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Meeting Report

Collaborating for the advancement of interdisciplinary research in benign urology (CAIRIBU): outcomes, effectiveness, and future directions of annual CAIRIBU meetings

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Abstract: The 5th annual CAIRIBU Meeting (CAIRIBU = Collaborating for the Advancement of Interdisciplinary Research in Benign Urology) was held November 29-December 2, 2022 in Bethesda, MD and organized by the CAIRIBU (U24) Interactions Core. Altogether, nearly 100 individuals participated, representing U54 Urology OBrien Centers, P20 Urology Centers, and K12 Urology Career Development Programs currently and previously funded by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). Several NIDDK Program Officers participated in the meeting, including those representing the NIDDK Central Repository and several urologic research consortia. The meeting included 36 presentations in 5 scientific sessions plus a take-home message session, 2 keynote (invited) speakers, networking and interactions sessions, and 3 poster sessions during which 44 posters were presented. Additionally, preceding the meeting was a 3-hour event targeting educational and career development needs of CAIRIBU trainees and early-stage investigators. Meeting attendees participated in lively interactive discussions for all events. The science presented during scientific and poster sessions represented the various areas of research among CAIRIBU and CAIRIBU-affiliated investigators. They included non-malignant prostate and lower urinary tract dysfunction; urinary tract microbes and infection; bladder function and physiology; neurourology in the lower urinary tract; and obstructions and calculi in the urinary tract. A primary objective of the CAIRIBU Interactions Core is to develop metrics for evaluating collaborative research initiatives. This requires understanding engagement within the CAIRIBU Community and whether it leads to cross-disciplinary interactions and collaborative research products and resources. The annual CAIRIBU meeting is one window through which the outcomes and direction of the CAIRIBU Community may be observed.

Keywords: Benign urology, non-malignant urology, genitourinary, interdisciplinary research, transdisciplinary research, CAIRIBU

Introduction

Science in the 21st century is increasingly conducted in networks in order to integrate the expertise, technology, and resources required to achieve groundbreaking, paradigm-shifting results [1, 2]. Clinical and translational research in particular requires synthesis of knowledge across basic, clinical, and population sciences. National Institutes of Health (NIH)-funded cooperative agreement grants ("U" mechanisms) require that Principal Investigators of several grants coordinate efforts and collaborate; they typically include substantial involvement by NIH staff [3]. The proportion of National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) funding for all "U" grants (excluding U01 grants) increased from 2010 to 2020 [4]; these included U24, U34, U54, UG3, UH3, and UM1 opportunities.

Collaborating for the Advancement of Interdisciplinary Research in Benign Urology (CAIRIBU) is an umbrella organization that conjoins basic science, clinical and translational, and epidemiology investigators funded by the NIDDK to study non-malignant urologic and genitourinary (GU) diseases and disorders. Overarching ob-

jectives of CAIRIBU are to: (1) bring together investigators from all points of the research continuum to understand the pathological and mechanistic changes of the GU tract, ultimately leading to the development of clinically-relevant models for testing promising therapies; and (2) foster the translation and dissemination of these advances to the full diversity of those living with GU diseases and conditions. CAIRIBU was initially formed as a pilot initiative by NIDDK Program Officers from the Division of Kidney, Urologic, and Hematologic Diseases. It built upon the NIDDK-funded George M. O'Brien Urology Research Centers, which were transitioned in 2012 to a Cooperative Research Centers Program (U54). In 2014 these Cooperative Urology Research Centers attended a meeting with NIDDK P20 Exploratory Centers, described elsewhere by WG Hill [5], in order to foment interdisciplinary collaborations. In 2018 these Centers were joined by NIDDK-funded K12 Programs to form CAIRBU (**Table 1**). Previously set aside funds supported a "Director of Interactions" to provide coordination between Centers, the rationale for which came from evidence demonstrating that research funding alone, such as the traditional research grant, is insufficient in motivating investigators to work together. A basis for collaboration must first be established through deep intellectual exchange (knowledge transfer). Other required conditions include motivation to solve the same research problem and appreciation for multiple perspectives [6]. Platforms for achieving these milestones must be developed and made available. In 2020 the NIDDK requested applications for a U24 Urology Centers Program Interactions Core. The Request for Applications (RFA-DK-19-034, posted 1/22/2020) required the CAIRIBU Interactions Core to function as a "focal point for establishing productive collaborations within the Urology Centers Programs and between these Programs and other NIDDK urology training and scientific efforts and the broader research and clinical communities".

In September 2020 an award for a "CAIRIBU Interactions Core" was given to the University of Wisconsin School of Medicine and Public Health, Department of Urology (PI, Kristina L. Penniston, PhD). In response to the RFA and with guidance from NIDDK Program Officers, the CAIRIBU Interactions Core proposed to engage in broad and diverse efforts to promote synergy within the urologic research community and advance science. Strategies to accomplish this include synchronizing activities and initiatives that encourage knowledge exchange between investigators, sharing research resources, collaboration-building, community/stakeholder involvement in research, training the next generation of leaders in GU research, and increasing the diversity, depth, and breadth of the urology research workforce (**Figure 1**).

Annual meetings

Scientific meetings and conferences enable investigators to build or continue relationships with colleagues, create and nurture collaborations, learn about new advances, and disseminate research findings. This exchange of knowledge is important for building a collaborative research culture. Verderame *et al* emphasized communication and networking as essential for scientists [7]. Scientific meetings are particularly important for trainees and early career scientists for sharing their work, getting feedback, gaining visibility, and networking with investigators beyond their own institutions [8, 9]. Scientific meetings also facilitate connections between investigators who might not otherwise meet. Because these connections can lead to collaborations that advance the field, their absence may reduce or delay fruitful research activity. Connections with those beyond one's institution are helpful not only for developing new collaborations but also for career advancement. Most institutions now ask for external references for promotions [10]. Depending on their scope and format, scientific meetings may draw attendees from all over the world. Some meetings are very large. For example, annual meetings of the American Urological Association, the world's largest gathering of urologists, attract as many as 16,000 domestic and international attendees [11]. The annual Experimental Biology meeting, an assembly of 6 sponsoring societies and a host of other guest societies, typically averages 14,000 attendees [12]. Smaller societies and specialty organizations draw hundreds of attendees; meetings centered on specific health conditions or physiology are usually smaller.

The annual CAIRIBU meeting is the primary mechanism for bringing together all active

Table 1. The CAIRIBU Community is comprised of research centers and programs funded by the National Institute of Digestive, Diabetes and Kidney Diseases (NIDDK) to study non-malignant genitourinary diseases and conditions

Cairibu center or program & institutional affiliation (PI)	Funding	Brief description
U24 Interactions Core		
University of Wisconsin-Madison (PI, Kristina Penniston, PhD)	2020-2025	PI and staff coordinate and facilitate networking, communication, knowledge exchange, and collaboration across CAIRIBU and among investigators in the broader urologic research community. Organize annual meeting and other activities and programs throughout the year
George M. O'Brien (U54) Urology Centers		
Mayo Clinic Rochester (PI, John Lieske, MD)	2014-2019	Investigators, collaborators, and trainees at all levels, including high school and other students during summer research programs, are engaged in research projects specific to each Center's mission and objectives. Additionally, Center leaders collaborate with and mentor early-stage investigators and/or investigators new to non-malignant urologic research through Opportunity Pool awards. Educational enrichment, training, and mentoring are significant emphases in these Centers. Center investigators are expected to engage in collaborative work and develop sharable resources
University of Wisconsin-Madison (PI, William Ricke, PhD)	2014-2019; 2019-2024	
Columbia University (PIs, Jonathan Barasch, MD, PhD; Ali Gharavi, MD; and Cathy Mendelsohn, PhD)	2014-2019; 2020-2025	
University of Pittsburgh (PI, Zhou Wang, PhD)	2015-2020	
Stanford University (PI, James Brooks, MD)	2021-2026	
P20 Exploratory Centers for Interdisciplinary Research in Benign Urology		
Beth Israel Deaconess Center-Harvard University (PI, Mark Zeidel, MD)	2018-2020	Investigators build research teams to generate novel research resources for the non-malignant urologic research community. Resources developed will be shared upon validation. Centers are focused on a single project and must contain an Educational Enrichment Program
Columbia University (PI, Simone Sanna-Cherchi, MD)	2018-2020	
NorthShore University HealthSystem for Research & Purdue University (Co-PIs, Simon Hayward, PhD and Timothy Ratliff, PhD)	2018-2020	
Washington University (PI, Indira Mysorekar, PhD)	2018-2020	
University of Alabama at Birmingham (PI, Dean Assimos, MD)	2018-2020	
Albert Einstein College of Medicine (PI, Kelvin Davies, PhD)	2019-2021	
Duke University (PI, Pei Zhong, PhD)	2019-2021	
University of Tennessee (Robert Wake, MD)	2019-2021	
Vanderbilt University (PI, Maria Hadjifrangiskou, PhD)	2019-2021	
Children's Hospital of Philadelphia & University of Pennsylvania (PI, Gregory Tasian, MD, MSc, MSCE)	2020-2022	
Duke University (PI, Pei Zhong)	2020-2022	
Medical College of Wisconsin (PI, Kathryn Flynn, PhD)	2020-2022	
University of Alabama at Birmingham (PI, Dean Assimos, MD)	2020-2022	
Oakland University William Beaumont School of Medicine (Co-PIs, Bernadette Zwaans, PhD and Michael Chancellor, MD)	2021-2023	
Fostering Research With Additional Resources and Development P20 Urology Centers		
Duke University (PI, Pei Zhong, MD)	2022-2025	Support a research project designed and conducted by a collaborative, multidisciplinary team comprising primarily of junior investigators with at least one early-stage investigator and/or researcher new to urology. Research project data are expected to support one or more follow-on independent grant applications (e.g., R01s) submitted by research project team investigators
Mayo Clinic Rochester (Co-PIs, Kevin Koo, MD, MPH and John Lieske, MD)	2022-2025	
Multidisciplinary Urologic Research K12 Career Development Programs		
Duke University (PI, Cindy Amundsen, MD)	2013-2023	PIs mentor K12 Scholars engaged in various types of basic and clinical/translational research of non-malignant urologic diseases and conditions; other established investigators are involved as needed to provide collaborative mentorship
University of Wisconsin-Madison (Co-PIs, Dale Bjorling, DVM, MS and Wade Bushman, MD, PhD)	2013-2023	
Urological Epidemiology Institutional K12 Career Development Programs		
University of California San Francisco-Kaiser Permanente (Co-PIs, Alison Huang, MD and Stephen Van Den Eeden, PhD)	2016-2026	PIs mentor K12 Scholars engaged in various types of clinical/translational and epidemiologic research of non-malignant urologic diseases and conditions; other established investigators are involved as needed to provide collaborative mentorship
University of Michigan (Co-PIs, Aruna Sarma, PhD, MHA and Quentin Clemens, MD)	2016-2026	
NIDDK Program Officers		
Julie Barthold, MD	2021-present	Project Scientist

Deepak Nihalani, PhD	2021-present	Program Official
Chris Mullins, PhD	2021-present	Scientific Advisor
	2018-2021	Program Official
Tamara Bavendam, MD, MS	2018-2021	Project Scientist

Centers and Programs whose active funding cycles that included the years 2018 and beyond are listed. NIDDK Program Officers who have been involved with CAIRIBU are also listed.

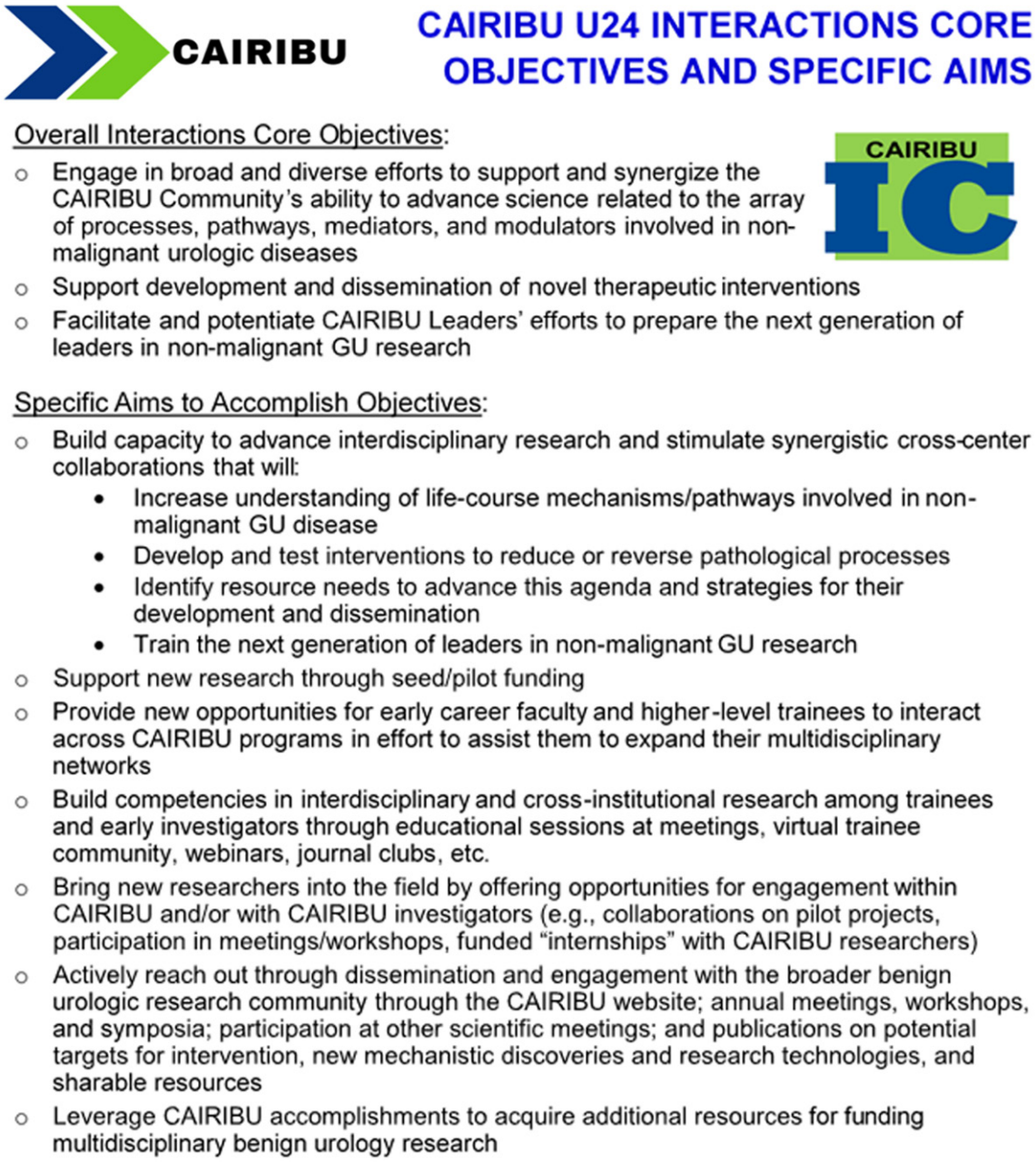

Figure 1. *CAIRIBU Interactions Core.* Primary goals and objectives are listed as are specific strategies to accomplish the goals.

CAIRIBU Centers and Programs (**Table 1**), CAIRIBU O'Brien Center Opportunity Pool Award recipients, and those who collaborate with CAIRIBU investigators. Many trainees and investi-

Table 2. Annual CAIRIBU meetings

Year	Dates	Location/Venue
2018	December 12-14	Ellicott City, MD
2019	December 4-6	Kansas City, MO
2020	December 3-4	Virtual
2021	December 2-3	Virtual
2022	November 30-December 2	Bethesda, MD

Dates and locations of annual CAIRIBU meetings are shown. The 2023 and 2024 meetings are scheduled to be somewhere in the middle of the country.

gators from previously-funded CAIRIBU Centers and Programs continue to attend CAIRIBU meetings. Additionally, investigators from the broader research community, many with connections to CAIRIBU investigators, increasingly attend meetings. Annual CAIRIBU meetings began in 2018; subsequent meetings are listed (**Table 2**). Meetings are organized around the science in which CAIRIBU Center and Programs are engaged. As funding for Centers and Programs ends and others begin, the research of CAIRIBU investigators at any given time may or may not include all areas of the GU tract. Presentation opportunities for trainees, CAIRIBU K12 Scholars, and other early-stage investigators (ESIs) are prioritized. Meeting attendance for in-person meetings has averaged 90-100; the virtual meetings of 2020 and 2021 saw more participants. Interactive elements are a hallmark of CAIRIBU meetings. These include poster sessions, structured networking and interactions sessions around specific topics, and unstructured times to encourage small group discussions.

The 2022 CAIRIBU meeting

Meeting participants

Nearly 100 investigators attended the 2022 meeting. Of these, 29 were affiliated with a P20 Exploratory or FORWARD P20 Center, 26 with a U54 Urology O'Brien Center, 18 with a CAIRIBU K12 Program (KURe or KUroEpi), and 7 with the NIDDK; the remaining were affiliated with other Centers or K12 Programs or with investigators at institutions with no current CAIRIBU presence. The proportions of attendees by education/career stage and by primary credential are shown (**Figure 2**).

Meeting abstracts

For each CAIRIBU meeting, abstracts from CAIRIBU-affiliated trainees and ESIs are solicited. Between 2018 and 2022, abstract submissions ranged from 39-45. Each abstract is reviewed by 3-4 reviewers from CAIRIBU or the broader research commuinity who are selected for their expertise. Reviews are completed using a standardized 1-page form with 4 evaluation criteria. Each criterion is scored on a 1-4 Likert scale; comments, suggestions, and constructive feedback are strongly encouraged. Anonymized abstract reviews are disseminated to presenters after each meeting. For the 2022 meeting, 40 abstracts were submitted by trainees or ESIs from 14 current or prior CAIRIBU Centers and K12 Programs; another 5 were submitted by those from institutions with no CAIRIBU Center or Program. Most abstracts (66%) described pre-clinical or lab bench work. Clinical/translational work represented 27%; translational and epidemiology abstracts were few. Abstracts reflected the research of current CAIRIBU Centers: bladder/cystitis (n=15), prostate/lower urinary tract dysfunction (n=14), urobiome/infection (n=6), urothelium (n=5), urolithiasis (n=5). Of 46 reviewers (from 59 who were invited); 74% were currently or previously CAIRIBU-affiliated. Each reviewer evaluated 3.6 ± 1.7 abstracts (min-max, 2-9).

Poster sessions

During meetings, abstracts are presented as posters. Because of their highly interactive format, poster sessions are essential networking platforms. They also support the development of trainees' communication abilities. Subramanian *et al* cited poster sessions as a key application of communication skills, a competency identified as essential for advancing the careers of trainees and early career scientists [8]. Moreover, poster sessions provide established investigators with education and mentoring opportunities. Poster presentations at CAIRIBU meetings are thus allocated ample time and priority. At this year's meeting, 44 posters were presented in 3 sessions (14-15 posters per session) over 3 days (1 per day). In response to comments from prior meetings and a decision by the meeting program planning committee, poster sessions were not mod-

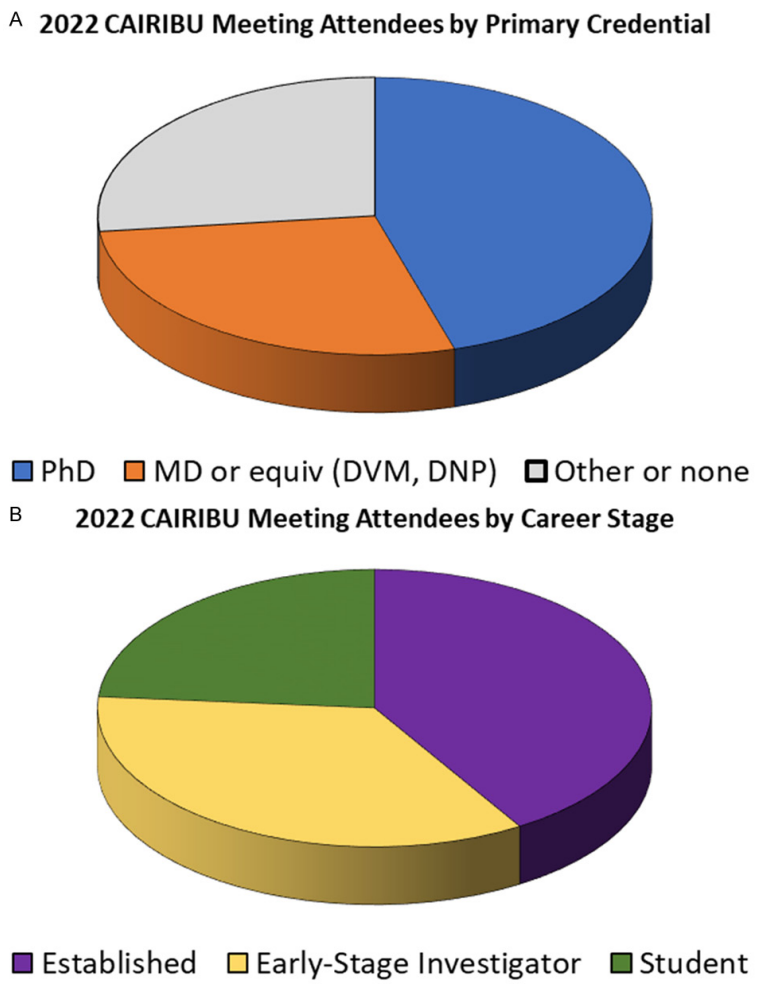

Figure 2. *2022 CAIRIBU meeting attendees*. Data shown are proportions of attendees by education or credential (A) and by career stage (B).

erated this year to allow maximum time for discussion. In a post-meeting survey, 86% of respondents said that this year's poster session format was excellent.

Networking, interactions, and interactivity

Making time during CAIRIBU meetings for small group discussions has been a mechanism for stimulating interdisciplinary collaboration. While investigators are encouraged to assemble *ad hoc* discussions for brainstorming and to discuss collaborations, pre-planned topics for semi-structured small groups are also offered. Examples of small group discussions previously offered include how to develop a good research question, identifying the research collaborators needed to answer specific research questions, building transdisciplinary research teams, and ensuring psychologically safe research teams. This year, pre-planned sessions for which group facilitators were identified beforehand included the urinary microbiota, effects of aging in the lower urinary tract, neuroanatomy of the bladder, tips on writing biosketches and curriculum vitae, applying for NIH diversity supplements, and using the NIH Small Business Innovation Research and Small Business Technology Transfer grant mechanisms for urology research. Nearly 50 attendees participated in these networking sessions; other investigators met in *ad hoc* groups to discuss manuscripts, grant applications, potential collaborations, and other business. In the post-meeting survey, 66% of respondents rated the networking and interactions sessions as excellent and 29% as good. In addition to these sessions, interactive opportunities were interspersed throughout the meeting to maintain engagement and enthusiasm. For example, 5 rounds of "Urology Jeopardy" were played, one prior to each scientific session. No formal teams were assembled. Instead, the Jeopardy board was projected on the main screen, and attendees volunteered specific squares to be revealed (e.g., $100, $200, etc.). The corresponding answer was read (e.g., *"According to Campbell's 2021, he coined the term 'LUTS' for BPH to replace the older and less appropriate term, 'prostatism'"*, and attendees were free to call out the appropriate question (e.g., *"Who was Paul Abrams?"*). Another Urology Jeopardy answer was, *"This type of kidney stone is commonly associated with dolphins, Dalmatians, and diabetes",* for which the correct question was, *"What are uric acid stones?"* Poster session "passports" were available to encourage participants to stop by every poster in each session and be eligible to win a prize. A CAIRIBU scavenger hunt worksheet was also available, the answers for which

could be found on the CAIRIBU website and/or from the CAIRIBU meeting program.

Pre-meeting event for trainees and early-stage investigators (ESIs)

For the fourth year, a trainee-focused event immediately preceded the CAIRIBU meeting. Attending were 33 trainees (undergraduate and graduate students, medical school students) and ESIs (postdocs, K12 scholars, junior faculty) from 18 institutions representing current and prior CAIRIBU-affiliated Centers and Programs. Also attending were several individuals from other institutions who are in various stages of collaboration with CAIRIBU investigators. The pre-meeting program was set months in advance by a trainee/ESI committee coordinated by the CAIRIBU Interactions Core. The committee articulated a high priority to hear how others have navigated the student-to-independent investigator journey. Thus, a panel of ESIs discussed steps taken to reach independent investigator status. Panelists included 2 prior CAIRIBU K12 scholars, both currently in junior faculty positions, and 1 assistant professor (previously a postdoc at a CAIRIBU U54 Urology Center). Two urologist scientists also played prominent roles in the discussion, particularly around the question of how to build basic science-clinical collaborations. The second portion of the meeting focused on enhancing trainees' self-efficacy in research by exposing them to the myriad of research resources that are available. This was thought to be particularly important for trainees developing their own independent research ideas and preparing to write grant applications. Representatives from the NIDDK Information Network (dkNET), the NIDDK Central Repository, the GenitoUrinary Development Molecular Anatomy Project, ReBuilding a Kidney, and the Kidney Precision Medicine Project delivered short presentations. These were followed by about 45 minutes during which participants rotated through these various "stations" for one-on-one conversation and to ask specific questions. Evaluations from the pre-meeting came from nearly 40% of attendees. More than half (55%) strongly agreed they would directly apply new knowledge learned, and 62% strongly agreed that the speakers were effective. A limitation identified from evaluations was that only 25% of participants felt they had sufficient opportunity to network with other trainees and ESIs. Thus, future pre-meeting agendas will include more time for this. Other actions inspired by attendees' suggestions include a plan by the CAIRIBU Interactions Core to develop a peer-to-peer networking and mentoring program for trainees and ESIs.

Scientific sessions

Presenters (n=31; 45% women) representing 16 current and prior CAIRIBU Centers and Programs delivered talks in 5 scientific sessions. Presenters represented graduate students, ESIs, and established investigators. *A detailed summary of the science addressed in each session is in the meeting brief in this issue.* Each session was moderated by 2 moderators (10 total; 70% women), an established investigator-trainee pair. At the end of the meeting, an additional 5 presentations - one corresponding to each scientific session - were delivered by 5 trainees (60% women) in a "take-home message" session. In post-meeting evaluations about these sessions, attendees said they appreciated hearing from "different voices", reflecting the diversity of presenters. One person used the word "egalitarian" to describe this.

Meeting evaluations

The response rate for this year's post-meeting evaluations was 40%. Most were completed onsite on the last meeting day. Some were completed after the meeting on an electronic platform. Respondents were graduate or medical school students (16%), ESIs (postdocs, K12 scholars, junior faculty; 39%), established investigators (40%); and research support or other (5%). Respondents felt the meeting was well-organized (92% strongly agreed) and that sufficient information about the meeting was shared ahead of time (92% strongly agreed). Scientific sessions were rated "excellent" by most (mean, 80%; range, 70-88%); none were rated as "poor". Metrics related to attendees' learning and research capacity were collected and compared to prior meetings. This year's results show marked improvement in nearly every area measured (**Table 3**).

Conclusion and future directions

The factors that contribute to GU dysfunction and pathophysiology include genetic, physio-

Table 3. CAIRIBU Meeting Evaluations

Survey Item	Strongly Agree (%)			Change (%)	
	2022	2021	2020	2021 to 2022	2020 to 2021
I learned new things about the research and research tools used by CAIRIBU investigators	79%	72%	83%	+9.0%	-13%
I will apply new knowledge or research tools to my own research	76%	62%	68%	+23%	-8.5%
The meeting enhanced my enthusiasm for doing research	76%	64%	59%	+19%	+9.2%
The meeting enhanced my ability to understand other disciplinary perspectives in non-malignant urology research	73%	76%	67%	-3.8%	+13%
The meeting provided the opportunity to initiate mentoring relationships or potential collaborative relationships with others	71%	59%	40%	+21%	+45%
The meeting enhanced my capacity to conduct research	63%	59%	33%	+7.8%	+79%

Post-meeting survey results from 39% of meeting attendees are shown. Changes over the last 3 years from one meeting to the next are shown. The 2022 meeting was in person in Bethesda, MD. The 2020 and 2021 meetings were virtual due to the COVID-19 pandemic.

logical, biological, behavioral, nutritional, social, and environmental; many of these factors comingle [13]. While a single investigator may be able to successfully address a problem, many current knowledge gaps in non-malignant GU research will not be adequately addressed in this way. Alternatively, a more comprehensive research strategy is required, one that integrates investigators from different disciplines who combine their disparate knowledge to form multidisciplinary and interdisciplinary teams [13], ultimately leading to full transdisciplinary teams and approaches that have the potential to exert an even greater impact on the urologic health of the population. CAIRIBU was formed with this in mind. In addition to other CAIRIBU-related events and initiatives (many are virtual), the annual CAIRIBU meeting is an important mechanism for promoting interactions and collaboration because it provides a basis for deeper knowledge exchange, networking, mentoring, small group conversation, and the development of trust through personal connections - all of which are precursors for effective collaboration.

The 2022 CAIRIBU meeting followed 2 years of virtual meetings during the COVID-19 pandemic. Meeting attendees rated many aspects of this meeting, if not most, as superior to the prior 2 (**Table 3**). This speaks to the value of in-person meetings. Indeed, Dua *et al* said they provide a "richer, easier experience with more chance interactions" and that "these somewhat random interactions could catalyze the next advance in biomedical research… (or) launch a student's life science career" [14]. Interestingly, they also advocate that the value of virtual meetings be appreciated and suggest we strive to make them "essential partners" with in-person events" [14]. Future directions for CAIRIBU meetings will thus include coupling in-person with virtual options that maximize and equalize interactions, engagement, networking, and interactivity across modalities. Another future direction is to incorporate more collaborative "working time" into the meeting. This might mean identifying and fostering nascent research collaborations before the meeting and then coordinating structured discussion and interactions within each collaboration at the meeting itself. Because CAIRIBU investigators and trainees are directly involved each year in meeting planning, the annual meeting will be able to evolve with the changing needs of the CAIRIBU and broader research communities.

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Disclosure of conflict of interest

None.

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