FACILITES AND OTHER RESOURCES

Laboratory: The PI's 200 sq. ft. lab is on the 2nd floor of the SRC building at CSU and is equipped with the necessities to perform common techniques used in cellular and molecular biology (see below for details). There are two desks and corresponding lab benches. The PI has 1 tissue culture hood, 1 CO2 incubator and an inverted CK40 microscope. The PI shares a cold room with Drs. Gnanapragasam, Severson and Boehner. A shared equipment room, a microscopy room, and a room equipped with autoclave and dishwasher are in the same hallway within 30-60 feet of the PI's lab (see below for details).

Animal: Not applicable

Clinical: Not applicable

Computer: The PI has a PC laptop with access to a printer. A Windows computer is in the lab space with access to departmental printers for lab members. Students in the lab utilize their PC laptops and are networked to the departmental printer. The entire university has wireless and hard-wired access.

Office: The PI shares a 12x14 ft office space with Dr. Merlin Gnanapragasam.

Other:
The Biology Department and the Center for Gene Regulation in Health and Disease (described in section 3 below) at CSU have the following common use equipment all located on the same floor as the PIs lab (restated and re-organized in Major Equipment section 7 below): two tissue culture rooms with Airstream ESCO Class II BSC hoods, Thermo Scientific Heracell 150L CO2 incubators and CK40-SLP Olympus microscopes, high and low speed centrifuges (2X Beckman Optima L90K, Optima TLX, 2X J2-21), two Innova Refrigerated 44R New Brunswick Shakers, two Steris Amsco Lab 250 autoclaves, Beckman LS 6500 scintillation counter, two cold rooms (of about 150 square feet each), Nikon AI multiphoton-ready confocal microscope with Perfect FocusTM and real-time video imaging, CCMI DeltaVision deconvolution microscope, Olympus fluorescent microscope, BD FACS Canto II Flow Cytometer (Beckton-Dickinson) with 6 colors, 8 parameter capability and Z200 workstation bundle, Perkin Elmer Wallac Victor3 1420 Multilabel Counter with Computer and Software, Applied Biosystems StepOnePlus™ Real-Time PCR system, MJ Research Opticon Realtime PCR system, Typhoon (4 lasers, 8 filters) Imaging Scanner 9410 (installed in Dr. Komar's laboratory), Amersham Typhoon 5 Imager, Thermo Scientific IEC French Laboratory Press, New Brunswick lyophilizer, UVP gel documentation system, Odyssey Fc Imaging System, Heska Hematology and Element Analyzers for mice blood work.

In addition, the student researchers and the research in the PI's lab benefit greatly from the close proximity of key-personnel/collaborator Dr. Merlin N Gnanapragasam's NIH funded adjacent lab and office. Student education and research is also enhanced by the adjacent labs of NIH funded researchers Dr. Anton Komar, Dr. Roman Kondratov, Dr. Barsanjit Mazumder, Dr. Bibo Li, Dr. Valentin Boerner, and Dr. Aaron Severson. The collegiality and proximity (all labs are located side by side and keys are shared) facilitate daily interaction with all these PIs and their students. The labs share reagents and equipment and conceptual as well as technical expertise (data interpretation, experimental design and troubleshooting protocols).

Also, on the same floor there are five full-time staff. A departmental secretary and an administrative coordinators assist faculty with ordering, hiring personnel, budgeting, and coordinating with university service departments including purchasing, accounts receivable, human resources, and grants management. Two full-time laboratory managers coordinate shipping, receiving and facilities maintenance. One facilities manager is responsible for equipment instruction and maintenance. Three

conference rooms of different sizes are available on the same floor, two are available on the 1st floor and one more on the ground floor. The larger rooms are equipped with integrated AV equipment. The PI and students can utilize all core facilities of Cleveland Clinic Foundation (ex: DNA sequencing/proteome analysis, see below) and in practice routinely use the Flow Cytometry core.

Information specific to the AREA program

1. Evidence of Undergraduate student mentoring by the PI:

Thus far, **19 undergraduate students** have trained in independent research with me, and many of these students are first generation students. Three of these students received training as part of the **Undergraduate Summer Research Award** (USRA) program at CSU and one of them received a **special mention at the summer research award symposium.**

These students are exposed to research techniques, designing experiments, interpreting and critiquing data and manuscripts, and participating in lab meetings and in lab journal clubs where we discuss the latest and relevant publications. Many of these students intend to apply for graduate programs in medical schools, dental schools or physician assistant programs in universities in Ohio and around the country. My aim for these students is to provide exposure to enable them to gain appreciation and excitement for the relevance of research and discovery in health sciences, and to provide opportunities to strengthen important soft skills such as resilience (to repeat and optimize experiments), patience (to follow up on those long experiments), scientific communication, and critical thinking.

A few examples of undergraduate students who have trained under me and their accomplishments:

- Rose Gott, a first-generation college student, who started on a non-thesis program, moved to a 4+1combined BS/MS program with thesis. She has published a co-first authored manuscript (Elagooz, R. *et al.* PUM1 mediates the posttranscriptional regulation of human fetal hemoglobin. *Blood Adv* (2022) doi:10.1182/BLOODADVANCES.2021006730) with me and my collaborator, Dr. Merlin Nithya Gnanapragasam. She is now working at a biotechnology company in Cleveland.
- Bashar Abujaradeh made Dean's list at CSU and is now training to become a dentist in University of Detroit Mercy.
- Nikhila Telagarappu received a CSU undergraduate summer research training award, and she received an outstanding poster recognition at the undergraduate summer research award symposium.
- Mehreal Roman and Dev Savaliya presented posters at the Undergraduate Summer Research Award (USRA) symposium.

2. Research and Training Environment:

Research Excellence in the CSU Center for Gene Regulation in Health and Disease (GRHD): The PI is a member of the GRHD, an Ohio Board of Regents recognized Center of Excellence. Dr. Komar, currently serves as the Director of GRHD. The Center is currently composed of 18 highly research active faculty members from Biology, Chemistry, and Physics. GRHD members conduct research on diverse topics in cell and molecular biology, including hematology, chromosomal biology, protein translation and folding, signal transduction, apoptosis, aging, and cancer. Over the years GRHD faculty have mentored nearly 300 undergraduate and graduate students in their laboratories, divided roughly in half between the two groups.

The vast majority of GRHD trained undergraduate students (87.25%) decided to further their education by enrolling in graduate or medical schools and most of our graduate students (after

graduation) remained in Academia (85.70%) and/or are employed by Biotech/Health Industry (26.28%). Doctoral students trained by GRHD faculty have gone on to pursue postdoctoral studies at prestigious institutions including Harvard and Stanford Universities, the National Institutes of Health (NIH), and the Lerner Research Institute of the Cleveland Clinic. However, the majority of GRHD trained students choose to remain in Ohio and continue their education and/or seek employment in Ohio (66% of undergraduate students and 43.8% of graduate students).

Opportunities that GRHD researchers provide to their students are very well aligned with the central mission of CSU, to educate those who might not otherwise have the opportunity, teach them to think constructively, critically, and creatively, and graduate them, fully prepared to succeed.

Undergraduate students at CSU are recruited to engage in our laboratory's research work by the following mechanisms:

1. McNair Scholar's program
2. Honors undergraduate thesis program
3. Undergraduate Student Research Award program (USRA)
4. BIO497: Undergraduate independent research course
5. Students are also recruited through undergraduate Biochemistry course (BIO306)

Two GRHD labs are particularly relevant to the proposed research:

1. Dr. Merlin N. Gnanapragasam (**collaboration letter attached**) studies posttranscriptional and post translational mechanisms underlying terminal erythropoiesis. She did her postdoctoral research with Dr. Jim Beiker on EKLF, a master transcriptional regulator of erythropoiesis and her graduate work with Dr. Gordon Ginder on methylation of the globin locus.
2. Dr. Aaron Severson is an Associate Professor and Associate Chair in the Department of Biological, Geological and Environmental Sciences at Cleveland State University. He studies sister chromatid cohesion and cohesin biology. He did his postdoctoral fellowship in Dr. Barbara Meyer's laboratory at the University of California/HHMI.

Our group has bi-weekly joint lab meetings with the Gnanapragasam, Severson, Börner, and Li labs, during which undergraduates, graduate students, and postdocs present their research and/or literature related to molecular and chromosomal biology.

The GRHD External Advisory Board (EAB) meetings:

The External Advisory Board consults annually with the GRHD Planning Committee, the CSU VP of Research, Provost and President regarding research directions and goals. Every member of GRHD presents their work every other year to the EAC Members who provide written and verbal feedback. . Members currently include:

• Dr. George Stark, Ph. D., Cleveland Clinic Lerner Research Institute, NAS member, Chair of EAB
• Dr. William M. Baldwin M.D., Ph.D., Cleveland Clinic Lerner Research Institute
• Dr. Stephen J. Benkovic, Ph.D., Pennsylvania State University, NAS member
• Dr. Carlos J. Bustamante, Ph.D., University of California, Berkeley, HHMI Investigator, NAS member
• Dr. Paul E. DiCorleto, Ph.D., Kent State University
• Dr. Harry F. Noller, Ph.D., University of California, Santa Cruz, CA, NAS member
• Dr. Roy L. Silverstein, M.D., Blood Center of Wisconsin, Milwaukee, WI

3. Impact of an AREA award on student research:

Increased extramural funding is critical to continuing my success in training the next generation of scientists. The biology department enrolls over 550 majors, many of whom want research experience. Of these, every year roughly 50 of these are honors students and 5 are McNair scholars (out of 22 McNair scholars) who are *required* to have research experience. **Securing funding for this proposal will enable me to achieve the AREA specific goals for my present**

team and aid me to continue my commitment towards engaging more undergraduate students. Undergraduate students are mentored and held to the same expectations as new graduate students, except for the complexity of their projects and the hours devoted to their projects. They are shown techniques by me, then they are watched by me until they are confident enough to act independently. They are expected to read the literature and to participate in weekly individual meetings with me and weekly group meeting discussions where they present and defend their data. During the one-on-one meetings with me, we discuss the goal of their project, the results from the previous week's experiment, and design the next experiment. During the group meeting, they take a turn presenting just like the graduate students. This gives them practice in explaining their project, their data, and the rationale behind designing the next experiments.
Students additionally have the following opportunities to practice presenting their work. These include:

- Research presentations at the weekly meetings of the Center for Gene Regulation in Health and Disease (GRHD). One graduate student from the lab (undergraduate in my case) typically presents each semester.
- Yearly poster presentations specifically for undergraduate students organized by CSU's Research Office
- Yearly poster presentations during Research Day, organized by the College of Sciences and
- Health Professions (COSHP).
- Yearly oral and/or poster presentations at the Graduate Student Interdisciplinary Research Club, a Graduate student run organization within COSHP (presentations by graduate students and advanced undergraduates).

As has previously been the case, I expect that students will move from my laboratory to one of the additional training opportunities at the Cleveland Clinic, Case University or at one of the area biotech companies. Each training opportunity also increases their chance of acceptance into graduate school or a doctorate program.

4. Impact of an AREA award on the PI and the research environment:
Increased extramural funding is critical to continuing my success in training the next generation of scientists. Specifically, AREA funds will:
(a) Allow the continued operation of my laboratory, pursuing the specific aims of the proposal.
(b) Help me continue my collaborations with investigators in the department who work in the areas of cell and molecular biology.
(c) Assist with continuing the GRHD culture, where research is expected and rewarded.

The three stated goals of the AREA program are to:
(1) Expose students to research,
(2) Support meritorious research, and
(3) Strengthen the overall research environment of the institution.

As outlined above, ***an AREA award would achieve all three stated goals of the AREA program.***

5. Institutional support for the proposed research project
In addition to providing the funds used to equip my laboratory, Cleveland State University (CSU) provides additional support for research active and extramurally funded faculty as follows:

Institutional funds: A competitive internal program exists to provide research funds for both PIs and students. Specifically, PIs can compete for up to $25,000 every two years. I am also able to compete for up to $10,000 in funding through the Vitullo Gift account housed in the GRHD Center. Moreover, undergraduates are invited to compete for $1,000 each semester and they are registered for research

credits. Each of the University Honors undergraduates or McNair scholars are awarded $1,000 in supply money.

Travel stipends*:* Competitive internal programs exist at the department, college and university levels to provide funds for travel to scientific meetings to present recent results for both faculty and students. These typically cover part of the travel budget.

6. Description of the student profile and special characteristics of the university:
Since its beginning in 1964, Cleveland State University (CSU) continues to mature as a public research institution. In 2023 alone, CSU enrolled 9505-plus undergraduate students. CSU has worked hard to improve and was again chosen for 2023 as one of America's best universities by U.S. News & World Report. The core mission of Cleveland State University is to provide undergraduate education to an urban and non-traditional population of students. In keeping with this mission (and as described above under the section, "Evidence of Undergraduate student mentoring by the PI") the student body is representative of the region's demographic profile. Over 90% of CSU students come from Greater Cleveland.

Students from all walks of life attend CSU which makes it an impactful urban public institution in the State of Ohio and is a state and national leader in preparing and graduating students from graduate and professional programs. CSU offers equal access to higher education to more low-income students, over 10 percent of its total enrollment, than any other Ohio public university. In addition, over 30 percent of CSU students are the first members of their families to attend college.

Cleveland State University is an affordable, urban university. It represents for most students the only opportunity to pursue higher education. We strive to have our students have the same opportunities and be exposed to the same research-active faculty as those students who can attend more elite institutions. Prior to experiencing the laboratory through real-life research experience, most of our students have never considered pursuing a Ph.D. degree and a career in research. Moreover, CSU is ideally located in Cleveland, one of the top biomedical and health care cities in the US.

Personally, one of the aspects that has been extremely rewarding about serving as a member of a **state university that ranks high in social mobility**, is the opportunity to interact with students and trainees who come from different backgrounds. I hope to advance a rigorous and impactful research program in our laboratory at CSU and contribute towards supporting next generation of talented individuals at CSU, from different backgrounds, to enhance retention in science.