natalie	Physiology & Neurobiology	Geoff Tanner
Pan, Derek	Physiology & Neurobiology	Joanne Conover
Phillips, Matthew	Speech, Language & Hearing Sciences	Emily Myers
Roy, Grace	Psychological Sciences	Gerry Altmann
Sayeed, Areej	Psychological Sciences	Robert Astur
Sirsikar, Aditi	Psychological Sciences	Inge-Marie Eigsti

APPENDIX 5

IBACS BIRC RESEARCH ASSISTANTSHIPS IN NEUROIMAGING (IBRAIN)

Name	Department	Advisor
Oshiro, Briana	Mathematics	Thomas DeFranco
Ozercan, Aliyar	Philosophy	Mitchell Green
Prystauka, Yanina	Psychological Sciences	Gerry Altmann
Wei, Yi	Psychological Sciences	Edward Large
Yearling, Emily	Psychological Sciences	Gerry Altmann

APPENDIX 6

IBACS AFFILIATED GROUP REPORTS

A. **BIRC IBRAIN PROGRAM** (submitted by Dr. R. Hancock)
B. **CSSERL** (submitted by Dr. J. Magnuson)
C. **MBNF** (submitted by Dr. R. Fitch)
D. **ECOM** (submitted by Dr. D. Bar-On)
E. **IBACS LAB MANAGER** (submitted by Dr. G. Joergensen)

A. BIRC IBRAiN PROGRAM

The IBACS-BIRC Research Assistantships in Neuroimaging (IBRAiN) program supported 5 graduate students during FY20. Students participate in three main activities:

Training

IBRAiN students received formal training in neuroimaging methods, design, and analysis, primarily using the popular FSL software package and containerized preprocessing pipelines. The second semester of training was expanded to include students outside the IBRAiN program through the PSYC5171 course offering.

The fellows also receive more generalized scientific training to prepare them for the increasing need to handle big data and conduct reproducible and transparent research. This aspect of the training has emphasized:

- The importance of reproducible research
- Scripting/programming generalized analysis pipelines
- The use of tools to facilitate reproducible research, e.g. standardized file hierarchies and GitHub (used for homework submission and feedback).
- Use of high-performance computing and big data infrastructure.

Five students participated in the Neuroimaging Analysis Replication and Prediction Study, a large-scale project studying outcome variability in neuroimaging associated with analysis choices.

Botvinik-Nezer, R., Holzmeister, F., Camerer, C. F., Dreber, A., Huber, J., Johannesson, M., ... **Davis, C.,** …, **Hancock, R**., …, **Li, M.Y.C.,** …, **Prystauka, Y.,** …, **Yearling, E.A., Zhang, X.**, … & Schonberg, T. (2020). Variability in the analysis of a single neuroimaging dataset by many teams. *Nature*. 10.1038/s41586-020-2314-9. IF: 43.070

Research Support

The fellows provide individual training and guidance to PIs and their students, helping to advance research programs for faculty who would like to conduct neuroimaging research, but may not have the necessary expertise in their own labs, while acquiring additional hands-on experience to further develop the fellows' expertise and intellectual breadth. The fellows supported PIs from multiple colleges and departments who received BIRC or IBaCS seed grants and/or use BIRC resources, including: Altmann (PSYCH), Britner (HDFS), Kearns (Neag Ed), Hancock (PSYCH), Large (PSYCH), Landi (PSYCH), Myers (SLHS), Shor (ECON), Yee (PSYCH). Research support was provided through regular office hours, individual meetings with PIs/students, EEG training, data analysis support, and developing tutorial resources.

In Spring 2020, BIRC also piloted a fee-based data analysis service, primarily intended for researchers who would not otherwise use BIRC resources. In this model, an IBRAiN fellow works under supervision to provide a complete analytic product for a customer. This program supported one PI (Steffens, UConn Health) in FY20.

Outreach

IBRAiN fellows lead occasional guided tours of BIRC for prospective graduate students, graduate and undergraduate courses, visitors, and pre-college students. Fellows supported tours for

- Prospective graduate applicants to the Clinical, Developmental, and PAC programs in Psychological Sciences
- Eastern Connecticut State University - PSY451 class
- Cub Scouts

B. CSSERL 2019-2020

Director: James Magnuson

Yi Wei was employed in an IBACS-funded RAship for 10 hours / week in Spring, 2020. In this document, we refer to them as the "eBRAIN RAs"; "e" stands for "electrophysiology". We can best summarize their activities by placing them in three categories: administration and maintenance, support, outreach, and research. Activities were distributed differently than in past years because (a) we had zero support for the Fall, and (b) Spring was disrupted by the pandemic.

Administration and Maintenance

This category includes activities that ensure the facility and its infrastructure are in top shape. These activities include:

- Monitoring and maintaining the online calendar system. *1 hour/week on average*
- Administering the website. *0.5 hours / week on average*
- Verifying equipment for cleanliness, proper storage, concerns regarding wear and tear; this includes fine technical work that requires substantial training and care, such as careful sanding of electrodes that show signs of corrosion. 2 *hours / week on average*
- Managing laundry services (towels). *0.5 hours / week on average*
- Monitoring consumables (e.g., electrode contact gel, shampoo, syringes) and ordering supplies when needed. *0.5 hours / week on average*
- Developing lab manuals that will help future eBRAIN RAs and lab users. *1 hours / week on average*
- Administering 7 computers (keeping operating systems and software up to date, monitoring data storage, installing user-requested software). 0.5 *hour / week on average*
- The eBRAIN RAs met with Magnuson nearly every week to discuss CSSERL operations. *0.5 hours / week on average*
  - ***Total time / week: 1 + 0.5 + 2 + 0.5 + 0.5 + 1 + 0.5 + 0.5 = 6.5 hours / week***

Support

- The eBRAIN RAs provide a variety of support services to lab users, including EEG/ERP experiment design, equipment and software assistance, and analysis support: **2.5 hours / week on average**

Research

The eBRAIN RAs are authorized to devote unassigned time to EEG-related activities like reading papers or books or learning new software. Both RAs devote an average of 1.5 hours per week to research. This time enhances the knowledge of the RAs and their ability to provide expert service. ***Total time / week: 2.0 hours***

Total eBRAIN RA time

6.5	**Maintenance and administration**
2.5	**Support**
2.00	**Research**
10 hours / week, spring only	

Labs that have benefited from eBRAIN activities this year (14 from 4 depts., 5 programs)

Landi (PSYC:DEV), Large (PSYC:PAC), Magnuson (PSYC:PAC), Myers (SLHS), Read (PSYC:BNS), Skoe (SLHS), Sprouse (LING), Stevenson (PSYC:BNS), Tabor (PSYC:PAC), Theodore (SLHS), Yee (PSYC:PAC)

CSSERL USAGE

The new calendar system allows us to track usage (when users reserve space; we estimate compliance at about 90%, although this was not tracked as carefully as normal in Fall, 2019, as we did not have RA support).

The lab was consistently used an average of 33.7 hours per week from September-March (leaving out vacation weeks), without considering additional summer usage.

SUMMARY STATEMENT AND REQUEST FOR CONTINUATION. The eBRAIN RAs are providing essential services to users and potential users of CSSERL. The eBRAIN support for CSSERL has allowed us to expand usage and support in ways that would simply not be possible if managing the space were only up to the 4 core faculty (Large, Magnuson, Skoe, Sprouse). Like other faculty, we are already besieged by tremendous amounts of overload work that impedes our ability to conduct research or seek external funding. In the semester when we had 0 hours of support (Fall, 2019), we were barely able to keep up with supplies and laundry, and were unable to offer any training. Although we are tremendously grateful for the current support we have, we could do substantially more if our funding level were returned to 20 hours per semester.

C. MBNF 2019-2020

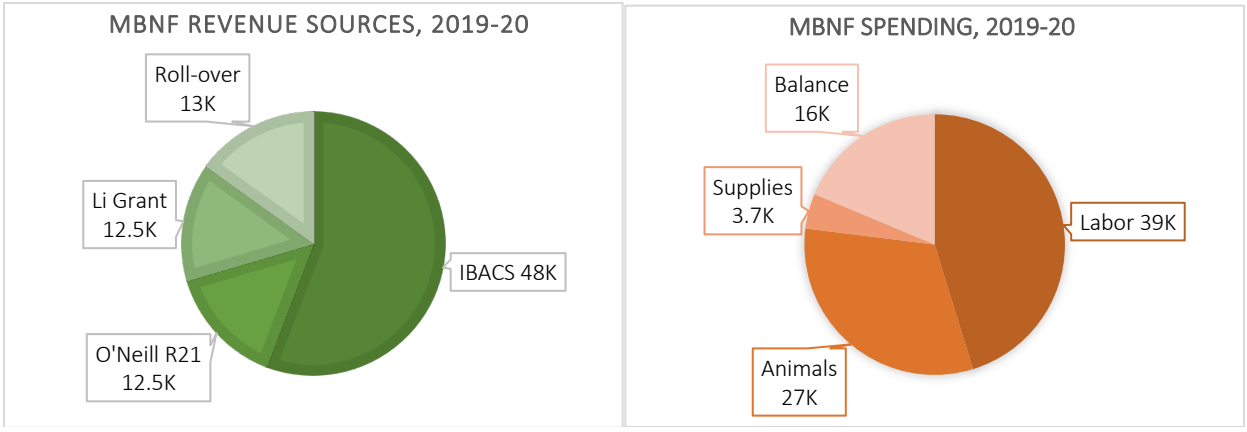
Director: R. Holly Fitch

MBNF Activity Summary, 2019-20

The MBNF has been in continuous use, and provided behavioral phenotyping services for a number of UConn PIs over the past year. A primary user has been Dr. Maxim Volgushev (Psych/BNS), who received an REP to support the collection of pilot behavioral data from A1 receptor knock-out mice towards an RO1. This project was recently completed and a manuscript is in preparation, as well as the RO1. In addition, Dr. John Salamone (Psych/BNS) continues to use the facility, and has received external funding to support that work. A number of publications came from his lab using the MBNF in just this past year (2 published, 1 submitted). We are also in process of breeding mice for Dr. James Li (UCHC) in order to test his *Foxp1* and *Foxp2* cerebellar KO – again, to obtain data for an RO1 application (this project was slowed by the need to re-derive the mice, due to the different health status of UCHC and UConn animal vivaria). The MBNF Director, R. Holly Fitch, has submitted multiple external grant applications over the past year that would provide additional subsidy to the MBNF, and one of these – from the *Angelman Syndrome Foundation* – was funded (2 years, 200K). Over a dozen peer-reviewed journal articles were either published or are under review that include data obtained from the MBNF (see ***IBACS Data Summary*** for details), and a further dozen plus posters and talks delivered with data from the MBNF.

MBNF Revenue Summary, 2019-20

In May 2019, the MBNF held ~ **13K** in rollover funds (**Figure 1**). We received **48K** from IBACS, **12.5K** from an internal grant with Dr. James Li, and **12.5K** from an R21 for Dr. Mike O'Neill (total revenue in, **86K; Figure 1**). During this same period we spent **39K** in Personnel (primarily graduate student support (GA); **Figure 2**), **27K** on animal costs (animal purchase, re-derivation, *per diems*), and **3.7K** in lab supplies, leaving a current balance of **16K** (total revenue out, **86K; Figure 2**). As can be seen, the IBACS contribution to the MBNF serves primarily to support the fulltime graduate student (GA) that manages the facility (performs behavioral testing), whereas animal costs have been largely offset by grant income.



MBNF Mission

It is important to note that the MBNF is a targeted facility that serves a small number of PI (unlike the Genomic facility or BIRC). However, our services typically include *months* of dedicated behavioral testing. The equipment and personnel required for this are a barrier to behavioral work for many PIs, who now have access to a comprehensive and well-equipped facility with professional consultation and

study design. The MBNF supports inter-disciplinary work, collaboration, and external funding opportunities. The facility runs on a modest budget (48K annual contribution from IBACS), which equates to the cost of a single REP proposal -- making it a productive and high-return investment.

COVID Impact

A large number of mice were euthanized in March 2020 due to research shut-downs and the need to minimize animal care, resulting in the loss of thousands of dollars of animals and work. Several studies were interrupted. The MBNF has been approved for research ramp-up (under RHF Research Plan), with interrupted studies now starting over, and breeding plans back underway.

D. ECOM 2019-2020

Director: Dorit Bar-On

About ECOM

Prof. Dorit Bar-On brought the Expression, Communication and Origins of Meaning (ECOM) research group to UConn in 2014, after founding it at UNC - Chapel Hill in 2010. ECOM is a hub of interdisciplinary research activity at UConn and across the world. It facilitates collaboration between researchers in philosophy, linguistics, psychology, cognitive science, anthropology, biology and neuroscience. As well as Chair Dorit Bar-On, ECOM has 12 active faculty members at UConn including Prof. William Snyder (linguistics), Professor Emerita Ruth Millikan (philosophy), and Prof. Letitia Naigles (psychology). Additionally, ECOM has 17 active graduate student members across philosophy, psychology and linguistics. ECOM is also officially affiliated with 12 faculty members and graduate students external to UConn. Within UConn, ECOM is affiliated with the Philosophy department, the Humanities Institute, the Institute for the Brain and Cognitive Sciences (IBACS), and the Cognitive Science program.

ECOM during Academic Year 2019/20

2019/20 marked ECOM's 10-year anniversary, and has been one of the research group's most productive. To mark the anniversary, Prof. Bar-On and a team of UConn faculty collaborators have organized a three-day international interdisciplinary conference titled Expression, Language and Music (ELM) to take place in May 2020. Unfortunately, the conference had to be postponed due to COVID-19; but it is provisionally rescheduled for May 2021. ELM will bring together leading researchers working on ECOM-related themes across linguistics, psychology, music cognition and music theory, philosophy, and evolutionary biology, among others. Eight invited speakers were scheduled for the event, including Ray Jackendoff, Jerrold Levinson and Elizabeth Margulis. Additionally, ELM had a lineup of 12 contributing speakers and 18 poster presentations. All speakers have confirmed their participation at the rescheduled conference.

ECOM secured extensive funding for ELM: $15,000 each from UConn Office of the Vice President for Research (OVPR) and UConn College of Liberal Arts and Sciences (CLAS), a 1/2 RAship from IBACS, and $4,000 from the Humanities Institute. The OVPR and CLAS funding is renewable for three future iterations of ELM.

In 2019/20, ECOM was more active than ever in organizing UConn events promoting interdisciplinary research. ECOM hosted its 6th annual workshop, titled 'Communication, Context, Conversation', on May 3-4 2019. The event had almost 60 registered participants and received 37 submissions from 14 countries in Europe, South America, and North America. The event featured five contributed papers and eight invited talks, as well as a poster session.

ECOM's inaugural graduate conference on Kinds of Knowledge was held in November 14-15, 2019, and featured presentations from six external graduate students. Prof.s Alex Byrne (MIT) and Kristin Andrews (York) gave the keynote talks.

In 2019, ECOM launched its first Summer Graduate Research Fellowship Program. With special support from the philosophy department, five graduate students were awarded a total of $7,500 to pursue ECOM-relevant summer research projects with interdisciplinary focus. The four awardees presented their work at the ECOM Meet & Greet event in September 2019. This summer, to help with special

challenges due to COVID-19, ECOM awarded a total of $5,900 of its funds to support 6 graduate students who will be working on ECOM-related projects during summer of 2020.

The past year also saw the inauguration of a new ECOM Spotlight Series: talks by ECOM faculty members presenting their latest research to the ECOM community at large. Four Spotlight talks were given in 2019/20 (by Prof.s Myers, Eiling, van der Hulst, and Xygalatas.

In addition, ECOM organized a reading group for Alex Byrne's book *Transparency and Self-Knowledge* in Fall 2019 (in preparation for his keynote talk at the graduate conference). A second ECOM-affiliated group – the 'Mind Discussion Group' – brought together graduate students and post-docs from philosophy, linguistics and psychology.

Papers, Conference Presentations, Awards & Honors

ECOM-affiliated faculty and graduate students published (or will soon publish) at least 15 ECOM-related papers in national and international journals and volumes. These include works by Prof. Eiling Yee and Prof. Letitia Naigles in *Language, Cognition and Neuroscience and the Journal of Child Language*, and a 40-page paper by Prof. Bar- On and philosophy graduate student Drew Johnson in a prestigious international volume on epistemology. Bar-On and Johnson also produced a 50+-page critical study of Alex Byrne's recent *Transparency and Self-Knowledge* for the journal *Inquiry*. In addition to several papers by Bar-On that have appeared in peer-reviewed journals in 2019- 20, Bar-On has published a co-authored paper with St. Andrews psychologist Kate Arnold at the journal *Animal Behavior and Cognition* (May 2020). This summer, Profs. Bar-On and Naigles have begun a research collaboration on the topic of the development of emotions and their expression.

ECOM-affiliated faculty and graduate students have been very active in 2019/20 in presenting their work at conferences, both domestically and internationally. There were (or were scheduled to be, before the COVID-19 disruption) at least 34 ECOM-related talks (not including ELM) given by ECOM members at conferences and events including the American Philosophical Association Central Division Meeting in Chicago, and the Society for Philosophy & Psychology at Princeton University. ECOM members presented their work in Austria, Brazil, Germany, the Netherlands, the United Kingdom, and Japan, among others. (A full list available upon request.) (Among the postponed presentations was an invited keynote talk by Bar-On at the premier interdisciplinary *European Society for Philosophy and Psychology*.)

Some notable awards, honors, and miscellanea:

- ECOM member Philip Barron was selected to attend the interdisciplinary Diverse Intelligences Summer Institute for three weeks at St. Andrews University in summer 2019, where Dorit Bar-On was an invited faculty. Ryo Tanaka received the Millikan Summer Fellowship for summer 2020. And Dorit Bar-On was awarded a yearlong NEH research fellowship (to be taken during Jan-Dec 2021).
- In 2019, Bar-On submitted an application for a small Templeton grant.
- ECOM faculty members Bar-On and van der Hulst submitted an application for a UConn Gen Ed summer grant to design a new undergraduate course on the evolution of language.

E. IBACS LAB MANAGER 2019-2020

Dr. G. Joergensen spends 1/3 time managing Yee Lab (currently paid for by Yee), and 2/3 time (paid by IBACS) managing Altmann Lab, and the IBACS projects listed here:

Summary: 8 IBACS projects with 8 PIs (and additional collaborators) across 4 departments. Five of these on MRI and simultaneous eye-tracking in BIRC (marked * below), and 3 on eye-tracking (†) using the shared resources in Arjona.

Name of study	PI	Department
*Brain Mechanisms of Empathy: A Study Using Spontaneous, Dynamic, and Naturalistic Displays	Ross Buck	Communication
*The neural correlates of early word recognition	Jay Rueckl	Psychology (PAC)
*An exploratory fixation-related fMRI study of text reading in poor comprehenders	Nicole Landi	Psychology, (DEV)
*Intervention & Neuroimaging for Polysyllabic Word Reading	Devin Kearns	NEAG
*ASD Optimal Outcomes	Inge-Marie Eigsti	Psychology (CLIN)
†Learning from the news: Eye-tracking perspective	Anne Oeldorf-Hirsch	Communication
†Language-mediated eye movements and cochlear implants	Rachel Theodore	SLHS
†Eye-tracking with kids	Letitia Naigles	Psychology, (DEV)

APPENDIX 7
PUBLICATIONS:
July 1st 2019 – June 30th 2020

Recipients of seed grants, and affiliate members, were asked to submit articles and book chapters published since July 1st 2019 that were supported directly or indirectly by IBACS. **"Direct Support"** means that the Institute had funded work that was described or referred to in the published work, or had funded work that led, one way or another, to the published work. **"Indirect Support"** means work that had been "inspired" by IBACS-related activities or the ethos that has been generated since the inception of the Institute. Names in bold indicate IBACS affiliates.

A. DIRECTLY SUPPORTED OUTPUTS

1. Peer Reviewed Journal Articles Directly Supported by IBACS, published or in press

Altmann, G. T. M., & **Ekves, Z.** (2019). Events as intersecting object histories: A new theory of event representation. *Psychological Review*, *126*(6), 817–840. https://doi.org/10.1037/rev0000154

Bar-On, D. & Arnold, K. (2020). Primate Pragmatics, Expressive Behavior, and the Evolution of Language. *Animal Behavior and Cognition*, Special Issue (Vonk et al. editors).

Botvinik-Nezer, R., Holzmeister, F., Camerer, C. F., Dreber, A. Huber, J., … **Davis, C. P.**, … **Prystauka, Y.**, . . . Poldrack, R., & Schonberg, T. (2020). Variability in the analysis of a single neuroimaging dataset by many groups. *Nature*. doi:10.1038/s41586-020-2314-9

Brooks, T. R.(g), Frank, T. D., & **Dixon, J. A.** (2020). Grasp Affordances in Bistable Perception of the Necker Cube. *Nonlinear Dynamics, Psychology, and Life Sciences*, *24*(2), 143-157.

Davis, C., **Altmann, G. T. M.,** & **Yee, E.** (2019). Above and Beyond the Concrete: The Diverse Representational Substrates of the Predictive Brain. Commentary on Gilead, M., Trope, Y., & Liberman, N. (2019). Above and beyond the concrete: The diverse representational substrates of the predictive brain. *Behavioral and Brain Sciences*, 1-63.

Davis, C., **Altmann, G. T. M.**, & **Yee, E.** (2020). Situational systematicity: A role for schema in understanding the differences between abstract and concrete concepts. *Cognitive Neuropsychology*. DOI: 10.1080/02643294.2019.1710124

Kang, X., Eerland, A., **Joergensen, G. H.**, Zwaan, R.A., & **Altmann, G. T. M.** (2019). The influence of state change on object representations in language comprehension. *Memory and Cognition*. Doi: 10.3758/s13421-019-00977-7

Lee, D. C., Vali, K., Baldwin, S. R., Feliciano, J. L., J. Fequiere, J. R., Fernandez, M. A., Frageau, J.C., Longo, F. K., Mahdoun, S. S., P. Mingione, V, **O'Toole, T. R.**, & **Tanner, G. R.** (2019) Dietary supplementation with the ketogenic diet metabolite beta-hydroxybutyrate ameliorates post-TBI aggression in young-adult male Drosophila. *Frontiers in Neuroscience*, 13: 1140. URL=https://www.frontiersin.org/article/10.3389/fnins.2019.01140

Lee, S. L. T., Lew, D., Wickenheisser, V., & **Markus, E. J.** (2019). Interdependence between dorsal and ventral hippocampus during spatial navigation. *Brain and Behavior*, 9(10). https://doi.org/10.1002/brb3.1410

Perrino, P. A., Talbot, L., Kirkland, R., Hill, A., Rendall, A. R., Mountford, H. S., ... & **Fitch, R. H.** (2020). Multi-level evidence of an allelic hierarchy of USH2A variants in hearing, auditory processing and speech/language outcomes. *Communications Biology (Nature)*, 3(1), 1-14.

Rosenkrantz, T. S., Hussain, Z. & **Fitch, R. H.** (2019). Sex differences in brain injury and repair in newborn infants: Clinical evidence and biological mechanisms. *Frontiers in Pediatrics*, Epub ahead of print.

Siegelman, N., **Kearns, D. M.**, & **Rueckl, J. G.** (2020). Using information-theoretic measures to characterize the structure of the writing system: the case of orthographic-phonological regularities in English.

Sklenarik S., Potenza, M. N., Gola, M., & **Astur, R. S.** (2020). Approach bias for erotic stimuli among heterosexual female college students who use pornography. *Addict Behav*, Apr 16;108:106438. doi: 10.1016/j.addbeh.2020.106438. [Epub ahead of print] PubMed PMID: 32325387.

Sklenarik, S. M., Potenza, M. N., Gola, M., Kor, A., Kraus, S. W., & **Astur, R. S.** (2019). Approach Bias for Erotic Stimuli in Heterosexual Male College Students Who Use Pornography. *Journal of Behavioral Addictions*. Jun 1;8(2):234-241

Sumsky, S. L., & **Santaniello, S.** (2019). Decision Support System for Seizure Onset Zone Localization Based on Channel Ranking and High-Frequency EEG Activity. *IEEE J Biomed Health Inform*, 23(4), 1535-1545. doi:10.1109/JBHI.2018.2867875

Tecoulesco, L., **Skoe, E.**, & **Naigles, L.** (in press) Phonetic discrimination mediates the relationship between auditory brainstem response stability and syntactic performance. *Brain and Language*.

Theodore, R. M., **Monto, N. R.**, & Graham, S. (2020). Individual differences in distributional learning for speech: What's ideal for ideal observers? *Journal of Speech, Language, and Hearing Research*, 63, 1-13. https://doi.org/10.1044/2019_JSLHR-S-19-0152

Yang, J. H. (g), **Presby, R.** (g), Rotolo, R. (g), Quiles, T., Okifo, K., Zorda, E., Fitch, **R. H.**, Correa, M., & **Salamone, J. D.** (in press). The dopamine depleting agent tetrabenazine alters effort-related decision making as assessed by mouse touchscreen procedures. *Psychopharmacology*.

Yang, J. H. (g), **Presby, R. E.** (g), Jarvie, A. A., Rotolo, R. A. (g), **Fitch, R. H.**, Correa, M., **Salamone, J. D.** (2020). Pharmacological studies of effort-related decision making using mouse touchscreen procedures: Effects of dopamine antagonism do not resemble reinforcer devaluation by pre-feeding. *Psychopharmacology*, 237, 33-43.

Zhang, X. & **Santaniello, S.** (2019). GABAergic Degeneration in Cerebellum May Elicit Pacemaker Oscillations Linked to Essential Tremor. *Proceedings of the National Academy of Science USA*, vol. 116, no. 27, pp. 13592-13601, Jul 2 2019, DOI: 10.1073/pnas.1817689116.

2. Peer Reviewed Journal Articles Directly Supported by IBACS, under review

Fisk, E. & **Lombardi, C. M.** (under review) Behavioral and math skill development over early childhood.

Giovannone, N., & **Theodore, R. M.** (under review). Contributions to individual differences in lexically guided perceptual learning.

Hardy, C. C., Al-Naggar, I. M., & **Smith, P. P.** (under review). The Aging Bladder: Contribution of mucosa-HCN channel interaction to adrenergic detrusor relaxation across the mouse lifespan. *PNAS*.

Kang, X., **Joergensen, G. H.**, **Altmann, G. T. M.** (under review). The activation of object-state representations during online language comprehension. *Acta Psychologica*.

Perrino, P. A., **Chamberlain, S. J.**, **Eigsti, I. E.**, & **Fitch, R. H.** (under review) Communication-related assessments in a mouse AS model. *Brain and Behavior*.

Yang, J. H., **Presby, R.**, Cayer, S., Rotolo, R., **Perrino, P. A.**, **Fitch, R. H.**, Correa, M., & **Salamone, J.** (under review) Effort-related decision making in humanized COMT mice: effects of Val158Met polymorphisms and possible implications for negative symptoms in humans. *Pharmacology, Biochemistry and Behavior.*

3. Book Chapters Directly Supported by IBACS

Buck, R., Graham, B., **Allred, R. J.**, and **Hancock, R.** (2020). Nonverbal Receiving Ability as Emotional and Cognitive Empathy: Conceptualization and Measurement. In R. J. Sternberg and A. Kostić (Eds.), Social Intelligence and Nonverbal Communication. (pp. 21-49). Cham: Springer International Publishing.

Eigsti, I. M., & Castelluccio, B. (2019). Language in autism spectrum disorder: What optimal outcomes can tell us about neural plasticity. In E. Grigorenko, Y. Shtyrov, & P. McCardle (Eds.), Working Title: All about Language: Science, Theory, and Practice. Baltimore, MD: Brookes.

4. Conference Presentations and Abstracts Directly Supported by IBACS

Altmann, G. T. M. (2019, September) *Building event representations on-the-fly: A new account of event cognition*. Oral presentation, Architectures and Mechanisms for Language Processing. Moscow.

Dahmani, C. D., O'Connell, J., **O'Toole, T.**, **Lee, D. C.**, Colodner, K. J., & **Tanner, G. R.** (2020, February) *The Ketone Body Beta-hydroxybutyrate Attenuates Pathological Markers in a Drosophila Model*

of Glial Tauopathy. NEURON conference, Quinnipiac University Netter School of Medicine. North Haven, CT.

Davis, C. P., Paz-Alonso, P. M., **Altmann, G. T. M.**, & **Yee, E.** (2019). *Abstract concepts and the suppression of arbitrary episodic context*. In A. K. Goel, C. M. Seifert, & C. Freksa (Eds.), Proceedings of the 41st Annual Conference of the Cognitive Science Society (p. 1592–1598). Montreal, QC: Cognitive Science Society.

DeVincenzi, J., Bulkley, E., Bowers, C., Hampson, M., **Sklenarik, S. M.**, Potenza, M., & **Astur, R. S.** (2020). *Approach Biases in People Demonstrating Problematic Gaming Habits*. Poster accepted to Eastern Psychological Association.

Lee, D. C. *Balsbaugh, J. L., &* **Tanner, G. R.** (2019) *Proteomic Analysis of the Effects of Beta-hydroxybutyrate Supplementation in a Drosophila Model of Traumatic Brain Injury*. NEURON conference, Quinnipiac University Netter School of Medicine. North Haven, CT.

Lee, D. C., Vali, K., Baldwin, S. R., Fequiere, J. R., Fernandez, M. A., Frageau, J. C., Madhoun, S. S., Mingione, P. V., **O'Toole, T. R.**, & **Tanner, G. R.** (2019, October) *Repetitive Head Trauma Induces Elevated Post-concussive Aggression in Young-adult Male Drosophila*. Tanner Society for Neuroscience Conference: Chicago, IL.

Mooney, K. N., Nanez, N., Gallery, M., Bray, A. M., **Lee, D. C.**, & **Tanner, G. R.** (2020, February) *Development and Refinement of Drosophila Seizure Models*. NEURON Conference: Quinnipiac University, North Haven, CT.

Perrino, P. A. (g), Rendall, A. R. (g), & **Fitch, R. H.** (2019, November). *Genetic effects on domain-specific pathways that alter communication*. [Poster Session]. Society for Neuroscience, Chicago, IL. [Published Abstract, Program No. 199.22. 2019, Neuroscience Meeting Planner, Online].

Perrino, P. A. (g), Nedevska, L., Reader, R., Hill, A., Rendall, A. R. (g), Mountford, H. S., Buscarello, A. N. (u), Lahiri, N, A. Saggar, A., **Fitch, R. H.**, & Newbury, D. F. (2019, June). *Multi-level evidence of an allelic hierarchy of USH2A variants; hearing loss, auditory processing and speech/language outcomes*. [*Poster Session]. European Society of Human Genetics Conference (2 P02.06D), Gothenburg, Sweden. https://doi.org/10.1038/s41431-019-0494-2

Prystauka., Y., & **Altmann., G. T. M.** (2019, August). *Traveling back in time: does switching the focus to the initial state of the changed object come at a cost?*. Poster presented at the *Society for the Neurobiology of Language* Annual Meeting, Helsinki, Finland.

Prystauka., Y., & **Altmann., G. T. M.** (2019, September). *Traveling back in time: does switching the focus to the initial state of the changed object come at a cost?* Poster presented at the *Architecture and Mechanisms of Language Processing* Conference, Moscow, Russia.

Rivera-Figueroa, K., Stevens, M. C., & **Eigsti, I. M.** (2019, August). *Individual differences in the neural organization of language, and their relationship to language abilities.* Paper presented at the Society for the Neurobiology of Language, Helsinki, Finland.

Rossi, E., **Krass, K.**, **Joergensen, G. H.**, Zirnstein, M., & **Altmann, G. T. M.** (2019, June) *The Influence of Cognitive Control and Bilingual Experience on Event Processing*. Talk presented at the International Symposium of Bilingualism, Edmonton, Canada.

Sklenarik, S. M., Jenkins, K., Fernandez, M., Livoti, R., Pellegrino, S., Bulkley, E., Purins, A., Miller, K, Lecky, E., Mourmouras, M., Gola, M., Potenza, M., **Astur, R. S.** (2019). *Approach biases in cannabis and pornography users*. Poster presented at the Annual Meeting of the Society for Neuroscience, Chicago, IL.

Yang, J. H. (g), Shah, A. (u), Quiles, T. (u), **Presby, R.** (g), Rotolo, R. (g), **Fitch, R. H.**, Correa, M. & **Salamone, J. D.** (2019, November). *Low effort bias induced by the dopamine depleting agent tetrabenazine in an effort-related decision-making task using mouse touchscreen procedures*. [Poster session]. Society for Neuroscience, Chicago, IL. [Published Abstract, Program No. 777.24. 2019, Neuroscience Meeting Planner, Online].

Yearling, E. & **Altmann, G.** (2019, October). *Keeping Track of Change: Developmental Insights into the Ability to Represent Events in Terms of Token-States*. Poster presented at the Cognitive Development Society Biennial Conference, Louisville, KY.

B. INDIRECTLY SUPPORTED OUTPUTS

1. Peer Reviewed Journal Articles Indirectly Supported by IBACS, published or in press

Bar-On, D. & Johnson, D. (In press). 'Transparent' Rules and Basic Self-Knowledge: A critical Study of Alex Byrne's Transparency and Self-Knowledge. *Inquiry*.

Bar-On, D. (2019). Neo-Expressivism: (Self-)Knowledge, Meaning, and Truth. *Philosophy*.

Bar-On, D. (2019). Crude Meaning, Brute Thought; or: What *Are* They Thinking?! *Journal for the History of Analytic Philosophy*, special issue.

Chen, T. (g), Kondepudi, D. K., **Dixon, J. A.**, & Rusling, J. F. (2019). Particle Flock Motion at Air–Water Interface Driven by Interfacial Free Energy Foraging. *Langmuir*, 35(34), 11066-11070.

Davis, C. P., **Joergensen, G.**, Boddy, P., Dowling, C., & **Yee, E.** (2020). Making it harder to "see" meaning: The more you see something, the more its conceptual representation is susceptible to visual interference. *Psychological Science*, 31(5), 505–517. doi:10.1177/0956797620910748

Davis, C. P., **Morrow, H. M.**, & Lupyan, G. (2019). What does a horgous look like? Nonsense words elicit meaningful drawings. *Cognitive Science*, 43(10), e12791. doi:10.1111/cogs.12791

De Bari, B. (g), **Dixon, J. A.**, Kay, B. A., & Kondepudi, D. (2019). Oscillatory dynamics of an electrically driven dissipative structure. *PloS ONE*, 14(5), e0217305

Fortinsky, R., **Kuchel, G. A.**, **Steffens, D. C.**, Grady, J., Smith, M., **Forrest, D.**, & Robison, J. T. (2020). Clinical Trial Testing In-Home Multidisciplinary Care Management for Older Adults with Cognitive Vulnerability: Rationale and Study Design. **Contemporary Clinical Trials**. Mar 92:105992. doi: 10.1016/j.cct.2020.105992. PMID:32194252

Frazier, P. A., Jamone, L., Althoefer, K, & Calvo, P. (in press) Plant bioinspired ecological robotics.

Fuhrmeister, P. & **Myers, E. B.** (2020). Desirable and undesirable difficulties: influences of variability, training schedule, and aptitude on non-native phonetic learning. *Attention, Perception, and Psychophysics*, 1-17. https://doi.org/10.3758/s13414-019-01925-y

Fuhrmeister, P., **Smith, G.**, & **Myers, E. B.** (2020). Overlearning of non-native speech sounds does not result in superior consolidation after a period of sleep. *The Journal of the Acoustical Society of America*,147(3), EL289-294. https://doi.org/10.1121/10.0000943

Fultot, M., **Frazier, A.**, Carello, C., & Turvey, M. (in Press). What are nervous systems for? *Ecological Psychology*.

Ghanbari, A., Lee, C. M., **Read, H. L.**, & **Stevenson, I. H.** (2019).Modeling stimulus-dependent variability improves decoding of population neural response. *Journal of Neural Engineering*, 16, 066018

Ghanbari, A., Ren, N., Keine, C., Stoelzel, C., Englitz, B., Swadlow, H., & **Stevenson, I. H.** (2020) Modeling the short-term dynamics of in vivo excitatory spike transmission. *Journal of Neuroscience*, *40*(21), 4185-4202

Goodwin, C. & **Lillo-Martin, D.** (2019). Morphological accuracy in the speech of bimodal bilingual children with CIs. *Journal of Deaf Studies and Deaf Education*, *2*4(4), 435-447. https://doi.org/10.1093/deafed/enz019

Hardy, C. C., Keilich, S. R., Harrison, A. G., **Knight, B. E.**, Baker, D. S., **Smith, P. P.** (In press) The Aging Bladder Phenotype Is Not the Direct Consequence of Bladder Aging. *Neurourology and Urodynamics*.

Kang, Y. J., Clement, E. M., Sumsky, S. L., Xiang, Y., Park, I. H., **Santaniello, S.**, . . . Lee, S. H. (2020). The critical role of persistent sodium current in hippocampal gamma oscillations. *Neuropharmacology*, 162, 107787. doi:10.1016/j.neuropharm.2019.107787

Kearns, D. M. (in press). Does English have useful syllable division patterns? *Reading Research Quarterly*.

Kearns, D. M., & Al Ghanem, R. (2019). The role of semantic information in children's word reading: Does meaning affect ability to say polysyllabic words aloud? *Journal of Educational Psychology*, 111, 933–956. https://doi.org/10.1037/edu0000316

Kearns, D. M., **Hancock, R.**, **Hoeft, F.**, **Pugh, K.**, & Frost, S. (2019). Neurobiology of dyslexia. *Teaching Exceptional Children*, 51, 175–188. https://doi.org/10.1177/0040059918820051

Khachaturian, A. S., Hayden, K. M., Devlin, J. M., Fleisher, L. A., Lock, S. .L, Cunningham, C., Oh, E. S., Fong, T. M., Fick, D. M., Marcantonio, E. R., Iyengar, V., Rockwood, K., **Kuchel, G. A.**, Eckenhoff, R. G., MacLullich, A. M. J., Jones, R. N., Davis, D., D'Antonio, P. M., Fargo, K. N., Albert, M. S., Jeff, D.. Williamson, J. D., Ling, S.M., Weiss J., Karlawish, J., Petersen, R. C., Blazer, D. G., Khachaturian, Z.S., & Inouye, S. K. (2020). International drive to illuminate delirium: A developing public health blueprint for action. *Alzheimer's and Dementia*. doi: 10.1002/alz.12075. PMID: 32212231

Ko, H., Chung, H., Kim, K., & **Sprouse, J.** (2019). An Experimental Study on Scrambling out of Islands: To the Left and to the Right. *Language and Information Society, 37*.

Kuchel G. A. (2019) Comment: Urinary Incontinence and Nocturia in Older Men: Associations with Body Mass, Composition and Strength in the Health ABC Study. *Journal of Urology*, *202*(5):1020-1021. doi: 10.1097/01.JU.0000580368.73227.25. PMID: 31403897

Kush, D., Lohndal, T., & **Sprouse, J.** (2019). On the Island Sensitivity of Topicalization in Norwegian: An experimental investigation. *Language*, *95*, 393-420.

Landi, N. & **Perdue, M. V.** (2019). Neuroimaging Genetics Studies of Specific Reading Disability and Developmental Language Disorder: A review. *Language and Linguistics Compass*.

Li, M., Kukona, A., Johns, C. L., **Tabor, W.**, **Van Dyke, J. A.**, Mencl, W. E., Shankweiler, D. P., **Pugh, K. R.**, & **Magnuson, J. S.** (in press). Individual differences in subphonemic sensitivity and phonological skills. *Journal of Memory & Language*.

Luthra, S., **Fuhrmeister, P.**, Molfese, P. J., Guediche, S., Blumstein, S. E., & **Myers, E. B.** (2019). Brain-behavior relationships in incidental learning of non-native phonetic categories. *Brain & Language*, 198.

Ly, M. T., Rowny, S. B., Kluisza, L., Casal-Roscum, L., Prudic, J., & **Chen, C. M.** (2020). Smaller increase in delta post-ictal suppression in magnetic seizure therapy than electroconvulsive therapy in geriatric patients with severe depression: a multi-case study. *Clinical Neurophysiology*, *131*(6): 1219-1220.

Magnuson, J. S., **You, H.**, **Luthra, S.**, **Li, M.**, Nam, H., **Escabi, M.**, **Brown, K.**, **Allopenna, P. D.**, **Theodore, R. M.**, **Monto, N.**, & **Rueckl, J.** (2020). EARSHOT: A minimal neural network model of incremental human speech recognition. *Cognitive Science*, *44*(4).

Newman, A. B., Salive, M., Kritchevsky, S. B., Guralnik, J. M., Cummings, S. R., **Kuchel, G. A.**, Schrack, J., Morris, M. C., Weir D., Baccarelli, A., Murabito, J., Ben-Shlomo, Y., Espeland, M. Papadopoulos, E., Kirkland, J. L., and Ferrucci, L. (2019). Accelerating the search for interventions aimed at expanding the health span in humans: the role of epidemiology. *Journal of Gerontology: Medical Sciences*. pii: glz230. doi: 10.1093/gerona/glz230. PMID: 31722007.

Pearl, L. & **Sprouse, J.** (2019). Comparing solutions to the linking problem using an integrated quantitative framework of language acquisition. *Language, 95*, 583-611.

Pejovic, J., **Yee, E**., Molnar, M. (2020). Speaker Matters: Natural inter-speaker variation affects 4-month-olds' perception of audio-visual speech. *First Language*, *20*(2), 113-127.

Perdue, M. V., Mascheretti, S., Kornilov, S. A., Jasińska, K. K., **Ryherd, K.**, Mencl, W. E., ... & **Landi, N.** (2019). Common variation within the SETBP1 gene is associated with reading-related skills and patterns of functional neural activation. *Neuropsychologia*, *130*, 44-51

Perdue, M. V., Mednick, J., **Pugh, K.**, & **Landi, N.** (in press). Gray matter structure is associated with reading skill in typically developing young readers. *Cerebral Cortex*.

Prystauka, Y., & Lewis, A. G. (2019). The power of neural oscillations to inform sentence comprehension: A linguistic perspective. *Language and Linguistics Compass*, *13*(9), e12347

Ryherd, K. & **Landi, N.** (2019). Category learning in poor comprehenders. *Scientific Studies of Reading*, *23*, 305-316.

Sadeghi, M. Z. X., **Stevenson, I. H.**, & **Escabi, M.** (2019). A Neural Ensemble Correlation Code for Sound Category Identification. *PLoS Biology*, *17*(10): e3000449

Satterwhite-Warden, J. E., Kondepudi, D**., Dixon, J. A.**, & Rusling, J. F. (2019). Thermal-and Magnetic-Sensitive Particle Flocking Motion at the Air-Water Interface. *Journal of Physical Chemistry B*, *123*, 3832-3840.

Saxena, S., Sarma, S. V., Patel, S. R., **Santaniello, S.**, Eskandar, E. N., & Gale, J. T. (2019). Modulations in Oscillatory Activity of Globus Pallidus Internus Neurons During a Directed Hand Movement Task-A Primary Mechanism for Motor Planning. *Front Syst Neurosci*, *13*(15), 15. doi:10.3389/fnsys.2019.00015

Senese P. V., Pezzella, M., Pasquariello, L., **Ali, S.**, & **Rohner, R. P.** (2019). Effects of social exclusion and maternal rejection on children's high-calorie food consumption. *Appetite*, 104494.

Sklenarik, S., Potenza, M. N., Gola, M., Kor, A., Kraus, S. W., & **Astur, R. S.** (2019). Approach bias for erotic stimuli in heterosexual male college students who use pornography. *Journal of Behavioral Addictions*, *8*(2), 234-241, DOI: 10.1556/2006.8.2019.31.

Seidenberg, M. S., Cooper Borkenhagen, M., & **Kearns, D. M.** (in press). Lost in translation? Challenges in connecting reading science and educational practice. *Reading Research Quarterly*.

Sood, D., Cairns, D. M., Dabbi, J. M., Ramakrishnan, C., Deisseroth, K., Black, L. D., 3rd, . . . **Santaniello, S.** (2019). Functional maturation of human neural stem cells in a 3D bioengineered brain model enriched with fetal brain-derived matrix. *Sci Rep*, *9*(1), 17874. doi:10.1038/s41598-019-54248-1

Sood, D., **Tang-Schomer, M.**, Pouli, D., Mizzoni, C., Raia, N., Tai, A., Arkun, K., Wu, J., Black, L., Scheffler, B., Georgakoudi, I., Steindler, D., Kaplan, D. (2019). 3D Extracellular Matrix Microenvironment in Bioengineered Tissue Models of Primary Pediatric and Adult Brain Tumors. *Nature Communications*.

Steacy, L. M., Fuchs, D., Gilbert, J. K., **Kearns, D. M.**, Elleman, A. M., & Edwards, A. A. (in press). Sight word acquisition in first grade students at-risk for reading disabilities: An item-level exploration of the number of exposures required for mastery. *Annals of Dyslexia*.

Troha, R. G., Dong, D., & **Markus, E. J.** (2020). Observational learning of a shifting goal location in rats: Impact of distance, observed performance, familiarity, and delay. *J Neurosci Methods*, 1;335:108617. doi: 10.1016/j.jneumeth.2020.108617. Epub 2020 Jan 31.

Yee, E. (2019). Abstraction and Concepts: when, how, where, what and why? *Language, Cognition and Neuroscience*, *34*(10), 1257-1265.

2. Peer Reviewed Journal Articles Indirectly Supported by IBACS, under review

Davis, C. P. & **Yee, E.** (under review). Building semantic memory from distributional language and embodied experience. *WIREs Cognitive Science*.

Fuhrmeister, P., Schlemmer, B., & **Myers, E. B.** (under review). Adults show initial advantages over children in learning difficult non-native speech sounds.

Kim, J. C., **Large, E. W.** (under review). Hebbian Plasticity in Gradient Frequency Neural Networks. *Biological Cybernetics*.

Lombardi, C. M., **Fisk, E.**, & Cook, K. D. (under review). Do child care characteristics during toddlerhood explain income-based gaps in cognitive skills at preschool?

Luthra, S. (under review). The role of the right hemisphere in processing phonetic variability between talkers.

Luthra, S., Correia, J. M., Kleinschmidt, D. F., Mesite, L., & **Myers, E. B.** (under review). Lexical information guides retuning of neural patterns in perceptual learning of speech.

Luthra, S., **Magnuson, J. S.**, & **Myers, E. B.** (under review) Boosting lexical support does not enhance lexically guided perceptual learning.

Mickelsen, L. E., Flynn, W .F., Springer, K., Wilson, L., Beltrami, E. J., Bolisetty, M., Robson, P., & **Jackson, A. C.** (under review). Cellular taxonomy and spatial organization of the murine ventral posterior hypothalamus. *bioRxiv.*

Parker, A., Parham, K., & **Skoe, E.**, (under review). Reliability of serological prestin levels in humans and the relation to otoacoustic emissions, a functional measure of outer hair cell function.

Tichko, P., **Kim, J.C.**, **Large, E. W.** (under review). Bouncing the Network: A Dynamical Systems Model of Auditory-Vestibular Interactions Underlying Infants' Perception of Musical Rhythm. *Developmental Science*.

Wang, S., Kido, Y., & **Snyder, W.** (under review). Acquisition of English Adjectival Resultatives: Support for the Compounding Parameter. *Language Acquisition*.

3. Book Chapters Indirectly Supported by IBACS

Braze, D., Salvarezza, F., & **Pugh, K. R.** (2020). Multi-sensory Structured Reading Instruction for Spanish-speaking First Grade Students in Buenos Aires Public Schools. *PsyArXiv*, https://doi.org/10.31234/osf.io/94rw2

Fuhrmeister, P. (2019). Interference in memory consolidation of non-native speech sounds. In S. Fuchs, J. Cleland, & A. Rochet-Capellan (Eds.), Speech Production and Perception: Learning and Memory (pp. 207-243). Berlin: Peter Lang. https://doi.org/10.3726/b15982

Kearns, D. M. (2019). On the value of theory-driven research on dyslexia. In J. Washington, D. L. Compton, & P. McCardle (Eds.), Dyslexia: Revisiting etiology, diagnosis, treatment, and policy. Baltimore, MD: Brookes Publishing.

Sprouse, J., & Schütze, C. T. (2020). Grammar and the use of data. Oxford Handbook of English Grammar. Edited by Geri Popova, Bas Aarts, and Jillian Bowie. Oxford University Press.

4. Conference Abstracts Indirectly Supported by IBACS:

Ali, S. (2019, November). *How low can you go? A systematic review of effects of rejection on mood and self-esteem*. In S. Ali & P. Britner (Chairs), Six decades of interpersonal acceptance-rejection theory: Bridging self-report and neuroscience perspectives. Symposium presented at the 2019 annual meeting of National Council on Family Relations (NCFR), Fort Worth, TX.

Ali, S. & Britner, P. A. (2019, November). *Neural Correlates of Remembered Parental Rejection in Childhood*. In S. Ali & P. Britner (Chairs), Six decades of interpersonal acceptance-rejection theory: Bridging self-report and neuroscience perspectives. Symposium presented at the 2019 annual meeting of National Council on Family Relations (NCFR), Fort Worth, TX

Davis, C. P., Paz-Alonso, P. M., **Altmann, G. T. M.**, & **Yee, E.** (2019). *Abstract concepts and the suppression of arbitrary episodic context*. In A. K. Goel, C. M. Seifert, & C. Freksa (Eds.), Proceedings of the 41st Annual Conference of the Cognitive Science Society (p. 1592–1598). Montreal, QC: Cognitive Science Society.

Fequiere, J. R., P. Mingione, V., **Lee, D. C.**, & **Tanner, G. R.** (2020, February*). Investigating Development of Sulfonylurea Drug Insensitivity in Katp Channels Using a Drosophila Behavioral Model*. NEURON conference, Quinnipiac University Netter School of Medicine. North Haven, CT.

McLeod, R. M. (g), Rosenkrantz, T. & **Fitch, R. H.** (2019, November). *Effects of caffeine administration timing, sex, and prenatal condition on cognitive outcomes in premature infants*. [Poster session]. Society for Neuroscience, Chicago, IL. [Published Abstract, Program No. 134.23. 2019, Neuroscience Meeting Planner, Online].

Nguyen, E., & Pearl, L. (2019). *Using Developmental Modeling to Specify Learning and Representation of the Passive in English Children*. In Proceedings of the Boston University Conference on Language Development (Vol. 43).

Nguyen, E. & **Snyder, W.** (2018). *It's hard to extend: A unified account of Raising-Past-Experiencers and Passives in child English*. In Anne B. Bertolini and Maxwell J. Kaplan (Eds.) Proceedings of the 42nd annual Boston University Conference on Language Development, 598-604. Somerville, MA: Cascadilla Press.

Rohner, R. P. (2019, November). *They Love Me, They Love Me Not—And Why It Matters?* In S. Ali & P. Britner (Chairs), Six decades of interpersonal acceptance-rejection theory: Bridging self-report and neuroscience perspectives. Symposium presented at the 2019 annual meeting of National Council on Family Relations (NCFR), Fort Worth, TX

Sumsky, S. L., Somma, T., **Santaniello, S.**, & **Schomer, M. T.** (2019). *Modularity-Based Detection of Ripples in Scalp EEG*. 2019 53rd Asilomar Conference on Signals, Systems, and Computers. pp. 250-253, doi: 10.1109/IEEECONF44664.2019.9048848.

Wang, S., Kido, Y., & **Snyder, W.** (2020). *Spontaneous Production of Adjectival Resultatives and N-N Compounds in Child English*. In Megan M. Brown and Alexandra Kohut (eds.) Proceedings of the 44th Boston University Conference on Language Development, pp. 717-723. Somerville, MA: Cascadilla Press.

Yang, X., (2019). *Predicting of cognitive control ability using resting-state cortico-subcortical connectivity*

APPENDIX 8

UCONN | UNIVERSITY OF CONNECTICUT

CONNECTICUT INSTITUTE FOR THE BRAIN AND COGNITIVE SCIENCES

Meet-and-Speak Event

Saturday, October 10th, 2020 in Oak Hall 101

9:00 AM	*Breakfast, Coffee – 30 minutes*
9:30 AM	**Gerry Altmann,** Director, CT Institute for the Brain and Cognitive Sciences *Welcome*
9:40 AM	**Dean Juli Wade** *Opening remarks*
9:50 AM	**Eric Levine,** Neuroscience *Cellular effects of a common BDNF gene variant associated with altered cognition in humans*
10:00 AM	**Sharon Casavant,** Nursing *Predicting neurodevelopmental outcomes of preterm infants using absolute telomere length*
10:10 AM	**Sabato Santaniello,** Biomedical Engineering *Cerebellar stimulation and network-wide oscillations in essential tremor*
10:20 AM	**Linnaea Ostroff,** Physiology and Neurobiology *Synaptic pathways of fear and safety*
10:30 AM	**James Magnuson,** Psychological Sciences *TBD*
10:40 AM	**Questions – 10 minutes**
10:50 AM	*Coffee Break – 10 minutes*
11:00 AM	**John Salamone,** Psychological Sciences *Inflammation and effort-related motivational dysfunction in rat models: Implications for psychopathology*
11:10 AM	**Umay Suanda,** Psychological Sciences *How toddlers learn the meanings of words: A Statistical Learning approach*
11:20 AM	**Noelle Wig,** Speech, Language and hearing Sciences *A Dynamic Duo: Interaction between referential context and bilingualism in sentence processing*
11:30 AM	**Gerry Altmann,** Psychological Sciences *Representing events in deep neural networks*
11:40 AM	**Sandra Villata,** Linguistics *An empirical investigation of ungrammatical sentence processing*
11:50 AM	**Questions – 10 minutes**
12:00 PM	*Lunch – 1 hour*
1:00 PM	**Graduate Student Data Blitz** (5 min talks with 2 mins for Q's) **Rama Ramasamy,** Neuroscience *Urinary Pathophysiology of a Demyelination Model of Multiple Sclerosis*

1:07 PM **Lana Delasanta,** Psychological Sciences
Analyzing group drumming using a Nonlinear Dynamics approach

1:14 PM **Yi Wei,** Psychological Sciences
Neural resonance to syncopated rhythms: Model predictions and experimental tests

1:21 PM **Hannah Morrow,** Psychological Sciences
Waves of Binding: EEG oscillations during integration of visual, auditory, and lexical stimuli

1:28 PM **Briana Oshiro,** Mathematics
A brief introduction to Dynamic Causal Modeling

1:35 PM **Emily Yearling,** Psychological Sciences
Using the past to understand the present: Insights into the episodic nature of tokenization

1:42 PM **Aliyar Ozercan,** Philosophy
Mental states and language development

2:15 PM **Panel Discussion** – featuring Whit Tabor, Holly Fitch, Sabato Santaniello, and John Gabrieli with Gerry Altmann as moderator
Current directions, challenges, and opportunities in the brain and cognitive sciences

3:00 PM **Keynote Speaker – John Gabrieli, Director of the Martinos Imaging Center at the McGovern Institute, MIT**

Title: *Environmental Influences on Human Brain Development*

Abstract: Neuroimaging provides new views on how environmental factors influence human brain development. I will review findings about associations (1) among family socioeconomic status (SES), brain anatomy, and academic performance; (2) between early language experience and brain function and structure; and (3) between stress and brain function and how those can be altered by mindfulness training.