OMB No. 0925-0001 and 0925-0002 (Rev. 11/16 Approved Through 10/31/2018)

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: ANURAG AGRAWAL

eRA COMMONS USER NAME (credential, e.g., agency login): ANURAG\_AGRAWAL

POSITION TITLE: Dean, Trivedi School of Biosciences, Ashoka University

EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)

| INSTITUTION AND LOCATION | DEGREE(if applicable) | Completion DateMM/YYYY | FIELD OF STUDY |
| --- | --- | --- | --- |
| All India Institute of Medical Sciences (AIIMS), Ansari Nagar, New Delhi, India |  MBBS  | 1/1995 | Medicine |
| Vallabhbhai Patel Chest Institute (VPCI), Delhi University, Delhi, India |  | 6/1996 | Pulmonary Physiology |
| Baylor College of Medicine (BCM), Houston, TX |  | 7/1998 | Internal Medicine Residency |
| Baylor College of Medicine, Houston, TX |  | 7/2000 | Internal Medicine/ Clinical Investigator Pathway  |
| Baylor College of Medicine, Houston, TX |  | 6/2003 | Pulmonary and Critical Care  |
| Delhi University, Delhi, India |  PhD | 1/2007 | Physiology |

**A. Personal Statement**

I am the founder Dean and Professor at the Trivedi School of Biosciences, Ashoka University, India, and former Director of a national lab - Institute for Genomics and Integrative Biology. I trained as a pulmonary physician-scientist at Baylor College of Medicine at the time of the human genome project, developing an enthusiasm for applying emerging technologies to clinical problems. This further led to the founding of an eHealth Centre network and a larger vision of national health data ecosystems and big-data analytics. As co-chair of the Lancet and Financial Times commission for governing digital health futures, I started contributing to national and global health data policy, especially genomic data. During the COVID-19 pandemic, I served as a lead of the Indian SARS CoV2 genome sequencing consortium, chair of the WHO technical advisory group for SARS CoV2 viral evolution, and a member of the global partnership for AI (pandemic preparedness) for real world evidence generation. As the pandemic hopefully winds down, my priorities are to use the last few years’ learnings towards better integrated disease surveillance systems.

**B. Positions, Scientific Appointments, and Honors**

**Positions**

**2022- Present** Professor and Dean, Trivedi School of Biosciences, Ashoka University

**2022- Present** Adjunct Professor, Indraprastha Institute of Information Technology, Delhi

**2017-2022** Director, Institute of Genomics & Integrative Biology, Delhi, India

**2007-2017** Scientist, Institute of Genomics & Integrative Biology, Delhi, India

**2003-2007** Assistant Professor of Medicine (tenure-track), Baylor College of Medicine, Houston,TX

## Scientific Appointments

**2023- Present** Member, Leadership committee, International Pathogen Surveillance Network

**2022- Present** Member, Scientific Advisory Board, Indian Council for Medical Research

**2022- Present** Member, Pathogens Project: Global standard-setting and monitoring systems

**2021- Present** Chair, WHO Technical Advisory Group for SARS CoV2 evolution

**2021- Present** Member, Global Partnership of AI (Pandemic Preparedness, Responsible AI)

**2021- Present** Board Member, International Clinical Epidemiology Network (India)

**2020- Present** Member, Apex R&D Board, Department of Biotechnology

**2020- Present** Chair, Scientific Advisory Council, National Institute of Biomedical Genomics

**2020-2022** Member, World Health Organization, Digital Health Technical Advisory Group

**2014- Present** Member, Planning Committee, American Thoracic Society, Respiratory Structure Function

## Honors

**2022 Elected Fellow, National Academy of Medical Sciences, India**

**2020 Sun Pharma Science Foundation Research Award (Medical Science)**

**2020 Elected Fellow, National Academy of Sciences, India**

**2019 Elected Fellow, Indian Academy of Sciences**

**2018 Elected Fellow, Indian National Science Academy**

**2016 Royal Society Commonwealth Science Conference award (established researcher)**

**2015 Chair and Kavli Fellow (India), Indo-US Frontiers of Science Symposium, National Academy of Sciences, USA**

**2015 National Bioscience Award**

**2015 Wellcome Trust DBT India Alliance Senior Fellowship**

**2014 Shanti Swaroop Bhatnagar Prize (Medical Sciences) \***

**2011 Elected member, Guha Research Conference, an honor-society for Indian Researchers**

**2010 Swaranjayanti Fellowship and award (Biological Sciences) \***

**2010 Lady Tata Memorial Trust Young Researcher Award**

**2003 Joseph Rodarte Award for Pulmonary Research, Baylor College of Medicine, USA**

**\* The Swarnjayanti Fellowship (2010) and the Bhatnagar award (2014) are the principal national awards for Indian nationals conducting research in India, at an intermediate and advanced stage respectively, with one to two annual awards per scientific discipline.**

**C. Contributions to Science**

**My primary contribution to science is through research, as highlighted below. Additional contributions are highlighted alongside. Best three publications are highlighted.**

1. **Respiratory Structure and Function**

**My longest running research work, now spanning over twenty-five years, is on understanding respiratory structure and function. This is broadly divided into two different aspects**

1. **Technical innovation to simplify or extend our ability to measure respiratory physiology. PFT provide important insight into lung health and are an essential part of experimental and clinical studies. My research career started with inventing a method of measuring lung volumes and most recently we have been working on a co-developed novel FDA approved lung oscillometry device (Pulmoscan, Cognita Labs, USA) to predict COPD exacerbations. In the middle, I have worked on simplified experimental methods for studying mouse respiratory physiology.**
2. **Agrawal A** and Agrawal KP. Body Plethysmographic measurement of thoracic gas volume without panting against a shutter. J Appl Physiol 1996, 81(2): 1007-11.
3. **Agrawal A\***, Singh SK, Singh VP, Murphy E, Parikh I. A novel method to partition nasal and pulmonary resistance changes during non-invasive plethysmography in mice. J Appl Physiology 2008, 105: 1975–79
4. Ahmad T, Mabalirajan U, Joseph DA, Makhija L, Singh VP, Ghosh B, **Agrawal A\*.** Exhaled nitric oxide estimation by a simple and efficient non – invasive technique and its utility as a marker of airway inflammation in mice. J Appl Physiol 2009: 107(1):295-301
5. **Experimental and public health studies to gain insight into determinants and predictors of respiratory health. My lab showed for the first time that reduced vital capacity in apparently healthy Indians, when compared to people with white European ancestry, is not explained adequately by genetics and is strongly related to adversity or inflammation. This is now incorporated into global recommendations for spirometry. In experimental studies, we showed the critical role of hyperinsulinemia and mitochondrial dysfunction in lung remodeling. The first description of Miro1-regulated mitochondrial donation by mesenchymal stem cells was a fundamental basic discovery during this work. We showed relevance of these pathways in epithelial injury and peri-bronchial fibrosis for severe asthma.**
6. **Agrawal A**\*, Aggarwal M, Sonnappa S, Bush A. Ethnicity and spirometric indices: hostage to tunnel vision? Lancet Respir Med. 2019 Sep;7(9):743–4.
7. Aggarwal M, Bansal A, Desiraju BK, Singh S, **Agrawal A**\*, Determinants of adolescent lung function in Indians: race, nutrition and systemic inflammation. Am J Resp Crit Care Med. 2021; 204(9):1209-11
8. Bhakta NR, Bime C, Kaminsky DA, McCormack MC, Thakur N, Stanojevic S, Baugh AD, Braun L, Lovinsky-Desir S, Adamson R, Witonsky J, Wise RA, Levy SD, Brown R, Forno E, Cohen RT, Johnson M, Balmes J, Mageto Y, Lee CT, Masekela R, Weiner DJ, Irvin CG, Swenson ER, Rosenfeld M, Schwartzstein RM, **Agrawal** A, Neptune E, Wisnivesky JP, Ortega VE, Burney P. Race and Ethnicity in Pulmonary Function Test Interpretation: An Official American Thoracic Society Statement. Am J Respir Crit Care Med. 2023 Apr 15;207(8):978-995.
9. Ahmad T, Mukherjee S, Pattnaik B, Kumar M, Singh S, Kumar M, Rehman R, Tiwari BK, Jha KA, Barhanpurkar AP, Wani MR, Roy SS, Mabalirajan U, Ghosh B, **Agrawal A\*.** Miro1 regulates intercellular mitochondrial transport & enhances mesenchymal stem cell rescue efficacy. EMBO J. 2014; 33 (9), 994-1010
10. Singh S, Bodas M, Bhatraju NK, Pattnaik B, Gheware A, Parameswaran PK, Thompson M, Freeman M, Mabalirajan U, Gosens R, Pabelick C, Linneberg A, Prakash YS, **Agrawal A\*.** Hyperinsulinemia adversely affects lung structure and function. Am J Physiol Lung Cell Mol Physiol. 2016 May 1;310(9):L837-45**.**
11. **SARS CoV2 epidemiology and evolution**

**Due to my background in pulmonary and critical care, public health, as well as genomics and informatics, I was entrusted with leading SARS CoV2 molecular epidemiology research by the office of the principal scientific advisor to the Govt of India. With funding from the government, Gates Foundation, Rockefeller Foundation, and Wellcome Trust, I led the creation of a network of labs capable of tracking SARS CoV2 evolution and contributing to risk-assessment and modeling of severe pneumonia cases and related health need. We were the first to inform regarding the Delta variant outbreak in India, and characterize the virus. Beyond personal research, I have served as the chair of the WHO technical advisory group for SARS CoV2 evolution (TAG-VE) since 2021 and helped formulate the early recognition and warning about Omicron as a variant of concern. TAG-VE has also been responsible for monitoring further Omicron evolution and advise on population health risks.**

1. Mahesh S Dhar …… **Anurag Agrawal\*,** Partha Rakshit\*. Genomic characterization and Epidemiology of an emerging SARS-CoV-2 variant in Delhi, India. Science. 2021. 374(6570):995-9.
2. Mlcochova P, Kemp SA, Dhar MS, Papa G, Meng B, Ferreira IA, … **Anurag Agrawal\*,** Ravindra Gupta\*. SARS-CoV-2 B. 1.617. 2 Delta variant replication and immune evasion. Nature. 2021;599(7883):114-9.
3. Ramachandran Thiruvengadam, ….. **Anurag Agrawal**, Sudhanshu Vrati, Shinjini Bhatnagar, Pramod Kumar Garg. Effectiveness of ChAdOx1 nCoV-19 vaccine against SARS-CoV-2 infection during the delta (B. 1.617. 2) variant surge in India: a test-negative, case-control study and a …The Lancet Infectious Diseases, 2o22. Vol 22, Issue 4, Pg. 473482.
4. Rajat Ujjainiya, Akansha Tyagi, Viren Sardana…. **Anurag Agrawal,** Debasis Dash, Sujeet Jha, Shantanu Sengupta. High failure rate of ChAdOx1-nCoV19 immunization against asymptomatic infection in healthcare workers during a Delta variant surge, Nature Communications 2022. Vol 13, Issue 1, Pg. 1726.
5. **Agrawal A.** India's COVID crisis flags need to forecast variants. Nature 2021 Jun. 594 (7861), 9
6. Lorenzo Subissi, ….., **Anurag Agrawal**. An early warning system for emerging SARS-CoV-2 variants. Nature medicine 2022. Vol 28, Issue 6, Pg. 1110-1115
7. **Health Informatics and Digital Health**

The basic and clinical research efforts in my lab have been paralleled by collaborative efforts to understand disease at a global scale, with smarter use of emerging technologies in global health. At an early stage of my career, the contribution was typically towards generating and interpreting data, whether molecular or clinical (see a-d). The pandemic led me towards reimagining global data ecosystems and addressing data governance challenges, as the co-chair of the Lancet-Financial Times commission for governing digital health futures 2030.

1. Sinha A, Yadav AK, Chakraborty S, Kabra SK, Lodha R, Kumar M, Kulshreshtha A, Sethi T, Pandey R, Malik G, Laddha S, Mukhopadhyay A, Dash D, Ghosh B, **Agrawal A\*.** Exosome-enclosed microRNAs in exhaled breath hold potential for biomarker discovery in patients with pulmonary diseases. J Allergy Clin Immunol. 2013 Jul;132(1):219-22
2. **Agrawal A\***, Bhattacharya B, Baranwal N, Balazova D, Sardana V, Brahmachari SK. Integrating Health Care Delivery and Data Collection in Rural India Using a Rapidly Deployable eHealth Center. PloS Medicine 2013, 10(6): e1001468
3. Salvi S, Apte K, Madas S, Barne M, Chhowala S, Aggarwal K, Sethi T, **Agrawal A**, Gogtay J. What ails India? A one-day point prevalence study of symptoms and medical conditions in 204,912 patients visiting primary healthcare practitioners across 880 cities and towns in India. Results of the POSEIDON Study. Lancet Global Health. 2015 Dec 3 (12) e776–e784
4. India State-Level Disease Burden Initiative CRD Collaborators. The burden of chronic respiratory diseases and their heterogeneity across the states of India: the Global Burden of Disease Study 1990-2016. Lancet Glob Health. 2018 Dec;6(12):e1363-e1374.
5. Kickbusch I, **Agrawal A**, Jack A, Lee N, Horton R. Governing health futures 2030: growing up in a digital world-a joint The Lancet and Financial Times Commission. Lancet. 2019 Oct 12;394(10206):1309.
6. Kickbusch, Ilona, Dario Piselli, **Anurag Agrawal,** Ran Balicer, Olivia Banner, Michael Adelhardt, Emanuele Capobianco, and Christopher Fabian. “Amandeep Singh Gill, Deborah Lupton, Rohinton P Medhora, Njide Ndili, Andrzej Ryś, Nanjira Sambuli, Dykki Settle, Soumya Swaminathan, Jeanette Vega Morales, Miranda Wolpert, Andrew W Wyckoff, Lan Xue, on Behalf of the Secretariat of the Lancet and Financial Times Commission. Governing health futures 2030: growing up in a digital world. Lancet 398 (2021): 1727–76.

*Selected from full list of publications at* <https://scholar.google.co.in/citations?user=zmebD9QAAAAJ&hl=en>

On 1st September 2023: **201 publications, h-index 70**

5 year citations, 61439; 5 year h index, 59

**D. Additional Information: Research Support**

1. Koita Centre for Digital Health. (Role: PI). Endowment from Koita Foundation, India to advance digital health research. (2023-2028) (USD 3 million)
2. Digital Transformation for Health Lab. (Role: Co-PI). Fondation Botnar, Geneva. (2023-2027) (sub-component USD 1.6 million)
3. Genomic Surveillance program for SARS-CoV-2: Consortium of India and Sri Lanka. (Role: PI) Wellcome Trust 223547/Z/21/Z (2022-2024). (USD 2 million)
4. Precision Cardiovascular Disease Phenotyping and Pathophysiological Pathways in the CARRS cohort (Precision-CARRS). (Role Co-investigator) NHLBI (Program project grant). INR 800 million (sub-component USD 500,000)

**COMPLETED**

1. Low Lung Function in Indians: Physiological Variation or Subclinical Pathology *(*Role: PI) Wellcome Trust DBT India Alliance Senior Fellowship for Clinicians and Public Health Researchers (12/2015 -12/2020, INR 40 million)
2. Developing a Systems View of Health Challenges in India (Role PI and Coordinator) Department of Science and Technology. This project aims to aggregate, validate, analyze and make available multiple health data sources across India (9/2017 - 3/2020, INR 200 million)
3. Commercialization grant, with Cognita Labs, Houston, for development of forced oscillation technique based lung function testing device (Role: PI, India), US-India Tech Endowment Fund (2015-18, USD 400,000)
4. Center of Excellence for Translational Research in Asthma and Lung Disease (role: PI and Coordinator). 2009 - 2012 and 2012-2017, supporting multidisciplinary research in lung disease. (MLP5502, INR 249 million)
5. Effective application of community health efforts through new age, IT based modes, EACH-IT (role : PI and coordinator) This was to bring ICT technology to rural health and integrate the processes of healthcare delivery and health data collection (BSC0303, 7/2014 - 3/2017, INR 70 million)

**PEER REVIEW / STUDY SECTION**

* **Member of study sections of Indian Council of Medical Research (ICMR), Department of Biotechnology (DBT), Department of Science & Technology (DST), Council of Scientific and Industrial Research India (CSIR) since 2016**
	+ **Chair of “Funding Infrastructure for Science & Technology” section, DST**
	+ **Member, Apex R&D study section, DBT and ICMR**
* **Reviewing editor eLife, Reviewer for most of the major journals in respiratory medicine**
* **International Reviewer for national funding agencies of Australia, New Zealand, Poland, Singapore, and South Korea**

**EDUCATION AND OTHER ACADEMIC ROLES**

* **Professor and Dean, Trivedi School of Biosciences, Ashoka University. Founded the Koita Centre for Digital Health for education and research**
	+ **Guided / co-guided 31 PhD students (30 completed, 6 have independent labs, 3 at industry)**
	+ **Mentored 5 physician-scientists (4 MBBS PhD, 1 MD PhD)**
* **Founding-organizer of the Developing Indian Physician Scientist program, sponsored by the Wellcome Trust DBT India Alliance**
* Mentor to GCI-INSACOG program. whose overall goal is to develop a network of laboratories nationwide for the surveillance of emerging viral pathogens and AMR in wastewater.
* Chair of scientific advisory board to National Institute of BioMedical Genomics, National Institute of Malaria Research
* Advisor to Symbiosis University, Institute of Life Sciences, Translational Health Science and Technology Institute
* **Board of Trustees for International Clinical Epidemiology Network (India)**