பாரதியார் பல்கலைக்கழகம்
BHARATHIAR UNIVERSITY
COIMBATORE – 641 046, TAMILNADU, INDIA

State University	Accredited with "A" Grade by NAAC	Ranked 13th among Indian Universities by MHRD-NIRF

SKILL CERTIFICATE COURSE ON

"DROSOPHILA MELANOGASTER AS A MODEL ORGANISM"

Report submitted to

Skill Development Centre, BEICH

Rashtriya Uchchatar Shiksha Abhiyan (RUSA 2.0)

Bharathiar University

Submitted by

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24.01.2021 to 02.02.2021

Skill development course on

"*Drosophila melanogaster* as a model Organism"

Organized by

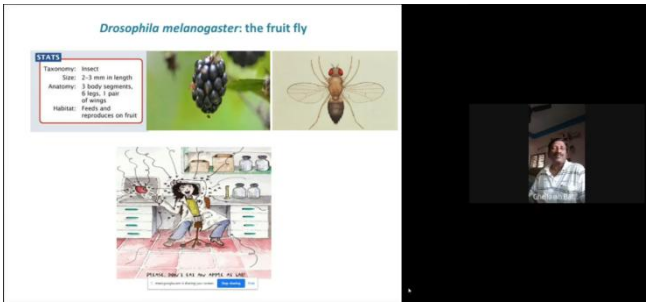
Skill Development Centre (SDC), BEICH RUSA.2.0

REPORT

"The Science of today is the technology of tomorrow - Edward Teller"

The Skill certificate course on "***Drosophila melanogaster* as a model organism**" was organized by the Skill Development Centre, BEICH, RUSA 2.0 and Department of Human Genetics and Molecular Biology, Bharathiar University, Coimbatore. This course was scheduled from 24th January 2021 to 2nd February 2021. The course began with the inaugural session on the morning of 24th January 2021 at 10:00 AM, virtually. The inaugural session was started with welcome address by **Dr. R. Sivasamy**, Assistant Professor and Head i/c, Department of Human Genetics and Molecular Biology, Bharathiar University, Coimbatore. **Prof. Dr. P. Kaliraj**, Vice-Chancellor, Bharathiar University, Coimbatore, in his absentia, **Dr. Rupa Gunaseelan,** Professor and Head, BSMED and Coordinator RUSA 2.0, given short introduction about RUSA 2.0, **Dr. A. Vimala,** Professor and Head, Department of Extension and Career Guidance & Director, Skill Development Centre, BEICH RUSA 2.0, given information on skill certificate course and its importance, **Dr. J. Satheesh Kumar,** Associate Professor of Computer Application and Nodal Office, BEICH RUSA, highlighted the RUSA 2.0 components and role of RUSA 2.0.

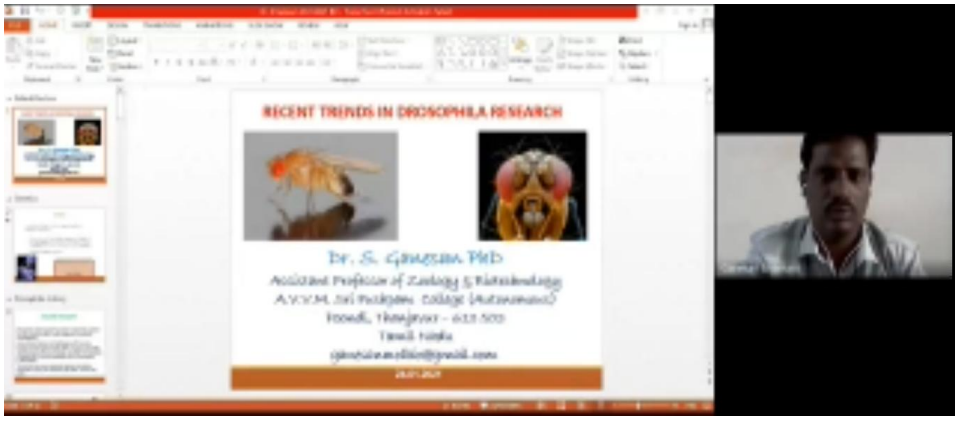
The skill certificate course on "*Drosophila melanogaster* as a model organism" sessions (**Session-I**) started with talk on "**An Introduction to Insect, Classification and Drosophila**" from **Dr. C. Balasubramanian**, Associate Professor, Department of Zoology, Thiagarajar College, Madurai, and his

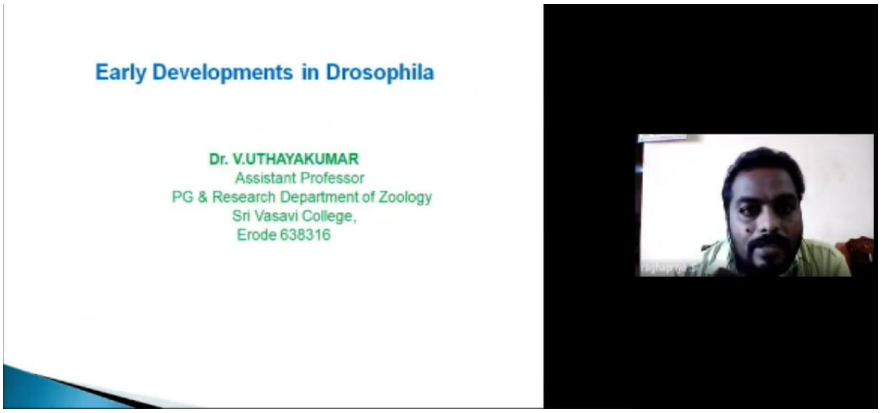


stated in his talk that "The use of *Drosophila* as an ideal system for human genetic studies are well justified by its 60% similarity to mutated genes in humans, short lifespan that takes 12

days when reared at 25°C, ease of culture and maintenance, less chromosome number and the small genome size. With 132 million base pairs and 15,000 genes, it makes up only 5-6% of the human genome and is an established model for several diseases prominent being the Alzheimer's disease to study the plaques and tangles. Use of *Drosophila* could pave the way to replace vertebrates as model system, to reduce experiments on rodents and also to refine relevant animal models"

The second talk (**Session-II**) on "**Recent trends in Drosophila Research"** was delivered by **Dr. S. Ganesan**, Assistant Professor, Department of Zoology and Biotechnology, AVVM Sri Pushpam College, Thanjavur. Cancer stem cells are known to be a main "antagonist" in the cancer progression. *Drosophila* could be used to understand thecancer stem cell physiology, pathways and the drug targets for such abnormalities. Similarly studies have been done and ongoing on insulin resistance diabetes which is caused by multifactorial reasons. Kidney stone and polycystic kidney disease models have been established by studying the nephrocytes. Apart from this the studies on gene expression, P-elements and locomotion are additive to the use of *Drosophila* models in the recent trends of medicine.



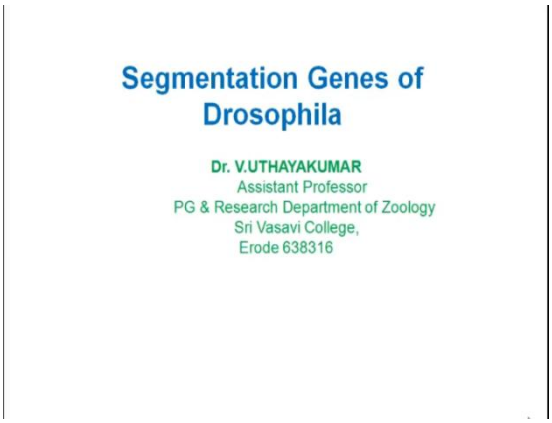


The third session (**Session-III**) of the day was given by **Dr. V. Uthayakumar**, Assistant Professor, Department of

Zoology, Sri Vasavi College, Erode on a title "**Early Development in *Drosophila***". In his talk he said that " For controlled mating as it happens in laboratories for achieving the desired progenies, virgins have to be isolated. Females and males can be distinguished from one another by certain unique morphological characteristics. Males have round abdomen, are small and possess sex combs (black bristles on the tarsal segment of forelegs) while females have pointed abdomen, are large and sex combs are not present. As the larva transforms to pupa they become sluggish, start crawling up the walls of culture vessel and slowly the mature organs like eye, legs and wings would start to develop once the shrinkage happens with the inner set of cells".

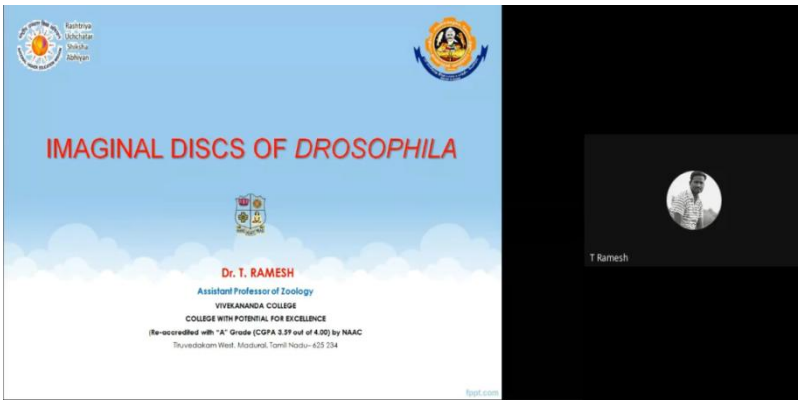
On 25th January 2021, (**Session-IV**) started with talk on "**Maternal Genes of Drosophila**" from **Dr. R. Chandirasekar**, Assistant Professor, Department of Zoology, Sri Vasavi College, Erode. He insisted that "Maternal effect genes which are translated upon fertilization are key to determining the body axes. The anterio-posterior and dorso-ventral axes are determined by interaction between the transcribed products of different maternal effect genes. *Bicoid* and *hunchback* are responsible for the anterior region while *nanos* and *caudal* for the posterior segments. The dorso-ventral axis is determined by the action of *dorsal* on the ventral side".

On 26th January 2021, the session (Session-V) for the skill certificate course on "*Drosophila melanogaster* as a model organism" sessions (**Session-V**) was started with talk on "**Segmentation Genes of Drosophila**" from **Dr. V. Uthayakumar**, Assistant Professor, Department of Zoology, Sri Vasavi College, Erode, and he informed that "the early stages of *Drosophila* development involve axis determination along dorsoventral and anterio-posterior

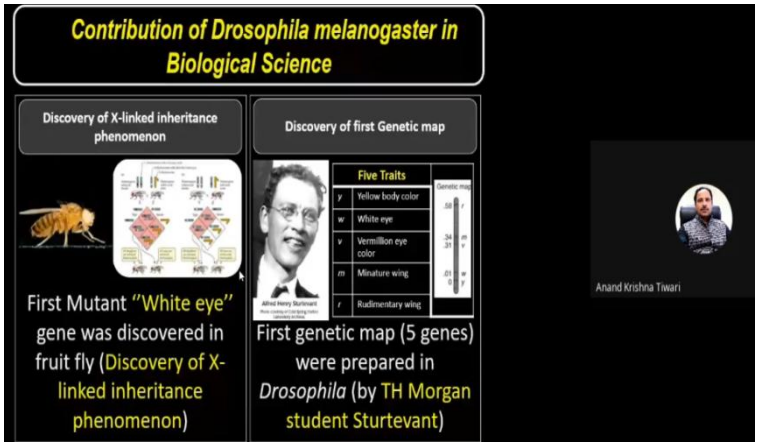


planes. The single celled zygote of *Drosophila* undergoes continuous cell proliferation to form a syncytial blastoderm and then transforms to cellular blastoderm. The main body axes i.e., anterior-posterior and dorsal-ventral, specification is by the egg polarity genes. These genes also called as maternal effect genes are transcribed in the egg and products act in the zygote. Once the axes have been defined, these genes activate the expression of another set of genes that is responsible for determining the number of polarity of the segments in the fly. Such genes are known as segmentation genes. There are three types of genes within the segmentation genes – gap, pair-rule and segment polarity genes.

Followed his talk, a talk (**Session-VI**) on "**Imaginal Discs of Drosophila"** was delivered by **Dr. T. Ramesh**, Assistant Professor, Department of Zoology, Vivekananda College, Madurai. He conveyed that "Imaginal (from the Latin *imago* meaning image) disc is a sac-like epithelium found inside the larva which is derived from the ectodermal cells and is the source of the adult organs. There are 19 discs in *Drosophila* that spans head, thorax and thorax (nine bilateral pairs) as well as genitalia (one medial disc).There is a high rate of proliferation in the imaginal discs and has great impact on its development also. The discs are: labial, clypeolabral, eye-antenna, humeral, wing, haltere, 1st, 2nd and 3rd leg as well as the genitalia. The disc of wings is the largest with 50,000 cells. More attention is given in studying the development of eye since it is manifested in several phenotypes associated with diseases such as Alzheimer's, Parkinson's disease etc. The legs of Drosophila like other insects are made of five segments – coxa, basal joint, femur, tibia and tarsus. The compartmentalization between each disc and that of the structures in an adult fly is well regulated by the molecules called "morphogens" from the organizing centres and responsible for the formation of what is known as the fate map for making the future adult in a matter of hours.



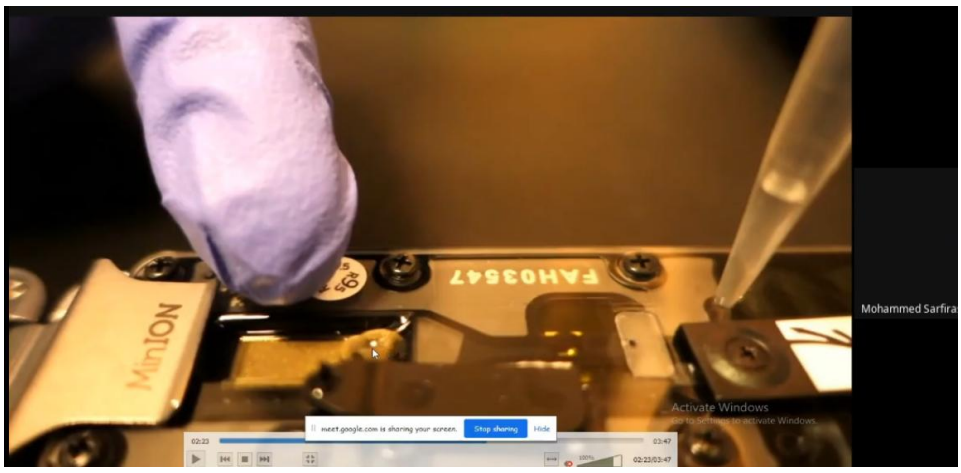
The third session (**Session-VII**) of the day was delivered by **Dr. Anand K Tiwari**, Associate Professor, Genetics & Developmental Biology Laboratory, School of Biological Sciences and Biotechnology, Institute of Advanced Research, Koba, Gujarat, India on ""**Drosophila Eye Development**". He insisted that "Eye phenotypes could be studied for understanding development as well as to associate with the occurrence of several diseases such as Alzheimer's. *Drosophila* eye is studied to understand cell shape change, cell polarity, cell death, cell cycle regulation and neurodegeneration. Different assays like that of phototaxis and climbing assay are used to understand the behavior of *Drosophila* and distinguish the wild type from the mutants. The phototaxis assay using Y maze tube is essential to check for eyes. The candidate gene for understanding the mechanism of Alzheimer's in *Drosophila* is a human homolog called *Appl* gene (is homolog to human *APP* gene). Studies revealed the interaction of *Appl* gene with ubiquitin ligases and the role of mitochondria (*Miro* gene) in neurodegeneration.



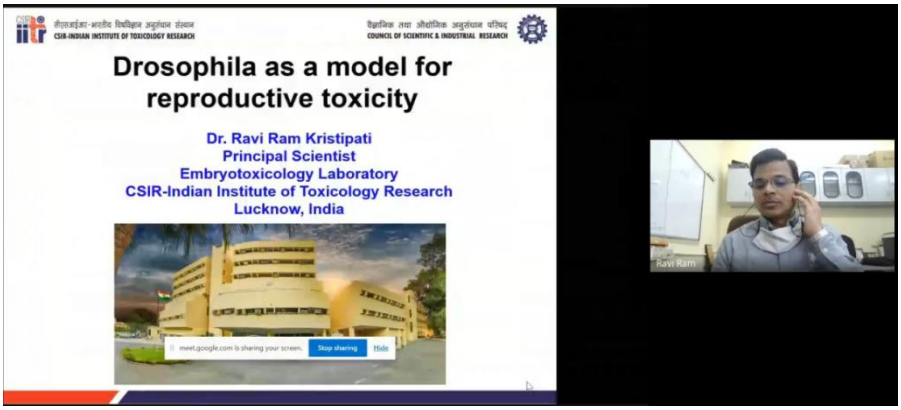
On 27th January 2021, **Dr. Subhash Rajpurohit**, Associate Professor, Biological and Life Sciences, School of Arts and Sciences, Ahmedabad University, Ahmedabad, India delivered a talk (**Session-VIII**) on "**Drosophila Ecology**". He conveyed that "The phylogenetics of *Drosophila* is poorly understood and errors corrected as the molecular data evolves and improves.

Morphologically each species could be identified on the basis of wing patterns, number of sex combs (in males), pigmentation etc. *D. melanogaster* development is much dependent on the temperature. As the temperature increases the time taken to develop decreases and as the temperature decreases the time taken to develop increases. The ecology of ectoderms like *Drosophila* differs according to the latitude and this has been shown in many species including that of the Indian subcontinent. They show optimum growth at 14°-28°C. The flies at high latitude show the most resistance to desiccation. An example being *D. mojavensis* of southwestern United States and Mexico can tolerate up to 40 hours of dry air, four days without food, 1 hour at 8°C, one week at 0°C, toxic products of cactus and also gain dry mass when exposed to 4% of ethanol vapour.

On 28th January 2021, the session (Session-IX) for the skill certificate course on "*Drosophila melanogaster* as a model organism" sessions (**Session-IX**) was started with talk on "**Drosophila: Sequencing and Metagenomics**" from **Ms. Sughanya Renoy, Senior Techician, Yaazh Xenomics, Coimbatore**. **Metagenomics** is the study of genetic material recovered directly from environmental samples. She emphasized in her talk that" **DNA extraction** is a routine procedure used to isolate **DNA** from the nucleus of cells. **DNA** precipitates. When ice-cold alcohol is added to a solution of **DNA**, the **DNA** precipitates out of solution. If there is enough **DNA** in the solution, you will see a stringy white mass. DNA extraction involves breaking cells open to release the DNA, Separating DNA from proteins and other cellular debris, precipitating the DNA, Cleaning the DNA, Confirming the presence and quality of the DNA. Column Nucleic Acid Extraction: sample preparation-lysis-protein removal-DNA binding-wash-DNA elution.

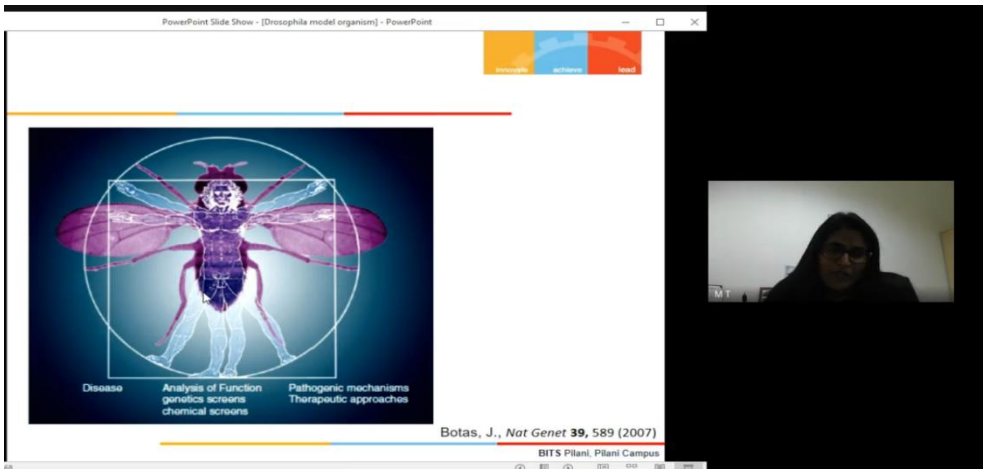


Bead Nucleic Acid Extraction: sample-lysis-binding-washing-elution-pure DNA/RNA. Nanopore Technique is the process in which electrical current flows through the holeleads to identification and analysis by disruption or block to electrical current. Flow cell: The **flow cell** is a glass slide containing small fluidic channels, through which polymerases, dNTPs and buffers can be pumped. The glass inside the channels is decorated with short oligonucleotides complementary to the adapter sequences.



A talk (**Session-X**) on "**Drosophila as a model for Reproductive toxicity"** delivered by **Dr. Ravi Ram Kritipati**, Principal Scientist, AcSIR, Embryotoxicology Laboratory, CSIR-Indian Institute of Toxicology Research, Lucknow. He elaborated that "Reproduction is the production of offspring, the perpetuation of species. The occurrence of biologically adverse effects on the reproductive system of females or males that resulted from the exposure to an environmental agent(reproductive toxicant) which may be expressed as the alteration in reproductive organs, related endocrine system or pregnancy outcomes. Xenobiotics exposure through the environment, drugs, cosmetics, other agents can cause Reproductive Toxicity. Xenobiotics mediated endocrine disruption may hamper fertility at different stages of fertilisation. Some of the endocrine disruption class (EDC) include drugs, plasticizers, organohalogens, personal care products, pesticides, herbicides, phytoestrogens, industrial chemicals, metals etc…Recent studies have been reported that increasing infertility has a direct correlation with a chemical that we are getting exposed to, since the 1960s, total global fertility rates have been cut in half. The mean sperm count and global plastic production since 1970 show direct impacts. Not only humans but Xenobiotics interference with reproduction also affects the ecosystem where there has been a huge loss of insect biodiversity thereby affecting pollination which leads to reduced agricultural yield. Hence the

Xenobiotic mediated Reproductive Toxicity research is important. Reproductive Toxicity research is highly animal intensive, but using a mouse as a model system, the throughput is highly low to study fertility research. Hence there is a need for a versatile model organism for Reproductive Toxicity study.



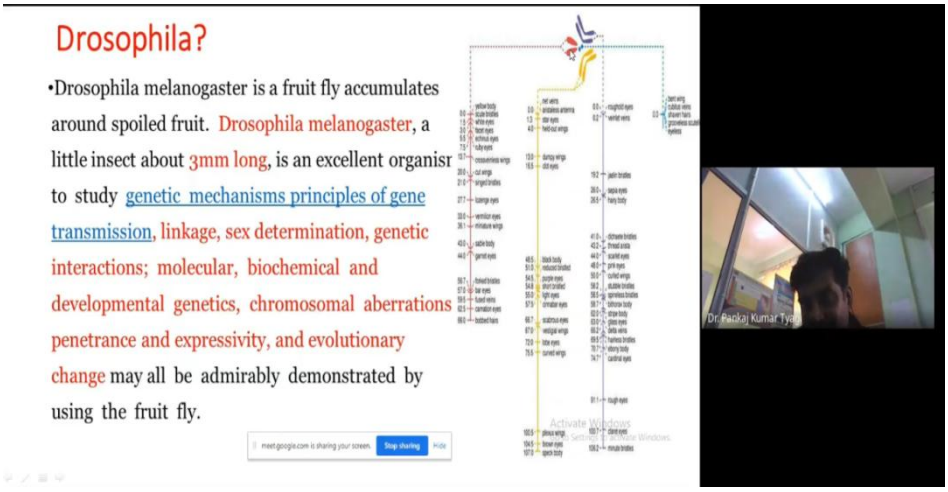
The third session (**Session-XI**) of the day was delivered by **Dr. Meghana Tare**, Assistant Professor, Department of Biological Sciences, Birla Institute of Technology and Science, Pilani, Rajasthan, India on "**Flies as a Disease model**". She started the discussion with the poem quotes written by B William Blake, 1794. The illustrious model and different Nobel laureates worked with *Drosophila melanogaster* from T H Morgan (1933) to W YOUNG (2017) for their studies in Drosophila melanogaster. *Drosophila melanogaster* is named as the HOMOPHILA model because of its half-human and half insect nature. *Drosophila melanogaster* shares so many similarities with humans mainly the digestive tract, nervous system, body organisation and circulatory, excretory, skeletal muscles system. The basic development stages of both species also share many similarities. Development is the process through cell division, specification and differentiation which is controlled/ regulated by genes which can be clearly studied using *Drosophila melanogaster*. The pattern formation defects in newborn and their screening for the genes affecting the body plan, defining a specific structure can be easily understood using *Drosophila melanogaster* as a model. E.B Lewis, C, Nusslein and E. Wieschaus used *Drosophila melanogaster* genetics to identify the proteins that set up the embryonic body plan, and a paper was published in NATURE. *Drosophila melanogaster* is called golden bug, which emerges as a tool for human genetic study. The naming of the gene can be also done using *Drosophila melanogaster*. Mutation of TWISTZ gene in Saether-Chotzen syndrome has also been recently studied using *Drosophila melanogaster* as a model organism. Mutation

leading to a different form of the segment in *Drosophila melanogaster* and its comparison study used to understand the pattern of body segmentation. To study different diseases, a *Drosophila melanogaster* eye has been used to understand organogenesis. Organogenesis of the eye through specification, axis determination and differentiation using the PAX 6 gene in *Drosophila melanogaster* is explored to study diseases. Eye development through the life cycle of fruit fly using GAL4 - UAS SYSTEM for expression study is an excellent tool to study the gain of functions of the gene of interest. Importance of the Pannier (PNR) gene in the development of blood cells and its screening through FRT Tagging and GFP Tagging also plays an important role in the mammalian adult study. Cancer (cell survival study) and Neurodegenerative diseases(cell death study) are done using *Drosophila melanogaster* as a model organism to check the phenotypic expression, screening and assessing the modification in disease cases. Studies like misexpression of Aβ 4 2 in the fly eye using GMR-GAL4 Expression study in neurodegenerative disease opened new sights on research.

On 29th January 2021, **Mr. Nataraj**, Facility Assistant in Drosophila Fly Facility, National Centre for Biological Science (NCBS), Bengaluru, India delivered a talk (**Session-XII**) on **"Identification of different phenotypes, growth conditions, food preparation, how to make transgenic flies of flies". He in his talk said that** "There are several systems available for producing transgenic organisms (like GAL4/UAS, CRISPR Cas9). Transgene production is done by microinjection during the syncytial blastoderm stage when they have a shared cytoplasm and the process could be site specific or random. The medium compensates for the natural requirements of flies by providing source of energy, the fermented environment, antimicrobials etc. The medium is prepared using corn flour, glucose, sugar, agar, yeast powder, propionic acid,

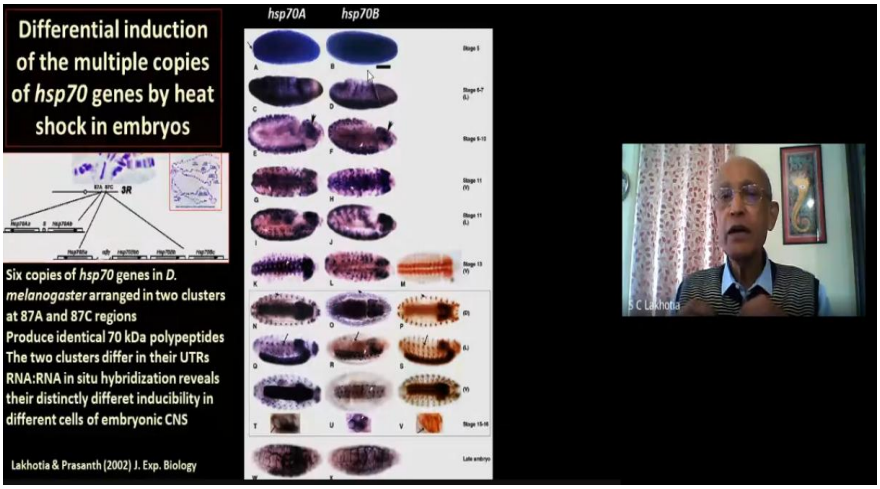
methylparaben and orthophosphoric acid. To maintain the stock (as in NCBS) there are key points to take care of - hygiene of work bench, label fly stock with utmost caution, avoid crosscontamination, always collect virgins for crosses, avoid mite infestation and quarantine new stocks before use. Various phenotypes have been noted and made for various characteristics like eye colour (apricot, sepia etc.), body colour (yellow, ebony etc.), wings (curly, vestigial etc.), larva size (*bicoid* mutant) etc. Maintaining a pure line involves batch setting and synchronization, embryo collection, aligning and microinjection (for transgenes), placing in moist chamber, transfer of injected embryos and screening of the transformants. Apart from this, two populations of flies (larvae and two week long) are maintained in the centre to make sure of availability of young and adults.

On 30th January 2021, the session (Session-XIII) for the skill certificate course on "*Drosophila melanogaster* as a model organism" sessions (**Session-XIII& XIV**) was started with talk on "**Bioassay and Behavioral Assay**" from **Dr. Pankaj K Tyagi, Professor, Department of Biotechnology & Dean Research**, Noida Institute of Engineering and Technology, Greater Noida, Uttar Pradesh, India. He in his talk, highlighted that "The toxicity assays could also be done with the fruit flies to understand how several chemicals (here nanoparticles, NPs) could affect various phenotype or characteristic features of fly or its development. One such study that focused on understanding how gold and silver NPs could affect the fly development was elucidated by using different concentration of <25 nm Ag NPs and <18 nm Au NPs. Various parameters like egg laying capability, hatchability, viability, behavior (climbing, mating), cell death as an estimation of oxidative stress and melanization were assessed for this. In study involving all these parameters, Ag NPs significantly affected all these parameters in negative manner. It was shown that concentration up to 50 mg/ml

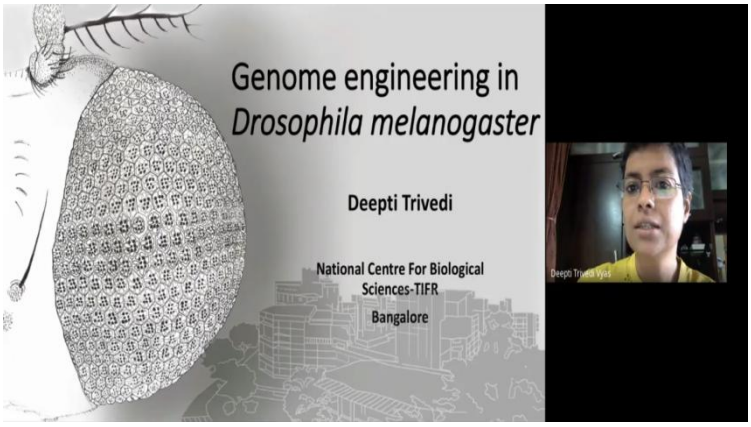


does not affect the activity while concentration between 50 to 100 mg/ml could affect hatchability and viability. Apart from this, the higher concentration of the NPs is toxic to the larva and affects their size. More cell death (as %) and less melanization were also reported in those groups that are negatively affected by NPs.

In a talk (**Session-XV**) on "**Heat shock responses in Drosophila"** delivered by **Prof. Dr. S.C. Lakhotia**, BHU Distinguished Professor and SERB Distinguished Fellow, Cytgenetics Laboratory, Banaras Hindu University, Varanasi, Uttar Pradesh, India. He emphasized that "there is a heat shock element (GATTCNNGAATC) that is responsible for the recognition of transcription for the *Hsp* genes. Once cell undergoes stress by heat shock there is a rapid relocalization of active RNA Pol II from developmentally active gene sites and there is redistribution of chromosome-bound hnRNPs following heat shock. *hsrω* is a heat shock protein that has highly conserved architecture but divergence is also noticed. They are developmentally active and at the same time active upon heat shock as stress-inducible noncoding gene. HSPs like hsp70 can act as molecular chaperones that help to fold or unfold the proteins and its key role is also in folding the naïve protein chain. Accumulation of misfolded proteins can stimulate HSPs and their as well as that of lncRNA's (long non-coding RNA's) presence have been known to have role in tumor development and proteinopathies where they play key role in several signaling pathways that includes apoptosis and lncRNAs plays a key regulatory role. Several neurotoxicity studies have been studied utilizing the HSPs as a tool as is the case with poly-Q inducted one in neurodegenerative disorders like Huntington's disease.

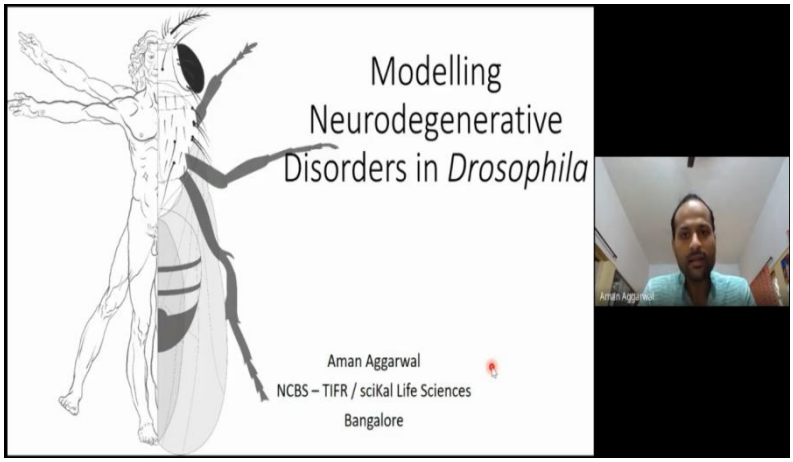


On 31st January 2021, the session (session- XVI) was addressed by **Dr. Deepti Trivedi**, Scientist, National Center for Biological Sciences, GKVK, Bellari Road, Bengaluru on a tilte "Genome engineering in Drosophila. In her talk, she said

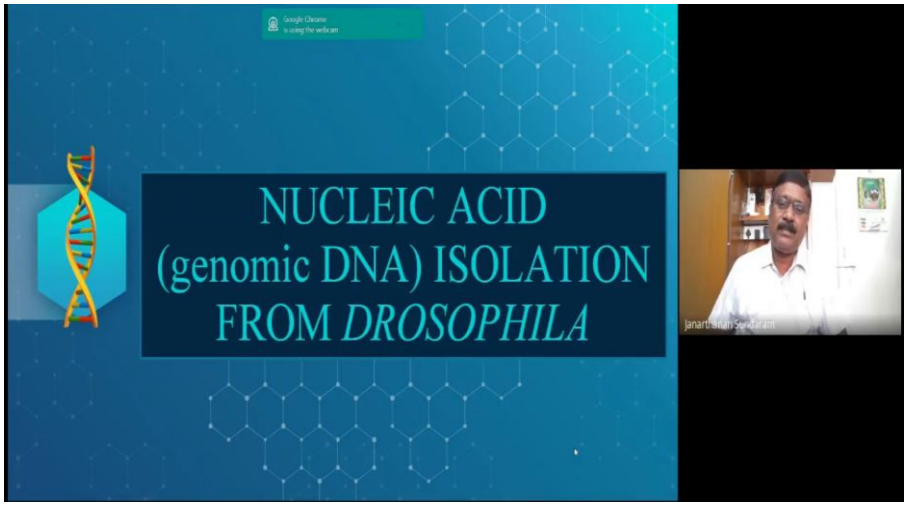


"Using the mutant form of Cas9: CRISPERa for gene activation and CRISPERI for the interference of expression of the gene of interest can be done. Engineered flies have been instrumental in understanding the fundamental principle of biology. Random or specific mutagenesis and advances in CRISPR- CAS9 TECHNOLOGY had made it easier to generate precise editing and help in understanding the biology in better ways.

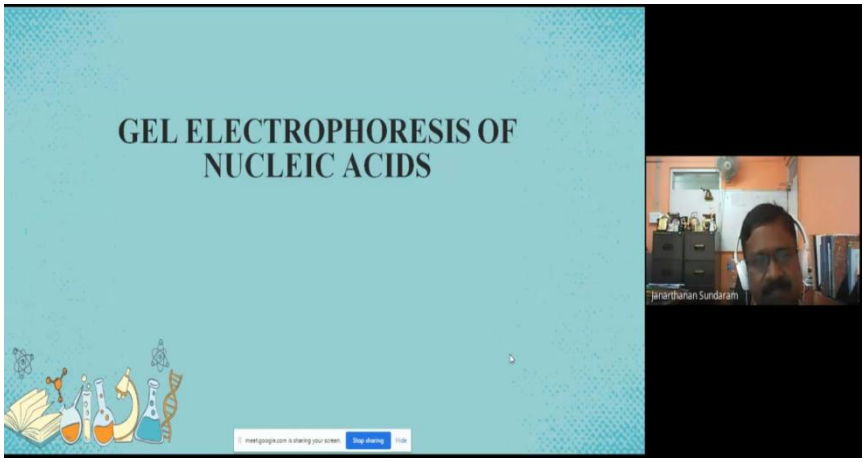
Followed by her talk, **Dr. Aman Aggarwal**, from NCBS- TIFR, Bengaluru delivered a talk on "**Modelling neurodegenerative disorders in flies**" during the XVII session of our skill certificate course on 31.01.2021. He revealed that "a significant one has been the one available for Parkinson's disease. α -synuclein is manifested in Parkinson's disease but normally not present in flies. To understand how it affects the fly, the gene could be injected and the phenotypes studied. Studies show that once injected with this gene the flies show symptoms of Parkinson's disease. In order to understand their mobility nature, we could make use of vertically rotating fly climbing assay where the flies are made to move without any physical assistance by the researchers. The studies involve analysis of various parameters like track duration, distance covered, speed and number of legs used in walking by the hexapods. The heterozygous mutants for *parkin* and *lrrk* show less track duration and speed as well as they won't walk straightly. The mutation in *irk2* which is homologue for



KCNJ10 could cause SeSAME syndrome. Similarly the fluorescence can be used to understand how the different regions are responding to various receptions (e.g. olfactory bulb) and could be used to understand their degeneration also. Use of GCaMP and RCaMP are established to understand the neurodegeneration.

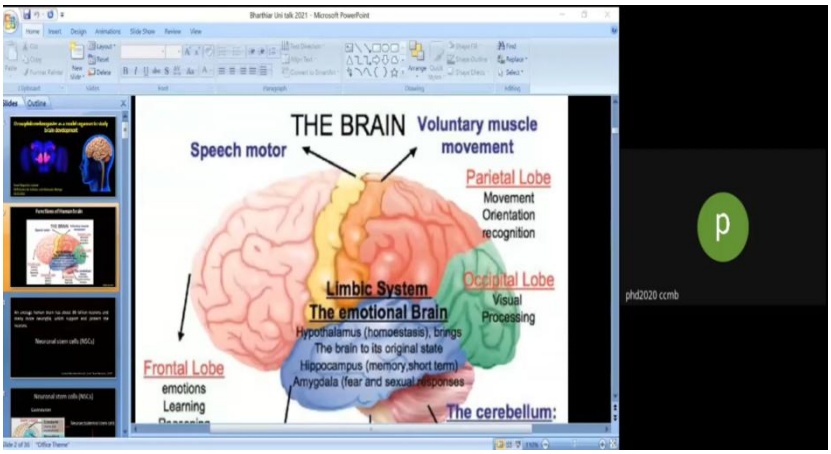


Dr. S. Janarthanan, Professor and Head, Department of Zoology, University of Madras, Chennai delivered a talk on **"Nucleic acid isolation from Drosophila"** in the afternoon session (XVIII) the day. He endorsed that "The DNA extraction methods could be broadly classified as chemical and physical methods. Phenol-chloroform method belongs to organic method while methods like salting out, silica and proteinase K belong to inorganic methods within the chemical process. Magnetic bead and paper DNA extraction methods are examples of physical methods. Whatever method we follow the basic principle involved is to undergo and achieve the following steps: cell membrane/wall lysis, nuclear envelope lysis, protein digestion, DNA precipitation and its dissolution in TE buffer. A diploid cell will give 6 pg of DNA cell and the DNA/µl of the blood is 30-60 ng. Once the DNA has been extracted they should undergo quality and quantity check before going to interpret results from the experiments on these molecules. The common and basic techniques used for this are UV spectrometry, agarose gel electrophoresis and fluorometry. The read of 1.7-2.0 for A260/A280 gives good DNA or RNA sample and could be considered for various experiments. Nowadays innovations are redefining the way we do DNA extraction with the commercially available ready-to-use kits and the purity attained would also vary with the method employed.



On the next day, 01.02.2021, session was scheduled for the afternoon and was handled by **Dr. S. Janarthanan,** Professor and Head, Department of Zoology, University of Madras, Chennai with the title "**Electrophoresis of nucleic acid isolated from Drosophila**". In his talk, he said that "Electrophoresis: Electrophoresis is an electrokinetic process which separates charged particles in a fluid using a field of electrical charge. It is most often used in life sciences to separate protein molecules or DNA and can be achieved through several different procedures depending on the type and size of the molecules. Classification of Electrophoresis: Vertical gel electrophoresis Horizontal gel electrophoresis. Difference between Vertical gel electrophoresis and Horizontal gel electrophoresis: One of the key differences between the two systems is their orientation. In horizontal gel electrophoresis, the gel matrix is cast horizontally and submerged in a continuous running buffer while in vertical gel electrophoresis, the gel is vertically oriented and the buffer system is discontinuous. Example of Vertical gel electrophoresis is PAGE (Polyacrylamide gel electrophoresis) AND that of agarose has been an example for Horizontal gel electrophoresis. Agarose gel Electrophoresis: Agarose gel electrophoresis is a method of gel electrophoresis used in biochemistry, molecular biology, genetics, and clinical chemistry to separate a mixed population of macromolecules such as DNA or proteins in a matrix of agarose, one of the two main components of agar. Principle of Agarose gel Electrophoresis: The negatively charged DNA molecules migrate towards the positive charge under the influence of constant current, thus the separation depends on the mass and charge of DNA. The DNA molecules are forced to move through the agarose gel pores.

On the final day of our course, **Dr. Sonal Nagarkar Jaiswal**, Senior Scientist, Centre for Cell and Molecular Biology, Hyderabad delivered a talk on "**Drosophila brain as a model system**". She listed the following in her talk,



"Comparison between Drosophila melanogaster and the Human brain: *Drosophila melanogaster* has been utilized to model human brain diseases. *Drosophila melanogaster* offers several advantages for investigation of molecular and cellular mechanisms underlying human disease. Short life span, a large number of offspring, many genetic techniques, a well known anatomical situation and a wide variety of mutants are convenient characteristics of *Drosophila melanogaster* as a model organism. Explained the Human Brain parts and their importance: Each hemisphere has four sections, called lobes: frontal, parietal, temporal and occipital. Each lobe controls specific functions. For example, the frontal lobe controls personality, decision-making and reasoning, while the temporal lobe controls memory, speech, and sense of smell.

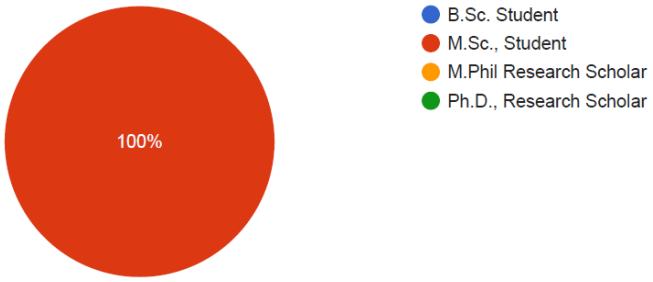
The valedictory function of the skill certificate course on "Drosophila as a model organism" was scheduled on 3rd February 2021. The welcome address was delivered by **Dr. R. Sivasamy,** Assistant Professor and Head i/c, Department of Human Genetics and Molecular Biology, Bharathiar University, Coimbatore followed by the valedictory address by **Dr. K. Murugan,** Registrar i/c, Bharathiar University, Coimbatore.

Dr. T. Parimezhagan, Professor and Deputy Coordinator, RUSA.2.0, Bharathiar University, Coimbatore felicitated the valedictory function.

The students have been invited to convey their feedback about the program followed by Course report and vote of thanks was proposed by **Dr. P. Vinayaga Moorthi**, Principal Investigator, SDC-RUSA BEICH, Bharathiar University, Coimbatore. The Principal Investigator thanked all authorities, faculties and office staffs of Bharathiar University, RUSA and Department of Human Genetics and Molecular Biology and with this the course came to conclusion.

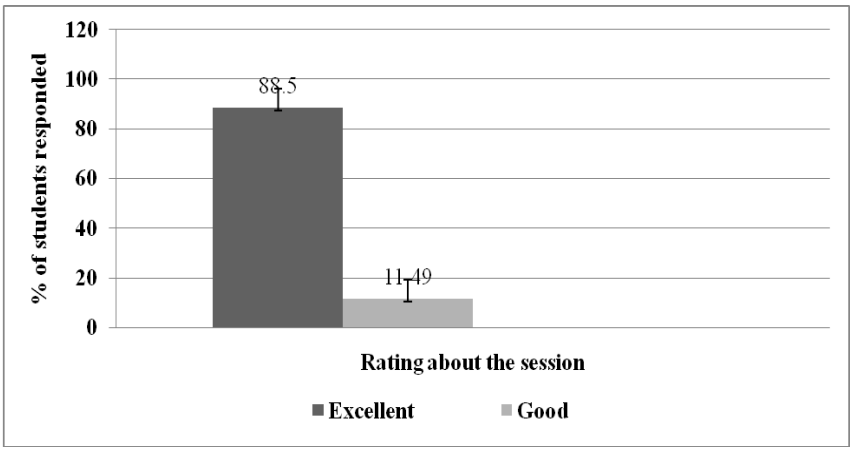
Feedback Report:

The skill certificiate course on "Drosophila melanogaster as a model organism" was conducted during 24th January 2021 to 2nd February 2021 as a 30 hours program with 20 sessions. Each session was handled by experts in this field from various colleges (Thiagarajar Colle Madurai, Vivekananda College, Madurai, Sri Vasavi College, Erode, Sri AVVM Pushpam College, Thanjavur, universities (University of Madras, Chennai, Banaras Hindu University, Varanasi) and central insitutes (CSIR-Indian Institute of Toxicology, Lucknow, Birla Institute of Technology and Science, Rajasthan, National Centre for Biological Science, Bengaluru, Tata Institute of fundamental Research (TIFR), Bengaluru, Centre for Cellular and Molecular Biology, Hyderabad).



A total of 51 students registered for the course and all are PG students stuyding M.Sc., Human Genetics and Molecular Biology and M.Sc., Biochemistry, Bharahiar University, Coimbatore. Out of 51 students registered, 39 students have successfully completed the course.

A set of questions have been asked (pre-test) along with registration form and is based on the three criteria (i) Basic (ii) Moderate and (iii) Advanced. Their performance were evaluated with questions in these categories at the end of the each session. Based on their answering ability, they have been grouped into answered correctly and not answered correctly. Based on this evaluation the following

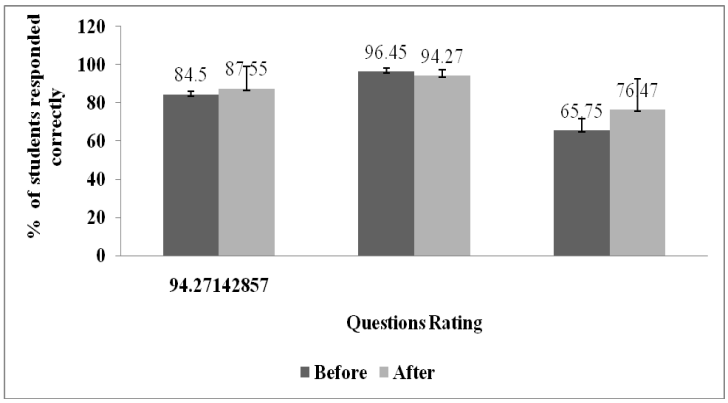


observation have been made and are, Out of the 39, most of the students said, the sessions were "Excellent" (88.5±7.8%) while 11.49±7.8 students expressed it as "Good".

Similarly, the response of students to the different types of questions such as (i) Basic (ii) Moderate and (iii) Advanced are as follows,

For the basic type of questions, the performance of students before the course was around 84.5±1.5% while it was 87.55±11.48% after the course.

For the moderate type questions in the course content, 96.45±1.75% of the students answered correctly, while even after the huge input through the lectures by the scientists and faculties from reputed institutes, the students' performance on moderate questions were 94.27±2.88%.



An interesting part of the course is the materials with advanced information delivered by the speakers were well recognized by the students and their performance before the course was 65.75±6.15% while after the course was 76.47±15.89%. This analysis reveals the understanding of the students with respect to the different aspects of the course content. Compared to their awareness about the course content such as *Drosophila melanogaster* rearing, its development, different instars, developmental stages, genetic architect of the Drosophila, molecular control of different organ development, diet, identification of flies, implementation of advanced techniques in transgenic flies development, creating flies with different disease model etc before has drastically improved after the course and this course provided platform for learning and it improved the students basic understanding and molecular architect of the *Drosophila melanogaster*.