



DEPARTMENT OF BOTANY UNIVERSITY OF CALICUT

Erudite Scholar in Residence Program

Online Workshop on Transcriptomics and Metabolomics for Discovery Science in Plant Biology May 16-20, 2022

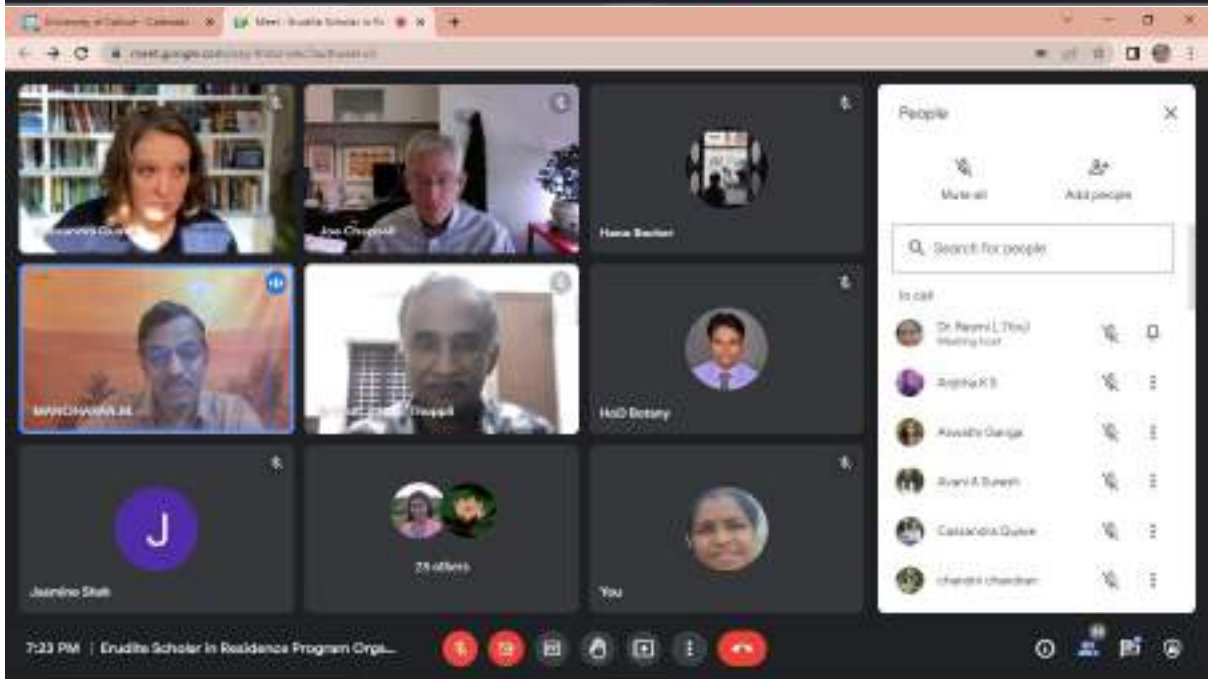
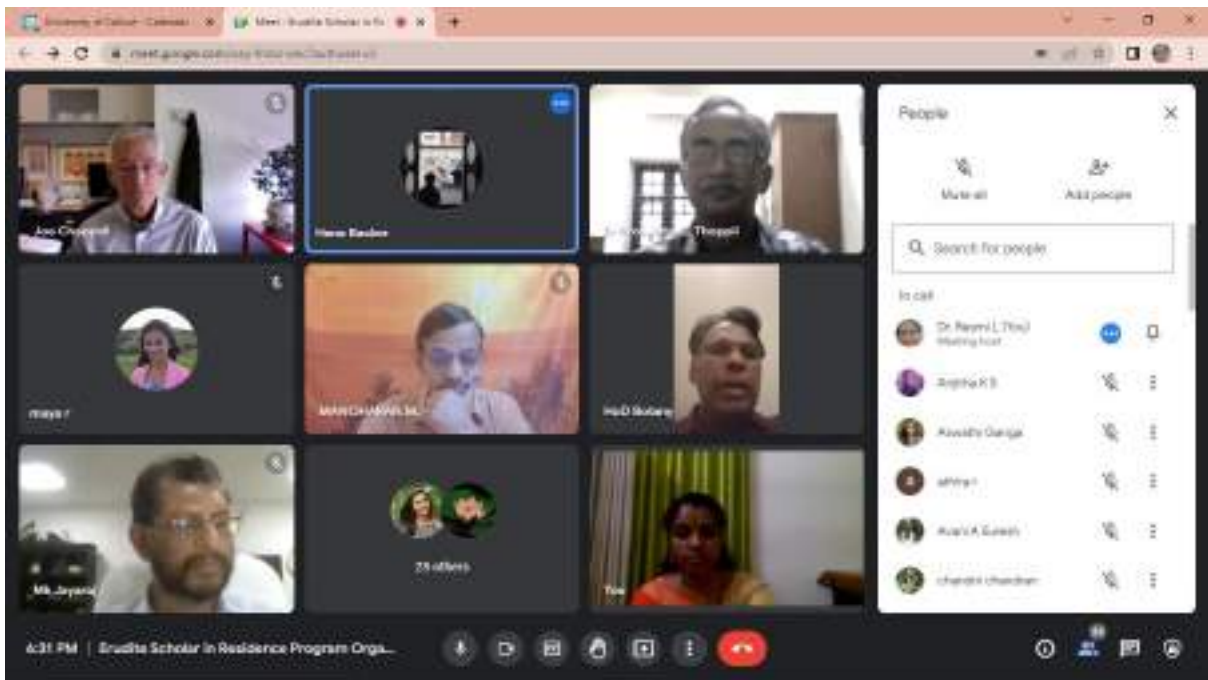
REPORT

Department of Botany, University of Calicut conducted a five-day online workshop on 'Transcriptomics and Metabolomics for discovery Science in Plant Biology' under the Erudite Scholar in Residence Program funded by Kerala State Higher Education Council from 16 May 2022 to 20 May 2022. Professor Joe Chappell, Chair, Pharmaceutical Sciences, Kentucky University, and Dr. Cassandra Quave, Associate professor of Dermatology and Human Health, Emory University, Atlanta were the Erudite Scholars. A total of 30 participants from different Universities and other academic institutions participated in the program.

The program started on 16 May 2022 on the Google meet platform (<https://meet.google.com/oay-fmbz-wkc>) with the Inaugural session. The inaugural session started with the welcome address by Dr. Jos T. Puthur, Professor and Head, the Department of Botany, University of Calicut, which was followed by the Inaugural address made by Prof. Dr. M. K. Jayaraj, Honourable Vice Chancellor, University of Calicut. Following the inaugural address Professor Joe Chappell made an introduction about the workshop. Prof. M. Manoharan, member, Syndicate, University of Calicut and Dr. John E. Thoppil, Senior Professor, Department of Botany, University of Calicut offered felicitations during the inaugural event. Vote of thanks was proposed by Dr. Resmi L., Co-ordinator of the program.

The official inaugural event was followed by the keynote address made by Dr. Cassandra Quave Department of Dermatology, Emory School of Medicine; Center for the Study of Human Health, Emory College of Arts and Sciences, Emory University on the topic 'Medical Ethnobotany and Anti-Infective Drug Discovery'.

Following the keynote address, Prof Joe interacted with the participants and had given an overview of the transcriptomic tools and assigned them a short homework exercise which included mapping and aligning sequences, then validating contigs and isoforms.



EMORY UNIVERSITY

Clrodane Diterpene Resensitizes MRSA to β -Lactams

A: [Chromatogram] B: [Chromatogram] C: [Chromatogram] D: [Chromatogram] E: [Chromatogram] F: [Chromatogram]

Phylogenetic tree showing MRSA strains categorized by Synergy, Non-synergistic, and Antagonistic.

Collaboration with Dr. Christian Melander (Noire Dame)

Delgado et al. (2020). ACS Infectious Diseases 5, 1842-1853

8:15 PM | Erudite Scholar in Residence Program Org...

Challenge of Synergy

Sometimes, isolation of compounds causes loss of activity

Methods to assess synergy:

- Reconstitute parts of the fractions and test
- Synthesize compounds identified in extract and test combinations
- Pair mass spectrometry and bioactivity data for PCA analysis of features

FDA Botanical Drug Pathway offers options for development of synergistic compositions

Frezza et al. (2017). Food & Bioprocess Technology

Collaboration with Dr. Emily Wehert (Penn State)

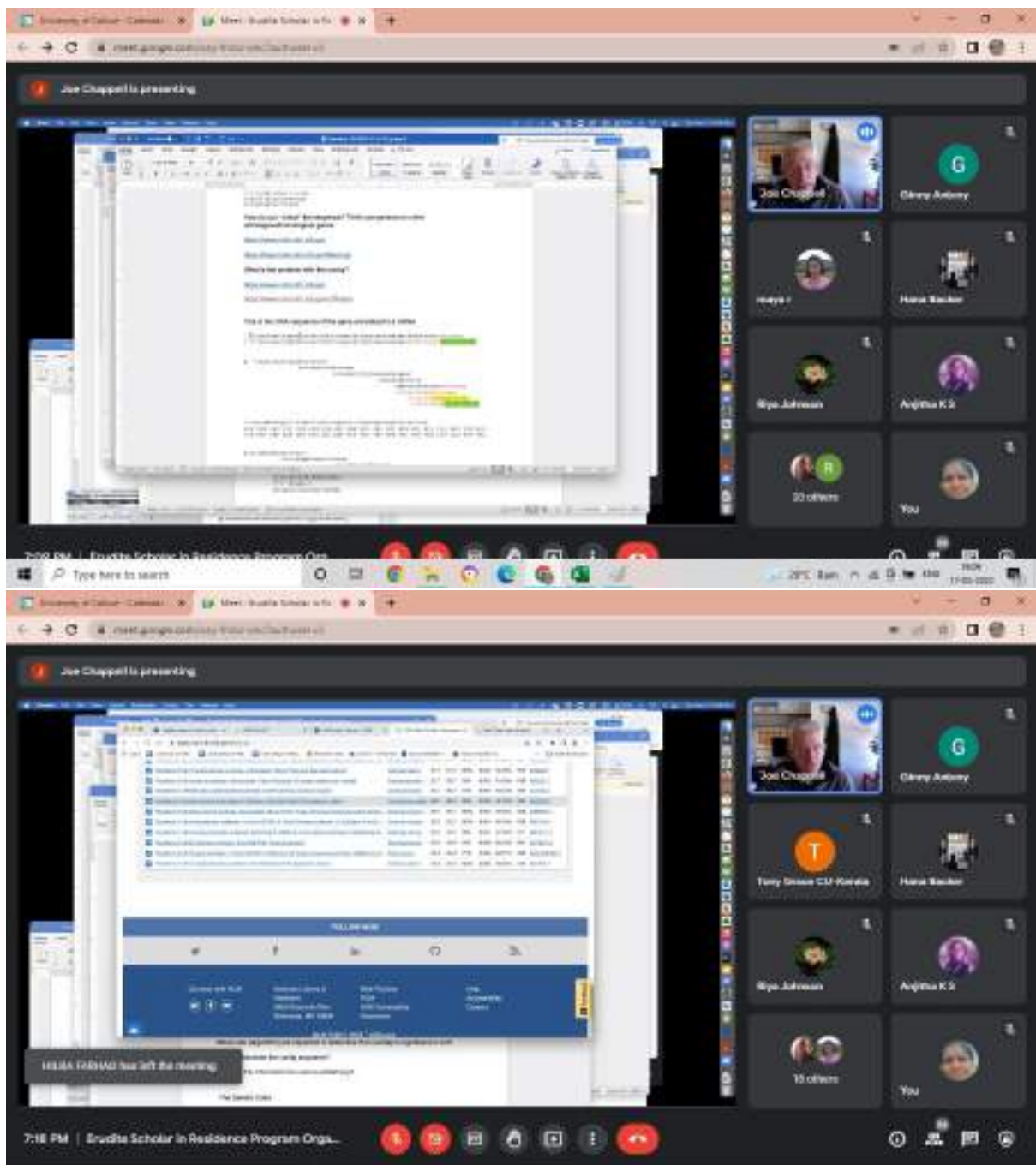
8:20 PM | Erudite Scholar in Residence Program Org...

A WhatsApp group has been created for giving instructions and making effective communications among the participants. The participants were divided into four working groups for peer interactions and team project works and assignments. Individual WhatsApp groups were created for each group for better communications and interactions among the team members to ease the team project works. Team members were encouraged to meet online to discuss about the homework assignments and to share their expertise to make the peer interactions effectively.

DAY 2

The Day 2 activities included the assessment of the Day 1 exercises performed by the four teams by way of presenting their results and followed by the talk on **Understanding and using transcriptomics** by Prof. Joe Chappell with special emphasis on using transcriptomics to uncover the cardenolide biosynthetic pathway and build hypotheses. The Day 2 assignment was profiling key transcript levels for cardenolide biosynthesis in various tissue samples of *Digitalis* and drawing inferences about cardenolide accumulation. The participants were shared with excel spreadsheet containing *Digitalis* transcriptome data.

The image displays two screenshots from a Zoom meeting. The top screenshot shows a slide titled "Pigment biosynthetic pathway to be used for your workshop objective". The slide contains a complex chemical pathway diagram with various chemical structures and arrows indicating the flow of the biosynthetic process. The bottom screenshot shows a document titled "The transcriptome" being presented. The document text is partially visible, including sections for "Methods", "Results", and "Discussion". On the right side of the meeting interface, a "People" list is visible, showing the names of participants: Murali, Add people, Anura Inhat, Anura Mittal, Anura Gupta, Anura Johnson, Anura G. Rao, Anura Ph., Tony Brock CU-Boulder, and Anura. The meeting interface also shows the name "Joe Chappell is presenting" and a time of 4:31 PM.



DAY 3

Day 3 activities started with reviewing the previous day's homework assignments and exercises on profiling key transcript levels for cardenolide biosynthesis in various tissue samples of *Digitalis* and drawing inferences about cardenolide accumulation which was followed by the talk by Prof Joe on **Understanding and using metabolomics** portals with special emphasis on using metabolomics to investigate your hypotheses about the differential accumulation of cardenolides in select plant tissues. Day 3 homework assignment was on profiling key metabolite levels for cardenolide biosynthesis in various tissue samples of *Digitalis* and drawing inferences about cardenolide accumulation in combination with transcript profiling.

Joe Chappell is presenting

Steps to transcriptomic profiling

1. Obtain (download) map for the metabolite process you are interested in investigating
2. Select 1 or more enzymes for profiling. Must have a substrate for your choice
3. Obtain (locate, add) or protein sequence information for the enzyme of interest from public databases (i.e. NCBI, UniProt)
4. Blast your sequence against the transcriptomic database for the plant of interest (i.e. Digital)
5. Select samples based on some selection criteria (e.g. total protein is small, average across genes of interest is good)
6. Determine expression level of targets in various tissue samples using matrix expression table (P W21 table)

Joe Chappell

People

Mute all Add people

- MARK MACKAY
- HILMA PERHAD
- JAYASREE S
- Jayant S
- JISHA S
- Joe Chappell
- Joe Chappell (Presenting)

6:53 PM | Grudita Scholer in Residence Program Orga...

Joe Chappell is presenting

Joe Chappell

People

Mute all Add people

- MARK MACKAY
- HILMA PERHAD
- JAYASREE S
- Jayant S
- JISHA S
- Joe Chappell
- Joe Chappell (Presenting)

6:56 PM | Grudita Scholer in Residence Program Orga...

7:18 PM | Joe Chappell is presenting

10/16/2022

The velocity for acquisition of the mitochondria and cells is dependent upon the mitochondria and cells to... (text continues)

16 others

People

Mute all Add people

- Amber...
- Lupita P
- Yves F
- Rebecca Gopal
- Ryle Johnson
- Tony Grace CO-Resid...
- ...

7:22 PM | Enrida Scholer in Residence Program Orga...

Mitochondrial Membrane Flow

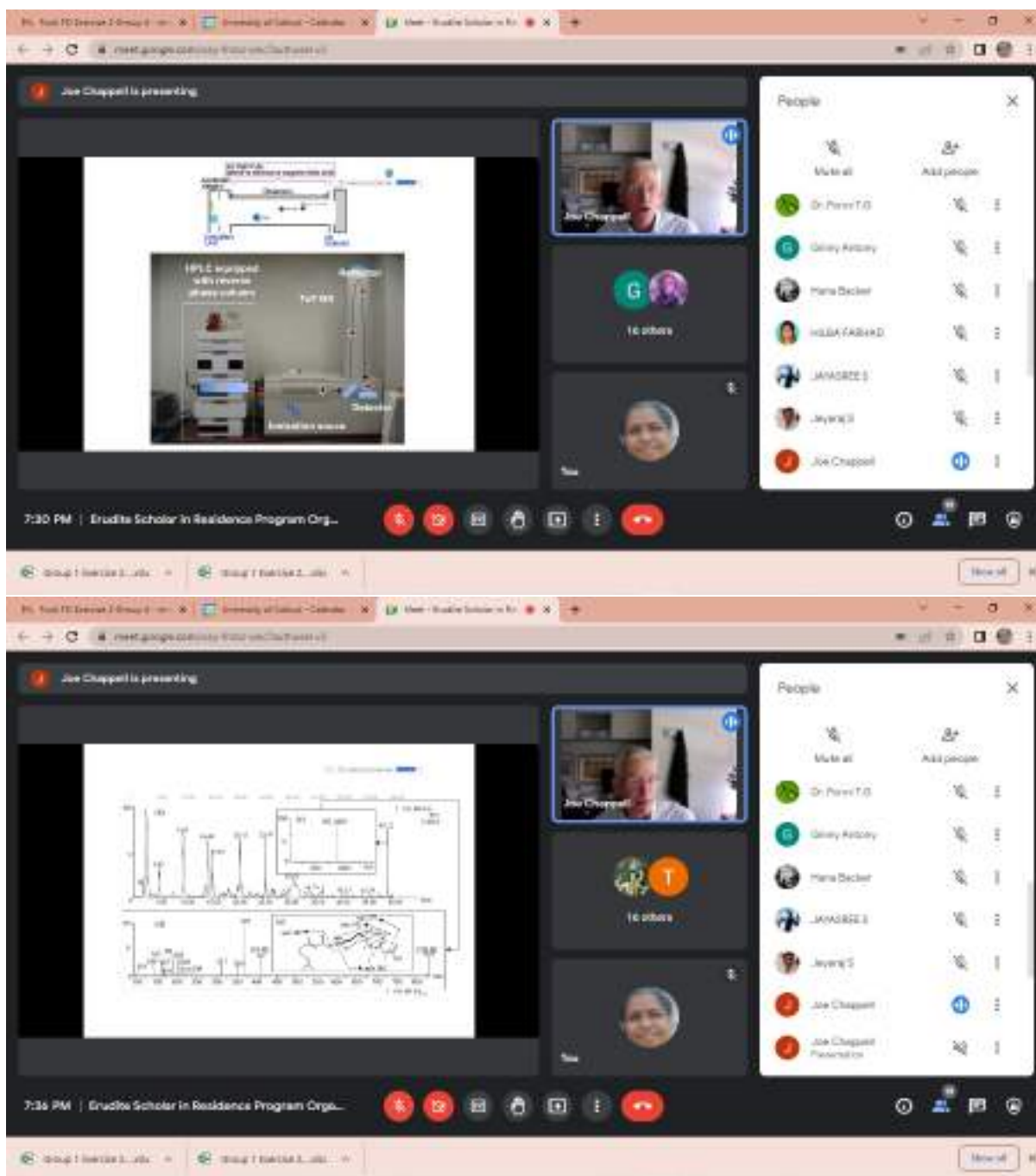
Graphs showing membrane flow over time and space. Text describes the process of mitochondrial membrane flow and its relationship to mitochondrial dynamics.

16 others

People

Mute all Add people

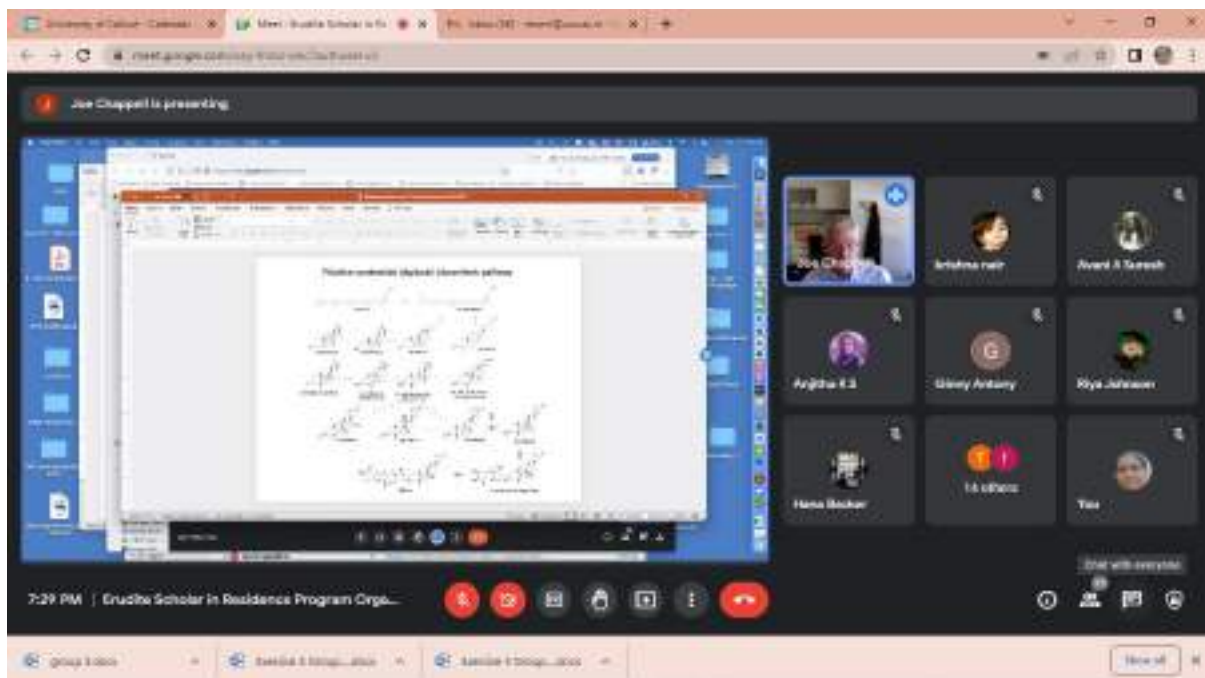
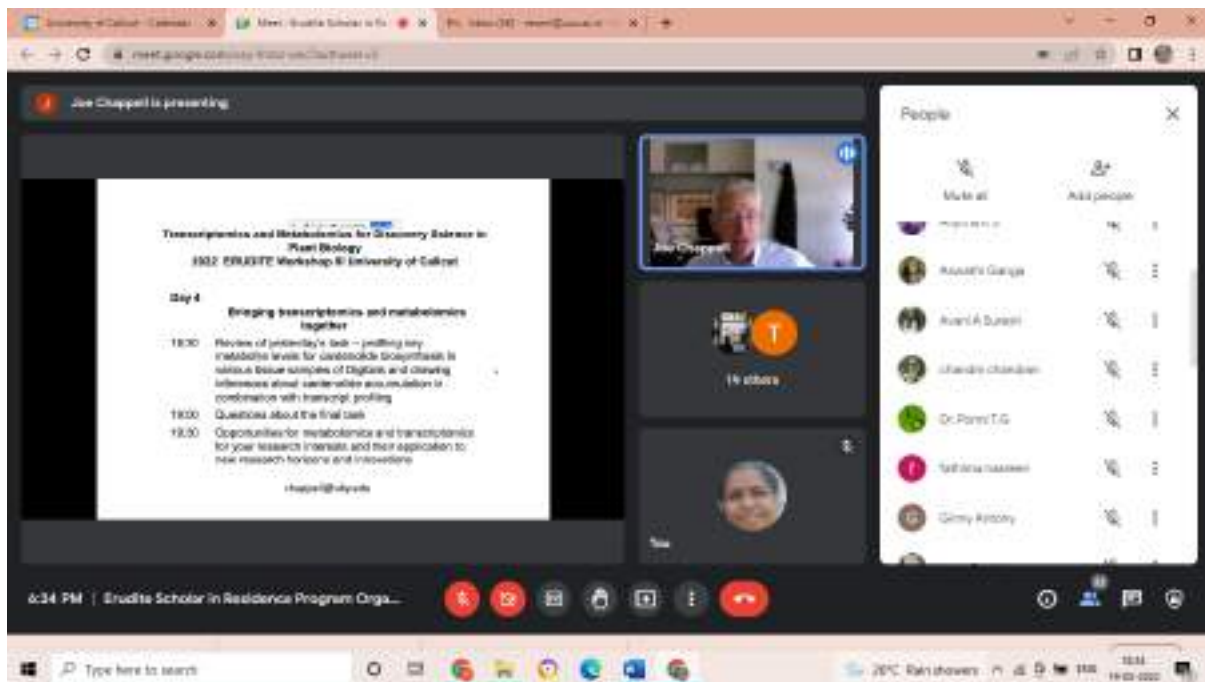
- Dr. Peter T.O
- Grady Anthony
- Maria Decker
- JAYASREE S
- Jayung S
- JUNA S
- Joe Chappell

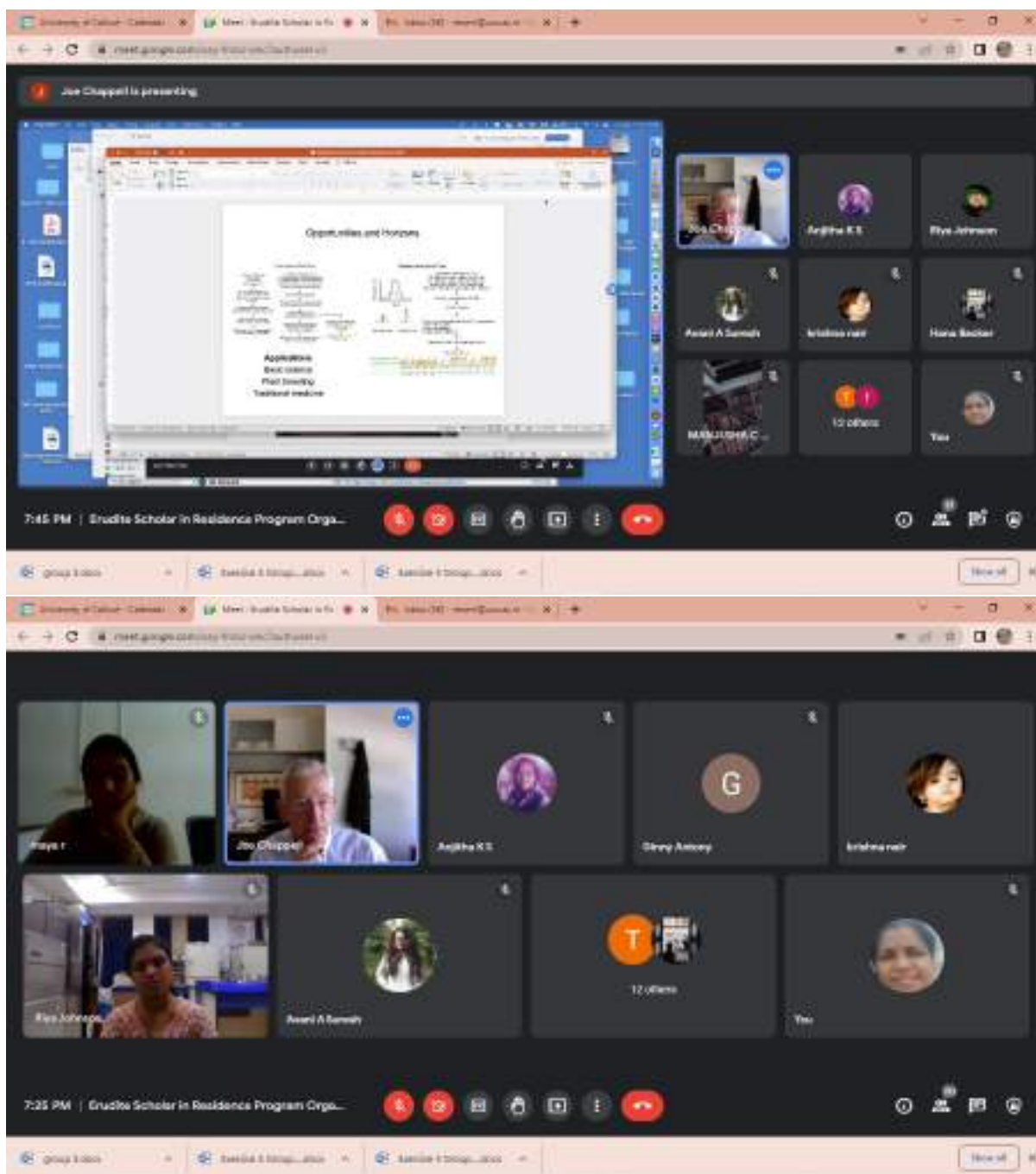


DAY 4

Day 4 activities started with the review of the previous day's task on profiling key metabolite levels for cardenolide biosynthesis in various tissue samples of *Digitalis* and drawing inferences about cardenolide accumulation in combination with transcript profiling. Each team presented their results and Prof Joe appreciated them for their interest and enthusiasm in performing the tasks he assigned. A discussion was made after that on the final project presentations and participants were asked to make questions if any they have on the final task. An active discussion was held between the resource person and participants to framework the final project presentations. This was followed by a highly enthusiastic talk by Prof Joe on the

opportunities for metabolomics and transcriptomics for the research interests and their application to new research horizons and innovations. He exemplified the context by stating the opportunity grabbed by one of his own students recently. The participants were highly excited to hear about the golden opportunities for transcriptomic and metabolomic research. Many of them expressed their special thanks to the resource person for such an eye-opening session.

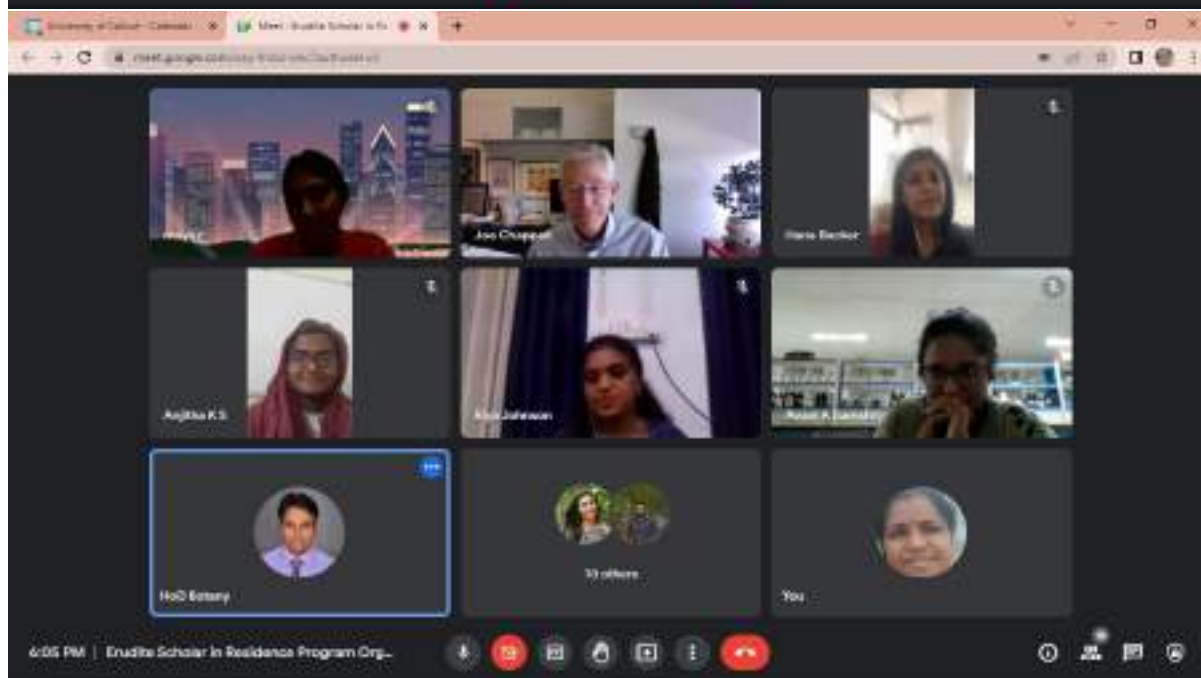
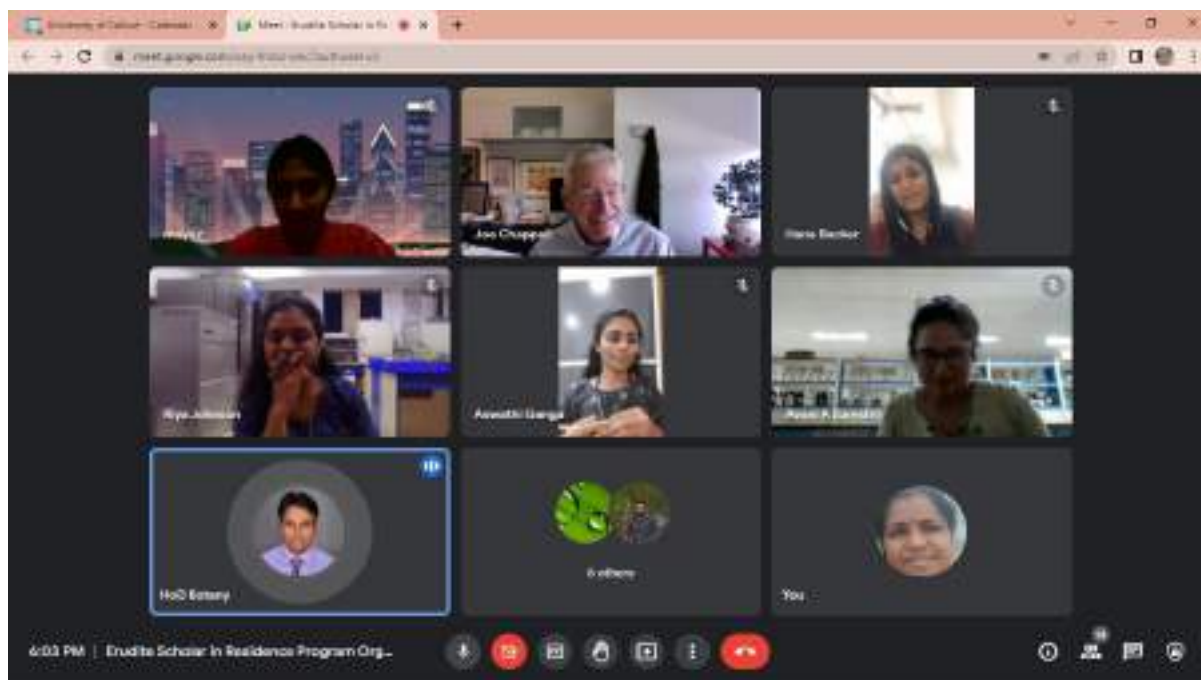


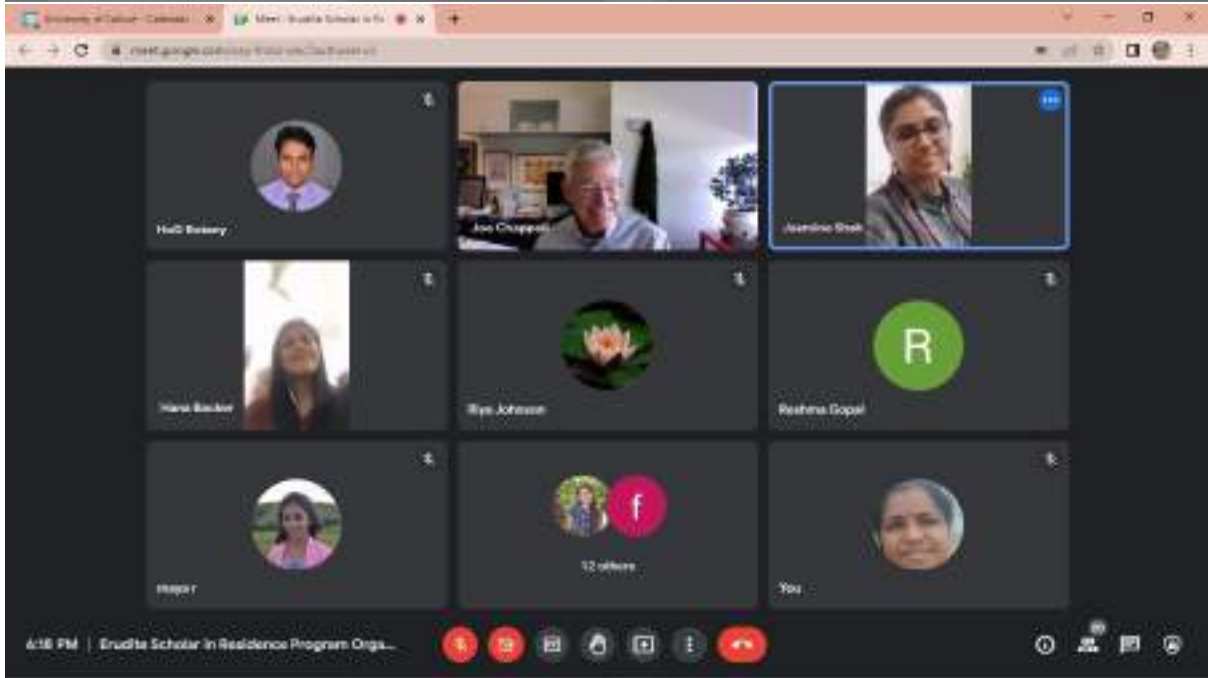
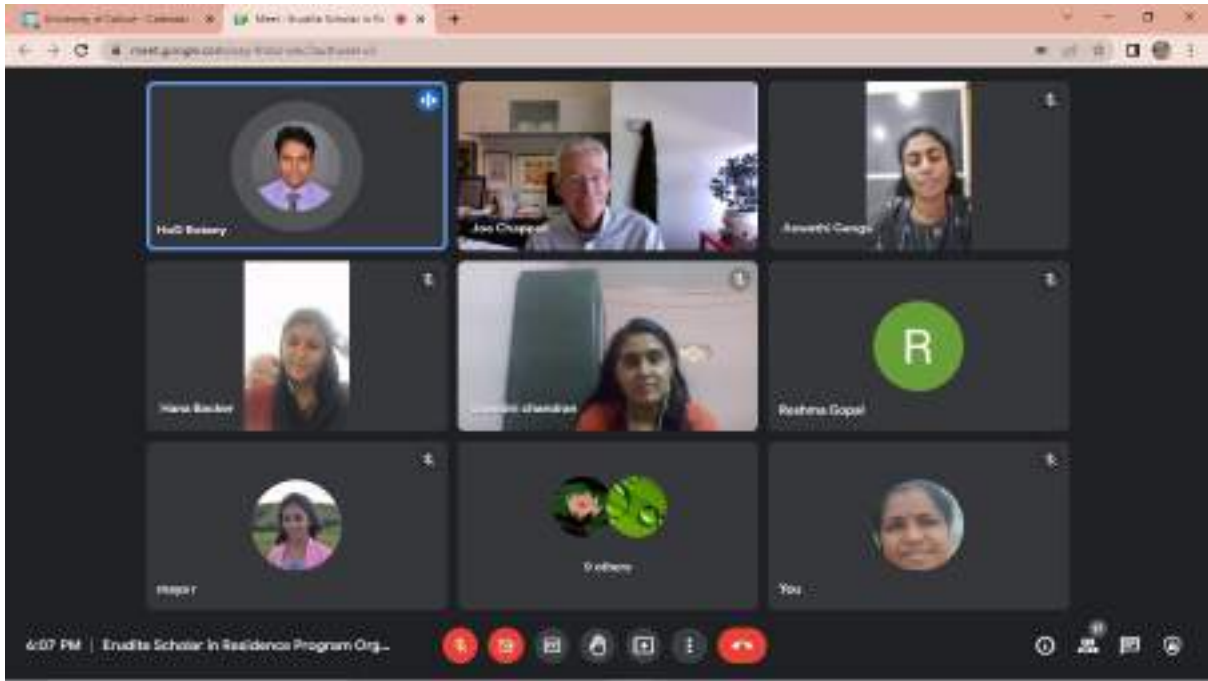


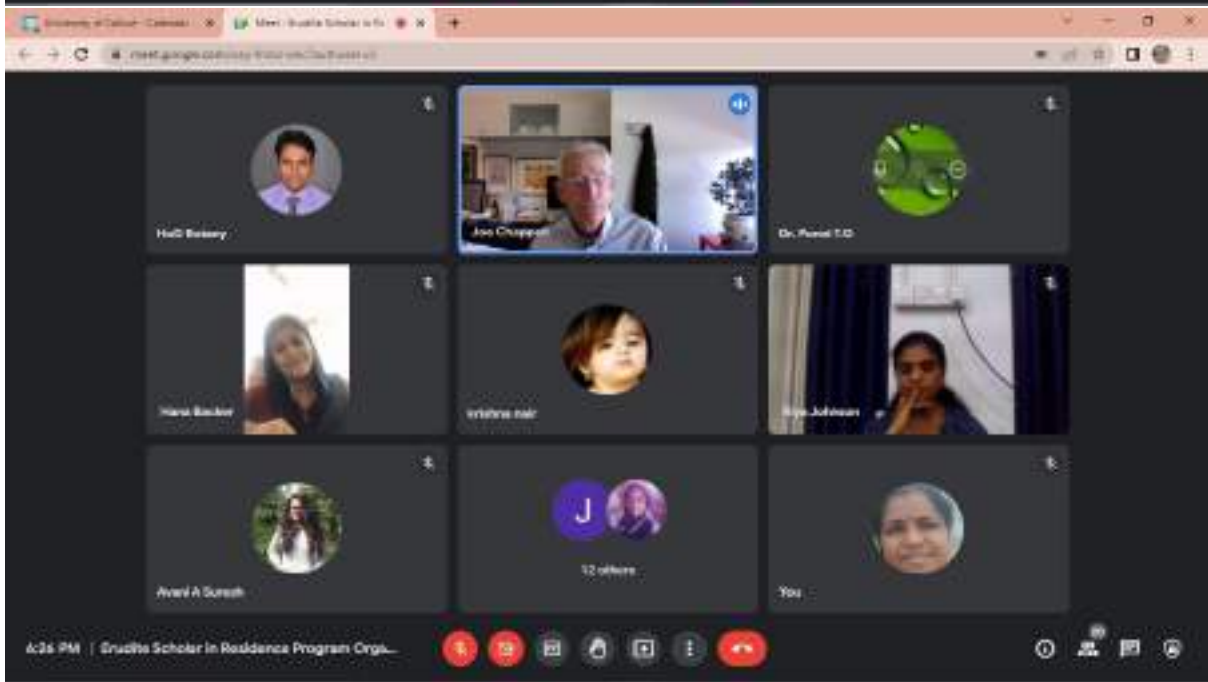
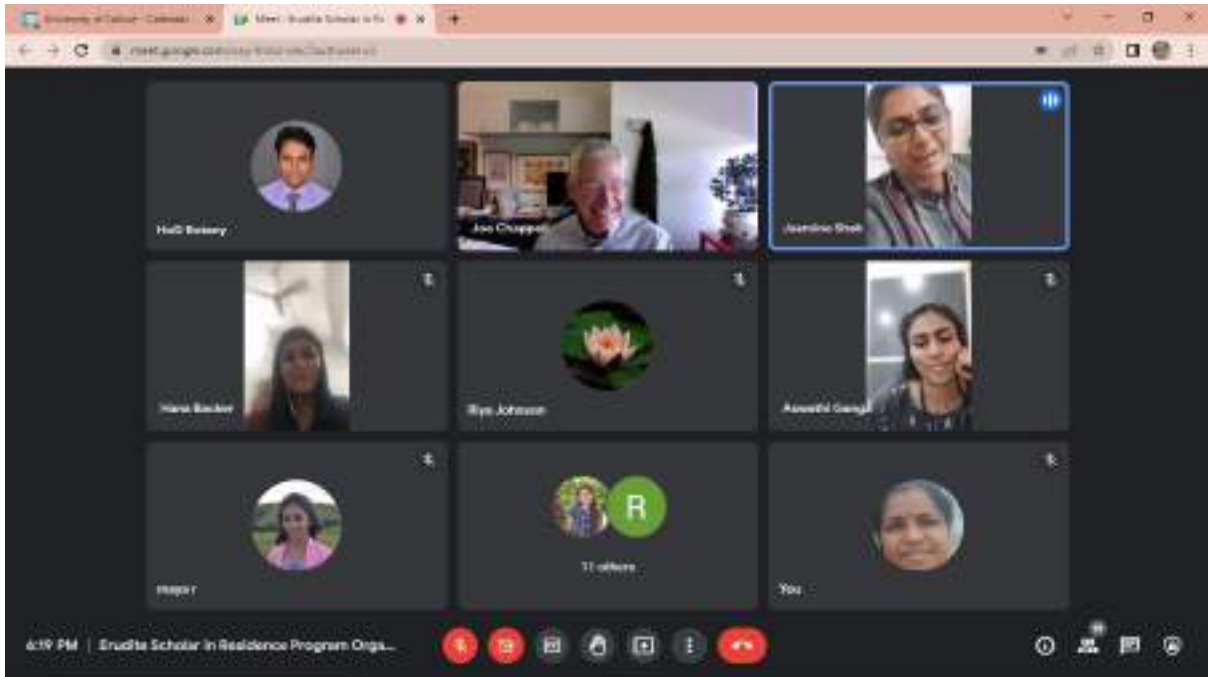
DAY 5

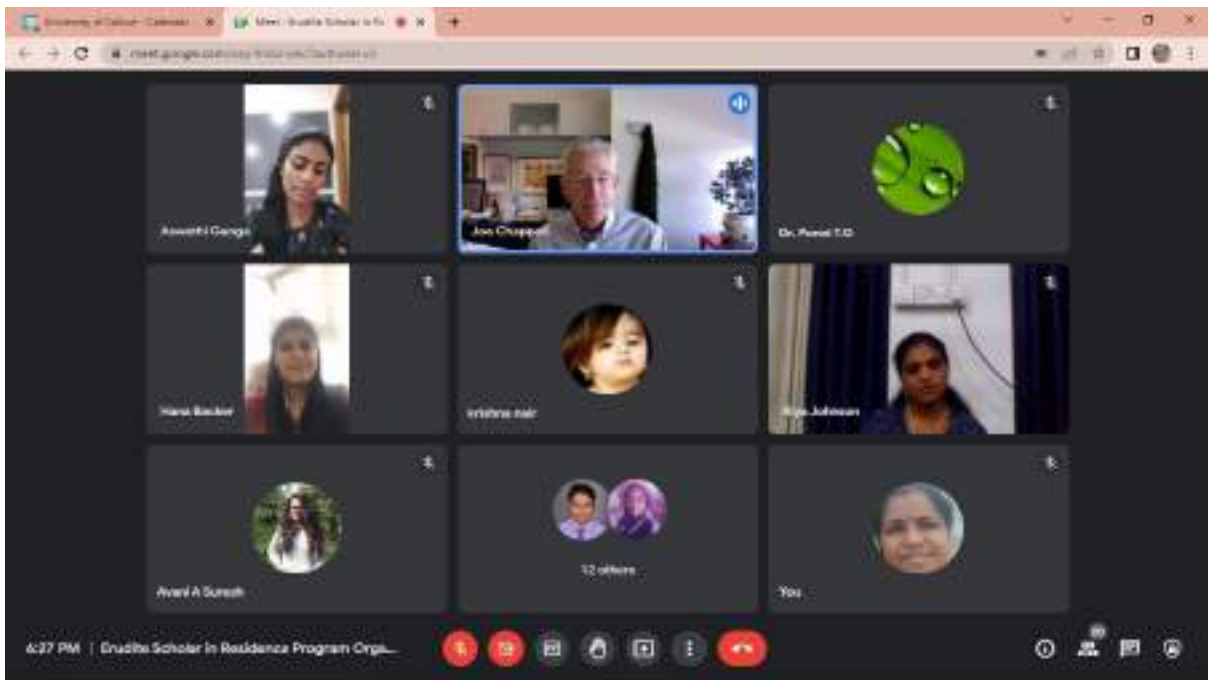
The Day 5 was marked with a valedictory session and final project presentations by each team. Each team presented their final task very well and Prof Joe appreciated each and every participant for their efforts in completing the assignments. The Valedictory session was supposed to be attended by Pro Vice Chancellor of the University of Calicut, Prof M. Nasser and Dr. V. Shefeeque, Research Officer, Kerala State Higher Education Council. Unfortunately, both of them were unable to join at the time of the valedictory session. Prof. Jos T. Puthur, Head of the Department of Botany joined and shared his happiness and joy in the good execution of the program. Prof Joe Chappell made concluding remarks and the participants shared their experiences in the subsequent feedback session. Participants were overjoyed to get an opportunity to interact with an eminent and one of the pioneer scientists with all facets

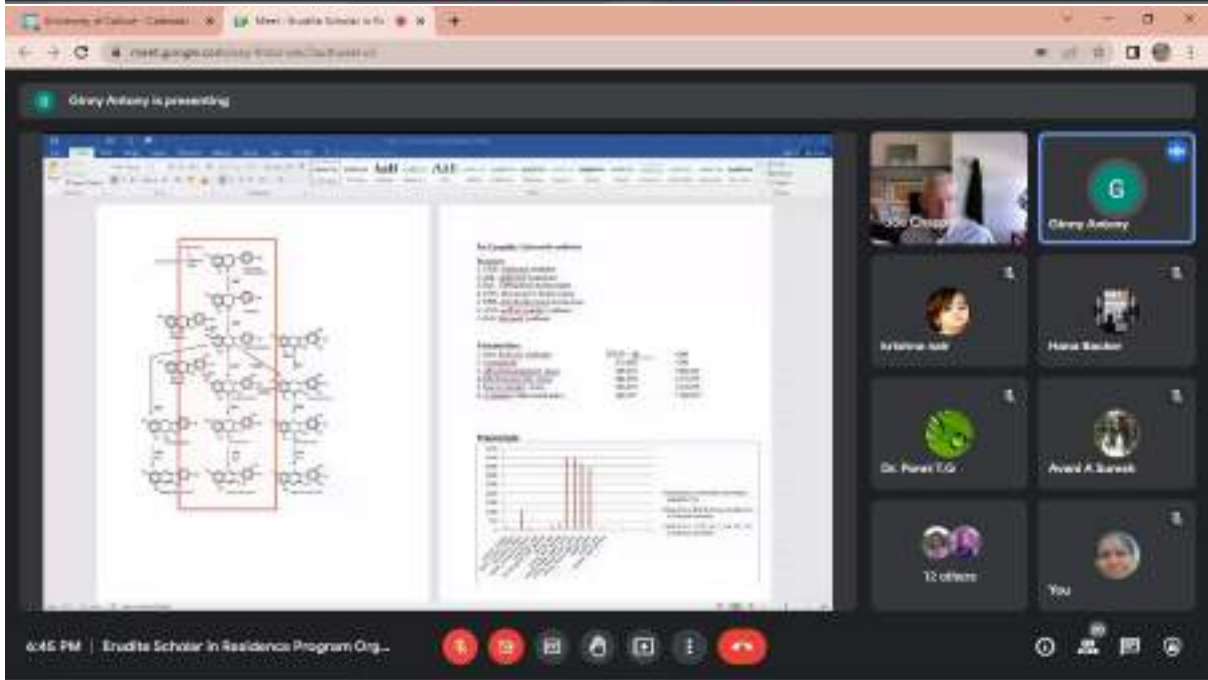
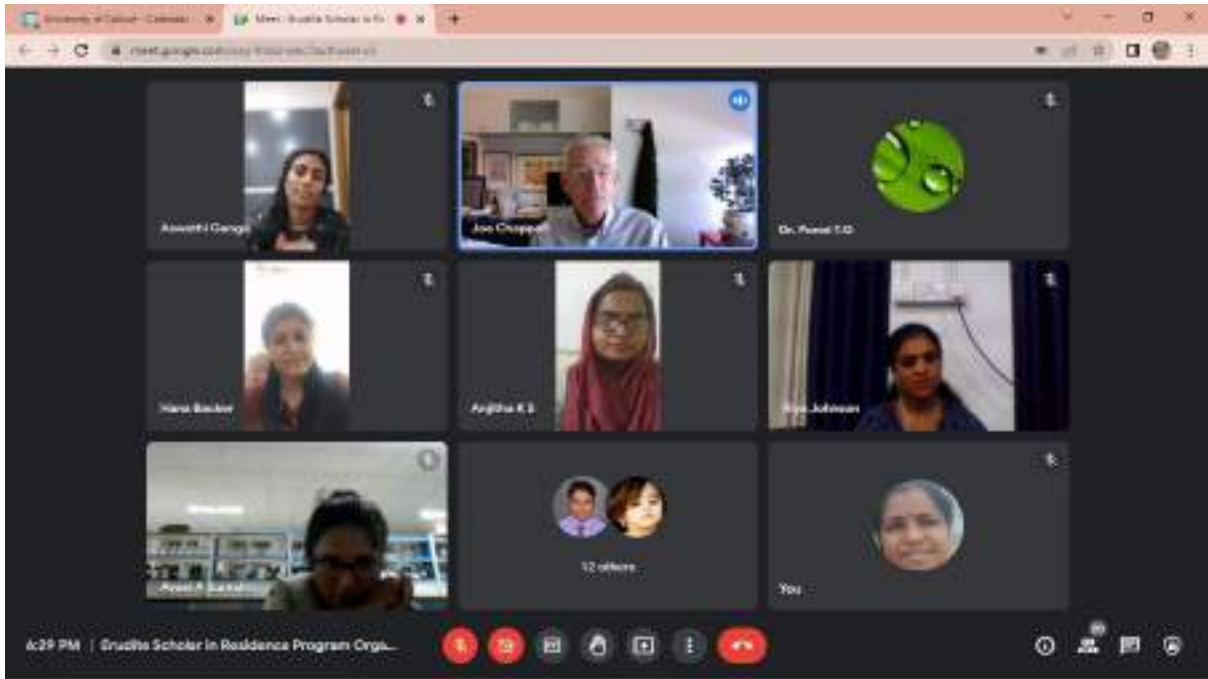
of isoprenoid metabolism. The participants have well learned the art of teamwork as they were able to arrange their own online meetings to discuss the final presentations and many of the beginners were extremely happy to get a newly added momentum for their future research careers. An official vote of thanks was proposed by Dr. Resmi L, the coordinator of the program. An online feedback form was circulated among the participants to obtain their feedback on the program. The certificates of participation were sent by speed post to the participants of other Universities and Institutions.











Erudite Scholar in Residence Program Org...

Meet - Erudite Scholar in Residence Program Org...

Erudite Scholar in Residence Program Org... is presenting

6:57 PM | Erudite Scholar in Residence Program Org...

Erudite Scholar in Residence Program Org...

Meet - Erudite Scholar in Residence Program Org...

Erudite Scholar in Residence Program Org... is presenting

Metabolomics

Key metabolites

- Mannoside
- Glucoside

Biopics

1. Mannoside
2. Mannoside
3. Mannoside
4. Mannoside
5. Mannoside
6. Mannoside
7. Mannoside
8. Mannoside
9. Mannoside
10. Mannoside

PMR Plant/Cellular and Microbial Systems Research

7:04 PM | Erudite Scholar in Residence Program Org...

People

Mute all Add people

- Joe Chappell
- Erudite Scholar
- Erudite Scholar
- Hans Becker
- Dr. Parag E.G.
- Anand K. Suresh
- 13 others
- You
- Time Chappell

Zoom Meeting: You are viewing the screen of **Arifina Nurli** presenting.

Naringenin

The slide displays several data visualizations related to Naringenin. The top chart is a bar chart with multiple bars of varying heights, some highlighted in yellow. Below it are three smaller charts: a line graph on the left, and two bar charts on the right, each with a legend and descriptive text in Indonesian.

7:02 PM - Enyita Subyanti, Pendidikan Ekonomi, On...

Zoom Meeting: You are viewing the screen of **Arifina Nurli** presenting.

Data analysis

The slide displays a data analysis. At the top is a table with multiple columns and rows of data. Below the table is a bar chart with several bars of varying heights, some highlighted in red and yellow. To the right of the bar chart is a legend and descriptive text in Indonesian.

7:04 PM - Enyita Subyanti, Pendidikan Ekonomi, On...

University of Calicut - Calicut x Meet - Virtual Session in fu x

meet.google.com/.../.../.../...

Virtual Session in fu presenting

Pelargonidin

7:00 PM - Faculty Session in fu - Virtual Session in fu

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2023-09-20 19:00

University of Calicut - Calicut x Meet - Virtual Session in fu x

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Virtual Session in fu presenting

Inference

7:01 PM - Faculty Session in fu - Virtual Session in fu

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2023-09-20 19:00

Virtual Session in fu

Virtual Session in fu

Dr. Parvath E.G.

Arvind A. Suresh

1828A FARIHAD Ghouse (University of Calicut) joined

Virtual Session in fu

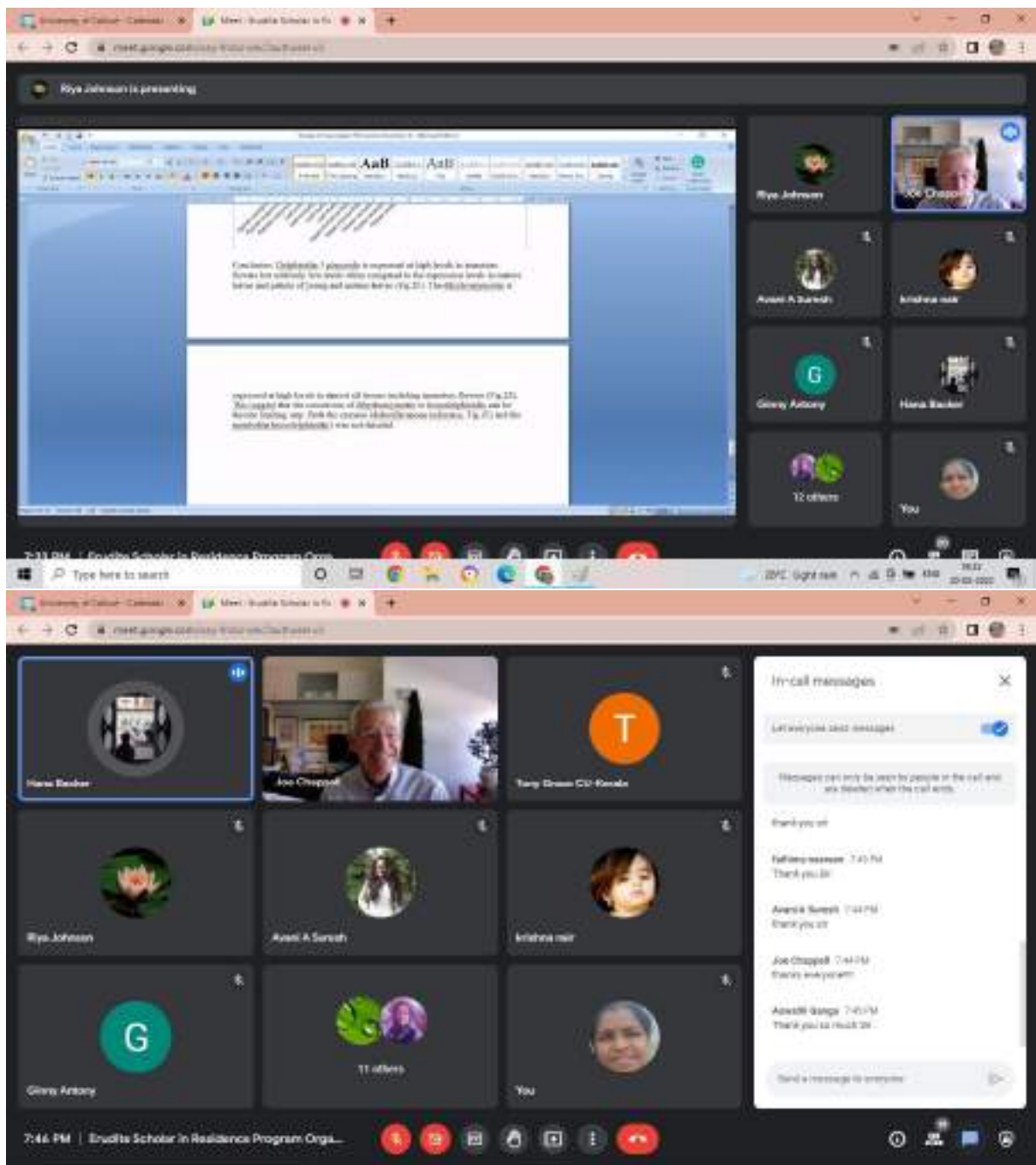
Virtual Session in fu

Dr. Parvath E.G.

Arvind A. Suresh

13 others

You



Major Outcomes

- Participants got a thorough expertise on the following.
- Mapping and aligning sequences, then validating contigs and isoforms
- Profiling key transcript levels for cardenolide biosynthesis in various tissue samples of *Digitalis* and drawing inferences about cardenolide accumulation.
- Profiling key metabolite levels for cardenolide biosynthesis in various tissue samples of *Digitalis* and drawing inferences about cardenolide accumulation in combination with transcript profiling.

- Integrating Transcriptomic and Metabolomic databases for future research perspectives.

Feedback from the participants

75% of the participants were very much satisfied with the content and organization of the online workshop conducted. 67% said that the workshop was very much relevant and helpful to their research/career. 83% said that the information presented / skills acquired were very much relevant and useful. 67% of the participants have the opinion that, the resource person provided adequate time for questions and answered them satisfactorily, and adopted student-centred learning strategies and techniques, the assignments/exercises were highly useful in improving their knowledge and skills, and as a whole, the workshop increased their knowledge and skills in the area of Transcriptomics and Metabolomics. 58% rated the overall experience as excellent whereas the rest 42% rated it as very good.