



Indian Institute of Science Education and Research (IISER) Tirupati

New Course Announcement

BIO329/629: Pandemics: Disease & Intervention

Lead instructors: Dr. Suchi Goel*, Dr. Ashwani Sharma*, Prof. BJ Rao, Dr. Raju Mukherjee, Dr. Shibdas Banerjee and Dr. Rajesh Viswanathan

General motivation to students on why this is an exciting course:

As the world grapples with COVID-19, there is an ever-increasing need for developing a scientifically rigorous awareness course on Infectious Diseases especially those which potentially could turn into a COVID-19 like pandemic. With biological and related expert faculty, you will get a first-hand contemporary scientific literature discussed in the course. With a focus on COVID-19, but deriving a broad analysis of related ones from history of pandemics, this course will systematically introduce the scientific topics of identification, analysis, biomarker discovery for detection and treatments with drugs and possible vaccination pathways in the context of a realistic pandemic, and integrates these with regulatory aspects of prevention / control of spread. As an institution, This part of our curriculum also lays importance to encourage students to develop new contemporary research streams on the projects related to health care with emphasis on COVID-19 orientation and this course will synergistically help in that direction for students to approach this topic as possible future research avenues.

1. Credits: 2 (with a Pass / Fail grading method)
2. Open to: BS-MS (III year), I-PhD (Years I and II), Ph. D. (Year I)
Year IV of BS-MS and any other year of Int-Ph.D. and Ph. D. can audit the course.
3. Semester: This course lectures will start on online teaching mode as on April 24th. The credits for attending and passing the course will be accounted for in the Monsoon 2020 semester.
4. The students after completion of this course will be able to:
 - Learn about different bacterial and viral pandemics in new and old world and mortality associated with these pandemics
 - Methods of identification of pathogen responsible for pandemic
 - Various approaches for development of diagnostics, biomarkers
 - Study regulatory guidelines for societal management during pandemic
 - Repurposing drugs for treatment and vaccine against pathogens
5. Module-wise course details with reading materials are provided below



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Module # 1: [BJR and SG]

Introduction- Difference between endemic, epidemic, and pandemic; Criteria for infections to be called as pandemic; Role of human and environmental factors for infection to become pandemic etc. History & Origins of pandemic diseases (old and new world); How pandemics that changed human history etc. [BJR: 2] Pandemics by bacteria: plague and cholera. HIV, Nipah, Ebola, Zika; Spanish flu, H1N1, Coronavirus. [SG: 3]

Module # 2: [AS and SB]

Introduction about viruses. Anatomy of a Virus. Special focus on SARS-CoV-2 (Covid-19) structure. Function of different macromolecules involved. Biomarkers for detection. Different detection strategies currently in use. New detection technologies in progress or at research stage. Case study: CRISPR-based new diagnostics for Covid-19 detection. [AS: 4] Metabolomics and proteomics in the biomarker discovery for pandemic diseases Mass spectrometric approach to develop diagnostics. Implications of biomarkers for risk stratification and therapeutic modulation on infectious diseases [SB: 2].

Module # 3: [RM and GL]

Infection cycle of a pathogen, transmission of pathogen (SARS-CoV-2, HIV, Mtb); Statistical modelling and computational network models for studying pandemics [GL: 1]; Management of pandemics - National Epidemic disease act of 1897, WHO and ICMR guidelines and social methods: Testing, quarantine, contact tracing, lockdown. [RM: 3]

Module # 4: [RV and SG]

Clinical management through (a) Designing of effective drugs - stages of drug intervention - viral genome replication versus entry versus protein-protein interaction based drug discovery strategies; (b) Repurposing of existing antivirals - Remdesavir case study. General features of nucleoside-based drugs targeting viral replication pathways; (c) Protease inhibitors (and other peptidomimetics) as novel drug candidates against COVID-19. New Synthetic methods for antivirals, Process automation and scale up. Comparison of favourable drug properties - ADME, toxicity. Drug delivery and Sustainable manufacturing [RV, 4 L] and (d) Vaccine efforts: role of animal models and development of vaccines against pathogens [SG: 2L]



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Assessment pattern: To be determined.

Suggested readings (full list with authors, publisher, year, edn etc.)

1. Medical Microbiology An introduction to Infectious disease by Ryan and Ray. McGraw Hill, 2004, ISBN-13: 978-0838585290
2. S. Jane Flint, Vincent R Racaniello, Glenn F Rall, Anna Marie Skalka, Lynn W Enquist. Principles of Virology, ASN Press, 4th edition, 2015, ISBN13: 978-1555819330
- 3 Viruses, A Very Short Introduction - Dorothy H Crawford, Oxford University Press, 2018, ISBN: 9780198811718
4. Spillover, Animal Infections and the Next Human Pandemic - David Quammen, W.W. Norton & Company, ISBN-13 978-0393346619
5. The Psychology of Pandemics, Preparing for the Next Global Outbreak of Infectious Disease - Steven Taylor, Cambridge Scholars Publishing, 2019, ISBN-13:978-1-5275-3959-4
6. Recent materials will be provided by instructors.