

PERSONAL INFORMATION

Anubhab Khan
DoB: 09 July 1991
Languages spoken: English, Hindi, Bangla, Marathi, Oriya

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EDUCATIONAL QUALIFICATION

Doctor of Philosophy, National Centre for Biological Science, TIFR, 26/02/2021
Master of Science, Institute of Bioinformatics and Biotechnology, University of Pune, 01/06/2013

PROFESSIONAL EXPERIENCE

Assistant Professor, Centre for Ecological Sciences, Indian Institute of Science, Bangalore, India, October 2024-Present
Adjunct Faculty, Department of Biology, Pwani University, Kilifi, Kenya, February 2024-Present
Post-doctoral Fellow, University of Copenhagen Copenhagen, Denmark, 15/11/2023-01/10/2024
Research Associate, University of Glasgow, Glasgow, UK, 15/2/2021-15/11/2023
Consultant (Bioinformatics and Genomics), National Centre for Biological Science, TIFR, Bangalore, India, 01/01/2021-01/10/2024
Consultant (Bioinformatics and Genomics), Penn State University, PA, USA, 01/08/2020-15/10/2022

EXPERTISE

Big data, genomics, population genetics, bioinformatics, wildlife studies, environmental DNA, genetic resources, outreach

PUBLICATIONS

 (*Reverse chronological order, *Equal contribution, #Corresponding author, ^ Student trained*)

Khan, A. [#], Yulianto, Y., Aninta, S.G. and Wirdateti, W., 2024. Reanalysis of sequences of alleged Javan tiger highlights the difficulties in studying big cats and the need for high throughput sequencing. *bioRxiv*, pp.2024-04. (*Oryx, accepted*)
We find evidence of a tiger from Ssundaland lineage present in Java where tigers have been extinct for more than 50 years.

Khan, A. [#], Carter, R., Mpamhanga, C.D., Masiga, D., Channumsin, M., Ciosi, M., Manangwa, O., Mramba, F., Ijaz, U.Z., Auty, H. and Mable, B.K., 2024. Swatting flies: Biting insects as non-invasive samplers for mammalian population genomics. (*Molecular ecology, in revision*)
We demonstrate that whole genomes of wild mammals like elephants can be sequenced from DNA extracts of blood sucking insects like tsetse flies.

Garcia-Erill, G., Wang, X., Rasmussen, M.S., Quinn, L., **Khan, A.**, Bertola, L.D., Santander, C.G., Balboa, R.F., Ogutu, J.O., Pecnerova, P. and Hanghoej, K., 2024. Extensive population structure highlights an apparent paradox of stasis in the impala (*Aepyceros melampus*). *Molecular ecology*, doi: 10.1111/mec.17539
We explore the genetic reasons behind evolutionary stasis of Impalas. Several genetic clusters are identified.

Khan, A. ^{*#}, Sil, M. ^{*}, Thekaekara, T., Sinha, I., Khurana, R., Sukumar, R. [#] and Ramakrishnan, U. [#], 2023. Serial dilution shapes genetic variation and defines conservation units in Asian elephants. *Current Biology*, doi: 10.1016/j.cub.2024.08.062

We find that Asiatic elephants in India underwent multiple founding events and probably colonized India in a north to south direction. This is led to lowering of genetic diversity and deleterious allele load among the Indian elephants from north to south.

Mellya, R.V.[^], Hopcraft, J.G.C., Mwakilema, W., Eblate, E.M., Mduma, S., Mnaya, B., Chuma, I., Macha, E.S., Wambura, D., Fyumagwa, R. and Kilbride, E., Mable, B.K.[#], **Khan, A.**[#] 2023. Natural dispersal is better than translocation for reducing risks of inbreeding depression in eastern black rhinoceros (*Diceros bicornis michaeli*). *bioRxiv*, pp.2023-06 (*PNAS, in review*).

We find that translocation of captive individuals to the wild is not the best solution for genetic rescue. Natural dispersal of wild individuals is best solution to ensure populations persist into the future as they have purged out their deleterious allele load.

Shukla, H.^{*^}, Suryamohan, K.^{*}, **Khan, A.**^{*}, Mohan, K., Perumal, R., Mathew, O., Menon, R., Dixon, M.D., Muraleedharan, M., Kuriakose, B., Michael, S., Krishnakutty S.P., Zachariah, A., Seshagiri, S., Ramakrishnan, U., 2023. Near-chromosomal de novo assembly of Bengal tiger genome reveals genetic hallmarks of apex-predation. *Gigascience*, 12(*giac112*), DOI: 10.1093/gigascience/giac112

We assemble chromosome level reference genomes of two Bengal tigers and the signatures of adaptations in tiger genomes that make them apex predators.

Khan, A., 2022. The year of the tiger and the year of the tiger genomes!. *Molecular Ecology Resources*, DOI: 10.1111/1755-0998.13726

I review the recent advances in the genome assemblies of tigers and the whole genome sequences that are available. This is comprehensive guide to finding all the tiger genome assemblies available till date and helps choose the right assembly for genome analysis.

Khan, A.[#], Swathy Krishna M., Ramakrishnan, U., Das, R.^{*#}, 2022. Recapitulating whole genome-based population genetic structure for Indian wild tigers through ancestry informative marker panel. *Heredity*, 128 (88-96)

We find that individuals from small isolated populations can be mapped accurately to the right geographical location even with few random markers. We further develop a SNP based ancestry informative marker panel to assign Indian tigers to their specific genetic cluster and geographic locations.

Tyagi, A., **Khan, A.**, Thatte, P., Ramakrishnan, U., 2022. Genome-wide SNPs from fecal samples reveal the anthropogenic impacts on connectivity: A case of Jungle cat (*Felis chaus*) in central Indian landscape. DOI: 10.1111/acv.12770 *Animal conservation*

We demonstrate that next-generation sequencing based methods can be applied effectively to samples collected from past landscape genetics studies. This also yields greater insights can previous methods.

Armstrong, E.^{*#}, **Khan, A.**^{*}, Taylor, R.W., Gouy, A., Greenbaum, G., Thiery, A., Kang, J.T., Redondo, S.A., Prost, S., Barsh, G., Kaelin, C., Phalke, S., Chugani, A., Gilbert, M., Miquelle, D., Zachariah, A., Borthakur, U., Reddy, A., Louis, E., Ryder, O., Jhala, Y., Petrov, D., Excoffier, L., Hadly, E., Ramakrishnan, U.[#], 2021. Recent evolutionary history of tigers highlights contrasting roles of genetic drift and selection. *Molecular Biology and Evolution*, 38(6), pp. 2366-2379

The work quantifies the global distribution of genetic variation in tigers, their inbreeding, demographic history and the selection on genomes. We show that Bengal tigers have the highest genetic variation but also have the most inbred tigers. Additionally, the tiger subspecies were formed only as recently as 20,000 years ago.

Khan, A.[#], Patel, K.[^], Shukla, H.[^], Vishwanathan, A., van der Valk, T., Borthakur, U., Nigam, P., Zacchariah, A., Jhala, Y.V., Kardos, M.[#], Ramakrishnan, U.[#], 2021. Genomic evidence for inbreeding

depression and purging of deleterious genetic variation in Indian tigers. *Proceedings of the National Academy of Sciences*, 118(49), e2023018118

The work shows that differences in genetic variation and inbreeding in tigers is a function of the population size. Additionally, the small isolated populations have lower deleterious allele loads than large connected populations. However, whatever deleterious alleles remain are high in frequency and homozygosity.

Khan, A.*#, Tyagi, A., 2021. Considerations for initiating a wildlife genomics research project in south and south-east Asia. *Journal of the Indian Institute of Science*, 101(2), pp. 243-256

We review the challenges faced by labs in south and south-east Asia in starting their own wildlife genomics projects. We review the limitations in expertise, infrastructure, funding and policies that limit the exploration of some of the most biodiverse regions of the world.

Khan, A.*#, Patel, K.^, Bhattacharjee, S., Sharma, S., Chugani, A.N., Sivaraman, K., Hosawad, V., Sahu, Y.K., Reddy, G.V. and Ramakrishnan, U.#, 2020. Are shed hair genomes the most effective noninvasive resource for estimating relationships in the wild?. DOI: 10.1002/ece3.6157 *Ecology and Evolution*

We develop a method to sample and sequence whole genomes of wild individuals from few strands of shed hair.

MANUSCRIPTS IN PREPARATION

Khan, A.*#, Reducing the disparity in global wildlife genomics research, *in preparation*

Elsner-Gearing, F.^, Shultz, S., Kretzschmar, P., Pilgrim, M., Hrubby, J., King, T., Walton, C.#, Khan, A.#, The Trojan Rhino: admixture, mutational load and purging in populations of the critically endangered Eastern black rhino, *in preparation*

Rodriguez, R.*^, Khan, A.*#, Tyagi, A., Ramakrishnan, U.#, The population genetics of Indian wild dogs (Dholes), *in preparation*

RESEARCH EXPERIENCE

- 1. Postdoctoral Scholar:** Section for Computational and RNA Biology, University of Copenhagen, Copenhagen
Guide: Dr. Rasmus Heller
Topic: Population structure and hybridization among cows, antelopes and hippos
- 2. Postdoctoral Scholar:** School of Biodiversity, One Health and Veterinary Medicine, University of Glasgow, Glasgow
Guide: Prof. Barbara Mable, Dr. Harriet Auty
Topic: What can you learn from a fly?
- 3. Bioinformatics Consultant:** Department of Anthropology, Penn State University, Pennsylvania
Guide: Dr. George Perry
Topic: Estimating origins of human cooking behaviour
- 4. Visiting Scholar:** Institute of Evolutionary Biology, School of Biological Sciences, University of Edinburgh, Edinburgh
Guide: Prof. Josephine Pemberton
Topic: Estimating pedigrees of wild tigers from incomplete datasets

5. **Visiting Student:** Department of Biology, Stanford University, California
Guide: Dr. Uma Ramakrishnan, Prof. Elizabeth Hadly and Prof. Dimitri Petrov
Topic: Mapping Genetic variation in tigers
6. **Research Scholar:** Population genetics and conservation Lab, National Centre for biological Science, TIFR. Bangalore
Guide: Dr. Uma Ramakrishnan
Topic: Studying inbreeding in tiger populations
7. **Junior Research Fellow:** Neural circuit development Lab, National Centre for Biological Science, TIFR. Bangalore
Guide: Dr. Vatsala Thirumalai
Topic: Do gap junctions synapses instruct the formation of chemical synapses during brain development?
8. **Master Thesis:** National Chemical Laboratory, Pune and Dept. of Zoology, University of Pune
Guide: Dr. Anuya Nisal and Prof. B.B. Nath
Topic: Investigation and characterization of aquatic midge-silk protein for potential applications
9. **NIUS Fellowship:** HBCSE, TIFR, Mumbai and Dept. of Zoology, University of Pune
Guide: Prof. B.B. Nath and Prof. Rekha Vartak
Topic: Abberent behavior of *Drosophila* with mutations of potentially non-sexual traits
10. **Internship:** Sparkler Ceramics, Pune and Department of Zoology, University of Pune
Guide: Prof. B.B. Nath
Topic: Effects of ultrasonic sound on chromosomes
10. **Summer Project:** Bhabha Atomic Research Centre (B.A.R.C), Mumbai
Guide: Dr. Rita Mukhopadhyay
Topic: Overexpression of tentative transcription expression genes in *Deinococcus radiodurans* to assess their role in controlling DNA repair after exposure to gamma rays
11. **KVPY Project:** Institute of Bioinformatics an Biotechnology, University of Pune
Guide: Prof. B.A. Chopade
Topic: Developing plasmid curing agents using novel phytochemicals
12. **Short term projects:**
 - a. Theoretical modeling of acoustical behavior of various organisms.
 - b. Designing ultrasonic tranducers with help from Sparkler Ceramics Ltd., Bhosari, Pune
 - c. Designing water purification process and instruments using biological principles.

TEACHING EXPERIENCE

1. Population Genomics, Pwani University, Kilifi, 2024
2. Conservation Genomics, Application of genomics in wildlife conservation, Bogor, 2023
3. Population Genomics, Pwani University, Kilifi, 2023
4. Conservation Genomics workshop, Pre-conference module, 31st International Congress for Conservation Biology, Kigali, 2023
5. Genetics of Complex Traits and Disorders, University of Glasgow, Glasgow, 2023
6. Conservation Genetics, University of Glasgow, Glasgow, 2022

7. Genetics and Bioinformatics Workshop, HABAKA Madagascar Innovation Hub, Madagascar, 2021
8. Evolution and Biogeography, NCBS, Bangalore, 2020
9. Empirical Population Genetics, Preparatory School on Population Genetics and Evolution, ICTS, Bangalore, 2019
10. Conservation Genomics workshop, Student Conference on Conservation Science, Bangalore, 2018
11. Conservation Genomics workshop, Student Conference on Conservation Science, Bangalore, 2017

ACHIEVEMENTS AND FELLOWSHIPS

1. One-off meeting grant to conduct conservation genomics workshop in Kigali, 2023
2. SBOHVM grants to attend SMBE satellite meeting on Molecular Evolution in Small Isolated Populations in Princeton, 2023
3. Conference Grant Scheme B from Genetics Society for attending ESEB meeting in Prague, 2022
4. Travel Grant from NCBS for best poster award in Ecology and Evolution for presentation in Zooming through biology in Bangalore, 2021
5. Travel Grant from SciGenome Research Foundation to attend NGBT in Jaipur, 2018
6. Travel Grant from SCCS Cambridge for Internship for studying “Recovering pedigrees from wild tigers using incomplete datasets”, 2017
7. Library preparation kits and support from Dovetail genomics to start Whole genome assembly of endangered species in India, 2018
8. Travel Grant from SciGenome Research Foundation to attend NGBT in Bhubaneswar, 2017
9. SciGenome Foundation Genomic Project grant for “Genetic variation, inbreeding and pathogenic load of Semi-Arid population of tigers in India”, 2016
10. Infosys Travel Grant for Collaborative Visit for studying “Genetic variation and Inbreeding in tigers using NGS tools” at Stanford University, 2016
11. Travel Grant from Wellcome trust to attend workshop on “Human and Vertebrate Genomics: Tools and online Resources”, Mahidol University, Bangkok, 2016
12. Travel Grant from Society for Ethology and Evolution to present poster in “National Conference on Ethology and Evolution”, Mohali, 2015
13. Research support from Sparkler Ceramics, Bhosari Pune for "Chromosomal Effects of Ultrasonic Sound", 2012
14. TOEFL score 111/120
15. NCBS-TIFR, Department of Atomic Energy, Research Scholarship, 2014
16. CSIR-UGC National Eligibility Test 2012 qualified with CSIR JRF rank 43 (Exam conducted by the Ministry of Human Resource Development, Govt. of India)
17. Graduate Aptitude Test In Engineering 2014 qualified in life sciences with all India rank of 9 (Exam conducted by National Coordination Board – GATE, Department of Higher Education, Ministry of Human Resource Development (MHRD), Government of India)
18. Indian Council of Medical Research, Junior Research Fellow qualified with all India rank of 40 (Exam conducted by Indian council of Medical Research, Government of India)
19. Won silver medal in Asian Science Camp for poster presentation, 2010 (Organized by Asian Science Camp International Board)
20. National Initiative for Undergraduate Science, TIFR, fellowship, 2010
21. Won the best thesis award in category for third year project towards partial fulfilment of MSc degree, 2011
22. Won first prize in oral presentation in a competition titled “Innovative Ideas In Evolutionary Biology” Organized By I.A.B.T., H.B.S.C.E., 2011

23. Won first prize in poster competition at IBB students annual conference in biotechnology, 2011
24. Won first prize in science model competition during the nation science day celebration organised by I.B.B., 2012
25. Won second position at a national level science exhibition visited by many foreign delegates and the then president of India Dr. A.P.J. Abdul Kalam
26. Centre topper of national biology olympiad organised by iabt
27. Passed the senior level U.N. Information Test organized by UNESCO
28. Passed the Homi Bhabha Bal Vaigyanik Examination
29. Passed the junior level U.N. Information Test Organized By UNESCO
30. Passed the primary level Green Olympiad

CONFERENCES AND SEMINARS

1. 31st International Congress for Conservation Biology, Kigali, 2023 (Talk)
2. 59th Annual Meeting of the Association for Tropical Biology and Conservation, Coimbatore, 2023 (Talk)
3. SMBE satellite meeting on Molecular Evolution in Small Isolated Populations, Princeton, 2023 (Poster)
4. European Conservation genetics Meeting, Edinburgh, 2022 (Short talk)
5. Congress of European Society for Evolutionary Biology, Prague, 2022 (Talk)
6. 30th International Congress for Conservation Biology, Online, 2021 (Talk)
7. Zooming through Biology, Bangalore, 2021 (Best poster award in Ecology and Evolution)
8. Student Conference on Conservation Science, Bangalore, 2019 (Workshop Conducted)
9. 29th International Congress for Conservation Biology, KLCC, Kuala Lumpur, 2019 (Poster Presentation)
10. Preparatory School on Population Genetics and Evolution, ICTS, Bangalore, 2019 (Resource Person)
11. Nextgen Genomics, Biology, Bioinformatics and Technologies Conference, Jaipur, 2018 (Poster Presentation)
12. Student Conference on Conservation Science, Bangalore, 2018 (Workshop Conducted)
13. Student Conference on Conservation Science, Cambridge University, Cambridge, 2018 (Poster Presentation)
14. Plant and Animal Genome XXVI Conference, San Diego, 2018 (Poster Presentation)
15. Nextgen Genomics, Biology, Bioinformatics and Technologies Conference, Bhubaneswar, 2017 (Poster Presentation)
16. Student Conference on Conservation Science, Bangalore, 2017
17. Third Bangalore School on Population Genetics and Evolution, ICTS, Bangalore, 2016 (Poster Presentation)
18. Second Bangalore School on Population Genetics and Evolution, ICTS, Bangalore, 2016 (Poster Presentation)
19. Welcome Genomics Centre workshop on “Human and Vertebrate Genomics: Tools and online Resources”, Mahidol University, Bangkok, 2016
20. Student Conference on Conservation Science, Bangalore, 2016
21. National Conference on Ethology and Evolution, IISER Mohali, Mohali, 2015 (Poster Presentation)
22. Winter School on “Analysis of Massively Parallel Sequencing (NGS) data” at NIBMG, Kalyani, 2015
23. International Symposium on Proteomics Beyond Ids & Fourth Annual Meeting of Proteomics Society, CSIR-National Chemical Laboratory, Pune, 2012
24. IBB students annual conference in biotechnology, University of Pune, Pune, 2011 (organized)

25. Dealing with evolution in the classroom: evolutionary perspectives in modern biological teaching and research, HBCSE, Mumbai, 2011 (organized)
26. Lecture sessions by Dr. Manda Claire Jost on evolutionary biology, University of Pune, Pune, 2011 (organized)
27. IBB Students Annual Conference in Biotechnology, University of Pune, Pune 2011
28. Frontiers in Physics-IV, Pune, 2011
29. Asian Science Camp, Mumbai, 2010 (Asian Science Scholar, Silver Medal)
30. National Laser Symposium, BARC, Mumbai, 2010
31. National Conference On Recent Trends In Biotechnology And Industry- Academia Interaction, University of Pune, Pune 2010
32. Frontiers In Physics-III, Pune, 2010
33. Mahabio conference, University of Pune, Pune, 2009 (organized)
34. Frontiers In Physics-II, Pune, 2009

OTHER SKILLS

1. Negotiation skills. Negotiated sequencing costs down by 31.25%; obtained sequencing supplies from companies for free; obtained special permissions from forest departments
2. Leading projects with large multinational, multi institutional and diverse groups.
3. Initiate collaborations. Initiated collaborations with NGOs (WCS, CWS, NCF, Panthera), Academic institutions (University of Edinburgh, Uppsala University, University of Montana, University of Missouri, Wildlife Institute of India), Government Department (Rajasthan Forest Department), Companies (Genentech, MedGenome, SciGenome)
4. Field work in remote location. Worked in Ranthambore Tiger Reserve, Sariska Tiger Reserve, Tal Chappar
5. Established a field station for research in Ranthambore Tiger Reserve
6. Co-ordinate and manage teams remotely. Managed a field team in Rajasthan for 4 years from Bangalore.
7. Teaching skills. Taught Population genetics to graduate students at ICTS. Conducted workshop on conservation genomics for graduates at SCCS, Bangalore.
8. Mentorship skills. Mentored several undergraduates and graduates; trained forest guards for the Rajasthan Forest Department.