



Dr. Broderick Eribo  
Cell Biology Search Committee  
Department of Biology  
Howard University  
EE Just Hall Biology building  
415 College St. NW, Washington DC 20059

November 10, 2022

Dear Search Committee,

I am Arif Ashraf, postdoctoral research associate at Facette lab, Biology department, University of Massachusetts Amherst and really excited about the Assistant professor position (Cell Biology) in the Biology department at Howard University.

My current research is focused on the cell polarity, nuclear movement, and asymmetric cell division for the stomatal development in *Zea mays*. My work on nuclear membrane proteins, LINC complex, during stomatal development and function are at the core of answering fundamental biology questions. I have a proven track record of working on fundamental plant cell biology and translating the research findings into crop plant improvement and environmental response. My graduate works (identifying temperature regulator, arsenite transporter, potassium-independent cesium transporters) on *Arabidopsis thaliana* root are into the transition phase to be implemented into crop plants such as rice and tomato. I also published these fundamental cellular and molecular plant biology works in top-tier plant journals (*Molecular Plant*, *The Plant Journal*, *Plant Communications*) as 1<sup>st</sup> author and have patent application in progress for cesium transporters. Additionally, my first author research article from postdoctoral work on nuclear movement and asymmetric cell division in maize helped to answer the long-standing fundamental biology question, how cell decides the future division site? This manuscript is now available on *bioRxiv*.

In a bigger picture, nuclear envelope proteins are conserved across eukaryotic organisms. As a result, the research in my future lab and focus on the cellular mechanisms will be widely applicable for other plant and non-plant systems. Additionally, I have already tested series of nuclear envelope mutants in maize and identified their phenotypes over the last three years as a postdoc. I have developed these genetic and cell biology materials, which are completely independent of my postdoc supervisor's interest area, to bring with me. It will be my competitive advantage to publish articles and receive grants. At the same time, I am an expert in quantitative cell biology and timelapse imaging in both model plant *Arabidopsis* and crop plant maize.

I am excited to develop my research lab at the Howard University and become part of the Biology department. My research in the future lab will be greatly benefitted from the expert collaborations with **Dr. Hemayet Ullah, Dr. Janelle Burke, and Dr. Mary McKenna**. I am planning to collaborate with experts outside of the department as well. For instance, **Dr. Bo Liu (University of California Davis)** for cell division and mitotic regulation of nuclear envelope proteins, **Dr. Ram Dixit (Washington University in St. Louis)** for *in vitro* experiments, and **Dr. Justin Walley (Iowa State University)** for comparative proteomics.

Focusing on teaching, along with developing strong research projects in my lab, will be one of the most important parts to contribute to the department. I am flexible to teach or share courses with other faculties in my expert areas. More specifically, I am interested to be involved in **Plant Physiology (344), Molecular Plant Physiology (460), Cell Biology (310)**. Furthermore, I am interested in introducing hands-on and application-based course materials in the curriculum and implementing outreach activities. In addition to contribute to the teaching, I am willing to serve in the departmental committees and DEI programs initiatives within the department.

I will bring my molecular, cellular, and microscopic expertise to the department and expand it through active collaborations. I would like to thank the committee for considering my application and looking forward to meeting faculties to discuss science and collaborative opportunities.

Sincerely,

**Arif Ashraf**

Arif Ashraf  
Postdoctoral Research Associate  
Facette Lab, Biology department  
University of Massachusetts Amherst  
Email: [mohammadarif@umass.edu](mailto:mohammadarif@umass.edu)  
Phone: (+1) 571-604-3802

# ARIF ASHRAF

180 Lincoln Avenue, Amherst, Massachusetts, 01002, USA

Email: [arif.ashraf.opu@gmail.com](mailto:arif.ashraf.opu@gmail.com) | Twitter: [@aribidopsis](https://twitter.com/aribidopsis)

## RESEARCH EXPERIENCE

**Postdoctoral Research Associate** (July 2019 – Present)

Department of Biology, University of Massachusetts Amherst, USA

Advisor: Michelle Facette

**Ph.D. Student** (October 2014 – March 2019)

United Graduate School of Agricultural Sciences, Iwate University, Japan

Advisor: Abidur Rahman

**Visiting Research Scholar** (October 2017 – March 2019)

Radio-Plant Physiology, Department of Applied Biological Chemistry,

University of Tokyo, Japan

Advisor: Keitaro Tanoi

**Research Intern** (Summer 2016)

School of Medicine, University of Saskatchewan, Canada

Advisor: Hong Wang

**Research student** (March 2013 – September 2014)

Plant Biotechnology Lab, Department of Biochemistry and Molecular Biology,  
University of Dhaka, Bangladesh

Advisor: Zeba Islam Seraj

## EDUCATION

Ph.D. (October 2014 – March 2019)

United Graduate School of Agricultural Sciences, Iwate University, Japan

**Thesis: The role of membrane proteins in abiotic stresses in *Arabidopsis thaliana***

MSc (March 2013 – July 2014)

Department of Biochemistry & Molecular Biology, University of Dhaka,  
Bangladesh

**Thesis: Cloning and characterization of Alcohol Dehydrogenase (Adh) promoter region for expression under submergence and salinity stress**

BSc (February 2009 – February 2013)

Department of Biochemistry & Molecular Biology, University of Dhaka,  
Bangladesh

## PUBLICATIONS

- **M. Arif Ashraf**, Le Liu, Michelle Facette. (2022) An outer nuclear membrane protein promotes a polarized nuclear position and the future division plane during asymmetric cell division. *bioRxiv*. 10.1101/2022.08.26.505454. (First author research article from postdoctoral work)
- **M. Arif Ashraf**, Abidur Rahman. (2022) Cellular protein trafficking: A new player in low-temperature response pathway. *Plants*. 11 (7): 933. (Invited review and featured article for the special issue: Plants Response to Temperature Extremes) (Citation: 1)
- Mohammad Aslam, Beenish Fakher, **M. Arif Ashraf**, Yan Cheng, Bingrui Wang, Yuan Qin. (2022) Plant low-temperature stress: Signaling and response. *Agronomy*. 12 (3): 702. (Collaborative review article) (Citation: 7)
- **M Arif Ashraf\***, Shomoita Sayed, Martiniano Bello, Nazmul Hussain, Rony Kumer Chando, Saruar Alam, Md Kamrul Hasan\*. (2022) CDK4 as a phytochemical based anticancer drug target. *Informatics in Medicine Unlocked*. 28: 100826. (Peer-reviewed article from the undergrad-led project) (Citation: 1)
- **M. Arif Ashraf**, Takashi Akihiro, Keita Ito, Sayaka Kumagai, Ryohei Sugita, Keitaro Tanoi, and Abidur Rahman. (2021) ATP binding cassette proteins ABCG37 and ABCG33 function as potassium-independent cesium uptake carriers in Arabidopsis roots. *Molecular Plant*. (14): 664–678. (Media coverage: [Spotlight](#), [EurekAlert](#), NHK; Under patent application) (First author research article from graduate study) (Citation: 8)
- Nazmul Hussain, Rony Chanda, Rushan Ahmed Abir, Mohsina Akter Mou, Md. Kamrul Hasan, **M. Arif Ashraf\***. (2021) MPDB2.0: A large scale and integrated medicinal plant database of Bangladesh. *BMC Research Notes*. 14:301. (Peer-reviewed article from the undergrad-led project) (Citation: 5)
- **M. Arif Ashraf**, Michelle Facette. (2020) BASL gives the plant nucleus a sense of direction. *Current Biology*. 30 (22): R1375-R1377. (Invited commentary article related to the postdoctoral research) (Citation: 2)
- **M. Arif Ashraf**, Kana Umetsu, Olena Ponomarenko, Michiko Saito, Mohammad Aslam, Olga Antipova, Natalia Dolgova, Cheyenne D. Kiani, Susan Nezhati, Keitaro Tanoi, Katsuyuki Minegishi, Kotaro Nagatsu, Takehiro Kamiya, Toru Fujiwara, Christian Luschnig, Karen Tanino, Ingrid Pickering, George Graham, and Abidur Rahman. (2020) PIN FORMED 2 modulates the transport of Arsenite in *Arabidopsis thaliana*. *Plant Communications*. 1(3): 100009. (First author research article from graduate study) (Citation: 12)
- **M. Arif Ashraf\***. (2020) Phytochemicals as potential anticancer drugs: Time to ponder nature's bounty. *BioMed Research International*. 3:1-7. (Invited review article) (Citation: 85)

- **M. Arif Ashraf**, Abidur Rahman. (2019) Cold stress response in *Arabidopsis thaliana* is mediated by GNOM ARF-GEF. *The Plant Journal*. (97): 500 – 516. (First author research article from graduate study) (Citation: 28)
- **M. Arif Ashraf**, Abidur Rahman. (2018) Hormonal regulation of cold stress response in *Cold Tolerance in Plants*. (eds: Shabir Hussain Wani and Venura Herath). *Springer Nature*. pp. 65 – 88. (Invited review as book chapter on graduate study) (Citation: 8)
- **M. Arif Ashraf**, Achia Khatun, Tanzila Sharmin, Faraid Mobin, Arifur Rahman Tanu, Toufique Morshed, Tawkir Ahmad Fakir, Rifat Ara Begum, AHM Nurun Nabi. (2014) MPDB1.0: A medicinal plant database of Bangladesh. *Bioinformation*. 10 (6), 284. (First author article from undergraduate research project) (Citation: 30)
- **M. Arif Ashraf**, Sudip Biswas, Samsad Razzaque, Taslima Haque, Zeba Islam Seraj. (2014) Cloning and characterization of alcohol dehydrogenase (Adh) promoter region for expression under submergence and salinity stress. *Plant Tissue Culture and Biotechnology*. 24(1): 111-120. (First author article from master's thesis) (Citation: 5)
- **M. Arif Ashraf**, Mohammed Monzur Morshed, AS Ahammad, Mohammad Neaz Morshed. (2013) Computation study of silicon transporter protein in rice and wheat. *International Journal of Computational Bioinformatics and In Silico Modeling*. 2 (4): 199-205. (First author article from undergraduate research project) (Citation: 4)

## BOOK

- Alan M Jones, Jane P Ellis, **M. Arif Ashraf**, Hemayet Ullah. (2016) My Life as a Plant - Bengali: Coloring & Activity Book for Plant Biology. *American Society of Plant Biologists*. ISBN: 978-0-943088-95-2. (Translated this book into my native language, Bengali, as an ASPB ambassador)

## EDITORIAL ARTICLES

Research highlight articles written as a *Molecular Plant* editorial team member (see service section below). These articles are published in the “*Editorial Highlights*” section in a collaboration with experts from the field.

- **M. Arif Ashraf**, Stavroula Fili. (2022) An evolutionarily conserved nitrate sensor in plants. *Molecular Plant*. 15 (11): 1.
- **M. Arif Ashraf**, Mohammad Aslam. (2022) pH sensing in plants. *Molecular Plant*. 15 (10): 1510.
- **M. Arif Ashraf**, Qiong Nan. (2022) Evolutionary conserved shoot-borne root developmental circuit. *Molecular Plant*. 15 (5): 783.

- **M. Arif Ashraf**, Erin Sparks. (2022) Hypermobility of SHORT-ROOT in the development of multiple cortex layers. *Molecular Plant*. 15 (2): 221.
- **M. Arif Ashraf**. (2021) Evolutionarily conserved mechanosensory PIEZO in land plants. *Molecular Plant*. 14 (11): 1-5.
- **M. Arif Ashraf**, Sunil K Kenchanmane Raju. (2021) Cellular-identity and regulatory variation in model plants at single-nuclei resolution. *Molecular Plant*. 14 (9): 1436-1437.
- **M. Arif Ashraf**, Aaron M Rashotte. (2021) Cytokinin-mediated nuclear shuttling of MYB3R4 regulates cell division. *Molecular Plant*. 14 (5): 720-721.
- **M. Arif Ashraf**, Jaimie M. Van Norman. (2021) SHR-SCR regulates cortical cell division and nodulation. *Molecular Plant*. 14 (2): 198.
- **M. Arif Ashraf**, Dior R. Kelley. (2021) CAMEL-CANAR regulates PIN trafficking and polarity. *Molecular Plant*. 14 (1): 6.
- **M. Arif Ashraf**. (2020) Cytokinin perception also starts at the plasma membrane. *Molecular Plant*. 13 (11): 1534.
- **M. Arif Ashraf**. (2020) Auxin-mediated chromatin remodeling in somatic embryogenesis. *Molecular Plant*. 13 (9): 1234.

Complete list of publication: [Google Scholar](#); [Research gate](#)

## SCIENTIFIC TALK/SEMINAR

- **The nucleus decides the future division site.** Plant Biology seminar series (Fall 2022), University of Massachusetts Amherst. October 27, 2022.
- **Nuclear positioning for asymmetric division site.** Motors in Quarantine series. Organized by Center for Mechanical Cell Biology. October 5, 2022. (Virtual)
- **The nucleus decides the future division site.** Guest seminar, Rasmussen's lab, University of California, Riverside. (Hosted by Aimee Uyehara and Carolyn Rasmussen). September 15, 2022. (Virtual)
- **An outer nuclear membrane protein dictates nuclear movement and future division plane during asymmetric cell division.** Plant and Microbial Cytoskeleton Gordon Research Seminar and Conference. August 12 – 19, 2022. (Selected talk from the submitted abstract)
- **Plant polarity and perception: You better take your side.** Winter seminar series, Bio-Bio-1 Research Foundation. January 4, 2021. (Virtual seminar)

- **A sense of asymmetry.** Bioinformatics User Group (BUG), University of Massachusetts Amherst. February 16, 2020 (Lightening talk)
- **The role of membrane proteins in abiotic stresses in *Arabidopsis thaliana*.** Department of Biology, University of Massachusetts Amherst, Massachusetts (Hosted by Michelle Facette). May 9, 2019. (On campus postdoctoral job interview/seminar)
- **The role of membrane proteins in abiotic stresses in *Arabidopsis thaliana*.** Cummings Conference room, Delbruck building, Cold Spring Harbor Laboratory, New York (Hosted by David Jackson and Ullas Pedmale). May 7, 2019. (On campus postdoctoral job interview/seminar)
- **The role of membrane proteins in abiotic stresses in *Arabidopsis thaliana*.** Department of Biology, HCK HHMI Lounge, University of Washington Seattle, Washington (Hosted by Keiko Torii). May 2, 2019. (On campus postdoctoral job interview/seminar)
- **The role of membrane proteins in abiotic stresses in *Arabidopsis thaliana*.** Department of Molecular, Cellular, and Developmental biology, Biological Sciences Building, University of Michigan, Ann Arbor (Hosted by Erik Nielsen). April 23, 2019. (On campus postdoctoral job interview/seminar)
- **The role of membrane proteins in abiotic stresses in *Arabidopsis thaliana*.** United Graduate School of Agricultural Sciences, Iwate University, Japan (Hosted by Abidur Rahman). February 17<sup>th</sup>, 2019. (PhD defense seminar)
- **Mutation in GNOM, resulting in BFA resistance induces overexpression and alters subcellular localization of GNOM in *Arabidopsis thaliana*.** 59<sup>th</sup> Annual Meeting of Japanese Society of Plant Physiologists, Sapporo, Hokkaido. March 28-30, 2018. (Selected talk from the submitted abstract)
- **Cesium transport in *Arabidopsis thaliana* is mediated by ABCG37 and ABCG33.** International Conference on Genomics, Nanotechnology and Bioengineering, North South University, Dhaka, Bangladesh. May 14-16, 2017. (Invited talk from the submitted abstract)

## POSTER PRESENTATION

- **An outer nuclear membrane protein dictates nuclear movement and future division plane during asymmetric cell division.** Plant and Microbial Cytoskeleton Gordon Research Seminar and Conference. August 12 – 19, 2022.
- **Tale of the nucleus: A protein in the nuclear membrane is required for correct division plane orientation.** Plant Cell Atlas symposium, Virtual



conference. December 9-10, 2021.

- **Tale of the nucleus: A protein in the nuclear membrane is required for correct division plane orientation.** Plant Cell Dynamics meeting, Virtual conference. June 1-3, 2021.
- **Tale of the nucleus: A protein in the nuclear membrane is required for correct division plane orientation.** 63<sup>rd</sup> Annual Maize Genetic meeting, Virtual conference. March 8-12, 2021.
- **A sense of asymmetry.** The Plant Biology of Climate Change, University of Massachusetts Amherst. October 12, 2019.
- **ATP binding cassette proteins ABCG37 and ABCG33 function as cesium uptake carriers in *Arabidopsis thaliana*.** 60<sup>th</sup> Annual Meeting of Japanese Society of Plant Physiologists (JSPP), Nagoya University, Japan. March 13-15, 2019.
- **GNOM-mediated endosomal trafficking pathway regulates cold stress in *Arabidopsis thaliana*.** Annual meeting of American society of Plant Biologists (ASPB), Plant Biology 2017, Honolulu, Hawaii, USA (June 24-28, 2017)
- **GNOM-mediated endosomal trafficking pathway regulates cold stress in *Arabidopsis thaliana*.** 1st UGAS International Symposium, Innovation in Plant and Food Sciences: From Genes to Production, Iwate, Japan. December 17-18, 2016.
- **Ethylene is a major regulator of root apical meristem development in *Arabidopsis thaliana*.** 57<sup>th</sup> Annual Meeting of Japanese Society of Plant Physiologists (JSPP), Morioka, Iwate, Japan. March 18-20, 2016.

## RESEARCH GRANT

- **American Society of Plant Biologist (ASPB) Ambassador seed grant**  
(The grant was submitted as ASPB ambassador to organize Academic job webinar from the Plant Postdocs platform)  
**Funding source:** American Society of Plant Biologist (ASPB)  
**Amount:** 100 USD  
**Year:** 2020
- **\*Ethylene is a major regulator of root apical meristem development in *Arabidopsis thaliana*.**  
**Funding source:** IU-UGAS Individual Graduate Student Research Grant 2017 (Grant number: C60911000).  
**Amount:** 2,00,000 Yen (~2,000 USD).  
**Duration:** 2017 – 2018



- **Travel Grant Fellowship**  
(This travel grant was awarded to attend Plant Biology 2017, Hawaii, USA)  
**Funding source:** American Society of Plant Biologist (ASPB)  
**Amount:** 675 USD  
**Year:** 2017
- The role of membrane proteins in abiotic stresses in *Arabidopsis thaliana*.  
(Written and submitted with the host professor Dr. Abidur Rahman)  
**Funding source:** Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan  
**Amount:** 6,864,000 Yen (~70,000 USD)  
**Duration:** 2014 – 2018
- \*Cloning and characterization of alcohol dehydrogenase (Adh) promoter region for expression under submergence and salinity stress.  
**Funding source:** Ministry of Science and Technology, Bangladesh.  
**Amount:** 54,000 BDT (~700 USD).  
**Duration:** 2013 – 2014

\*The grant proposal was written and submitted as an independent researcher. The grant was used to purchase reagents and travel expenses of conference.

## AWARDS

- **American Society of Cell Biology's (ASCB) annual image and video contest award (3<sup>rd</sup> place).** Asymmetric Cell Division in Corn Plant. (2021)  
(A global annual competition for the cell biology image and movies)
- **American Society of Plant Biologist (ASPB) Ambassador of the year 2019,** American Society of Plant Biologists (ASPB) (2019)  
(Selected among 25 early career researchers for the service to ASPB and featured interview was published in the ASPB newsletter)
- **The President Award for Academic Excellence (Session 2016-2017),** United Graduate School of Agricultural Sciences, Iwate University, Japan (2017) (This award was given for winning 1<sup>st</sup> place in poster presentation, securing individual research funding and successful summer internship opportunity at the University of Saskatchewan, Canada)
- **American Society of Plant Biologist (ASPB) Newsletter Membership Corner interview,** November/December 2017, Page 11 – 12 (2017)  
(This is an invited interview published in the ASPB newsletter as an early career researcher and student member of ASPB)
- **Poster Presentation Award (1<sup>st</sup> place),** 1st UGAS International Symposium, Innovation in Plant and Food Sciences: From Genes to Production, Iwate, Japan. (December 17 – 18) (2016)

- **Summer Internship Program (University of Saskatchewan)**, United Graduate School of Agricultural Sciences, Iwate University, Japan (2016)  
(Selected among 23 PhD students from 4 universities based on the research proposal to work at the University of Saskatchewan as a summer intern)
- **MEXT Scholarship (Ph.D. program)**, Japanese Government Scholarship (2014) (4 years fellowship for the graduate study)
- **Best Poster Presentation award (3<sup>rd</sup> place)**. 3<sup>rd</sup> National Biochemistry Olympiad, Bangladesh. December 24, 2011.
- **Best Poster Presentation award (2<sup>nd</sup> place)**. 4<sup>th</sup> National Biochemistry Olympiad, Bangladesh. December 22, 2012.

## TEACHING EXPERIENCE

- **Lecturer, Writing in Biology (BIO 312), University of Massachusetts Amherst (January 2023 – May 2023)**  
(It is an undergraduate level mandatory course. I will teach a class of ~50 undergraduate students.)
- **Teaching training workshop at Westfield State University**. Organized by University of Massachusetts – Office of Professional Development. (September 30, 2022)  
(It is a day long workshop on teaching and creating inclusive classroom.)
- **Workshop on Data Visualization and Statistical Analysis in R**. Organized by Abidur lab at United Graduate School of Agricultural Sciences (UGAS), Iwate University, Japan. (2021 Summer)  
(Designed and taught a 3-hour workshop to teach a pipeline from experimental data to generate the publishable figures with statistics in R)
- **Invited lecture on “Asymmetric Cell Division in Stomatal Development”**. Shared Online Projects Initiative (SOPI) of **University of Ottawa** and **Carleton University**. (2020 Summer) (Part of undergraduate curriculum)
- **Coordinator – Open campus science outreach event for high school students**. (2014-2019, Both Spring and Fall semester)  
(Explain and demonstrate localization of hormonal markers under microscope)

## UNDERGRADUATE MENTEES

- Erika Norris, University of Massachusetts Amherst (2022-Present)
- Phoenix Carreiro, University of Massachusetts Amherst (2022-Present)
- Liam Rooney, University of Massachusetts Amherst (2020-2021)
- Nancy Ma, University of Massachusetts Amherst (2019-2020)

- Ian Worstell, University of Massachusetts Amherst (2019-2020)
- \*Nazmul Hussain, Tejgaon College, Bangladesh (2019-2021)
- \*Rony Chanda, Tejgaon College, Bangladesh (2019-2021)
- \*Shomoita Sayed, University of Dhaka, Bangladesh (2019-2021)
- \*Saruar Alam, University of Dhaka, Bangladesh (2019-2021)
- \*Keita Ito, Iwate University, Japan (2018-2019)
- \*Sayaka Kumagai, Iwate University, Japan (2014-2015)
- Atia Amin Oni, University of Dhaka (2012-2014)

\*Co-author in the peer-reviewed research article

## SERVICE

- Elected member of **Early Career Scholars Subcommittee (ECSS)** at **North American Arabidopsis Steering Committee (NAASC)** (Fall 2022- Fall 2023)
- Review Editor, Plant Cell Biology, **Frontiers in Plant Science** (2022 – Present)
- Feature Editor, **Molecular Plant (Cell Press)** (2020 – Present).  
(Selected as a member of the *Molecular Plant* editorial team to contribute to the *Editorial Highlights* section of each issue)
- Co-founder (July 2019 – Present) and Chair (September 2020 – August 2021) of **Plant Postdocs**  
(Co-founded the Plant Postdocs, a global postdoctoral community to serve early career researchers in navigating academic, industry/government sector)
- **Research article Reviewer:** Current Biology\* (1 article), Plant Biotechnology Journal\* (1 article), G3\* (1 article), Frontiers in Plant Sciences (10+ articles), PLOS One (1 article), Journal of Plant Growth and Regulation (20+ articles), Micro publication\* (1 article)  
\*Co-reviewed with the postdoctoral advisor Dr. Michelle Facette
- **Editorial board member, Maize Genetics and Genomics Database (MaizeGDB)** (January 2020 – Present)  
(Write summary for MaizeGDB website's *Hot New Paper* section)
- **Plantae Fellow (January 2019 – December 2019)**  
(Selected for a year long program to contribute to the ASPB's Plantae website and resource creation for science communication)
- **Ambassador, American Society of Plant Biologists (ASPB)** (2015 - 2021)  
(Selected from a global applicant's pool to serve ASPB in science communication and service)

## SCIENCE WRITING/COMMUNICATION

- Creator and Host – **No Time To Read** ([Podcast](#) | [Twitter](#)) podcast  
(A bi-weekly plant biology podcast series available at Spotify, Google podcast, Apple podcast, Audible, and Amazon music)
- Promoting plant cell biology ([Twitter](#))  
(Share and promote a plant cell biology bi-weekly with the hashtag #Plant\_Cell\_Biology\_Movie on Twitter)
- Science writing: **Plant Science Research Weekly** (September 2017 – Present; 100+ research article summaries).  
(An ASPB initiative maintained by Mary Williams. These article summaries were written as a ASPB ambassador and Plantae Fellow)
- Coordinator and Editor of **Faculty Job: Myths and Realities – Planate Interview series** (February 2019 – Present; 13 interviews and 20k+ reads)
- **Personal Plant Science Blog** ([www.aribidopsis.com](http://www.aribidopsis.com))  
(June, 2015 – Present; 83 posts and 110k+ reads worldwide).

## REFEREES

### **Michelle Facette**

Assistant Professor, Biology department  
University of Massachusetts Amherst, USA  
Email: [mfacette@umass.edu](mailto:mfacette@umass.edu)  
Lab website: <http://facettelab.weebly.com/>

### **Laurie Smith**

Professor, School of Biological Science  
University of California San Diego  
Email: [lgsmith@ucsd.edu](mailto:lgsmith@ucsd.edu)  
Lab website: <https://labs.biology.ucsd.edu/smith/>

### **Abidur Rahman**

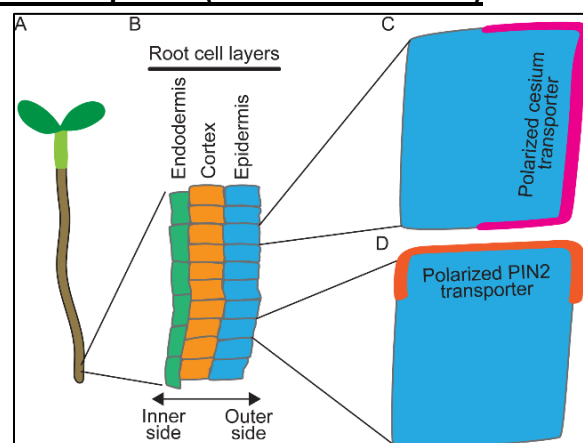
Associate Professor  
Department of Plant Biosciences, Iwate University, Japan  
Adjunct Professor, Department of Plant Sciences,  
College of Agriculture and Biosciences  
University of Saskatchewan, Canada  
Email: [abidur@iwate-u.ac.jp](mailto:abidur@iwate-u.ac.jp)  
Lab website: <http://news7a1.atm.iwate-u.ac.jp/~abidur/>

Plants show dynamic cell behaviors to achieve proper development and to respond to the environment. In particular, cell polarization is the fundamental basis for key functions, such as material transport, signal perception, and asymmetric cell division. As a graduate student, I identified the function of polarly localized proteins as temperature response regulators and the uptake carriers of arsenite and cesium from soil. Furthermore, as a postdoctoral researcher, I revealed that nuclear movement depends on the direction provided by polarized proteins and the positioning of the nucleus decides the future cell division site. In my future lab, I will focus on nuclear envelope proteins to understand their function during nuclear movement and cell division (**Aim 1**), molecular components of nuclear envelope proteins involved in cytoskeleton interaction (**Aim 2**), and their role in environmental response (**Aim 3**).

### Cell polarity and mitosis in plant development and environmental response (Graduate research)

As a graduate student, I studied the functions of polarized proteins (PIN-FORMED [PINs] auxin transporter proteins and ABC transporters) in Arabidopsis. I discovered that polarized PIN2 trafficking is blocked during low temperature stress and this trafficking pathway is mediated by GNOM (Ashraf and Rahman, 2019, *The Plant Journal*) (Fig. 1). Alteration of GNOM helps to restore PIN2 protein trafficking and adaptation to low temperature stress in Arabidopsis and GNOM-mediated PIN2 trafficking is conserved in crop plants (Ashraf and Rahman, 2022, *Plants*).

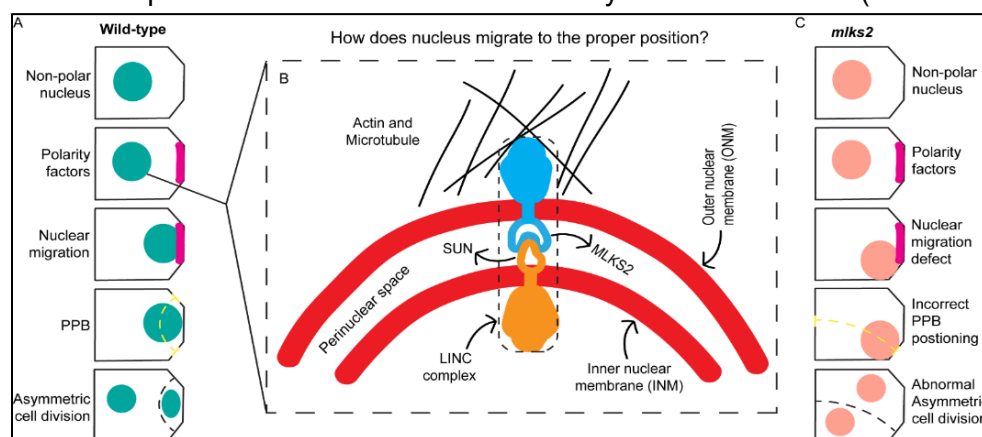
Additionally, using reverse genetic screening, I found that polarly localized ABCG33 and ABCG37 redundantly act as cesium transporters but are independent of chemically similar potassium transporters (Ashraf et al., 2021, *Molecular Plant*) (Fig. 1). Transport functions of ABC transporters have potential future use of phytoremediation of contaminated soils for massive nuclear power plant incidents, such as Chernobyl (1986) and the 2011 Tsunami in Japan.



**Fig. 1:** Polar localization of proteins are crucial for cellular functions.

### Cell polarity and nuclear movement during asymmetric cell division (Postdoctoral research)

As a postdoctoral research associate, I continue to work on cell polarity and try to understand the driving force of cell polarization during asymmetric cell division in maize. Immediately before asymmetric division, nuclei polarize based on the established cell polarity (Fig. 2A). Nuclear movement during asymmetric cell division depends on the actin or microtubule cytoskeleton or both (Ashraf and Facette, 2020, *Current Biology*).



To understand the molecular mechanism of the key step, the polar nuclear migration, I focused on the inner and outer nuclear envelope spanning LINC (Linker of Nucleoskeleton and Cytoskeleton) complex, consist of KASH and SUN domain containing proteins to interact with cytoskeleton (Fig. 2B). I utilized the mutant of one of the core components, MLKS2, and found that this *mlks2* mutant fails to properly position the nucleus, although the polarity factors are normally set (Fig. 2C). I further established a live cell imaging system and revealed that the mispositioned nucleus in *mlks2* leads to the misplacement of

**Fig. 2:** "LINC complex" mediates the proper nuclear migration in maize stomata development. (A) Asymmetric cell division in wildtype; (B) "LINC complex" mediated nuclear movement; and (C) asymmetric cell division defect in *mlks2*.

PPB, resulting in the abnormal cell division pattern (Ashraf et al., 2022, *bioRxiv*). In summary, this study revealed that nuclear position decides the future division site.



**Future research proposal at Howard University:****(1) What is the function of LINC complex components during mitosis?**

Polar migration of the nucleus is the fundamental process prior to asymmetric cell division and the migration of the nucleus is mediated by the interaction of LINC complex with cytoskeleton (Fig. 2B). In my postdoctoral work, I have discovered that LINC complex is required during nuclear migration. Surprisingly, after nuclear envelope breakdown, the LINC complex components stay around during mitosis and colocalize with mitotic apparatus (spindle, phragmoplast, new cell plate) (Ashraf et al., 2022, *bioRxiv*; Oda et al., 2011, *The Plant Journal*; Graumann et al., 2011, *Biochem. J.*). This data triggers the question about function of LINC complex during mitosis. To test this hypothesis, my lab will generate transgenic lines, where LINC complex proteins will be fused with fluorescent proteins, in both maize and Arabidopsis. These LINC complex marker lines will be combined with actin and microtubule markers for time lapse imaging to observe the dynamic localization during mitosis using maize leaves (postdoctoral expertise) and Arabidopsis root meristems (PhD expertise). I have already tested a series of LINC complex mutants in maize and identified their phenotype for aberrant asymmetric cell division during stomatal development. At the same time, I have integrated them with cell biology marker lines, which are available to use for experiment in my future lab. This project will be suitable for NSF MCB grant.

**(2) What are the molecular components of the LINC complex interacting with the cytoskeleton?**

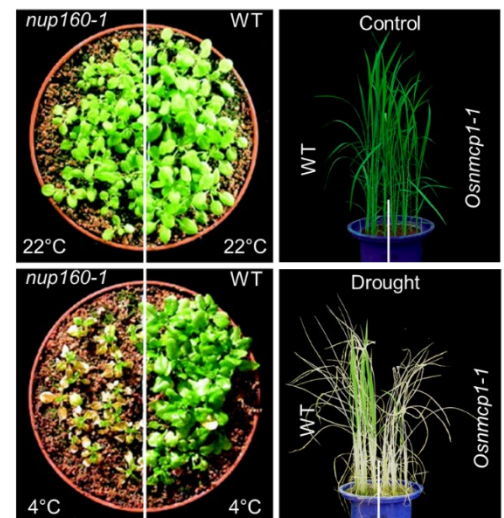
LINC complex components interact with cytoskeleton (actin and microtubule) during pre- and post-NEBD (nuclear envelope breakdown) for nuclear migration and mitosis, respectively. It is still the major missing puzzle how LINC complex connects the nucleus to the cytoskeleton. My lab will take two-way approaches for deciphering LINC complex component interacting cytoskeleton and motor proteins. Firstly, we will use coimmunoprecipitation (Co-IP) using fluorescent tagged LINC complex component (materials generated for Aim 1). Secondly, my lab will combine *in silico*, *in vitro*, and *in vivo* approaches to narrow down the actin and microtubule (MT) binding domains of LINC complex components (Fig. 2B). Finally, to determine the *in vivo* role of the identified binding domain, my lab will introduce point mutations into the relevant region of the fluorescent LINC markers and examine whether they could co-localize with actin/MT and rescue the respective LINC mutants. As LINC complex is conserved across eukaryotes, these finding will have broader impact in non-plant systems and deciphering disease-causing mechanism. This project will be ideal for the NSF IOS grant.

**(3) How do nuclear envelope proteins respond to environmental changes?**

Nuclear envelope proteins are involved in various cellular functions, including movement of the nucleus, export and import molecules between nucleus and cytoplasm, mechanosensing, and cell division. These individual cellular events are known to be affected due to environmental cues, such as alteration of temperature. For instance, nuclear proteins NUP136 in Arabidopsis and NMCP1 in rice are involved in low temperature and drought stress response, respectively (Dong et al., 2006, *Mol. Cell Bio.*; Yang et al., 2020, *New Phytologist*) (Fig. 3).

In this project, my lab will utilize reverse genetic approach to screen nuclear envelope proteins, including LINC complex and nucleoporins, in Arabidopsis and maize for temperature stress. Temperature responsive nuclear envelope mutants and proteins will be studied for comparative gene expression and protein-protein interaction. These list of genes and proteins will help to understand the nuclear envelope protein-mediated temperature responsive pathway; and will provide target genes/proteins for future study. The knowledge from this project will be utilized to knockout or overexpress temperature responsive genes in maize. My lab will submit the USDA NIFA grant for this project. Additionally, this project will provide excellent opportunity for industry collaboration and partnership.

Altogether, my lab will be frontrunner in understanding the role of nuclear envelope proteins during cell division and translate this knowledge into crop plants for developing temperature-resistant crop plants.



**Fig. 3: AtNUP160 and OsMNCP1 are required for temperature response.**

I believe active learning through an interactive course curriculum is more effective and longer lasting for a student. As a faculty member at Howard University, I will emphasize on application-based course curriculum and inclusive classroom environment at both the undergraduate and graduate level.

My teaching philosophy is based on my own experience. As a graduate student, I had the opportunity to teach high school students bi-annually during open campus days about plant movement and gravity. For this purpose, I utilized my research materials, such as auxin, ethylene, and cytokinin visualization markers, to show them GUS staining under the microscope. This teaching opportunity was done using both English and Japanese.

In recent years, as a postdoctoral researcher, it was the time of global pandemic and unfortunately, the in-person teaching opportunity was limited. During this time, I invested myself in teaching online courses, designing workshops, and teaching remotely. For instance, I was invited to provide lectures for the Shared Online Projects Initiative (SOPI) launched between the **University of Ottawa and Carleton University** on “**Nuclear movement and asymmetric cell division**” in the summer of 2020. This lecture is a part of their Plant Biology undergraduate curriculum. Additionally, I designed and conducted a three-hour long hands-on workshop entitled “**Data Visualization and Statistical Analysis in R**” for the **United Graduate School of Agricultural Sciences (UGAS), Iwate University, Japan** in the summer of 2021. This data visualization workshop covers handling real-life lab generated data, making plots, using rational statistical tests, and generating final graphs in a publication ready format. Students who attended the workshop published research articles, including *Journal of Experimental Botany*, recently and used the skills earned through the workshop for drawing graphs and statistical analysis in R.

As we are coming out of the pandemic, my in-person teaching has started to resume. In the Spring 2023 semester, I have been officially assigned to teach **Writing in Biology (BIO 312)**, an undergraduate mandatory course for Biology majors at the University of Massachusetts Amherst. I will be teaching a class of around 50 undergraduate students for the entire semester. I believe my experience in teaching will be an asset for the department. I will be interested in taking part in **Plant Physiology (344), Molecular Plant Physiology (460), Cell Biology (310)** courses at Howard University. Additionally, I am flexible in teaching other courses required by the department within my expertise.

At the beginning of 2022, I started a plant biology podcast, **No Time To Read**. As a host, I invite the first author of a recently published plant biology article to share their findings in simple and plain language. The podcast episodes can be used as course materials for undergraduate and graduate level courses. I will be interested in implementing this course idea at Howard University based on the opportunity.

I want to implement multiple techniques to improve the classroom and teaching based on my own experience. Firstly, it is important to remove the power disparity between instructor and students at the very beginning of the course. For example, in my writing class, I am planning to tell the story how I mastered English as a second language and use it now professionally every day. This example will help the students to connect with me. Secondly, I need to know the students first before teaching them. At the beginning of the class, I will hand them out five questions card and their answers will inform me about the students' expectations from the course. Thirdly, I will conduct a mid-semester survey to find out the students' feedback. In this way, the course curriculum does not need to be fixed, rather it will be an organically developed dynamic course curriculum to meet students' expectations. Finally, I will use new technology in the classroom environment. One of the major problems for the minority group students is to ask questions in the class. I will introduce the app “Slideo”, which generates QR code to ask questions anonymously. In this way, students will feel safe asking questions, even if they are shy or hesitant, and get the maximum out of the class.

I believe my teaching experience and philosophy will help to contribute to the existing coursework in the department and design new courses and outreach activities in future.



## **REFEREES**

### **Michelle Facette**

Assistant Professor, Biology department  
University of Massachusetts Amherst, USA  
Email: [mfacette@umass.edu](mailto:mfacette@umass.edu)  
Lab website: <http://facettelab.weebly.com/>

### **Laurie Smith**

Professor, School of Biological Science  
University of California San Diego  
Email: [lgsmith@ucsd.edu](mailto:lgsmith@ucsd.edu)  
Lab website: <https://labs.biology.ucsd.edu/smith/>

### **Abidur Rahman**

Associate Professor  
Department of Plant Biosciences, Iwate University, Japan  
Adjunct Professor, Department of Plant Sciences,  
College of Agriculture and Biosciences  
University of Saskatchewan, Canada  
Email: [abidur@iwate-u.ac.jp](mailto:abidur@iwate-u.ac.jp)  
Lab website: <http://news7a1.atm.iwate-u.ac.jp/~abidur/>