

CAREER OPPORTUNITIES IN MICROBIOLOGY

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Before proceeding with the career counselling session, I will be very happy to discuss only 3 terms with you all.

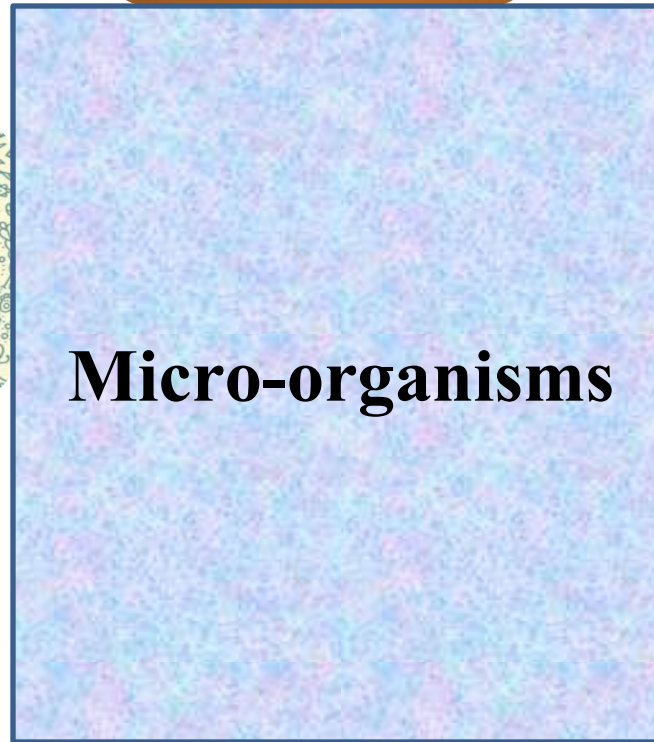
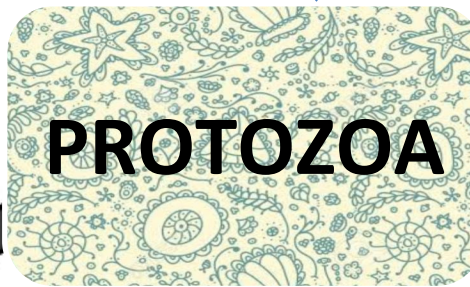
MICRO-ORGANISMS

MICROBIOLOGY

MICROBIOLOGISTS

- Microorganisms are present everywhere on earth which includes humans, animals, plants and other living creatures, soil, water and atmosphere.
- Microbes can multiply in all three habitats except in the atmosphere. Together their numbers far exceed all other living cells on this planet.
- Microorganisms are relevant to all of us in a multitude of ways. The influence of microorganism in human life is both beneficial as well as detrimental also.





SOME ECOLOGICAL AND INDUSTRIAL IMPORTANCE OF PROTOZOANS

1. Protozoans plays important role in soil fertility.
2. Studies have shown that the presence of protozoans in soil enhance plant growth.
3. They play important role in wastewater treatment processes, in both activated sludge and slow percolating filter plants.
4. The protozoans are a fundamental component in recycling essential nutrients (Nitrogen and Phosphorous) to the phytoplankton.

SOME ECONOMIC AND INDUSTRIAL IMPORTANCE OF FUNGI

1. **Fermentation** : *Saccharomyces cerevisiae* or its closely related strains are used in production of wine and beer, *Aspergillus oryzae* is used to produce koji, bread making etc.
2. **Food processing and supplements**: Mushrooms (class Basidiomycetes), Truffles (class Ascomycetes), Natural food supply for wild animals, yeast as food supplement, supplies vitamins(*Ashbya gossypii*), Penicillin- ripens cheese, adds flavour (roquefort, etc), many other fungi used to alter texture, improve flavour of natural and processed foods.
3. **Drugs from fungi**: Penicillin from *Penicillium chrysogenum*, Cephalosporin from *Cephalosporium*, Amphotericin B etc, Gliotoxin also have immunological and antibiotic activity is also produced by many fungi including *Aspergillus fumigatus*.

4. Fungi in biological control of pests: Entomopathogenic fungi can be used as biopesticides, for they actively kill insects. Example of fungi that have been used widely as biopesticides are *Beauveria bassiana*, *Metarhizium anisopliae*, *Paecilomyces spp.* And *Verticillium lecanii*.

5. Cellulose degradation by fungi

6. Biocconversion of Lignin

7. Fungi as “Microbial weed killer” (Bioherbicides)

Fungi are known for its quite specific & effective action and have low residual effects in comparison with synthetic pesticides and also used as herbicides.

8. Biodegradation of Azo dye and Hydrocarbons

9. Fungi in Hazardous waste remediation

10. Biomineralization of Heavy Metals

ECONOMIC IMPORTANCE OF ALGAE

1. **Algae are the main oxygen producers in areas.** They are also useful in decreasing water pollution by releasing oxygen. 10% of total photosynthesis carried out by plants is carried out by the algae.
2. **Algae as food:** Algae species are used as food in several countries in several forms, as they have proteins, vitamins (A, B, C and E), lipids and minerals. Ex: *Laminaria* species is the important edible seaweed in Japan and the food item “KOMBU” is prepared from it.
3. **Algae as fodder for cattle:** *Rhodomenia palmata* is used as food for sheep in Norway, *Laminaria saccharina*, *Ulva*, *Ascophyllum*, etc. species are used as food for cattle.
4. **Algae as fertilizers:** Blue-green algae are treated as bio-fertilizers from older days, *Nostoc*, *Oscillatoria*, *Scytonema*, *Spirulina*, etc. are used as fertilizers to rice fields, cultivation of *Spirulina* is gaining importance as feed for fish, poultry and cattle.

5. Algae in Pisi culture: Some green algae, diatoms, some blue-green algae are used as food material to fishes, these are also making the water clean by realizing oxygen. So, they play an important role in Pisi culture.

6. Algae in industry: Iodine industry is mainly depended upon algae, algae belonging to *Phaeophyceae*, like *Laminaria*, *Ecklonia*, *Eisenia*, etc. are used in the industry to prepare iodine.

Phyllophora is used to prepare iodine in Russia.

7. Algae in Antibiotics: Antibiotic Chlorellin, obtained from chlorella is effective against a number of pathogenic bacteria, extracts from *Cladophora*, *Lyngbya* can kill pathogenic *Pseudomonas* and *Mycobacterium*. Seaweeds have beneficial feects on gall bladders, pancreas, kidney, uterus and thyroid glands.

8. Role of algae in sewage disposal: Some species like *Chlamydomonas*, *Scenedesmus*, *Chlorella*, *Pondorhina*, *Euridina*, etc are living in sewage water. They are mainly useful to clean the water by releasing oxygen.

Various types of algae being used for power generation, soil fertility improvement and wastage treatment.

Marine blue green algae and freshwater green algae used for various manufacturing processes like medicine and preservatives.

9. Algae as research material: Blue-green algae are used in studies on nitrogen fixation, researches in genetics and cytology are carried out on *Acetabularia*. While *Chlorella*, *Scenedesmus* and *Anacystis* are used in investigations in photosynthesis.

10. Algae in space: *Chlorella* and *Synechococcus* are finding application in space ships and nuclear submarines as oxygen regenerating and food and water recycling organisms.

11. Algae recreational use: Some selected algae are grown in recreational areas like lakes and streams along with fish. Like *Trentophila* giving reddish colour to land looks beautiful, *Oedocladium* imparts velvety appearance to the soil, *Vaucheria* gives parrot-green colour to gardens.

12. Algae as fertilizer: Many algae increase the water-holding capacity besides the addition of their chemical constituent in the soil. In India, *Turbinaria* is used around palm tree while sea weeds are used as compost.

13. Algae in soil fertility and land reclamation: The species of *Nostoc*, *Syctonema*, *Aulosira*, *Lyngobya*, *Microcoleus*, *Alphanothece*, *Anabaena*, etc. show adaptability to moist soil surfaces and most of these can fix atmospheric nitrogen and increase the soil fertility. Even due to their mucilaginous sheath, they are able to prevent soil erosion by binding the soil particles firmly.

14. Algae in Medicine: Brown algae mainly used in manufacture of various goitre medicines due to their high iodine content. Some algae, like *Gelidium* are used for treatment of kidney, bladder and lung diseases while *Laminaria* is used as surgical tool in the opening of wound due to its gentle swelling property.

Acetabularia major is used in treatment of kidney and bladder problem. Even in Japan *Spirogyra* is used in manufacturing of lens paper, suitable for cleaning of optical instruments etc.

Economic importance of Bacteria

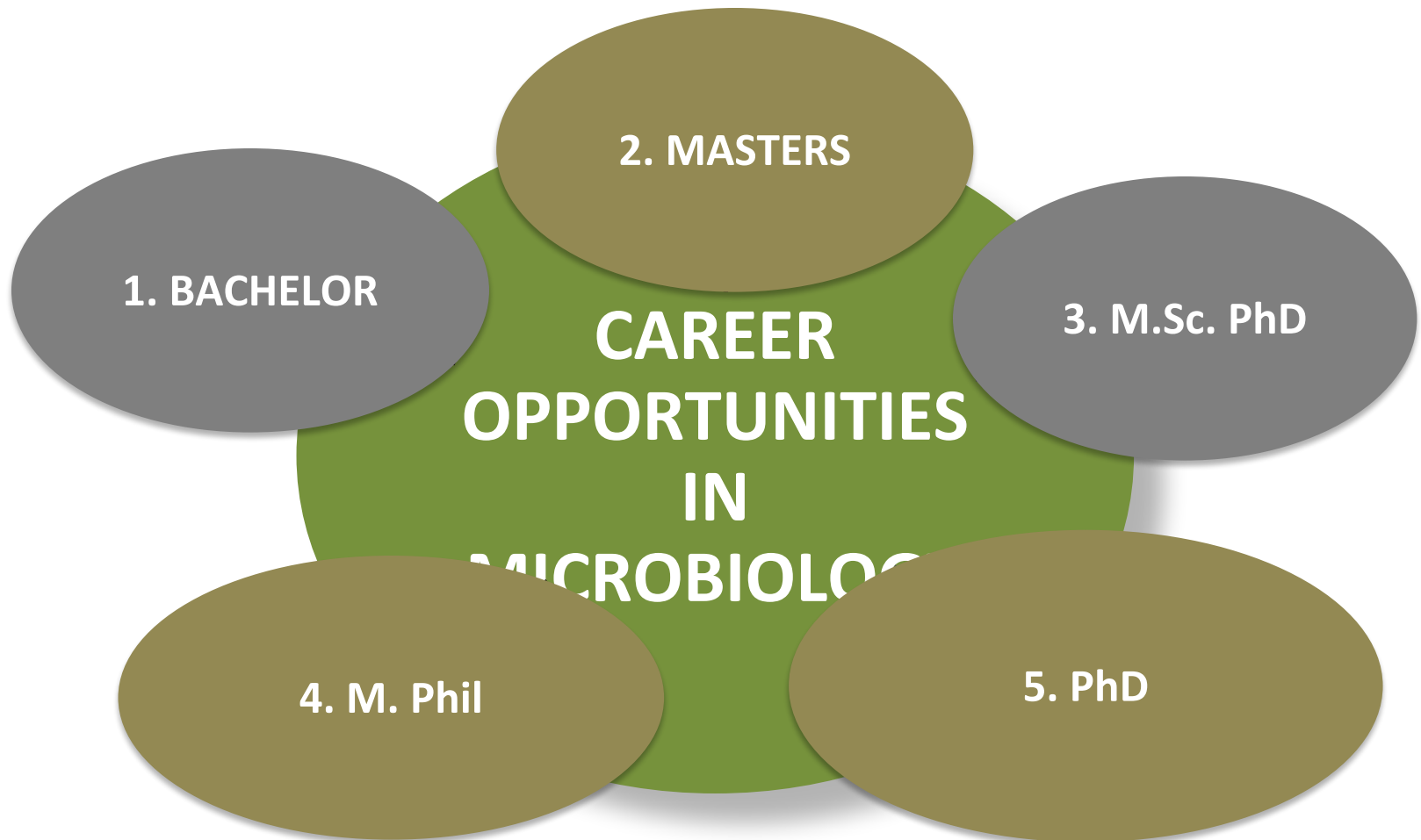
1. Plays important role in soil fertility: (Nitrogen fixing bacteria, ammonification, nitrification, Phosphorous solubilizers or Phosphobacteria)etc.
2. Bacteria as Biofertilizers
3. Bacteria as decomposers- Natural scavengers
4. Role of bacteria in food production: Production of Curd, Butter, Cheese, Yoghurt, Vinegar (4% acetic acid), probiotics, production of fermented foods, Single cell protein (SCP).
5. Bacteria in production of antibiotics: Production of Butanol and Propionic acid etc.
6. Bacteria for the production of medically useful enzymes.
7. Role of bacteria in Bioremediation
8. Bacteria as a biocontrol agent
9. Agrobacterium mediated gene transfer technique
10. Production of Biogas

11. Genetically Modified crops

12. Biodegradable plastics and many more.

VIRUS USES IN VIROLOGY

- 1. Viruses in Biological studies:**
- 2. Viruses in Medicine:**
- 3. Viruses in Bacteriophage therapy:**
- 4. Viruses in nanotechnology:**
- 5. Viruses in weapons and biological warfare:**
- 6. Viruses in agriculture:**
- 7. Viruses in cancer prevention and control:**
- 8. Viruses and vaccines:**
- 9. Viruses and biological pest control:**
- 10. Virus-directed enzyme prodrug therapy (VDEPT):**
- 11. Vaccines for cancer prevention:**



CAREER OPPORTUNITIES IN MICROBIOLOGY

BACHELOR

Duration:
3 year
Marks:
50-55%

- Microbiology
- Applied Microbiology
- Industrial Microbiology
- Food Technology
- Clinical Microbiology
- BE/ Btech.

MASTERS

Duration: 2 years (4 semester)
Marks: 60% at least
ENTRANCE TESTS

- Microbiology
- Applied Microbiology
- Medical Microbiology
- Microbial Genetics
- Bioinformatics
- M.Tech.

M.Sc. PhD

Duration: 6-7 yrs. (not in all institutes)
• IISc. (Banglore)
• IIT (QUALIFY JAM)
Feb/March
• IISER (Pune, Bangalore)
(Qualify JAM or JGEEBILS)
• Bose Institute, Kolkata
• TIFR (JGEEBILS)
Feb/March
(Scholarship/ stipend by gov.)

M. Phil

- Duration: 2 years
- Eligibility : NET, SET (state), GATE, PET (universities)
Should be qualified

PhD

Duration: Approx. 6-7 years (NET/JRF)-> direct admission, 31K-35K Scholarship by gov.
• NIT
• NII
• IITs
Some other Institutes:
• NIV (Pune)- Eligibility for NIV ICMR, DBT INSPIRE, BINC



**JOB
OPPORTUNITIES**



JOB OPPORTUNITIES IN MICROBIOLOGY

SO
MANY

ACADEMIC OPTION

- SALARY:** ~ 30K/m
- **School Teacher**
- **Assistant Professor**
- **Associate Professor** (~70K- 1.2 Lac/m)
- **Lab Assistant** (10K-15K/m)
- **PhD** (~31k-34k)
- **NET JRF** (can work as research scholars in IITs or any national institute)
- **Post Doc for higher education** (stipend above 34K)
- TA/DA, HRA also include

RESEARCH

- **Research Assistant** (2-3 Lac/yr.)
- **Jn. Research Associate** (2-4 Lac/yr.)
- **Sr. Research Associate** (4-5 Lac/yr.)
- **Scientist** (~50K/m or 6 Lac/yr.)
- Institutes where you can work or research**
DRDO, CSIR, IITs, BARC, ISRO, NCCS, AIIMS etc

GOVERNMENT SECTOR

- **FSSAI**
- **National Health Mission**
- **FCI**
- **Punjab Agriculture University**
- **Indian Association for the Cultivation of Science**
- **Ministry of Environment, Forest and Climate change.**
- For these job opportunities check posts, entrance exams. You can only apply after entrance and interview.

PRIVATE SECTOR

- **INDUSTRIES:**
 - QC (2-3.2Lac/yr)
 - QA (2-3.7Lac/yr)
 - R&D (~7Lac/yr)
- **HOSPITALS** (15k-20k/m)
Pathology lab
- **MEDICAL CODER**
- **MANAGER AFTER MBA IN HOSPITAL MANAGEMENT** (upto 7 Lac/yr.)
- **Pharmacologist:**

AFTER THIS COURSE YOU CAN BE

1

VIROLOGIST: Study the structure, development and other properties of viruses and any effects that viruses have on infected organisms.

2

ENVIRONMENTAL MICROBIOLOGIST : Study how microorganisms interact with the environment and each other. They may study the use of microbes to clean up areas contaminated by heavy metals.

3

CLINICAL MICROBIOLOGIST: Perform a wide range of clinical laboratory tests on specimens collected from plants, humans, and animals to aid in detection of disease.

4

MEDICAL MICROBIOLOGIST: Clinical and medical microbiologists whose work involves directly researching human health may be clasified as medical scientists.

5

MARINE MICROBIOLOGIST: They work on the microscopic organisms from seas and oceans. The little is known about them, since most of them are either non-culturable or difficult to isolate. The recent technological developments like bathymetry, GPS, Shipboard laboratories and ship maneuvering have made sampling of marine microbes living in various ocean.

6

INDUSTRIAL MICROBIOLOGIST: These microbiologists apply engineering and scientific principles to the processing of materials by micro-organisms, plants and animal cells to create useful products or processes

7

FOOD MICROBIOLOGIST: The major responsibility of food microbiologist is to ensure safe and efficient development, manufacturing and modification of food products and processes.

8

PHARMACOLOGIST: Usually pharmacologists specialise in a specific field of research such as pharmacokinetics, toxicology etc. Microbiologists can choose pharmacology as one of the subject at the PhD LEVEL.

9

PUBLIC HEALTH MICROBIOLOGISTS: Examine specimens to track, control and prevent communicable diseases and other health hazards. They typically provide laboratory services for local health departments and community health programs.

10

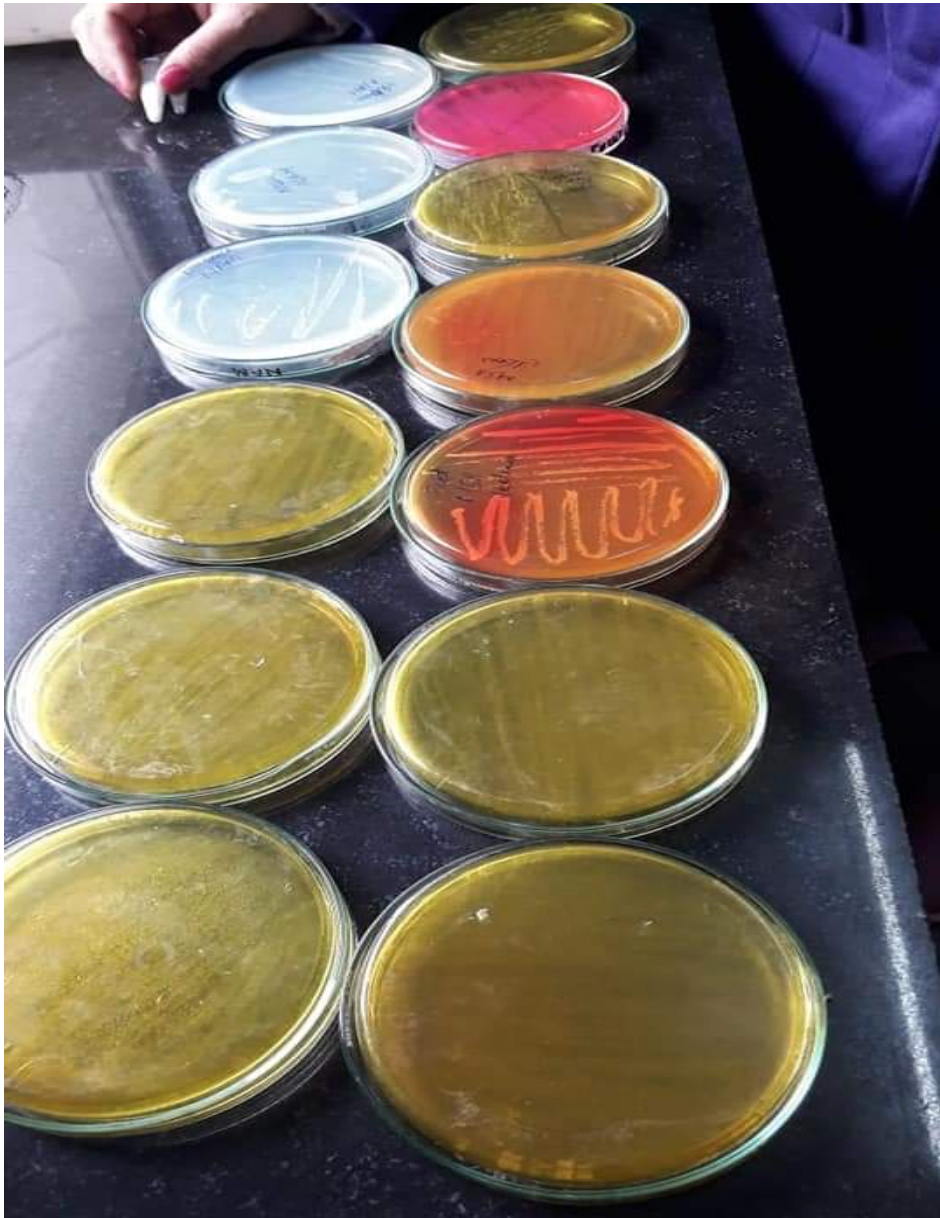
AGRICULTURAL MICROBIOLOGIST: They deal with plant associated microbes, it also deals with the microbiology of soil fertility, such as microbial degradation of organic matter and soil nutrients transformation.

11

PARASITOLOGISTS: Study the life cycle of parasites, the parasite-host relationship, and how parasites adapt to different environments. They may investigate the outbreak and control of parasitic diseases such as malaria.

12

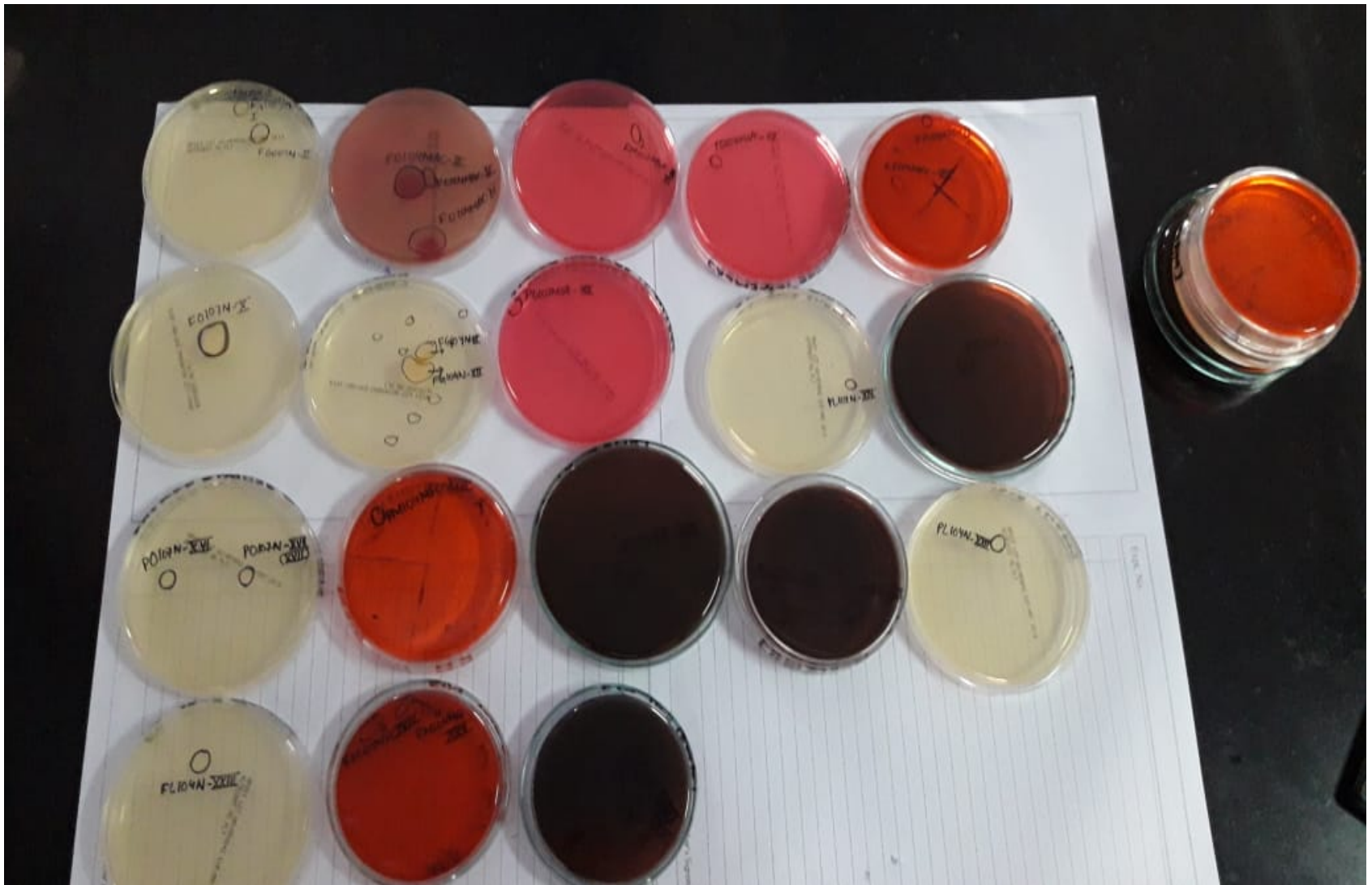
BACTERIOLOGISTS: Study the growth, development, and other properties of bacteria, including the positive and negative effects that bacteria have on plants, animals and humans



**BACTERIAL ISOLATES ON DIFFERENT
CULTURE MEDIA**



MIXED FUNGAL CULTURE



SOME BACTERIAL ISOLATES FROM DIFFERENT FRUIT JUICE SAMPLES



WHILE WORKING IN LAB WITH ONE OF MY STUDENT KASHISH NOOR,
HERE WE ARE DETERMINING THE ANTIMICROBIAL PROPERTY OF
BIOFILM

Yakult

DANONE



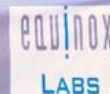
केन्द्रीय गोवंश अनुसंधान संस्थान







Meerut Institute of Engineering and Technology
Department of Biotechnology and Microbiology



**WINTER SCHOOL
TRAINING PROGRAM
ON**

**EXPERTISE IN TECHNIQUES OF BIOTECHNOLOGY AND
MICROBIOLOGY
(ETBM-2019)**

Thrust Areas

- Bioinformatics.
- Environmental Biotechnology.
- Molecular Biology.
- Food and Dairy Microbiology.
- Immunology.
- Medical Microbiology.

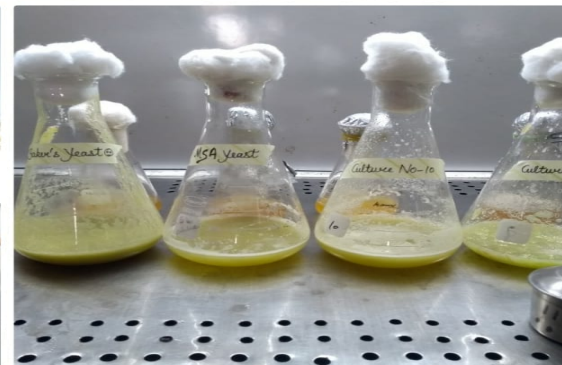
Highlights

**(16TH JAN. TO
15TH FEB., 2019)**

One Day FOSTAC TRAINING (Food
Safety Training and Certification)
programme by FSSAI trained trainer

❖ FSSAI certification





The background of the slide is a microscopic image showing numerous rod-shaped bacteria, likely Bacillus subtilis, in shades of blue and cyan. The bacteria are scattered across the frame, with some appearing in sharp focus and others blurred in the background. The text "THANK YOU" is centered in a white, serif font.

THANK YOU