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Education

Ph. D. (Molecular Medicine)
2012-2019

Dr. Panjwani Center for Molecular Medicine and Drug Research, International Center for Chemical and Biological Sciences, University of Karachi, Pakistan

BS (Medical Technology)
2007-2010

Z.A School of Medical Technology, Sindh Institute of Urology and Transplantation, University of Karachi, Karachi, Pakistan

Experience

Postdoctoral Researcher
April 01, 2025 - Present

Department of Molecular Medicine,
Aarhus University Hospital, Aarhus, Denmark.

Guest Researcher
Oct16, 2024 –March31, 2025

Department of Molecular Medicine,
Aarhus University Hospital, Aarhus, Denmark.

Research Officer
Jan26, 2018 – Oct10, 2024

Jamil-ur-Rahman Center for Genome Research,
PCMD, International Center for Chemical and Biological Sciences, University of Karachi.

Medical Technologist
Feb01, 2011 – Jan31, 2012

M olecular Diagnostic & Immunology Laboratory,
Sindh Institute of Urology and Transplantation
(SIUT), Karachi.

Publications

1. Wardah Qureshi, ..., **Muhammad Irfan**, Ishtiaq Ahmad Khan & Muhammad Shakeel. Relapse-specific genetic patterns in the exomic mutational landscape in acute myeloid leukemia. *Egyptian Journal of Medical Human Genetics* volume 26, Article number: 57 (2025)
2. Wafa Naeem,, **Muhammad Irfan**, Muslim Khan, Syed Ali Khurram & Asif Ali. Profiling genetic mutations in the DNA damage repair genes of oral squamous cell carcinoma patients from Pakistan. *Scientific Reports* volume 15, Article number: 7896 (2025).
3. Ayesha Wisal,, **Muhammad Irfan**, Asad Ullah, Syed S Hassan. Bridging drug discovery through hierarchical subtractive genomics against *asd*, *trpG*, and *secY* of pneumonia causing MDR *Staphylococcus aureus*. *Molecular Genetics and Genomics* 2024 Mar 13;299(1):34.
4. Samra Khan, Sharmeen Fayyaz, **Muhammad Irfan**, .., Ishtiaq Ahmed Khan. Investigating vertical transmission and maternofetal outcomes in pregnant women with COVID-19: a case-control study from Pakistan *Journal of the Pakistan Medical Association* 74: S-33 (Supple-2); 2024.
5. Mah Noor Mumtaz, **Muhammad Irfan**, .., Asifullah Khan. Whole-genome sequencing of extensively drug-resistant *Salmonella enterica* serovar Typhi clinical isolates from the Peshawar region of Pakistan. *Journal of Infection and Public Health*. 06 Dec 2023. IF:6.7.
6. Mahrukh Nasir,, **Muhammad Irfan**, Sarah Rizwan Qazi, Ishtiaq Ahmed Khan, Tariq Ashraf. Analysis of genetic mutation in dilated cardiomyopathy. *Gene Reports*. 101821, 28 July 2023.
7. Syed Ali Shah Bukhari, Muhammad Shahid, Saad Farooq, **Muhammad Irfan**, Muhammad Shakeel, Ishtiaq Ahmad Khan. Association of Mitochondrial HVS-I Region Variants with Type 2 Diabetes in Pakistani Diabetic Subjects. *J Coll Physicians Surg Pak – Pakistan, Journal of College of Physicians and Surgeons Pakistan*, 2023, 33(7):748-753.
8. **Sirmast Faiz***, **Muhammad Irfan***, .., Muhammad Shakeel, Peng Gong, Thomas Iftner and M. Iqbal Choudhary Study of drug resistance-associated genetic mutations, and phylogenetic analysis of HCV in the Province of Sindh, Pakistan. *Scientific Report*. 27 Jul 2023;13(1):12213. [* equal contribution]
9. Sareen Fatima, Ali Akbar, **Muhammad Irfan**, Muhammad Shafee, Amjad Ali, Zaara Ishaq, Syed Kashif Raza, Abdul Samad, Mohammad Y. Alshahrani, Syed Shah Hassan. Virulence factors and antimicrobial resistance of Uropathogenic *Escherichia coli* EQ101 (UPEC) isolated from UTI patient in Quetta-Balochistan, Pakistan. (Accepted, *BioMed Research International*, 2023).
10. Sareen Fatima, Zaara Ishaq, **Muhammad Irfan**, Ali Akbar. Whole-genome sequencing of multidrug resistance *Salmonella* Typhi clinical strains isolated from Balochistan, Pakistan. *Frontiers in Public Health*, 16 May 2023.
11. Muneeba Afzal,, **Muhammad Irfan**, Muhammad Salman, Carlos M Morel. Genomic landscape of the emerging XDR *Salmonella* Typhi for mining druggable targets *clpP*, *hisH*, *folP* and *gpmI* and screening of novel TCM inhibitors, molecular docking, and simulation analyses. *BMC Microbiology* (2023) Jan 21;23(1):25.
12. Hafiza Farhat, Faizah Urooj, **Muhammad Irfan**, ... Hafza Asma Shafique. Biological control potential of endophytic fungi with amelioration of systemic resistance in Sunflower

- and GC-MS metabolic profiling of *Talaromyces assiutensis*. *Current Microbiology*, (2023) Jan 2;80(2):61.
13. **Muhammad Irfan**,, Syed Shah Hassan, Ishtiaq Ahmad Khan. Genomic analysis of *Chryseobacterium indologenes* and conformational dynamics of the selected DD-peptidase. *Research in Microbiology* (2023),Jan;174(1-2), 103990.
 14. Syeda Sadia Bokhari, Hafiza Farhat,..... **Muhammed Irfan**, Syed Ehteshamul-Haque. Role of mycorrhizospheric fluorescent *Pseudomonas* in suppressing the root rot disease, enhancement of vesicular arbuscular mycorrhizal (VAM) population and phosphorus uptake in sunflower. *Pakistan Journal of Botany* (2023); 2(36).
 15. Syed Shah Hassan, Rida Shams,..... **Muhammad Irfan**, Javed Ali, Muhammad Bilal, Carlos M. Morel Subtractive sequence analysis aided druggable targets mining in *Burkholderia cepacia* complex and finding inhibitors through bioinformatics approach. *Molecular Diversity*, (2022).
 16. Mariam Zehra, Rukhsana Parveen, Muhammad Irfan, Mahrukh Nasir, Sidra Bashir. Forensic analysis of raw meat adulteration using mtDNA. *Journal of forensic science and research*, (2022) Dec 29, 6: 088-092.
Muhammad Shakeel*, Muhammad Irfan*, Ishtiaq Ahmad Khan. Genome sequencing and analysis of genomic diversity in the locally transmitted SARS-CoV-2 in Pakistan. *Transboundary and Emerging Diseases*, (2022), Sep;69(5):e2418-e2430. [* equal contribution]
Sarah Rizwan Qazi*, **Muhammad Irfan***, Ishtiaq Ahmad Khan. Identification of putative genetic variants in major depressive disorder patients in Pakistan. *Molecular Biology Report*, (2022), Mar;49(3):2283-2292. [* equal contribution]
 17. Nida Anwar,, **Muhammad Irfan**, Aisha Arshad, Arshi Naz, Ikram Din Ujjan, Tahir Shamsi. The dawn of next-generation DNA sequencing in myelodysplastic syndromes-experience from Pakistan. *BMC Genomics* (2021), Dec 16;22(1):903.
 18. Ayesha Jamal,, **Muhammed Irfan**, Syed Ehteshamul-Haque. Characterization of endophytic yeast and its suppressive effect on root rotting fungi of tomato under neem cake soil amendment. *Egyptian Journal of Biological Pest Control* (2021), Dec 7;31(1):1-12.
 19. Muhammad Shakeel,, **Muhammad Irfan**, Daniel C. Hoessli, Muhammad Iqbal Choudhary, Muhammad Aurangzeb, Ishtiaq Ahmad Khan. Distinct genetic landscape and a low response to doxorubicin in a luminal-A breast cancer cell line of Pakistani origin, *Molecular Biology Report*, (2021) Oct;48(10):6821-6829.
 20. Abdul Rehman Khalil Shaikh, Ikram Ujjan, **Muhammad Irfan**,, Muhammad Shakeel. TET2 mutations in acute myeloid leukemia: a comprehensive study in patients of Sindh, Pakistan. *PeerJ*, (2021) Feb 9;9:e10678.
 21. Muhammad Shakeel, **Muhammad Irfan**, and Ishtiaq Ahmad. Rare genetic mutations in Pakistani patients with dilated cardiomyopathy. *Gene*, (2018),673:134-9.
 22. Muhammad Shakeel, **Muhammad Irfan**, and Ishtiaq Ahmad. Estimating the mutational load for cardiovascular diseases in Pakistani population. *Plos One* (2018),13(2):e0192446.
 23. **Muhammad Irfan**, Muhammad Zahid Azam, Saeed Khan, Muhammad Shakeel, Urooj Naz, Ishtiaq Ahmad Khan. SNP analysis of NS5B of HCV3a treated with sofosbuvir, peg-IFN, and ribavirin in Pakistani patients. *Pakistan Journal of Biochemistry and Molecular Biology*, (2019), 52(1):17-28

Technical Skills

Molecular Biology and Genomics

- ❖ DNA/RNA isolation from biological samples such as human body fluids, tissues, plants, fungi, bacteria, viruses, sea animals etc.
- ❖ Cell free DNA and circulating tumor DNA isolation
- ❖ Cell Culture
- ❖ DAN evaluation using Agarose gel electrophoresis, Nanodrop, spectrophotometer, qubit fluorometer
- ❖ Conventional PCR, Allele specific PCR, qPCR
- ❖ Droplet Digital PCR
- ❖ Chain termination reaction and Sanger sequencing using ABI Genetic Analyzers
- ❖ Next generation sequencing (NGS) DNA/RNA libraries preparations and validation
- ❖ Highthrough put sequencing platform
 - Nextseq 500, Miseq (Illumina), MinIon (Oxford Nanopore)

Bioinformatics

- ❖ NGS DNA data analysis pipeline for
 - WGS/WES/RNA-seq/gene panel data
- ❖ Extrachromosomal DNA identification from WGS using:
 - CoRAL, Decoil, AmpliconArchitect
- ❖ Micro array data analysis for
 - Gene expression and Mutation screening
- ❖ GWAS analysis
 - plink
- ❖ Variant calling
 - Bwa-mem, Samtools, Picard, Genome analysis tool kit (GATK)
- ❖ Transcriptome analysis
 - Hisat2, STAR, HtSeq, Feature count, DESEQ2, Limma, EdgeR
- ❖ Data manipulation
 - bedtools, bcftools, vcftools, sed/awk/grep, nano, vim etc
- ❖ Population genomic analysis
 - Admixture analysis, Principal component analysis (PCA), FST statistics, Kinship analysis
- ❖ Comparative genome analysis
- ❖ *de novo* assembly of the bacterial and viral genome
 - Unicycler, Spades, Velvet, Canu etc
- ❖ Annotation using Prokka, RAST and Patric.
- ❖ Pangenome analysis using BPGA and Roary
- ❖ Phylogenetic relationship and evolution
- ❖ Antimicrobial resistance genes identification using CARD, ResFinder, Abricate
- ❖ Serotype, Virulence genes, and CRISPR-CAS identification.
- ❖ Plasmid identification using PlasmidFinder, PLSDB
- ❖ Primer designing for the targeted region using Primer3
- ❖ Muscle, BioEdit, MEGAX, Clustalw, Clustal Omega, Figtree, RAxML etc.,

Courses / Seminars / Certificates

1. Participated in the International Course and Symposium on “Applied Genomics and Genome Editing for Food Security” (December 28, 2023 to January 05, 2024), International Center for Chemical and Biological Sciences, University of Karachi, Pakistan.
2. Participated in 8th International Symposium-Cum-Training Course on Molecular Medicine and Drug Research (Mmrd-8)” (November 27-30, 2023), International Center for Chemical and Biological Sciences, University of Karachi, Pakistan.
3. Participated in the training course on “OIC/MIC 35/36 Foundation Training”, (23 October 2023) held in Jeddah, Kingdom of Saudi Arabia.
4. Participated in IPVS Satellite Symposium on “Human Papillomavirus and Cervical Cancer” jointly organized by Dr. Panjwani Center for Molecular Medicine and Drug Research and The International Papillomavirus Society (IPVS) & COMSTECH Alliance of Virology Laboratories (CAVL) held during September 22 - 24, 2022, Karachi, Pakistan.
5. Participated in the “7th International Symposium-cum-Training Course on Molecular Medicine and Drug Research (MMDR-7)”, (November 4-7, 2019), International Center for Chemical and Biological Sciences, University of Karachi, Pakistan.
6. Participated in “14th Eurasia Conference in Chemical Sciences (EuAsC₂S-14)”, (December 15-18, 2016), University of Karachi.
7. Participated in “4th Pak-France Bi-national Workshop on Drug Discovery and Molecular Medicine” (October 12-14, 2015), University of Karachi, Pakistan.
8. Participated in “5th international symposium-cum-training course on molecular medicine and drug research, organized by Dr. Panjwani Center for Molecular Medicine and Drug Research” (January 12 -15, 2015), University of Karachi.
9. Participated in In-house Workshop on “Scientific Writing” (January 5-7, 2015), University of Karachi, Pakistan
10. Participated in International COMSTECH-SIUT Workshop on “Bioinformatics: ENSEMBL Database Mining and Whole Genome Sequence Analyses” (December 20-22, 2014), Sindh Institute of Urology and Transplantation (SIUT), Karachi, Pakistan.
11. Participated in the Workshop on “Advancement in Molecular Biology, Research and Diagnostic” (May 3, 2014), Dow University of Health Sciences, Ojha Campus, Karachi
12. Participated in “4th International Symposium–Cum–Training Course on Molecular Medicine and Drug Research” (January 7-10, 2013), University of Karachi, Pakistan

WORKSHOPS ORGANIZED

1. Member of organizing committee, “Techniques in Human Genomics Studies” (August 20-22, 2014), Jamil-ur-Rahman Center for Genome Research, University of Karachi, Pakistan.
2. Member of organizing committee, “Gene Cloning Techniques” (November 11-14, 2014), Jamil-ur-Rahman Center for Genome Research, University of Karachi, Pakistan.

POSTER PRESENTATION

1. Sirmast Faiz , **Muhammad Irfan** , Ishtiaq Ahmad Khan , Hanaa Iqbal , Atia-tul-Wahab, Muhammad Shakeel, Amtul Qudoos, Zoha Khan, Pang GONG, Thomas Iftner, Muhammad Iqbal Choudhary and Saba Farooq. “**Prevalence of resistance-associated genetic mutations, and phylogenetic analysis of HCV in Sindh, Pakistan**”. IPVS Satellite Symposium on “Human Papillomavirus and Cervical Cancer”. September 22 – 24, 2022, Karachi, Pakistan. Organized by PCMD, International Center for Chemical and Biological Sciences, University of Karachi, Pakistan.
2. Faaria Tariq, Saba Farooq, **Muhammad Irfan**, Ishtiaq Ahmed, Hana’a Iqbal, Atia-tul-Wahab, Thomas Iftner and M. Iqbal Choudhary. “**Evaluation of Genomic Diversity of Dengue Virus in Karachi**”. IPVS Satellite Symposium on “Human Papillomavirus and Cervical Cancer”. September 22 – 24, 2022, Karachi, Pakistan. Organized by PCMD, International Center for Chemical and Biological Sciences, University of Karachi, Pakistan.
3. Maleeha Zaman Khan, **Muhammad Irfan**, Muhammad Shakeel, Sarah Rizwan Qazi, Mahrukh Nasir, Urooj Naz, Muhammad Jahanzaib and Ishtiaq Ahmad Khan. “**Genetic characterization of a rare neuromuscular disorder using next generation sequencing technology**”. 5th Science and Technology Exchange Program on Challenges of Communicable and Non-Communicable Diseases (STEP-5), February 27-March 02, 2019, International Center for Chemical and Biological Sciences, University of Karachi, Pakistan.
4. **Muhammad Irfan**, Zahid Azam, Muhammad Shakeel , Saeed Khan, Saba Nafay, Mohsin Shahzad and Ishtiaq Ahmad Khan. “**Analysis of Host Genetic Variants Involved in Spontaneous Viral Clearance and Therapeutic Response to HCV Genotype-3 in Pakistani Population**”. Presented at 10th PSSLD (Pakistan Society Study for Liver Diseases), December 9- 11, 2016, Karachi.

REFERENCES

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Syed Shah Hassan

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