



Kristu Jayanti College

AUTONOMOUS

Bengaluru

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DEPARTMENT OF FORENSIC SCIENCE



Celebrating 75 years of Indian
Independence



VERITAS

Vol.2 Issue 2

MESSAGE FROM THE PRINCIPAL



Forensic science comprises a diverse array of disciplines, from fingerprint and DNA analysis to anthropology and wildlife forensics. Though they represent varied disciplines, all forensic scientists face a common set of challenges. The rise of Artificial Intelligence, mass production, cloud computing and encrypted networking tools have challenged the forensic science community like never before.

The Department of Forensic Science at Kristu Jayanti College (Autonomous), Bengaluru runs a Bachelor's (single major) and Master's in Science in Forensic Science programmes. During the coming academic year, the department will also initiate a Bachelor dual major programme in the disciplines of biotechnology and forensic science. The department has made massive leaps in providing knowledge and training in the past 4 years and has excelled in the quality of education provided to the students of the department.

The Forensic Science newsletter, 'Veritas' is a bi-annual newsletter published by the department of forensic science which compiles articles written by the forensic science students. The previous issues of Veritas have set a high standard with respect to content, design and quality. The editorial board of the newsletter comprised of teachers and students have worked hard to provide a rich and effective reading experience to the readers in each issue.

This issue touches on topics of Artificial Intelligence, self-driving cars and many more. On this occasion, I congratulate the department of Forensic Science and the editorial board of Veritas for the effective contents and design of the issue.

**-Rev. Fr. Dr. Augustine George
Principal**

MESSAGE FROM THE DEAN



The interesting field of Forensic Science comes with its challenges. The evolution of criminals' minds to commit crimes to circumvent the investigation protocols already available makes this field both interesting and challenging. Some of the challenges faced by forensic investigators needs brainstorming, combined deliberations and access to current knowledge of science.

The forensic science newsletter, Veritas published by the department of forensic science, Kristu Jayanti College is unique and focussed in bringing out the requirements of forensic investigators. Each issue of the newsletter combines works by many students of the department in multiple fields of forensic science and craftily edited and designed to please the eye.

Previous issues of Veritas have been on the top of the choice for readers. I am sure, this issue too will evoke positive impact on the readers.

I congratulate the editorial team of Veritas and the department of forensic science for bringing out this issue of the newsletter and wish the readers an insightful and enriching journey as they read this issue of Veritas.

**-Dr. Calistus Jude
Dean of Sciences**

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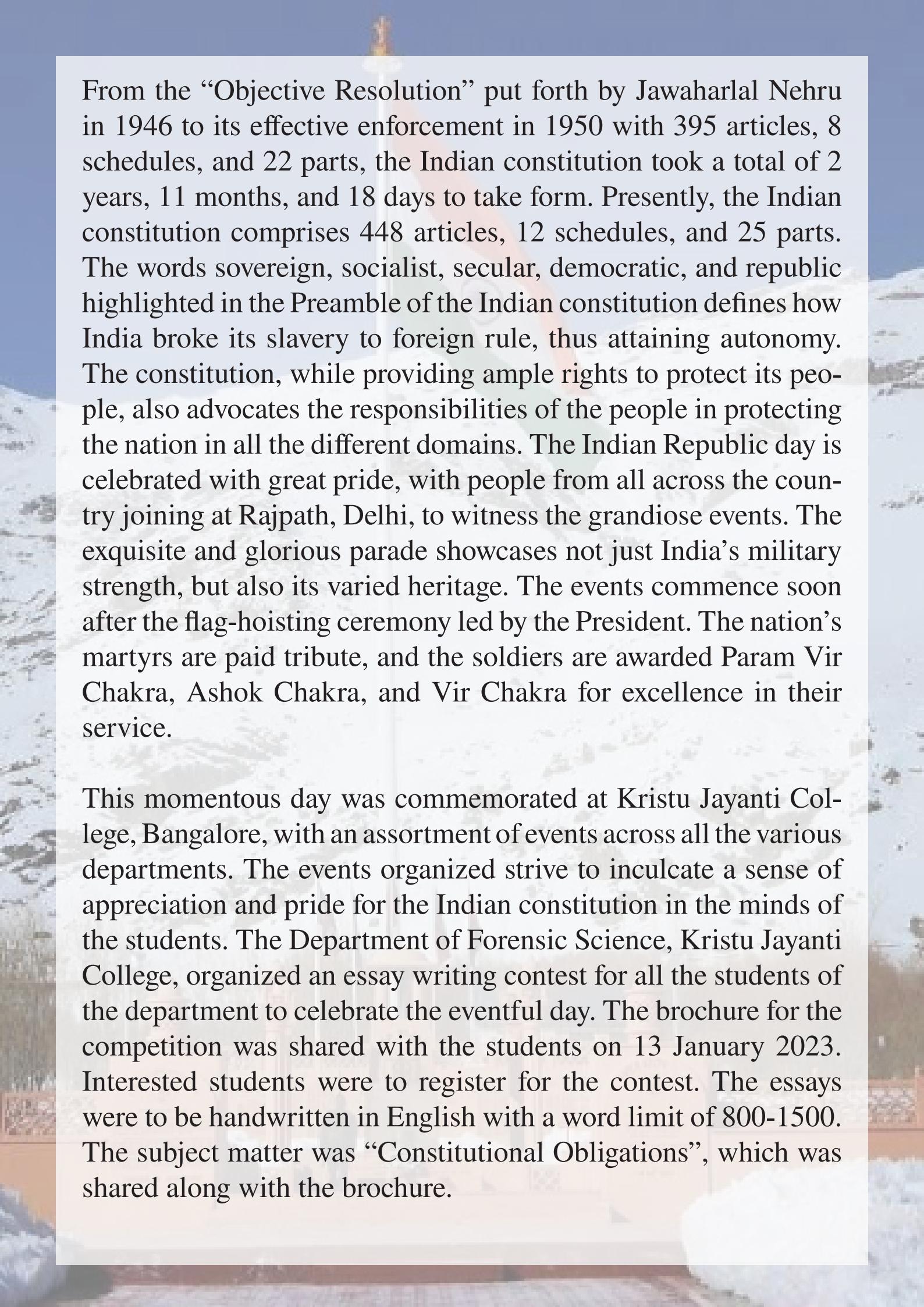
UPHOLDING THE INDIAN CONSTITUTIONAL LEGACY : THE 74th INDIAN REPUBLIC DAY

From the Editors

This second issue of the second volume of Veritas, the bi-annual forensic science newsletter of the Department of Forensic Science at Kristu Jayanti College, Autonomous, Bangalore, is a special edition memorializing the 74th Indian Republic Day. 26 January 1950 marks one of the most historical moments of the Indian nation when the Indian constitution came into force and declared Purna Swaraj or complete independence for India. The contemplations and deliberations of several virtuous individuals, including Dr. B. R. Ambedkar, B N Rau, K.M.Munshi, Muhammed Saadulah, Alladi Krishnaswamy Iyer, Gopala Swami Ayyangar, N. Madhava Rao, and T. T. Krishnamachari gave birth to the world's longest written constitution. The constitution drafted by the drafting committee was signed by the 284 members of the constitutional assembly at the Constitution Hall in New Delhi on 24 January 1950.



Img 1: The grand celebrations held at Rajpath, Delhi, on the 74th Indian Republic Day



From the “Objective Resolution” put forth by Jawaharlal Nehru in 1946 to its effective enforcement in 1950 with 395 articles, 8 schedules, and 22 parts, the Indian constitution took a total of 2 years, 11 months, and 18 days to take form. Presently, the Indian constitution comprises 448 articles, 12 schedules, and 25 parts. The words sovereign, socialist, secular, democratic, and republic highlighted in the Preamble of the Indian constitution defines how India broke its slavery to foreign rule, thus attaining autonomy. The constitution, while providing ample rights to protect its people, also advocates the responsibilities of the people in protecting the nation in all the different domains. The Indian Republic day is celebrated with great pride, with people from all across the country joining at Rajpath, Delhi, to witness the grandiose events. The exquisite and glorious parade showcases not just India’s military strength, but also its varied heritage. The events commence soon after the flag-hoisting ceremony led by the President. The nation’s martyrs are paid tribute, and the soldiers are awarded Param Vir Chakra, Ashok Chakra, and Vir Chakra for excellence in their service.

This momentous day was commemorated at Kristu Jayanti College, Bangalore, with an assortment of events across all the various departments. The events organized strive to inculcate a sense of appreciation and pride for the Indian constitution in the minds of the students. The Department of Forensic Science, Kristu Jayanti College, organized an essay writing contest for all the students of the department to celebrate the eventful day. The brochure for the competition was shared with the students on 13 January 2023. Interested students were to register for the contest. The essays were to be handwritten in English with a word limit of 800-1500. The subject matter was “Constitutional Obligations”, which was shared along with the brochure.

The contest was held on 25 January 2023 at 4:30 PM. The highlights of the events are shared in the following sections.

Alongside the commemorative event, this issue also houses an extensive range of themes relating to forensic science. The diverse themes cover fundamental topics like toxicology, ballistics, and forensic medicine to more progressive and riveting topics like DNA (Deoxyribonucleic acid) databases, cloud forensics, Interpol and metaverse, digital vehicle forensics, and even self-automated cars and their forensic challenges. The issue also accommodates an expert talk with Mr. P Suresh Kumar, honorable judge of the POCSO (Protection of Children from Sexual Offences) special court in Kasargod, Kerala, where sir has elaborated on questions pertaining to the Indian judiciary and domestic violence. On the whole, the issue covers a total of 1 expert talk, 5 research articles, 3 global news updates relevant to the forensic field, 4 case studies, 9 feature articles, 3 literature reviews, and 2 statistical data articles. The exhaustive concepts covered in this comprehensive issue are far-reaching when concerned with the various domains dealt with in forensic science.

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- [Img 1] Gupta, S. (2023, January 24). Five Interesting Things You Should Know About the 74th Republic Day Celebration. The Better India. <https://www.thebetterindia.com/309303/public-day-2023-celebrations-parade-new-delhi-red-fort-kartavya-path-india-gate/>

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DEPARTMENT ACTIVITIES

- National Level 7-day Virtual Faculty Development Programme on ‘Evolving Research Paradigms in Forensic Science’
- Workshop on ‘Forensic Psychology’
- International Guest Lecture on ‘Forensic Science in Ghana’
- Expert Lecture on ‘Forensic Ballistics’
- Expert Lecture on ‘Forensic Epigenetics in Criminal Investigation’
- Expert Lecture on ‘Development Prints Using Non-Conventional Methods’
- Expert Lecture on ‘Artificial Intelligence in Forensic Science’
- Expert Lecture on ‘Wildlife DNA Forensics’
- Expert Lecture on ‘Application of GC-MS in Anti-Doping Analysis’
- Career Orientation Session on ‘Forensic Odontology in India’
- Atrium – Intra-Collegiate Forensic Science Fest
- Forensis – Curriculum Enrichment Activity (Session 1)
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- Essay Writing Competition: Constitutional Obligations

NATIONAL LEVEL 7-DAY VIRTUAL FACULTY DEVELOPMENT PROGRAMME ON ‘EVOLVING RESEARCH PARADIGMS IN FORENSIC SCIENCE’

The Faculty development programme (FDP) was organised between 12-20 December 2022 over the Zoom platform. The faculty development programme was specifically crafted for the discipline of forensic science and had various topics ranging through the different disciplines of forensic science. The FDP spanned 7 days and each day had two technical sessions. The FDP gathered a lot of interest from delegates from different parts of India from various academic institutions. The FDP was conducted in the virtual mode over the Zoom platform.

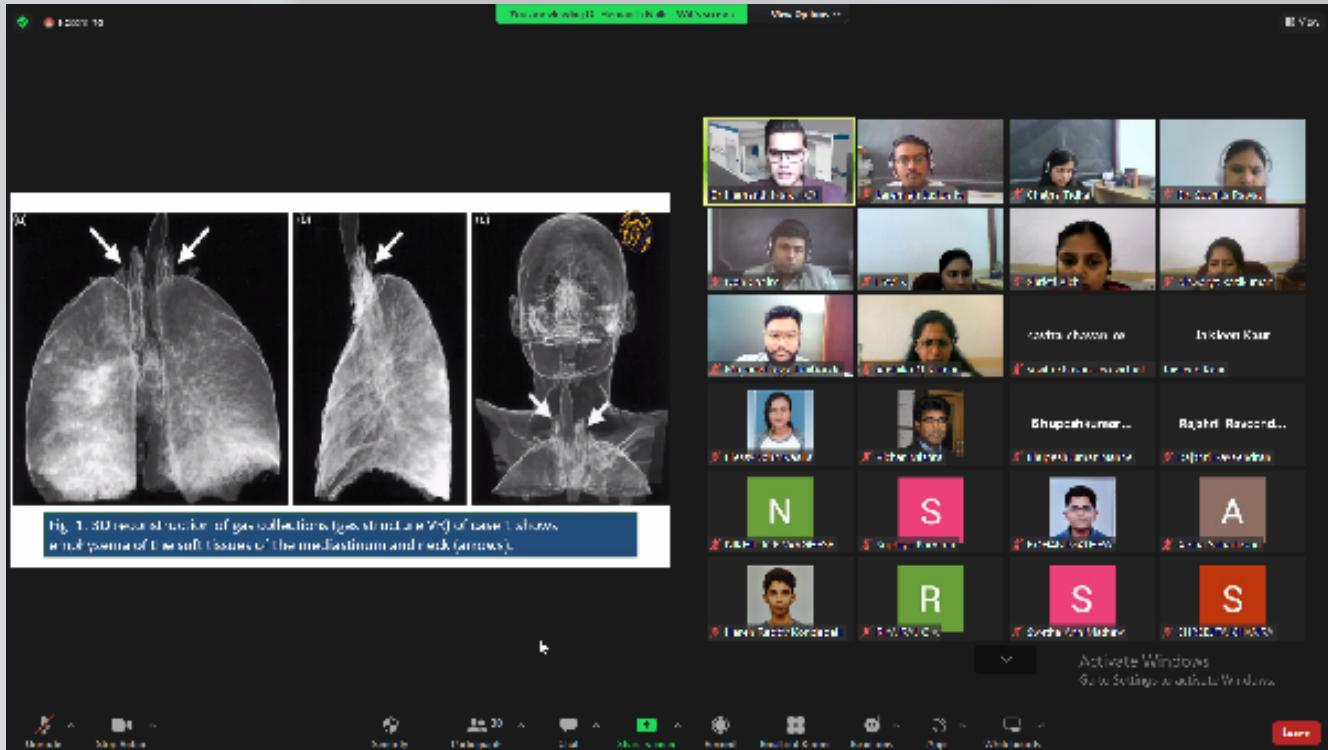
With 10 sessions, the FDP was rich in substance and diverse in variety.

Overall, there were 22 external delegates in the FDP from around 8 different institutions spanning 7 different states of India.

INAUGURATION

The FDP started with the inauguration on 12th December 2022. The ceremony was set in motion by the presence of Dr. N P Waghmare, Director, State Forensic Science Laboratory, Goa who was the chief guest of the ceremony. Sir delivered a talk on the various research opportunities in the field of forensic science and the rich scope in the field of forensic science as of date. Sir's talk was enlightening and enriching and offered many ideas for planning forensic science research. The ceremony was also graced by the Principal, Kristu Jayanti College, Rev. Fr Augustine George. Father emphasised the importance of forensic science and the need to be updated in the field in order to sufficiently support the criminal justice system.

The convener of the FDP, Dr. Suchita Rawat, Assistant Professor, Department of Forensic Science presented the prelude to the FDP.



Technical session I

The first session was on ‘Paradigm shift in research in forensic science’ by Dr. Vina Vaswani, Professor at Yenepoya Medical College, Mangalore. Mam rightfully began the FDP by outlining the shift and the paradigm shift that we are witnessing in the field of forensic science research. She encouraged the audience to indulge in the field of research at a right time such as this. She also outlined the ethical and moral responsibilities to possess during research.

DAY 2 - TECHINCAL SESSIONS II & III

Technical session II

The second session was on ‘ethical guidelines for responsible conduct of research’ by Dr. Piyush Singh, Scientist, National Institute of Malaria Research. Sir with his rich experience outlined the need for ethical guidelines, the organisations involved in ethical guidelines, and outlined the steps a researcher needs to take in order to conduct fair and responsible research. He exhorted the audience to take these guidelines both seriously and rightly for being effective researchers of tomorrow.

Technical session III

The third session was an engaging one on ‘The art and science of research paper writing’ by Dr. Prajakta Harne, Senior Scientific Editor Elsevier. Being from an editor’s point of view, the session provided aptly and key pointed guidelines on how to target journals, how to prepare research papers, tools to use for drafting and finalising, how to make use of the article transfer tools and she could also outline plan maps for proposal seeking. The session was engaging and had many queries from the delegates.

DAY 3 – TECHINCAL SESSIONS IV & V

Technical session IV

The fourth session was on ‘Virtual Autopsy’ by Dr Hemanth Naik, CMO (Chief Medical Officer), Virtual Autopsy India. Sir from an industry point of view could break down the need and application of Virtopsy and from a medical doctor’s point of view was able to explain the science and reliability of the tool. The session was interestingly crisp and had a lot of learning points as to the use and status of virtopsy in India. Questions on legal admissibility and reliability along with its cost factor were discussed during the session.

Technical session V

The fifth session was on the research challenges and opportunities in the field of cyber criminology by Dr. Febin Baby, Assistant Professor and Head, Department of Criminology and Police Science, St Thomas College Autonomous, Thrissur. This session was eye opening as to how this field of cyber criminology even though rudiment in India is fashioning itself into a prospective and futuristic field. The session took us through the science, the theories and the application of the principles of the emerging field of cyber criminology.

DAY 4 – TECHINCAL SESSIONS VI & VII

Technical session VI

The sixth session was on Structural investigations of biomolecular interactions using advanced experimental and computational strategies by Dr. Prateek Pandya, Assistant Professor & Research Coordinator (AIFS), Amity Institute of Forensic Sciences, Amity University Uttar Pradesh, Noida, Uttar Pradesh. Sir took us through a journey of computational biology beginning from crystal structuring using computational tools onwards to advanced drug kinetics using computational tools. The session targeted the interest of researchers in the field of forensic toxicology and pharmacokinetics and could help in the scope and extent to which technology can aid their research.

Technical session VII

The seventh session was on the usage of mitochondrial DNA (Deoxyribonucleic acid) and Y-SNPs. (Y Chromosomal Single-Nucleotide Polymorphism) in Forensic Science and Population Genetics by Dr. I Arjun Rao, Assistant Professor Department of Life Science Faculty – Forensic Science Christ University (Central campus) Bengaluru Karnataka. The session covered primer requirements, PCR (Polymerase Chain Reaction) conditions, and DNA sequencing strategies for Mitochondrial and Y chromosome SNP analysis. The session also introduced the audience to various software available for DNA sequence alignment and software for the creation of phylogenetic analysis. Sir also emphasised the use of Mitochondrial and Y chromosome SNPs in population genetics understanding the evolutionary aspect.

DAY 5 & 6 – TECHINCAL SESSIONS VIII & IX

The eighth and ninth sessions were two-hour sessions and were handled by Dr. Suniti Yadav, Assistant Professor, Department of Anthropology, University of Delhi.

Dr. Suniti took us through a hands-on demonstration of data analysis using SPSS (Statistical Package for the Social Sciences). Maam covered topics such as Introduction to SPSS, using data editor, summary statistics for individual variables, creating and editing charts, simple inference for continuous and categorical data, data presentation, and many more. Mam was patient enough to teach right from the basics of data analysis and also took us to the common challenges faced and how to troubleshoot them.

DAY 7 – TECHINCAL SESSIONS X

The tenth session of the 7-day FDP happened today and Dr. Nelson Justin Michael, Director of the Centre for Research at Kristu Jayanti College spoke to us on institutional research quality. Sir took us through the UGC API (University Grants Commission Academic Performance Indicators) policy and laid a roadmap for improving one's individual research score and even for an institution to improve its research quality drawing inspiration from today's assessment environment.

WORKSHOP ON ‘FORENSIC PSYCHOLOGY’

The Department of Forensic Science conducted an offline workshop on ‘Forensic Psychology’ on 24/09/2022 to provide hands-on and case study-based training on the field of forensic psychology to UG students of forensic science. The resource person for this workshop was Ms. Joulyn Kenny, Forensic Expert / Trainer, Mumbai.

SESSION I: Ms. Joulyn Kenny, Forensic Expert / Trainer, Mumbai. The session on ‘Introduction, Roles & Responsibilities, Eyewitness identification & Testimony’ concentrated on basic features of the file forensic psychology. The resource person took the audience through a series of small activities that explain the difference between the field of psychology, psychiatry, criminal psychology, courtroom psychology, eye witness identification etc. She listed the branches and the unique features of each branch of forensic psychology. The exercises helped the students understand the differences in a stark manner. She also elaborated on the DNA Innocence project which led the movement against unjust criminalization of thousands and played a few clips from the series of events which led to the movement.

SESSION II: Ms. Joulyn Kenny, Forensic Expert / Trainer, Mumbai. The session on ‘Forensic Psychology in Courtroom, Treatment & rehabilitation of offenders’ included case study based activity where multiple cases of similar nature were discussed and the students had to perform activities individually and give opinions on their findings and impressions. Multiple students took part actively and they could get to understand how the roles and responsibilities of a forensic psychologist must be properly understood in a compartmentalised fashion in order to be able to get the right conclusions. This exercise was made in a student-friendly fashion and helped students grasp the lessons learnt in the first session in a first-hand manner.

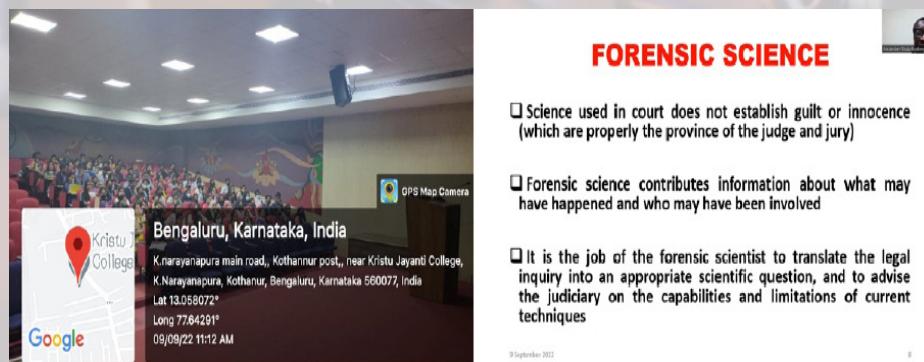
SESSION III: Ms. Joulyn Kenny, Forensic Expert / Trainer, Mumbai. The final session on ‘Offender profiling & evaluation - Activity based’ has a group activity where an entire case file was distributed to each group. Students formed a total of 10 groups with 8 members in each group and got the same case file. Each group went through the case file and were asked to fill up a forensic psychology report in the given format. This activity tested their knowledge gained from previous two sessions and gave a group level understanding. They could speak and discuss among classmates and got to understand how interpretations and qualitative measures have to be in a graded and regulated manner. This helped understand how cases can be interpreted in multiple ways, but how the science behind each interpretation must remain the same. Students could understand the value of the basic components in the field of forensic psychology.



INTERNATIONAL GUEST LECTURE ON ‘FORENSIC SCIENCE IN GHANA’

The first international lecture for the academic year 2022-2023 was organised by the Department of Forensic Science, Kristu Jayanti College, Autonomous on 9th September 2022 on the topic ‘Forensic Science in Ghana’.

The resource person was Mr. Alexander Badu Boateng. He is the senior police officer of Ghana police service. He is a BSc graduate in biological science and pursued his master’s in forensic science with a specialisation in DNA (Deoxyribonucleic acid) typing, PCR (Polymerase Chain Reaction) technique and crime scene investigation. Currently he is doing his PhD in Biotechnology.



The session started with a brief introduction about forensic science and moved on to various aspects like forensic science education, various universities providing the program, job opportunities, different forensic aspects. He spoke about the Forensic Science Laboratory in Ghana, different disciplines there and about the equipment used there. He also directed the attention of students to different cases happening in Ghana and the role of forensic science in all of it.

During his talk he explained the use of forensic science in some high profile cases that he had handled as part of his police and forensic service in his country.

Finally, he also discussed the various challenges faced there in the field of forensic science. Also during the question answer session the doubts of students were clearly answered by the guest. It was an informative and useful session.

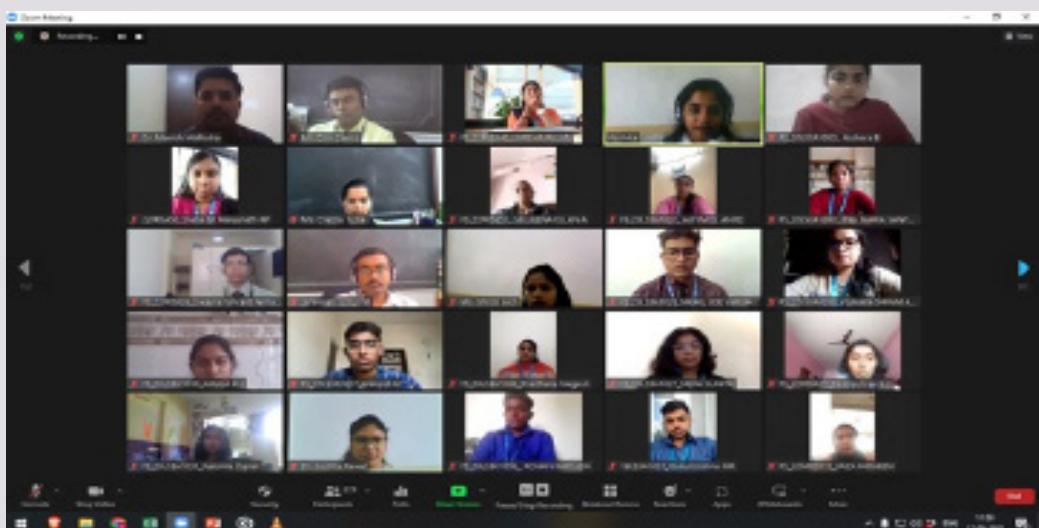
EXPERT LECTURE ON 'FORENSIC BALLISTICS'

The first expert lecture for the academic year 2022-2023 was organised by the Department of Forensic Science, Kristu Jayanti College, Autonomous on 17th September 2022 on the topic 'Forensic Ballistics'. The session was conducted online over the Zoom platform.

The resource person was Dr. Manish Malhotra, Scientist B, Central Forensic Science Laboratory, Bhopal. Sir is from the physics division and specialises in forensic physics.

The session started with a short inaugural session and the speaker was introduced to the audience. Soon after, the resource person took over the session. Sir, gave a brief introduction of the field for forensic ballistics and went on to provide in depth knowledge of the field of forensic ballistics.

Sir had also shared his experiences in the field with the hands-on cases that he had encountered. From determining the shooter and the whether the same firearm was used to fire, sir had explained the concepts and procedures in a detailed and methodological manner. In the end the session was opened for queries and the each and every question asked was taken up positively and appropriate answers were provided



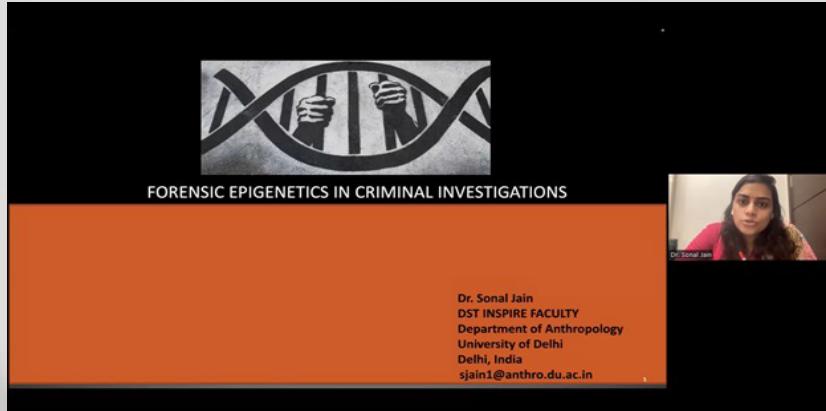
EXPERT LECTURE ON ‘FORENSIC EPIGENETICS IN CRIMINAL INVESTIGATION’

The second expert lecture for the academic year 2022-2023 was organised by the Department of Forensic Science, Kristu Jayanti College, Autonomous on 24th September 2022 on the topic ‘Forensic epigenetics in criminal investigation’. The session was conducted online over the Zoom platform

The resource person was Dr. Sonal Jain, DST (Department of Science and Technology) Inspire Faculty, University of Delhi. She works on DNA (Deoxyribonucleic Acid) Methylation and DNA Phenotyping. Her scientific interests span forensic genetics, evolutionary and population genetics, palaeogenomics, forensic zoology, and medical genetics.

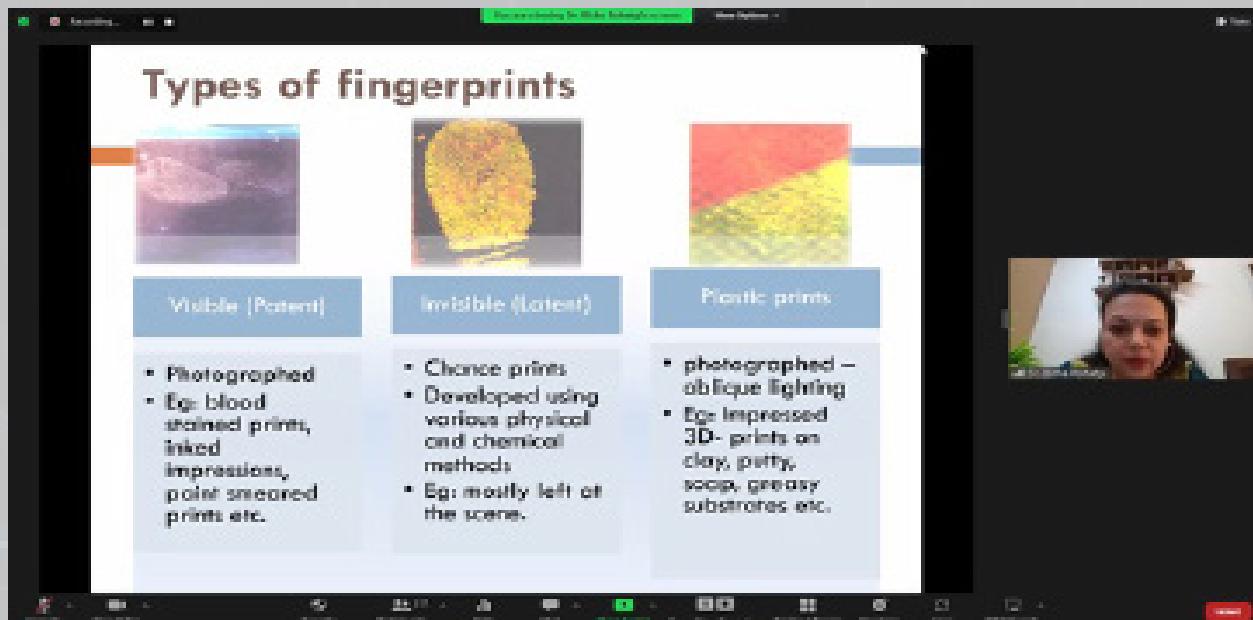
The session started with a short inaugural session and the speaker was introduced to the audience. Soon after, the resource person took over the session. Madam, gave a brief introduction of the Forensic epigenetics and spoke in detail on current efforts to develop forensic epigenetic techniques which are focused on four issues in criminal investigation i.e. Body fluid identification, individual age prediction, distinguishing monozygotic twins, and potentially stain age prediction. Madam explained the concepts and procedures in a detailed and methodological manner.

In the end the session was opened for queries and each and every question asked was taken up positively and appropriate answers were provided



EXPERT LECTURE ON ‘DEVELOPMENT OF LATENT PRINTS USING NON-CONVENTIONAL METHODS’

The third expert lecture for the academic year 2022-2023 was organised by the Department of Forensic Science, Kristu Jayanti College, Autonomous, on 15th October 2022 on the topic “Development of latent prints using non-conventional methods”. The session was conducted online over the Zoom platform.



Dr. Richa Rohatgi, Assistant Professor at NICFS (National Institute of Criminology and Forensic Science) NFSU (National Forensic Sciences University), Delhi, served as the resource person. The session began with a brief introduction of the speaker to the audience. Soon after, the resource person took over the session. Ma'am provided a brief overview of the importance of fingerprints as evidence, the different types of prints found at crime scenes, and the characteristics of patent, latent, and plastic prints recovered at crime scenes on porous, non-porous, and semi-porous surfaces. She went on to explain that the formation of latent prints is caused by organic and inorganic secretions from the hand, palm, and feet.

Ma'am discussed how traditional methods include the use of physical powders such as magnetic powders, organic powders, luminescent powders, thermoplastic powders, SPR (Small Particle Reagent), and so on Iodine fuming, cyanoacrylate fuming, ninhydrin methods, DFO (1,8-Diazafluoren-9-one), silver nitrate, amido black, and other chemical methods of latent print development were also mentioned by Ma'am. She then discussed non-traditional methods for developing latent prints using common kitchen powders such as turmeric, cocoa powder, henna powder vermillion, and cornstarch powder.

Non-traditional methods include using a laser beam, poly ray, poly light, OmniprintTM 1000, and a dust lighting kit. Ma'am also discussed recent advances in research in the development of latent prints using nanoparticles, human metabolites, spectroscopy: Raman spectroscopy, IR (Infrared) spectroscopy, micro x-ray fluorescence, ToF-SIMS (Time-of-Flight Secondary Ion Mass Spectroscopy), immunolabeling methods, and bacterial profiles. Finally, the session was opened for questions, and each question was positively received, and appropriate answers were provided.

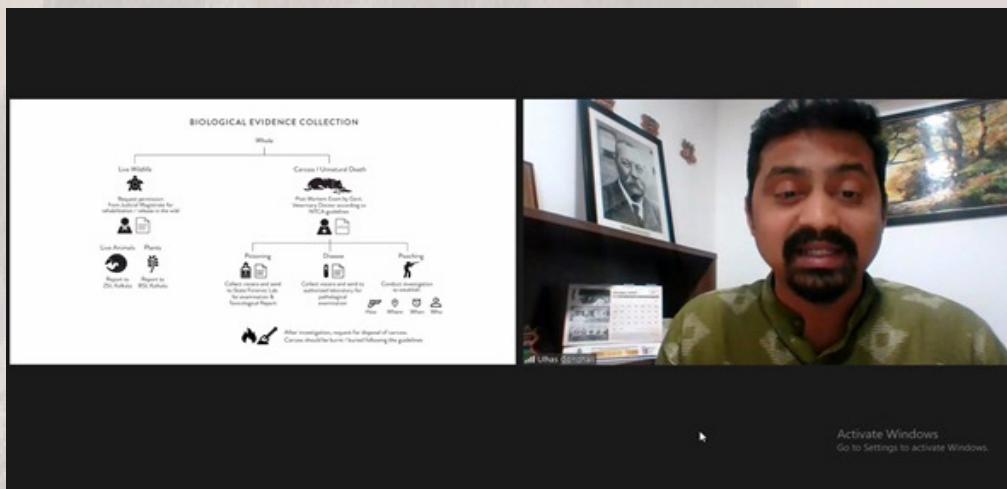
EXPERT LECTURE ON ‘ARTIFICIAL INTELLIGENCE IN FORENSIC SCIENCE’

The fourth expert lecture for the academic year 2022-2023 was organised by the Department of Forensic Science, Kristu Jayanti College, Autonomous, on 21st October 2022 on the topic “Artificial intelligence in Forensic Science”. The session was conducted online over the Zoom platform. The resource person was Ms. Vinny Sharma, Assistant Professor in the Department of Forensic Science at Galgotias University, Noida. Ma’am has been designated as an Innovation Ambassador for IIC (Institution’s Innovation Council), an initiative of the Ministry of Education, Government of India, and has two patents. The session began with a brief introduction to the speaker. The session was quickly taken over by the resource person. The presentation included topics such as intelligence, cognitive intelligence, multiple domains in AI (Artificial Intelligence), introduction to AI, AI usage in various domains, sample size limitation, legal admissibility, etc. Finally, a question and answer session was held, and each and every question was positively received, and appropriate answers were provided.



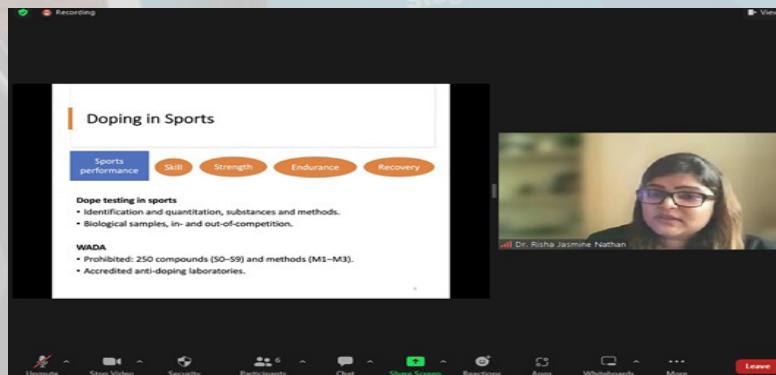
EXPERT LECTURE ON ‘WILDLIFE DNA FORENSICS’

The fifth expert lecture for the academic year 2022-2023 was organised by the Department of Forensic Science, Kristu Jayanti College, Autonomous, on 7th November 2022 on the topic “Wildlife DNA Forensics”. The session was conducted online over the Zoom platform. Mr. Ulhas Gondhali, Lecturer (O.P. Jindal Global University, Delhi, India), was the resource person. Sir is involved in teaching forensics and wildlife conservation courses as well as conducting research. The session began with a brief introduction to the speaker. Soon after, the session was taken over by the resource person. Sir explained the different types of wildlife crime: hunting, trading (for example, tiger skin), aiding and abetting wildlife crime, habitat destruction, and consumption. He went on to say that the potential applications of DNA (Deoxyribonucleic acid) include hunting, trading, and consumption. Sir elaborated that biological evidence in the form of skin, fur, hair, bone, blood, and meat, as well as horns and tusks obtained from the crime scene, is useful for DNA analysis. He discussed the DNA analysis of species origin, geographical location, and individual origin using mitochondrial DNA, lineage markers, and micro STRs (Short Tandem Repeats). He spoke about the infrastructure gaps in India. Finally, during the question-and-answer session, each question was positively received, and appropriate answers were provided.



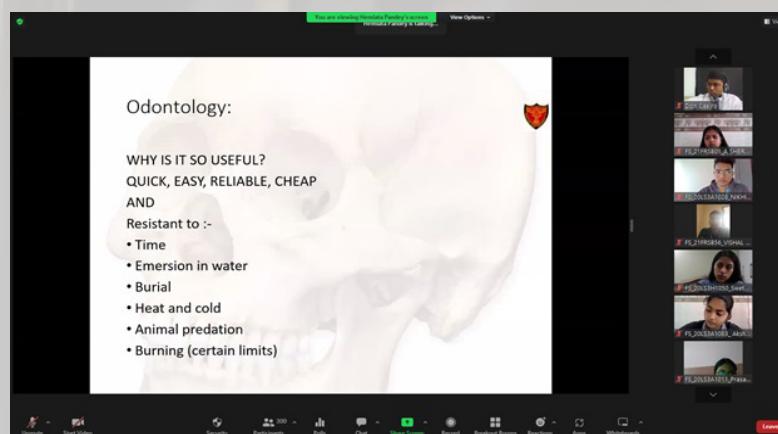
EXPERT LECTURE ON ‘APPLICATION OF GC-MS IN ANTI-DOPING ANALYSIS’

The Department of Forensic Science, Kristu Jayanti College, Autonomous, organised the second international lecture for the academic year 2022-2023 on the topic “Application of GC-MS in anti-doping analysis” on November 8, 2022. The session was held online using the Zoom platform. Dr. Risha Jasmine Nathan, lecturer in chemistry at Anglia Ruskin University, was the resource person. The session began with a brief inaugural session during which the speaker was introduced to the audience. The resource person soon took over the session. Madam defined doping in sports and discussed the WADA (World Anti-Doping Agency) 2022 list of prohibited drugs; she also discussed the role of these drugs in enhancing skill, strength, endurance, and recovery. According to Madam, the most common biological matrices for doping analysis are urine, whole blood serum, or plasma samples. She also emphasised the new biology markers used in recent studies, such as hair and dry matrix spots. Using research articles, Madam described the steps involved in anti-doping analysis, including screening and confirmation using a GC-MS (Gas Chromatography-Mass Spectrometry) instrument. She also emphasised the significance of athletes’ biological passports, which contain unique haematological, steroid, and endocrinological parameters. Finally, she discussed the difficulties of anti-doping analysis. Finally, the session was opened for questions, and each and every question was positively taken up, and appropriate answers were provided.



CAREER ORIENTATION SESSION ON 'FORENSIC ODONTOLOGY IN INDIA'

The first expert talk for the career orientation series for the academic year 2022-2023 was organised by the Department of Forensic Science, Kristu Jayanti College, Autonomous, on 1st October 2022 on the topic “Scope and Practical Applications of Forensic Odontology in India”. The session was conducted online over the Zoom platform. The resource person was Dr. Hemlata Pandey, Assistant Professor and Consultant in Forensic Medicine at Mumbai’s prestigious Seth Gordhandas Sunderdas Medical College and King Edward Memorial Hospital. The session began with a brief introduction to the speaker. The session was quickly taken over by the resource person. Madam provided an overview of forensic odontology and its forensic significance. Ma’am discussed her bite mark analysis findings from case reports, which included child abuse recognition, age assessment for civil cases and insurance claims, animal versus human bite mark difference, and high-profile cases such as the Nirbhaya case, in which the culprits’ bite mark was admissible as evidence in court. Ma’am also explained the importance of forensic odontology and Interpol (International Criminal Police Organization) guidelines for DVI (Disaster Victim Identification). Lastly, she discussed facial reconstruction and used a case as an example. Finally, a question and answer session was held, and each and every question was positively received, and appropriate answers were provided.



atrium- intracollegiate forensic science fest

The Forensic Science Club, Department of Forensic Science, organised Atrium 2022, an intracollegiate UG (Undergraduate) Forensic Science fest for first and second-year undergraduate students of Forensic Science. This forensic fest aimed at discovering students' knowledge and understanding of the subject as it offered a wide range of science-related events.

The inaugural ceremony of the fest was presided over by Fr. Joshy Mathew, Director, Library and Information Centre & Head, Department of English, Kristu Jayanti College, and the chief guest was Mr. Santhosh Kumar, CEO (Chief Executive Officer), Group Cyber ID Technology, Bangalore. In his presidential address, Father enlightened about the importance of forensic science and its scope in everyday life. Mr. Santhosh spoke about the need for forensic enthusiasts to be in touch with everyday happenings and to look out for advancements in the field. He encouraged students to keep upskilling and following their dreams and motivated them to use opportunities provided during such fests to empower themselves.

The event was organised by the student coordinators of the Forensic Science Club at Kristu Jayanti College, Bangalore. The final-year students formed the working group and were event and team organisers. The participants included first and second-year Forensic Science students.

THE EVENTS HELD WERE:

1. X-Word - A crossword event.
2. Cross-Examination - A case study presentation event.
3. Third Eye - A documentary event
4. Crimetoonist - A sketching event
5. i-Witness - An observation game.

6. Life Jacket - A role-play event.
7. Unravel the Enigma - A crime fiction writing event.
8. Wiz Quiz - A Forensic Science quiz event.
9. Room of Opinions - A debate event.
10. Tail a Trail - A treasure hunt event.
11. Montage - A reel-making event.
12. Sherlock & Watson - A personality-type contest with a forensic theme.



The high-spirited forensic fest started with preliminary rounds of various events on 19th September 2022.

12 teams formed by the students participated in good spirits. Team names were inspired by famous forensic pioneers or achievers both from India and abroad, like Bertillon, Lattes, Jeffreys, M S Rao, HC Bose, JP Modi, etc.

In the valedictory ceremony, Fr. Lijo P Thomas, Vice Principal & Chief Finance Officer, Kristu Jayanti College, and Dr. Calistus Jude, Dean, Faculty of Science, Kristu Jayanti College, exhorted the students to keep trying and giving their best in fests such as this. They also felicitated the winners of various events and appreciated the Forensic Science Club coordinators for having conducted the forensic fest successfully.

FORENSIS – CURRICULUM ENRICHMENT ACTIVITY (Session 1)

The first session of Forensis - the curriculum enrichment programme for the academic year 2022-23 - was organised by the Forensic Science Club at Kristu Jayanti College on 5th November 2022. The session was conducted online over the Zoom platform with all the undergraduate students of the 1st, 3rd, and 5th semester BSc. Forensic Science being the organisers and participants. The session began with a brief introduction about the department-initiated Forensic Science Club and the activities planned annually by the club for the students. The session was then taken over by Ms. Elizabeth Deepika Ponnuraj, of Vth semester BSc. Forensic Science, where she presented an e-poster on the topic “Working of Breath-Analyzer”. The poster contained a detailed explanation of the working of the breath analyzer as well as its pros and cons. The poster also contained a graphical representation of accidents vs age ratio stating its seriousness.

The second session was handled by Ms. Shreya Katti, Ms. Siddhi Pant, and Ms. Nishani Sahoo of 3rd semester BSc. Forensic Science. They presented a case study on the title “Use of fingerprint surgeries to fraudulently send people to Kuwait for jobs”. The presentation extensively covered the principles of fingerprinting, fake and altered fingerprints, and also the methods of alteration of fingerprints. The presentation concluded with a case study as well as punishments listed under various criminal laws.

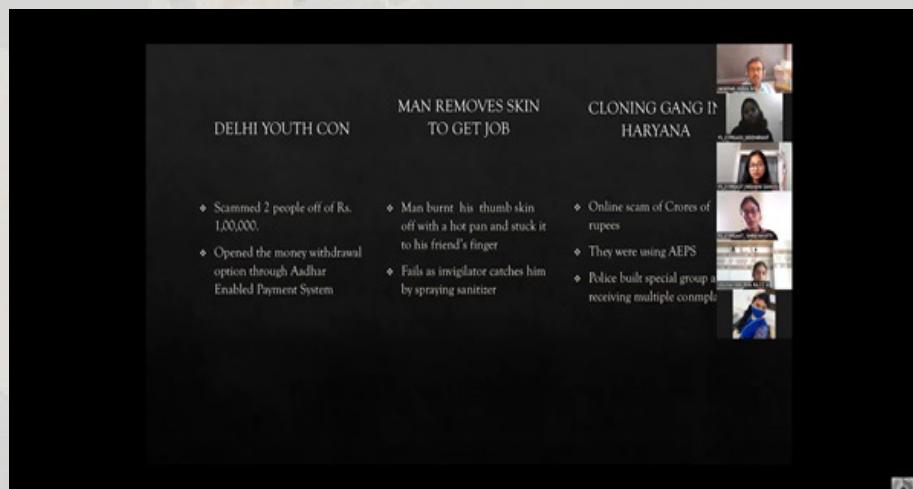
After each session, a question-and-answer session was held, and each and every question was positively received, and appropriate answers were provided. Finally, a quiz session was organised by Ms. Kavya Priya L and Ms. Akshara B of 5th semester BSc. Forensic Science on the topic “Technologies in Forensic Science”. The quiz was innovative and informative, with questions from in and out of the BSc curriculum.

FORENSIS – CURRICULUM ENRICHMENT ACTIVITY (Session 2)

The second session of Forensis - the curriculum enrichment programme for the academic year 2022-23 - was organised by the Forensic Science Club at Kristu Jayanti College on 19th November 2022. The session began with an e-poster presentation by Ms. Bhavya Kamath, Ms. Sherlin Gomez, and Ms. Emil Bobben, of 3rd semester BSc. Forensic Science. They presented on “Advanced techniques of fingerprint development”, where they spoke about silica-based nanoparticles, quantum dots, and small particle reagents.

The session was then handed over to Ms. Swetha Ann Mathew and Ms. Neha Elsa John of 5th semester BSc. Forensic Science, where they presented a case study report on “India-made cough syrups causing deaths in Gambia. They highlighted the present state of the case and explained with detail about the arguments.

After each session, a question-and-answer session was held, and each and every question was positively received, and appropriate answers were provided. Finally, an extracurricular event, Just a Minute, was organised by Ms. Mugdha Bhattacharyya, Ms. Amala KJ, and Ms. Fiya Maria Santhosh of 5th semester BSc Forensic Science. They gave interesting scenarios for the UG (Undergraduate) students of the 1st and 3rd semesters and asked them to speak about them. Funny and entertaining questions were asked to the participants after each spoke.



ESSAY WRITING COMPETITION: CONSTITUTIONAL OBLIGATIONS

Ms. Nisarga Lakshmi, 20LS3K1086

Winning essay of the Essay competition on ‘Constitutional Obligations’ held to commemorate Republic day 2023.

Constitutional obligations are the set of rules that all the citizens of India must abide by as the citizens and the fellow beings who enjoy the government facilities. Indian Constitution provides us with the freedom of religion, education, political and many more provisions under which we Indian or the citizens, government officials and the people reside here enjoy these, so we have that minimal sense of responsibility that we must follow in order to enjoy the ‘Republic -Democratic’ government of India.

The Constitution under the chairmanship of Dr Rajendra Prasad in 1946, was the first step towards the formation of the Constitution assembly. Dr BR Ambedkar, prominently known as the architect of Indian constitution visited many countries and read many constitutions of other countries in order to bring the flexible and practicable laws for Indian Constitution.

The Indian Constitution is known as the ‘Elephantine Constitution’ due to its size which contains more than 4000 pages in it. It is the world’s largest hand-written constitution which was started in 1945 December 9th and was completed on 26th January 1949. 11 sessions were held to discuss the Constitution that we hold and finally on 24th January 1950 our constitution was signed and 26th of January 1950 our constitution was given/taken by our people of India. Initially our constitution consisted of 395 articles, 08 parts and 22 schedules. Now 446 Articles, 12 parts, 24 Schedules and 101 Amendments.

Our Constitution took more than 141 days to be hand written completely and exactly 2 years 11 months and 18 days to be completed completely. The Constitution consists of 'Preamble' Fundamental rights and duties, Directive principles of state policy and many more. Preamble being the index of the constitution contains the major highlighting words like freedom, 'Federal', Socialistic, secular, Equality which are hereby given by the constitution to our people and hereby adopted on 26th of January 1950. The new amendments, the 42nd amendment of 1976 brought secular and federal word into the Preamble of India.

Our Constitution is flexible and rigid at the same time. Fundamental rights are as mentioned in Part III of our constitution.

- » Right to Equality [14-18]
- » Right to Freedom [18-22]
- » Right against Exploitation [13-24]
- » Right to follow Religion [25-28]
- » Cultural and Educational right [29-30]
- » Right to Constitutional remedies [31]

Right to Equality; Under article 14 justifies both men and women are equal; under article 15 justifies both men and women get paid equally for their work; under 16 every individual are equal; under 27 abolition of untouchability and punishable offence; under 18- no discrimination based on caste, creed or sex, colour, etc.

Right to Freedom; Under article 19 there are a set of 6 rules mentioned about the expression of a person though and the person travelling any place in India is not an offence. The other articles under this right justifies a person has his right to speak, dress, follow any religion, study, do what he/she wishes to do unless it tampers with any constitutional right or duties. Article 19 speaks about the privacy of a person and respecting another personal privacy.

Right against Exploitation; Under article 23 mentions about the human trafficking or illegal labour of any personal; under article 24 mentions about the child labour (below 14 years) cannot be labours.

Right to follow Religion; Under these the article speaks about the persons freedom to follow any religion of his wish under section 25 the other sections 26 deals with the funds and the rules in the religious institutions.

Right to Cultural and Education; It is the person can do any form of cultural achievement in order to bring honour to the nationality also educational wise.

Right to Constitutional remedies; speaks about a person's basic right like 'habeas corpus' Mandamus; 'to forbid', 'command', 'warrant' which are the person himself has the right to question upon when delayed so.

The fundamental duties of the Constitution are mentioned as follows in part IV-51 A of the constitution:

- To respect ideals, institutions, national anthem and national flag.
- To inspire and get motivated from the freedom struggle of India.
- To abide by the rules of the government law.
- To render the service to the nation when called upon to do so.
- To have common brotherhood with all-the citizens of the nation and to protect the dignity of a woman.
- To protect the environment.
- To protect the public property and abjure violence.
- To promote and protect the rich heritage of our country.
- To promote and protect the rich heritage of our country.
- To have intellectual thinking [scientific temper].
- To promote and bring the country to a superior level by achievement and endeavours.

The 11th constitutional duties were added by the 86th amendment of 2002 which says free and compulsory education must be provided to children 4-16 years by their parents.

Directives of state policy [51-60] under which mentions the set of different kinds of principles like Gandhian principles, socialist principles, General principle and Liberal principle. The Rajya Sabha in which major functions are to be brought into force by Executive Judiciary and Legislative.

However, our Constitution is flexible as well as rigid in the way its government follows the set of rules. Enjoying the freedom of the Constitution also needs the fulfillment of the set of duties and also gives us the rights to talk about these. Small foot paths like paying regular taxes, following the constitutional regulations, respecting the national flag and the anthem and the other set of duties like maintaining peace and integrity of our country., protecting our national environment, rich heritage of our country, public monuments/places, refraining from violence and achieving the success of an individual to promote and up bring our India's pride and achievement are the basic obligations that we must follow being the Constitutional citizens of India.

INTERACTION WITH EXPERTS

- Expert talk with Mr. P Suresh Kumar

EXPERT TALK WITH MR. P SURESH KUMAR

Veritas Volume: 2, Issue: 2, Pages:27-30

Ms. Riya Raj C A



I had the opportunity to interact with Mr. P Suresh Kumar, honourable special judge, POCSO (Protection of Children from Sexual Offences) special court, Hosdurg, Kasaragod, Kerala. Sir has completed his Legum Baccalaureus (LLB) from Seshadripuram Law College, Bangalore, and has been working in the field since 2005. I am extremely honoured to have had the opportunity to interview sir and learn about his experience being a special judge.

1. What, according to you, is the main reason for the piling up of so many cases in the courts, and why do people take laws so lightly?

The main reason behind the huge pendency of cases in the courts in India is the huge disparity in the judge-citizen ratio. The number of judges is highly disproportionate to the population. The number of judges is 12 -13 per million population as against an estimated requirement of 50 judges per million population. The judge-population ratio in India is the lowest in the world. Moreover, 25-30% of the posts out of the existing sanctioned strength of judges are normally lying vacant at any point in time. A judge in India handles 4 to 5 times more cases every day than the maximum a judge can normally handle a day. This results in liberal adjournments and delays in the disposal.

Another reason is that the institution of cases in the courts far exceeds their disposal. More cases are filed every year than the number of cases disposed of. This amounts to adding up more and more cases to the existing pendency. Even if the judges struggle hard to dispose of matters proportionate to the pendency, there would not be any result. The pendency will remain the same or even higher, depending on the number of institutions of cases.

Yet another reason is the poor infrastructure of courts. The courts in India still lag in computerization and adapting information technology.

People take laws lightly not because the punishment for offences are inadequate. The people in India are very poor followers of our civic duties and have very poor civic sense. They are too reluctant to abide by laws, respect their fellow men, and maintain decorum in public places. This is the reason why people take laws so lightly.

2. Do you think the Indian society even now views domestic violence and mistreatment of women to be natural or as part of the society even if stringent laws have been imposed in the country?

The main reasons for domestic violence against women are the patriarchal mindset of people, lack of education, dowry system, traditional and cultural practices like Sati and Devadasi systems which once existed, financial dependency, insensitivity of law enforcement agencies, etc. It is true that different communities in India, once and for long, had a notion that women were inferior to, and they should obey, men. But, at present, Indian society at large does not treat violence against women to be natural or part of the society. Still, there are men and certain communities and groups who retain the same patriarchal mindset and gender-based authority and treat or believe men have the right to rule or overpower women. It is a paradox that despite constitutional provisions and laws to protect women from gender discrimination and violence, the cases of gender discrimination and violence against women increase day by day. It is not the lack of law or punishment that matters, but the mindset of men, which could be changed only by education, sensitization, and spreading awareness.

3. Is the Indian judiciary slow? In situations where other nations would have given stringent punishments, why is the Indian legal system taking too much time? Isn't it a reason for people losing trust in it?

It is not correct to say that the Indian judiciary is slow in disposing of cases. The judges in India strive hard to expedite trials of each individual case, but the huge pendency of cases in courts makes their efforts insignificant. The reasons for piling up cases and delay in disposal have already been discussed in response to the first question. It is true that people will lose faith in the system

when the courts take a long time for trial and disposal of cases. There should be expeditious trial and disposal of cases. As it is often said, justice delayed is justice denied. In order to reduce pendency and to render effective justice, we need more judges, the infrastructure of courts has to be increased, and the judiciary has to be equipped with advanced technology.

RESEARCH ARTICLES

- Effect of cosmetics and sanitizer on the quality of latent fingerprint
- A comparison study of morphometric features of scalp hair among different regions of India
- A study to design a software module for a Forensic software
- A review on frequency and prevalence of Pyrethroid poisoning in india
- Development of latent fingerprint using masala powders and flours

EFFECT OF COSMETICS AND SANITIZER ON THE QUALITY OF LATENT FINGERPRINT

Veritas Volume: 2, Issue: 2, Pages:32-37

Ms. Hennah Jennifer

Mr. Karthik M

Ms. Ruchitha R

INTRODUCTION

As we are in the modern era, we use distinct products in our daily life on various parts of the body. Due to the COVID (Coronavirus Disease) pandemic, we started using sanitizers on our hands, and the usage of various products such as lotion, creams and oils. Some of these products could affect or deteriorate or degrade the original fingerprints over time, and there is a probability of getting a chance print (oil, sanitizer, lotion applied print) that suspects may use these substances during their criminal conviction, making it difficult for the forensic expert to identify a criminal due to the product properties. Fingerprints are important and the best forms of physical and commonly used forensic evidence over DNA (Deoxyribonucleic acid) profiling because of their uniqueness and are commonly used by forensic scientists as reliable evidence.

AIM

To develop the latent fingerprint stained by oil, lotion, and sanitizer at different intervals to identify the efficiency of the latent print.

METHODOLOGY

For this study, a control sweat print was taken both on porous and non-porous surfaces, followed by a sweat print after application of oil, lotion, and sanitiser each separately on both porous and non-porous surfaces.

The fingerprints were analysed on days 1, 7, 14, 21, and 28 consecutively and compared with the control print.

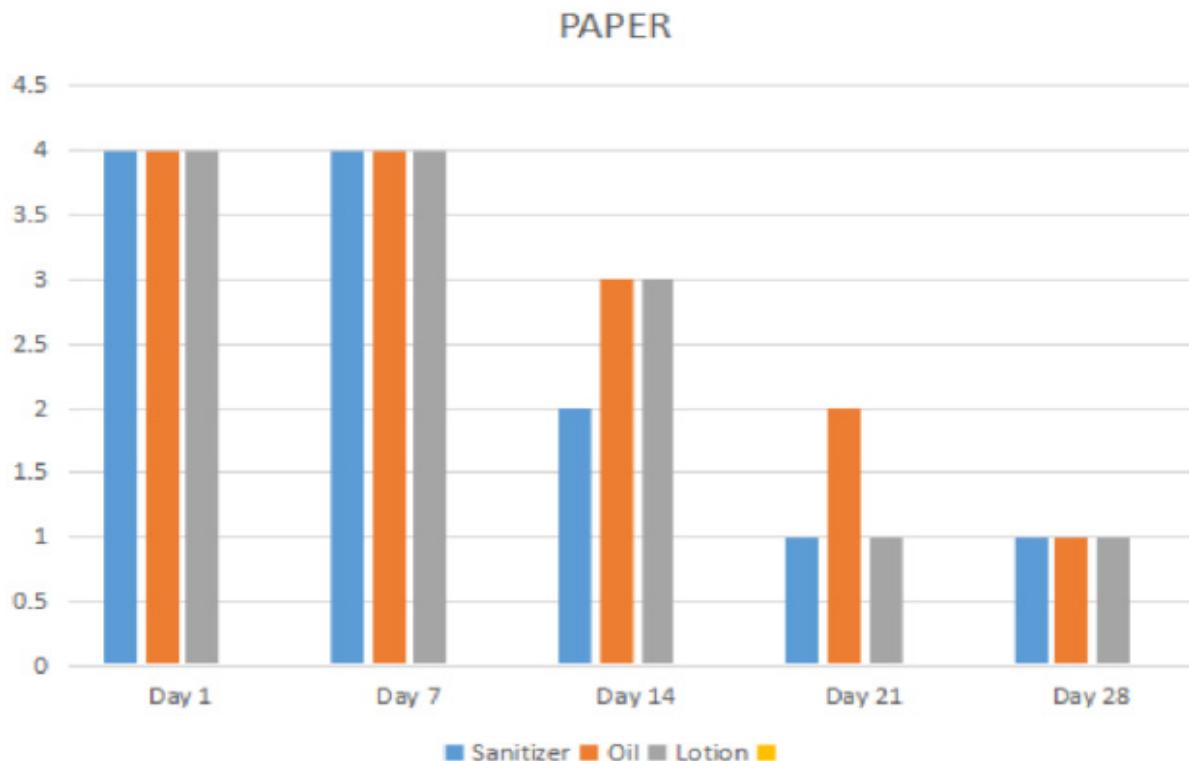
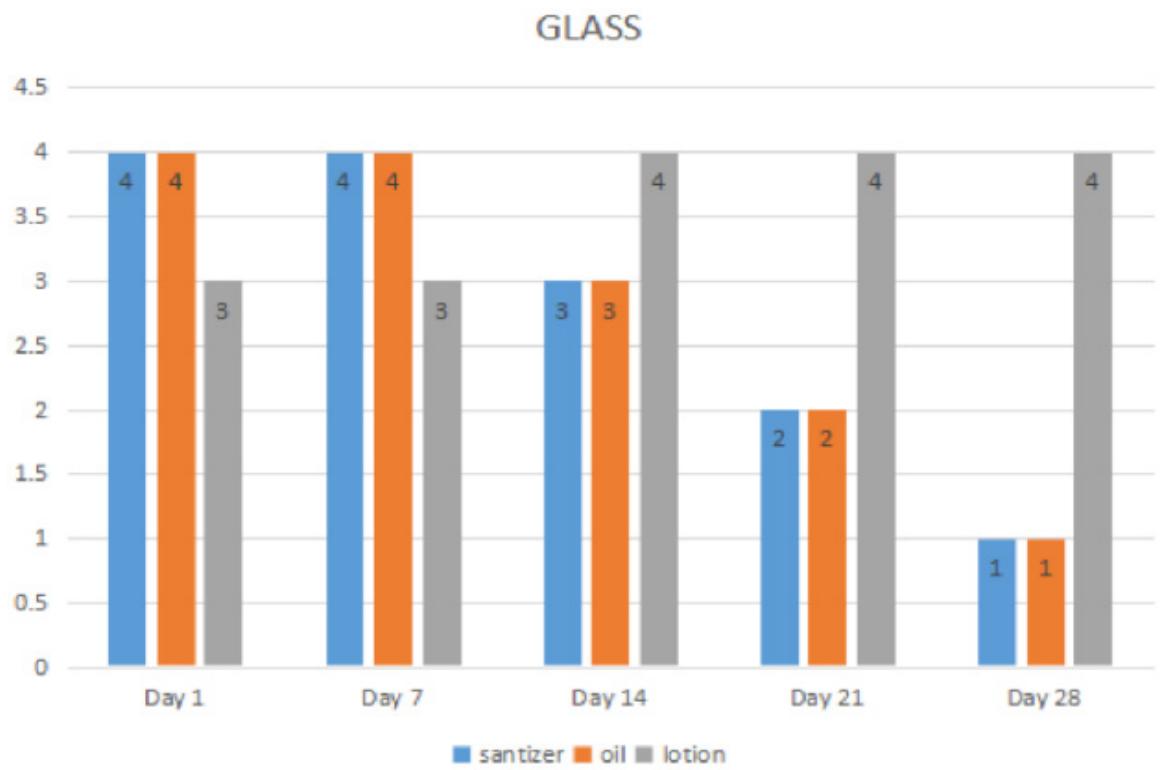
The following scale was used to classify/grade the prints

Visibility score value	Classification of prints	Ridge visibility and level-1,2,3 features of fingerprint
5	Very good visibility (sweat control sample)	Identifiable friction ridges across the print. Classifiable fingerprint pattern (arch, loop, or whorl). Core and the minutiae are visible. Individual scars are also visible.
4	Good visibility	Friction ridges are visible on the portion of the print. Identifiable pattern. Partially visible minutiae and partial merging of ridgelines. Very less smudges found.
3	Poor visibility	Only two-thirds of the print has visible friction ridges. Some parts of the print may be smudged. Partially visible fingerprint pattern. Less prominent appearance of minutiae and scars. The core is visible and less merging of ridgelines.
2	Bad visibility	Only one-third of the print has visible friction ridges. Partially or less prominent visible fingerprint pattern. No minutiae or scars are seen. The core may or may not be seen. Smudges may be present all over the print.
1	Blur/No print	No print is visible or only the outline of the print is visible

The findings were documented.

RESULTS

Comparison charts of different fingerprint quality on porous and non-porous surfaces up to day 28



From the above illustrated graphs, we come to know that the oil, sanitizer, and lotion have the same effect on the paper surface on day 1 and day 7, as shown in the figure and the graphical representation.

On day 14, the lotion and oil print has the same visibility score value, but here the sanitizer print has lesser quality than the other two products when it is placed on the paper surface.

On day 21, two-thirds of the print is clearly visible other than the oil; the other two products have lesser quality than the oil on the paper surface.

On day 28, all the prints have the same visibility score in which the print is less in quality, and thereby on paper surface, all the prints are deteriorating day by day. As this is a paper surface, the print is absorbed and degrading accordingly day by day.

Because of the oil viscous nature and lotion non greasy nature and some properties in the sanitizer make the print deteriorate.

DISCUSSION

Despite the fact that fingerprints have been used as evidence in forensic science for over a century, advances in the field are still being made. Academic interest in assisting research should rise, as should progress in identifying exogenous elements that are usually found to be modified and used to perpetrate a crime and develop complete knowledge. The main aim of the study is to determine the effect of different daily-use products like sanitizer, lotion, and oil on fingerprint visibility and degradation over a period. The presence of oil, lotion, and hand sanitizer on the distal end of the phalanges affects the fingerprint quality on porous and non-porous surfaces. If the fingerprint pattern reveals clear ridge characteristics, minutiae, and pore details, precise identification of an individual can be made. If the features on the latent fingerprints are influenced by exogenous factors, the investigation will be halted due to a lack of

identification. Any flaw in fingerprint development or procedural error will almost certainly result in the assailant being released or an innocent person being imprisoned rather than a proper conviction.

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A COMPARISON STUDY OF MORPHOMETRIC FEATURES OF SCALP HAIR AMONG DIFFERENT REGIONS OF INDIA

Veritas Volume: 2, Issue: 2, Pages:38-45

**Ms. Diya Sajan John
Ms. Prathiksha R S
Mr. Jinson Jacob
Mr. Sarath A S
Ms. Suma Tehreem**

INTRODUCTION

From the follicles found in our dermis, hair is a protein filament that grows out of it. Hair is one of the most defining features of all mammals. Hair is made of a tough protein called keratin. It mainly consists of two different parts that are the follicle and the shaft. Hair is also one of the most common biological evidence found at a crime scene, it is accounted as a class evidence. We can easily use hair to solve the question of who committed the crime as hair helps in individualising a person. From the root of the hair, we can get nuclear DNA (Deoxyribonucleic acid) and from the shaft of the hair, we can get mitochondrial DNA. We can use hair to find out the race of an individual; forensic officers differentiate between hair of caucasoids, mongoloids, and negroids, as all of these hairs exhibit particular microscopic characteristics that distinguish them from one another.

METHODOLOGY

In this study, the aim was to distinguish between the morphometric features of hair from the different regions of India. To do this, India was divided into six regions that included the North, South, West, East, Central, and Northeast. 300 hair samples were collected in total

and their hair length was measured first, then the hair was examined under the microscope for the medullary width, medullary index, hair diameter, and root diameter. The medullary width and hair diameter were examined from the proximal, distal, and intermediate region. This study was conducted as there is a lack of a database to identify people from different regions of India through hair.

FINDINGS

The data collected from analysing all the samples was compiled into a Google sheet, and the mean value of each of the parameters was calculated for each region, and the resulting values were compared with each other.

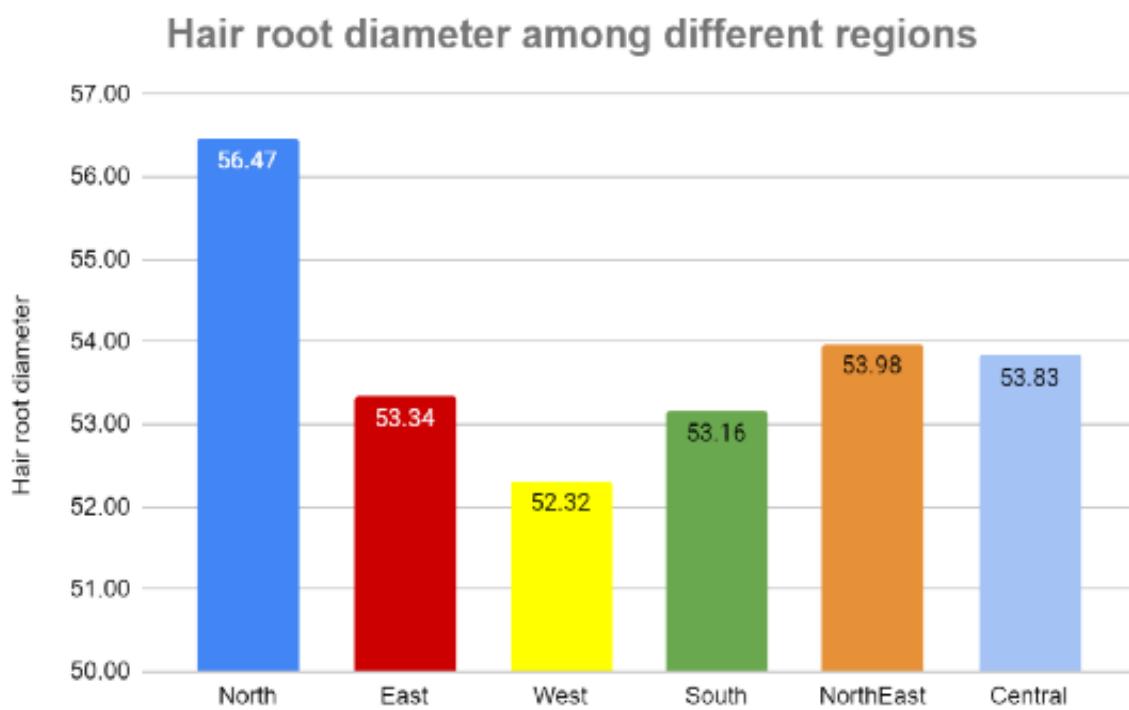


Fig 1.1: Graph showing the mean value of hair root diameter among different regions

It can be seen that the people in the North region have the largest root diameter and the people in the West region have the smallest root diameter.

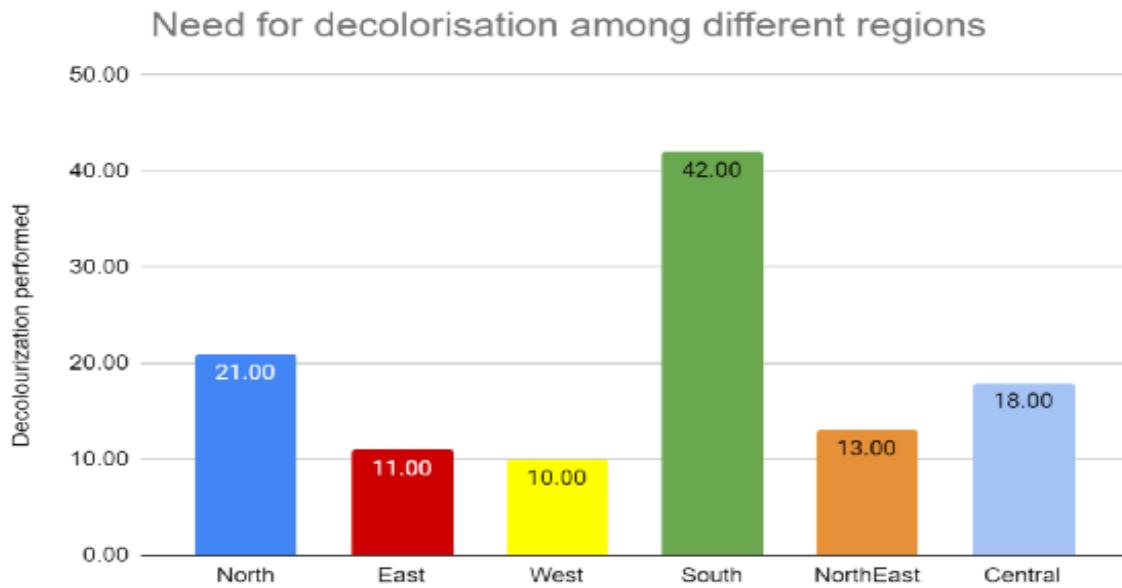


Fig 1.2: Graph showing the value of need for decolourisation among different regions

It can be inferred that due to a large number of samples requiring decolourisation in the South region, the hair of people in the South region contain more pigment compared to all the other regions. And in the West region, only 10 hair samples required decolourisation, so it can be inferred that the hair of the people belonging to that region have lesser pigmentation compared to the other regions.

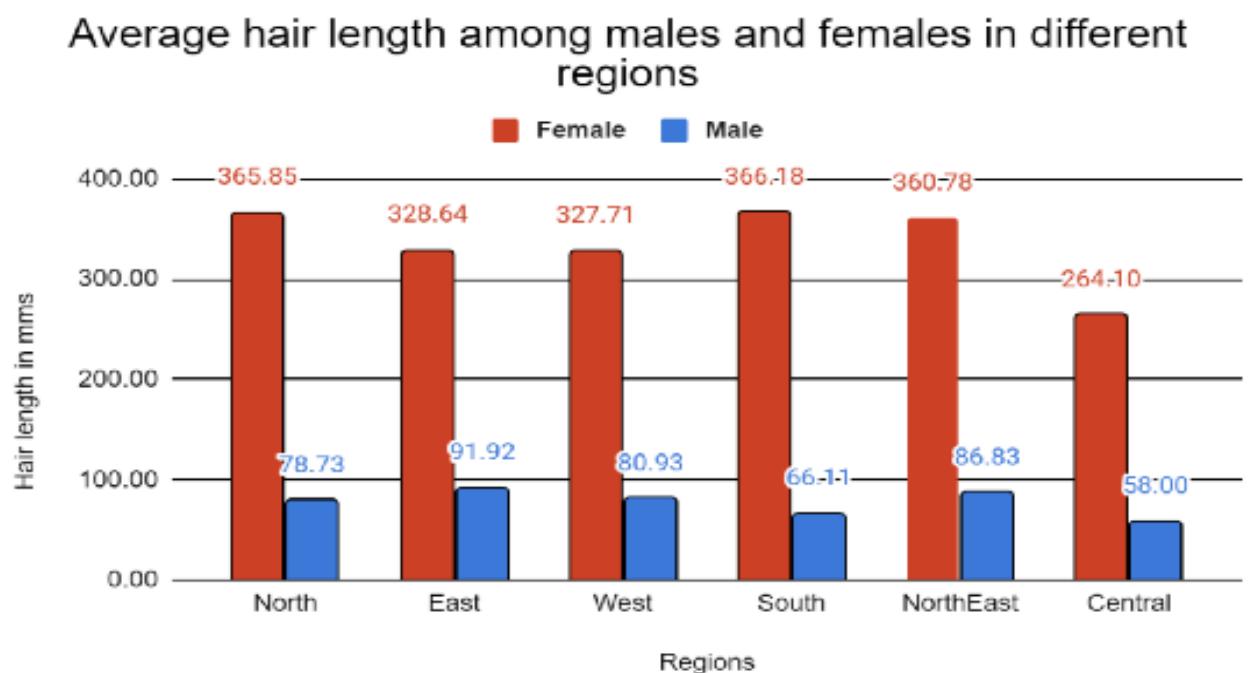


Fig 1.3: Graph showing average hair length among males and females in different regions

It can be observed that females in the South and North region have the highest hair length, and the males of the East and Northeast region have the highest hair length. The females of Central and West have the shortest hair length, and the males of Central and South have the shortest hair length.

Average hair diameter in proximal, intermediate and distal regions of hair among different regions

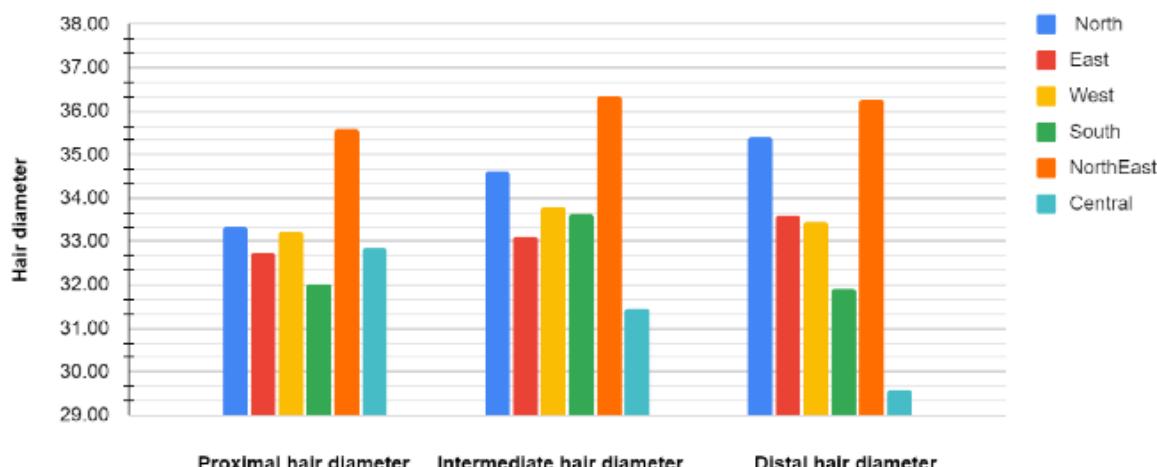


Fig 1.4: Graph showing average hair diameter in proximal, intermediate, and distal regions of hair among different regions

It can also be observed that the mean hair diameter value of Northeast region is highest in proximal, intermediate, and distal regions compared to the other regions. And there is a significant difference in the value of the central region in the distal part compared to the other regions.

Average hair root diameter in males and females of different regions

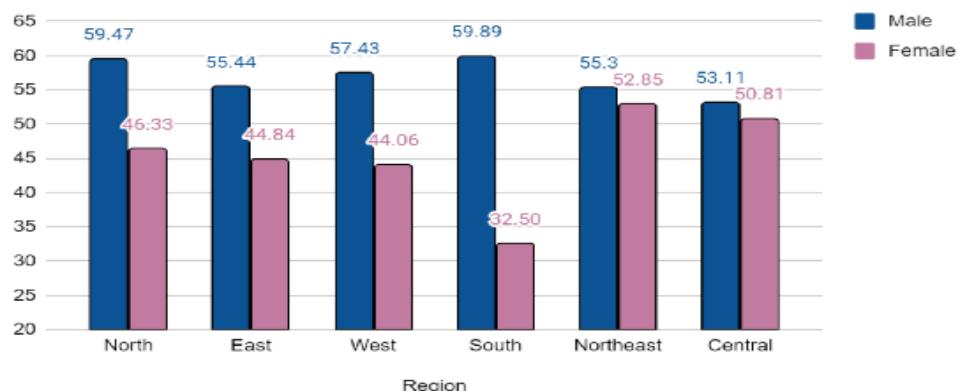


Fig 1.5: Graph showing the average hair root diameter in males and females of different regions.

It was seen that the Northwest region showed the lowest value of hair root diameter for male population and the south region showed the lowest value of hair root diameter for the female population. It was observed that the average hair root diameter was higher in male population compared to that of the female population.

CONCLUSION

The major findings of the present study are:

- 1) People in the north region have the largest root diameter and people in the west region have the smallest root diameter.
- 2) A large number of samples required decolourisation in the south region, the hair of people in the south region contain more pigment compared to all other regions.

It was also observed that there was a similar range between the hair root diameter of females of all the regions and males of all regions respectively. But since this is a study conducted with a small sample size, this particular observation cannot be declared. This study is only a preliminary study and therefore can be expanded further with a larger sample size.

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A STUDY TO DESIGN A SOFTWARE MODULE FOR A FORENSIC SOFTWARE

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INTRODUCTION

Technologies are used to perpetrate crimes, and law enforcement increasingly employs computer systems to fight crime because of the rising science of virtual proof forensics. The information recorded or transferred in digital shape that may be utilised in the courtroom is referred to as virtual evidence. It may be located on a PC (Personal Computer), fixed disc, or a cellular cell phone. Digital crimes, or e-crimes, consisting of child pornography or credit card fraud, are often connected with virtual proof. Virtual proof, however, is being employed within the prosecution of all types of crimes, not solely for e-crimes. Suspects' email or cell telephone documents may encompass important proof about their purpose, whereabouts at the time of the crime, and relationships with different suspects. For instance, in 2005, a floppy disk led the government to the BTK (Bind, Torture, Kill) serial assassin, who had prevented police arrest for the reason that 1974 and killed at least ten people. The medical gathering, evaluation, and renovation of statistics contained in electronic media that can be used as proof in a court of regulation are known as virtual forensics. Now police regulation enforcement groups are incorporating virtual forensics into their infrastructure to combat e-crime and acquire relevant virtual evidence for all offences.

AIM

To design a software module for a forensic software

OBJECTIVES:

1. To develop software capable of finding files on the basis of keywords whether it is hidden or visible to the user.
2. To create a software that can recognize and categorise photos, reduce noise from the dataset regardless of rotation, magnification, or both.
3. To Incorporate the criminal record in a decentralised manner through the use of a consolidated blockchain application.

METHOD

Using FileTree, Python, IPFS (InterPlanetary File System), and blockchain resources, a suitable program code was created to test the efficiency of finding files from basic keywords

RESULTS

```
1 from itertools import chain
2 import os
3 import sys
4
5 print("Do you want to search file?")
6 print ("1. word list in the dictory")
7 print ("2. On the basis extension")
8 A = float(input("Enter the choice: "))
9 Document = ('.docx', '.pdf', 'doc', 'csv', 'xlsx', 'xlsm', 'xlsb', 'xltx', 'xltm', 'xls', 'xlt', 'xsl', 'xml', 'xlam')
10 Image = ('.png', '.avif', '.gif', '.jpg', '.jpeg', '.jfif', '.ppg', '.png', '.svg', '.webp', '.bmp', '.ico', '.cur', '.tif', '.tiff', '.heic')
11 Video = ('.mp4', '.mov', '.wmv', '.avi', '.avchd', '.flv', '.f4v', '.swf', '.mkv')
12 Rape = ('Child abuse', 'Domestic violence', 'Blackmail', 'Guilt', 'Sex', 'Murder', 'Victim', 'Fear', 'Gang Rape', 'Rod', 'Vagina', 'Condoms')
13 Murder = ('Hit and run', 'Homicide', 'Peaching', 'Genocide', 'Assassination', 'Felony', 'Manslaughter', 'Bloodshed', 'Guns', 'Pistols', 'Rifle', 'Knife', 'Hammer', 'Strangulation')
14 Terrorism = ('Bombing', 'Espionage', 'Dynamite', 'Conflict', 'Hijacking', 'Kidnapping', 'Cyber terrorism', 'Explosive', 'Explosion')
15 paths = ('C:', 'D:')
16
17 if (A == 1):
18     print("Which Case")
19     print("1.Murder")
20     print("2.Rape")
21     print("3.Terrorism")
22     Madhu = float(input("Enter Your Choice: "))
23     Z = open('D:\Outputs\Murder\output.txt', 'w+')
24     sys.stdout = Z
25     if (Madhu == 1):
26         for root, dirs, files in chain.from_iterable(os.walk(path) for path in paths):
27             for file in files:
28                 if file.startswith(Murder):
29                     print(os.path.join(root, file))
```

```

29     print(os.path.join(root, file))
30 Z.close()
31 N = open('D:\Outputs\rape\output.txt', 'w')
32 sys.stdout = N
33 if (Madhu == 2):
34     ##Print the paths of all files in the specified directories that start with the specified string.
35     #@param paths - the paths to search for files in.
36     #@param Rape - the string to search for in the file names
37     for root, dirs, files in chain.from_iterable(os.walk(path) for path in paths):
38         for file in files:
39             if file.startswith(Rape):
40                 print(os.path.join(root, file))
41 N.close()
42 I = open('D:\Outputs\Terrorism\output.txt', 'w')
43 sys.stdout = I
44 if (Madhu == 3):
45     for root, dirs, files in chain.from_iterable(os.walk(path) for path in paths):
46         for file in files:
47             if file.startswith(Terrorism):
48                 print(os.path.join(root, file))
49 I.close()
50 if (A==2):
51     print("Which File type you want to search")
52     print("1.Picture")
53     print("2.Document")
54     print("3.Video")
55 D = float(input("Enter Choice: "))
56 L = open('D:\Outputs\Picture\output.txt', 'w')
57 sys.stdout = L
58 if (D == 1):
59     for root, dirs, files in chain.from_iterable(os.walk(path) for path in paths):
60         for file in files:
61             if file.endswith(Image):
62                 print(os.path.join(root, file))
63 L.close()
64 M = open('D:\Outputs\Document\output.txt', 'w')
65 sys.stdout = M
66 if (D == 2):
67     for root, dirs, files in chain.from_iterable(os.walk(path) for path in paths):
68         for file in files:
69             if file.endswith(Document):
70                 print(os.path.join(root, file))
71 M.close()
72 Q = open('D:\Outputs\Video\output.txt', 'w')
73 sys.stdout = Q
74 if (D==3):
75     for root, dirs, files in chain.from_iterable(os.walk(path) for path in paths):
76         for file in files:
77             if file.endswith(Video):
78                 print(os.path.join(root, file))
79 Q.close()
80

```

In [2]:

```
import matplotlib.pyplot as plt
import numpy as np
import PIL
import tensorflow as tf

from tensorflow import keras
from tensorflow.keras import layers
from tensorflow.keras.models import Sequential
```

In [3]:

```
import pathlib
dataset_url = "https://storage.googleapis.com/download.tensorflow.org/example_images/flower_photos.tgz"
data_dir = tf.keras.utils.get_file('flower_photos', origin=dataset_url, untar=True)
data_dir = pathlib.Path(data_dir)
```

In [4]:

```
image_count = len(list(data_dir.glob('*//*.jpg')))
print(image_count)
```

3670

In [5]:

```
roses = list(data_dir.glob('roses/*'))
PIL.Image.open(str(roses[0]))
```

Out[5]:



In [6]:

```
PIL.Image.open(str(roses[1]))
```

Out[6]:



In [7]:

```
tulips = list(data_dir.glob('tulips/*'))  
PIL.Image.open(str(tulips[0]))
```

Out[7]:



In [8]:

```
PIL.Image.open(str(tulips[1]))
```

Out[8]:



In [9]:

```
batch_size = 32  
img_height = 180  
img_width = 180
```

In [10]:

```
train_ds = tf.keras.utils.image_dataset_from_directory(  
    data_dir,  
    validation_split=0.2,  
    subset="training",  
    seed=123,  
    image_size=(img_height, img_width),  
    batch_size=batch_size)
```

Found 3670 files belonging to 5 classes.
Using 2936 files for training.

In [11]:

```
val_ds = tf.keras.utils.image_dataset_from_directory(  
    data_dir,  
    validation_split=0.2,  
    subset="validation",  
    seed=123,  
    image_size=(img_height, img_width),  
    batch_size=batch_size)
```

Found 3670 files belonging to 5 classes.
Using 734 files for validation.

In [12]:

```
class_names = train_ds.class_names  
print(class_names)  
  
['daisy', 'dandelion', 'roses', 'sunflowers', 'tulips']
```

In [13]:

```
import matplotlib.pyplot as plt  
plt.figure(figsize=(10, 10))  
for images, labels in train_ds.take(1):  
    for i in range(9):  
        ax = plt.subplot(3, 3, i + 1)  
        plt.imshow(images[i].numpy().astype("uint8"))  
        plt.title(class_names[labels[i]])  
        plt.axis("off")
```



In [14]:

```
for image_batch, labels_batch in train_ds:  
    print(image_batch.shape)  
    print(labels_batch.shape)  
    break
```

(32, 180, 180, 3)

(32,)

In [15]:

```
AUTOTUNE = tf.data.AUTOTUNE  
train_ds = train_ds.cache().shuffle(1000).prefetch(buffer_size=AUTOTUNE)  
val_ds = val_ds.cache().prefetch(buffer_size=AUTOTUNE)
```

In [16]:

```
normalization_layer = layers.Rescaling(1./255)
```

In [17]:

```
normalized_ds = train_ds.map(lambda x, y: (normalization_layer(x), y))  
image_batch, labels_batch = next(iter(normalized_ds))  
first_image = image_batch[0]  
print(np.min(first_image), np.max(first_image))
```

0.0 1.0

In [18]:

```
num_classes = len(class_names)  
model = Sequential([  
    layers.Rescaling(1./255, input_shape=(img_height, img_width, 3)),  
    layers.Conv2D(16, 3, padding='same', activation='relu'),  
    layers.MaxPooling2D(),  
    layers.Conv2D(32, 3, padding='same', activation='relu'),  
    layers.MaxPooling2D(),  
    layers.Conv2D(64, 3, padding='same', activation='relu'),  
    layers.MaxPooling2D(),  
    layers.Flatten(),  
    layers.Dense(128, activation='relu'),  
    layers.Dense(num_classes)  
])
```

In [19]:

```
model.compile(optimizer='adam',  
              loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=True),  
              metrics=['accuracy'])
```

In [20]:

```
model.summary()
```

Model: "sequential"

Layer (type)	Output Shape	Param #
rescaling_1 (Rescaling)	(None, 180, 180, 3)	0
conv2d (Conv2D)	(None, 180, 180, 16)	448
max_pooling2d (MaxPooling2D)	(None, 90, 90, 16)	0
conv2d_1 (Conv2D)	(None, 90, 90, 32)	4640
max_pooling2d_1 (MaxPooling2D)	(None, 45, 45, 32)	0
conv2d_2 (Conv2D)	(None, 45, 45, 64)	18496

max_pooling2d_2 (MaxPooling2D)	(None, 22, 22, 64)	0
flatten (Flatten)	(None, 30976)	0
dense (Dense)	(None, 128)	3965056
dense_1 (Dense)	(None, 5)	645

Total params: 3,989,285
Trainable params: 3,989,285
Non-trainable params: 0

In [21]:

```

epochs= 20
history = model.fit(
    train_ds,
    validation_data=val_ds,
    epochs=epochs
)

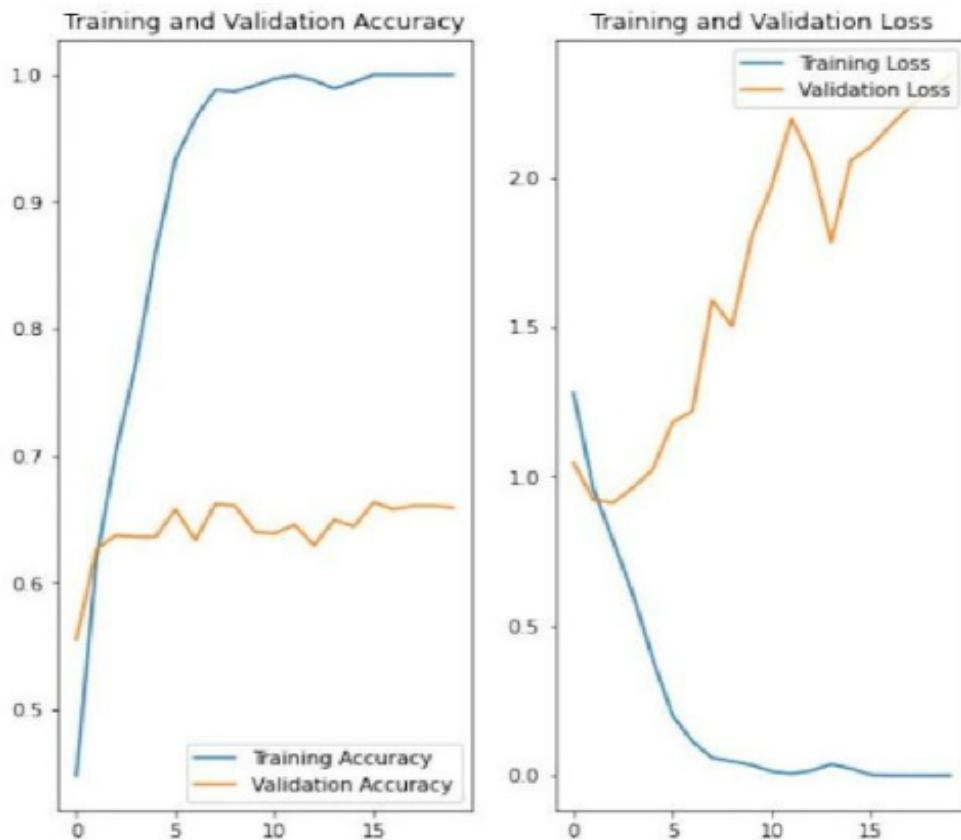
Epoch 1/20
92/92 [=====] - 2s 113ms/step - loss: 1.2804 - accuracy: 0.4486
- val_loss: 1.0471 - val_accuracy: 0.5559
Epoch 2/20
92/92 [=====] - 4s 46ms/step - loss: 0.9594 - accuracy: 0.6178 -
val_loss: 0.9224 - val_accuracy: 0.6267
Epoch 3/20
92/92 [=====] - 4s 45ms/step - loss: 0.7853 - accuracy: 0.7040 -
val_loss: 0.9126 - val_accuracy: 0.6376
Epoch 4/20
92/92 [=====] - 4s 44ms/step - loss: 0.6064 - accuracy: 0.7728 -
val_loss: 0.9624 - val_accuracy: 0.6362
Epoch 5/20
92/92 [=====] - 4s 42ms/step - loss: 0.3887 - accuracy: 0.8607 -
val_loss: 1.0244 - val_accuracy: 0.6362
Epoch 6/20
92/92 [=====] - 4s 43ms/step - loss: 0.2010 - accuracy: 0.9336 -
val_loss: 1.1821 - val_accuracy: 0.6580
Epoch 7/20
92/92 [=====] - 4s 44ms/step - loss: 0.1135 - accuracy: 0.9659 -
val_loss: 1.2181 - val_accuracy: 0.6335
Epoch 8/20
92/92 [=====] - 4s 44ms/step - loss: 0.0595 - accuracy: 0.9881 -
val_loss: 1.5906 - val_accuracy: 0.6621
Epoch 9/20
92/92 [=====] - 4s 44ms/step - loss: 0.0478 - accuracy: 0.9867 -
val_loss: 1.5029 - val_accuracy: 0.6608
Epoch 10/20
92/92 [=====] - 4s 43ms/step - loss: 0.0352 - accuracy: 0.9915 -
val_loss: 1.8065 - val_accuracy: 0.6403
Epoch 11/20
92/92 [=====] - 4s 43ms/step - loss: 0.0139 - accuracy: 0.9969 -
val_loss: 1.9720 - val_accuracy: 0.6390
Epoch 12/20
92/92 [=====] - 4s 43ms/step - loss: 0.0064 - accuracy: 0.9993 -
val_loss: 2.1985 - val_accuracy: 0.6458
Epoch 13/20
92/92 [=====] - 4s 44ms/step - loss: 0.0164 - accuracy: 0.9956 -
val_loss: 2.0582 - val_accuracy: 0.6294
Epoch 14/20

```

```
92/92 [=====] - 4s 44ms/step - loss: 0.0385 - accuracy: 0.9891 -  
val_loss: 1.7845 - val_accuracy: 0.6499  
Epoch 15/20  
92/92 [=====] - 4s 45ms/step - loss: 0.0236 - accuracy: 0.9942 -  
val_loss: 2.0582 - val_accuracy: 0.6444  
Epoch 16/20  
92/92 [=====] - 4s 46ms/step - loss: 0.0026 - accuracy: 1.0000 -  
val_loss: 2.1042 - val_accuracy: 0.6635  
Epoch 17/20  
92/92 [=====] - 4s 45ms/step - loss: 7.3304e-04 - accuracy: 1.00  
00 - val_loss: 2.1749 - val_accuracy: 0.6580  
Epoch 18/20  
92/92 [=====] - 4s 45ms/step - loss: 3.9710e-04 - accuracy: 1.00  
00 - val_loss: 2.2380 - val_accuracy: 0.6608  
Epoch 19/20  
92/92 [=====] - 4s 46ms/step - loss: 2.9957e-04 - accuracy: 1.00  
00 - val_loss: 2.2946 - val_accuracy: 0.6608  
Epoch 20/20  
92/92 [=====] - 4s 44ms/step - loss: 2.3911e-04 - accuracy: 1.00  
00 - val_loss: 2.3444 - val_accuracy: 0.6594
```

In [22]:

```
acc = history.history['accuracy']  
val_acc = history.history['val_accuracy']  
  
loss = history.history['loss']  
val_loss = history.history['val_loss']  
  
epochs_range = range(epochs)  
  
plt.figure(figsize=(8, 8))  
plt.subplot(1, 2, 1)  
plt.plot(epochs_range, acc, label='Training Accuracy')  
plt.plot(epochs_range, val_acc, label='Validation Accuracy')  
plt.legend(loc='lower right')  
plt.title('Training and Validation Accuracy')  
  
plt.subplot(1, 2, 2)  
plt.plot(epochs_range, loss, label='Training Loss')  
plt.plot(epochs_range, val_loss, label='Validation Loss')  
plt.legend(loc='upper right')  
plt.title('Training and Validation Loss')  
plt.show()
```

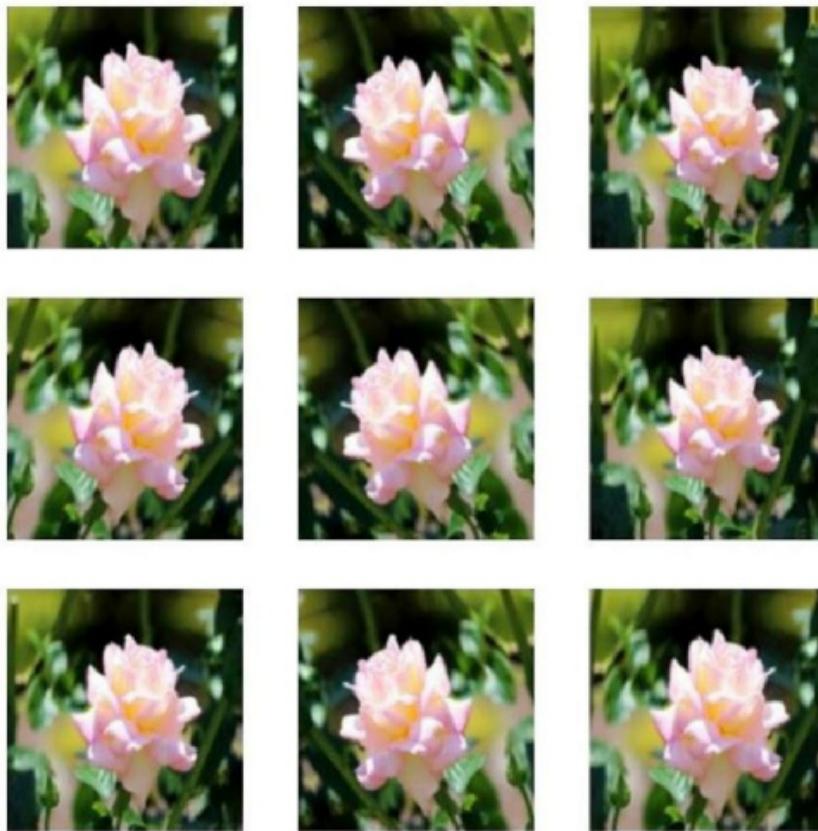


In [23]:

```
data_augmentation = keras.Sequential(
    [
        layers.RandomFlip("horizontal",
                           input_shape=(img_height,
                                       img_width,
                                       3)),
        layers.RandomRotation(0.1),
        layers.RandomZoom(0.1),
    ]
)
```

In [24]:

```
plt.figure(figsize=(10, 10))
for images, _ in train_ds.take(1):
    for i in range(9):
        augmented_images = data_augmentation(images)
        ax = plt.subplot(3, 3, i + 1)
        plt.imshow(augmented_images[0].numpy().astype("uint8"))
        plt.axis("off")
```



In [25]:

```
model = Sequential([
    data augmentation,
    layers.Rescaling(1./255),
    layers.Conv2D(16, 3, padding='same', activation='relu'),
    layers.MaxPooling2D(),
    layers.Conv2D(32, 3, padding='same', activation='relu'),
    layers.MaxPooling2D(),
    layers.Conv2D(64, 3, padding='same', activation='relu'),
    layers.MaxPooling2D(),
    layers.Dropout(0.2),
    layers.Flatten(),
    layers.Dense(128, activation='relu'),
    layers.Dense(num_classes)
])
```

In [26]:

```
model.compile(optimizer='adam',
              loss= tf.keras.losses.SparseCategoricalCrossentropy(from_logits=True),
              metrics=['accuracy'])
```

In [27]:

```
model.summary()
```

Model: "sequential_2"

Layer (type)	Output Shape	Param #
sequential_1 (Sequential)	(None, 180, 180, 3)	0

rescaling_2 (Rescaling)	(None, 180, 180, 3)	0
conv2d_3 (Conv2D)	(None, 180, 180, 16)	448
max_pooling2d_3 (MaxPooling2D)	(None, 90, 90, 16)	0
conv2d_4 (Conv2D)	(None, 90, 90, 32)	4640
max_pooling2d_4 (MaxPooling2D)	(None, 45, 45, 32)	0
conv2d_5 (Conv2D)	(None, 45, 45, 64)	18496
max_pooling2d_5 (MaxPooling2D)	(None, 22, 22, 64)	0
dropout (Dropout)	(None, 22, 22, 64)	0
flatten_1 (Flatten)	(None, 30976)	0
dense_2 (Dense)	(None, 128)	3965056
dense_3 (Dense)	(None, 5)	645
<hr/>		
Total params: 3,989,285		
Trainable params: 3,989,285		
Non-trainable params: 0		

In [28]:

```
epochs = 35
history = model.fit(
    train_ds,
    validation_data=val_ds,
    epochs=epochs
)
Epoch 1/35
92/92 [=====] - 9s 60ms/step - loss: 1.4114 - accuracy: 0.3988 -
val_loss: 1.1200 - val_accuracy: 0.5450
Epoch 2/35
92/92 [=====] - 5s 55ms/step - loss: 1.1092 - accuracy: 0.5548 -
val_loss: 1.0482 - val_accuracy: 0.5790
Epoch 3/35
92/92 [=====] - 5s 54ms/step - loss: 0.9933 - accuracy: 0.6090 -
val_loss: 0.9491 - val_accuracy: 0.6090
Epoch 4/35
92/92 [=====] - 5s 56ms/step - loss: 0.9017 - accuracy: 0.6499 -
val_loss: 0.8856 - val_accuracy: 0.6335
Epoch 5/35
92/92 [=====] - 5s 57ms/step - loss: 0.8647 - accuracy: 0.6621 -
val_loss: 0.8315 - val_accuracy: 0.6826
```

```
Epoch 6/35
92/92 [=====] - 5s 53ms/step - loss: 0.8052 - accuracy: 0.6836 -
val_loss: 0.8086 - val_accuracy: 0.7044
Epoch 7/35
92/92 [=====] - 5s 52ms/step - loss: 0.7510 - accuracy: 0.7136 -
val_loss: 0.8714 - val_accuracy: 0.6567
Epoch 8/35
92/92 [=====] - 5s 55ms/step - loss: 0.7359 - accuracy: 0.7173 -
val_loss: 0.8816 - val_accuracy: 0.6485
Epoch 9/35
92/92 [=====] - 5s 57ms/step - loss: 0.7102 - accuracy: 0.7340 -
val_loss: 0.7484 - val_accuracy: 0.7030
Epoch 10/35
92/92 [=====] - 5s 56ms/step - loss: 0.6564 - accuracy: 0.7493 -
val_loss: 0.8033 - val_accuracy: 0.7030
Epoch 11/35
92/92 [=====] - 5s 56ms/step - loss: 0.6407 - accuracy: 0.7541 -
val_loss: 0.7205 - val_accuracy: 0.7193
Epoch 12/35
92/92 [=====] - 5s 54ms/step - loss: 0.6252 - accuracy: 0.7687 -
val_loss: 0.7144 - val_accuracy: 0.7166
Epoch 13/35
92/92 [=====] - 5s 53ms/step - loss: 0.6054 - accuracy: 0.7729 -
val_loss: 0.7206 - val_accuracy: 0.7207
Epoch 14/35
92/92 [=====] - 5s 54ms/step - loss: 0.5691 - accuracy: 0.7820 -
val_loss: 0.7445 - val_accuracy: 0.7289
Epoch 15/35
92/92 [=====] - 5s 53ms/step - loss: 0.5535 - accuracy: 0.7905 -
val_loss: 0.7016 - val_accuracy: 0.7302
Epoch 16/35
92/92 [=====] - 5s 53ms/step - loss: 0.4949 - accuracy: 0.8113 -
val_loss: 0.7093 - val_accuracy: 0.7343
Epoch 17/35
92/92 [=====] - 5s 55ms/step - loss: 0.5035 - accuracy: 0.8038 -
val_loss: 0.7374 - val_accuracy: 0.7207
Epoch 18/35
92/92 [=====] - 5s 53ms/step - loss: 0.4715 - accuracy: 0.8215 -
val_loss: 0.6697 - val_accuracy: 0.7452
Epoch 19/35
92/92 [=====] - 5s 53ms/step - loss: 0.4555 - accuracy: 0.8324 -
val_loss: 0.6963 - val_accuracy: 0.7480
Epoch 20/35
92/92 [=====] - 5s 52ms/step - loss: 0.4439 - accuracy: 0.8321 -
val_loss: 0.6642 - val_accuracy: 0.7670
```

```
Epoch 21/35
92/92 [=====] - 5s 53ms/step - loss: 0.4315 - accuracy: 0.8386 -
val_loss: 0.7395 - val_accuracy: 0.7398
Epoch 22/35
92/92 [=====] - 5s 54ms/step - loss: 0.4229 - accuracy: 0.8430 -
val_loss: 0.6980 - val_accuracy: 0.7520
Epoch 23/35
92/92 [=====] - 5s 53ms/step - loss: 0.3817 - accuracy: 0.8583 -
val_loss: 0.8149 - val_accuracy: 0.7262
Epoch 24/35
92/92 [=====] - 5s 56ms/step - loss: 0.3776 - accuracy: 0.8610 -
val_loss: 0.6811 - val_accuracy: 0.7725
Epoch 25/35
92/92 [=====] - 5s 53ms/step - loss: 0.3409 - accuracy: 0.8702 -
val_loss: 0.7799 - val_accuracy: 0.7520
Epoch 26/35
92/92 [=====] - 5s 55ms/step - loss: 0.3486 - accuracy: 0.8682 -
val_loss: 0.7301 - val_accuracy: 0.7520
Epoch 27/35
92/92 [=====] - 5s 53ms/step - loss: 0.3146 - accuracy: 0.8794 -
val_loss: 0.7901 - val_accuracy: 0.7548
Epoch 28/35
92/92 [=====] - 5s 54ms/step - loss: 0.2991 - accuracy: 0.8966 -
val_loss: 0.7249 - val_accuracy: 0.7670
Epoch 29/35
92/92 [=====] - 5s 53ms/step - loss: 0.3128 - accuracy: 0.8893 -
val_loss: 0.7471 - val_accuracy: 0.7602
Epoch 30/35
92/92 [=====] - 5s 53ms/step - loss: 0.2812 - accuracy: 0.8958 -
val_loss: 0.7277 - val_accuracy: 0.7738
Epoch 31/35
92/92 [=====] - 5s 53ms/step - loss: 0.2688 - accuracy: 0.8999 -
val_loss: 0.7353 - val_accuracy: 0.7520
Epoch 32/35
92/92 [=====] - 5s 55ms/step - loss: 0.2611 - accuracy: 0.9067 -
val_loss: 0.8474 - val_accuracy: 0.7371
Epoch 33/35
92/92 [=====] - 5s 54ms/step - loss: 0.2534 - accuracy: 0.9118 -
val_loss: 0.7922 - val_accuracy: 0.7711
Epoch 34/35
92/92 [=====] - 5s 53ms/step - loss: 0.2297 - accuracy: 0.9138 -
val_loss: 0.8594 - val_accuracy: 0.7493
Epoch 35/35
92/92 [=====] - 5s 54ms/step - loss: 0.2312 - accuracy: 0.9227 -
val_loss: 0.8389 - val_accuracy: 0.7425
```

In [29]:

```

acc = history.history['accuracy']
val_acc = history.history['val_accuracy']

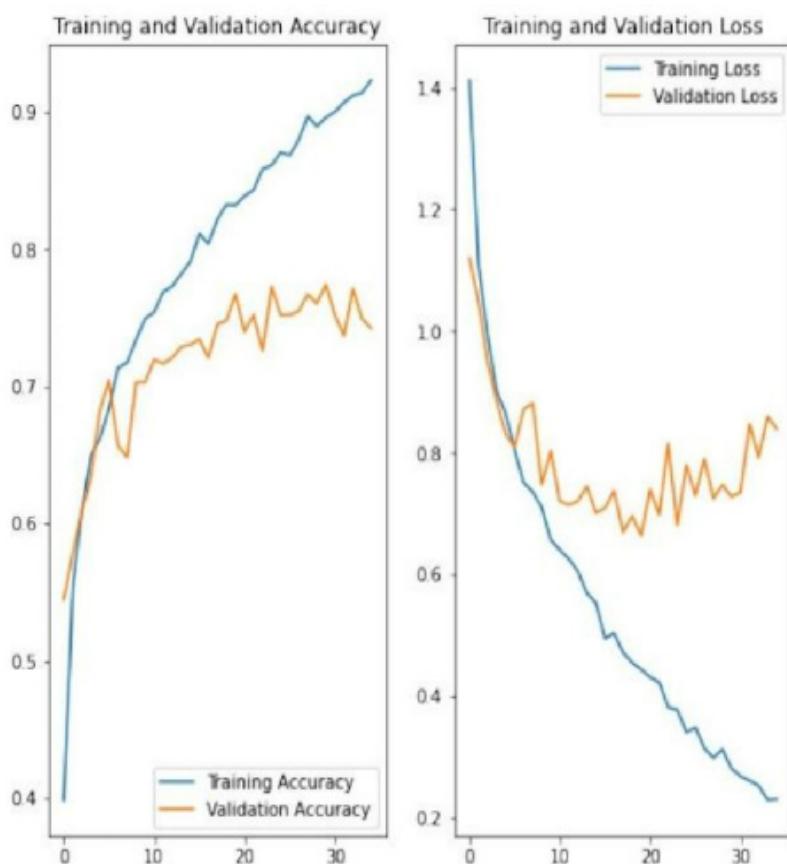
loss = history.history['loss']
val_loss = history.history['val_loss']

epochs_range = range(epochs)

plt.figure(figsize=(8, 8))
plt.subplot(1, 2, 1)
plt.plot(epochs_range, acc, label='Training Accuracy')
plt.plot(epochs_range, val_acc, label='Validation Accuracy')
plt.legend(loc='lower right')
plt.title('Training and Validation Accuracy')

plt.subplot(1, 2, 2)
plt.plot(epochs_range, loss, label='Training Loss')
plt.plot(epochs_range, val_loss, label='Validation Loss')
plt.legend(loc='upper right')
plt.title('Training and Validation Loss')
plt.show()

```



In [30]:

```
tulip_url = "https://5.imimg.com/data5/ZR/00/EA/SELLER-34246236/tulip-flower-500x500.jpg"
tulip_path = tf.keras.utils.get_file('sunflowers', origin=tulip_url)

img = tf.keras.utils.load_img(
    tulip_path, target_size=(img_height, img_width)
)
img_array = tf.keras.utils.img_to_array(img)
img_array = tf.expand_dims(img_array, 0) # Create a batch

predictions = model.predict(img_array)
score = tf.nn.softmax(predictions[0])

print(
    "This image most likely belongs to {} with a {:.2f} percent confidence."
    .format(class_names[np.argmax(score)], 100 * np.max(score))
)
```

This image most likely belongs to tulips with a 99.98 percent confidence.

CONCLUSION:

We were able to use AI (Artificial Intelligence) and blockchain in virtual forensics by establishing a document finder, image classifier, Filecoin, and IPFS by storing criminal records in a decentralised format, including a blockchain that combines the first-class functions of IPFS and Filecoin, and to analyse and correlate the virtual statistics contained in an investigation's evidence based on their expertise, thereby reducing the number of records. In addition, we developed an application that provides an efficient storing and sharing machine.

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A REVIEW ON FREQUENCY AND PREVALENCE OF PYRETHROID POISONING IN INDIA

Veritas Volume: 2, Issue: 2, Pages:63-69

Ms. Riya Raj C A

INTRODUCTION

Poisoning is one of the most ancient crimes among humanity and one that will never fade in society. The intentions of poisoning range from accidental, homicidal, to suicidal. The choice of poisons also differ across intentions of poisoning. For example, a suicidal poison choice would be an easily available, yet effective poison, whereas an accidental or homicidal poison may go unnoticed (less effective) for many days. Traditional pesticides are the organophosphates, organochlorines, and carbamates that are commonly used in pest management in the agro-business. A new and emerging class of pesticides are the pyrethroids which are of interest in forensic science due to its undue use in poisoning - both with suicidal and homicidal intent.

Pyrethroids are a synthetic version of pyrethrin, a naturally occurring pesticide found in chrysanthemum (flower). They were developed in such a way as to maximise their stability in the environment. It has insecticidal properties of pyrethrin that are strongly lipophilic and rapidly penetrate into insects, paralysing their nervous system.

In this background, some facts about pyrethroids are presented below:
Chemistry of pyrethroids - Pyrethrins are a mixture of six structurally related insecticidal esters formed by a combination of two acids (chrysanthemic acid and pyrethic acid) and three alcohols (pyrethrolone, cinerolone, and jasmolone). The mode of action of pyrethroid poisoning - They act as axonic excitotoxins, i.e., the toxic effects are mediated by preventing the closure of the voltage-gated sodium channels in the axonal membranes. When the toxin keeps the channels in their

open state, the nerves cannot repolarize, leaving the axonal membrane permanently depolarized and thus paralysing the organism. This present study attempts to understand the frequency and prevalence of pyrethroid poisoning in India by understanding the production, sale, and number of poisoning cases reported during the period 2018-2021 in India.

RESEARCH GAP

A study to understand India-specific data with relation to production, sale, and poisoning occurring in India is missing. A study with such an objective can give a picture of the frequency and prevalence of pyrethroid poisoning in India.

OBJECTIVES OF THE STUDY

The study was performed with the following objectives

- To estimate the production capacity of pyrethroids in India
- To identify the sales of pyrethroids in India
- To identify the number of poisoning cases involving pyrethroids in India
- To estimate the number of fatalities involving pyrethroids in India

MATERIALS AND METHODS

The study took place during the period 2018-2021. The study adopted a meta-analysis cum data acquisition process. The information on production & import of pyrethroid pesticides was collected from published online sources. The data was collected from a comprehensive list of online portals that detail and list the production and import details of chemical pesticides in India. The details on sales of pyrethroid pesticides were collected from published online sources as well as information gathered from vendors. A comprehensive list of online stores which deal with pesticide sale as well

as market vendors were used to collate data on the sale of pyrethroid pesticides in India. The incidences of poisoning cases involving pyrethroid pesticides were collected from state crime records, medical hospital records, and indices from poison control centres (PCCs) across India. All PCCs were taken into consideration for this information.

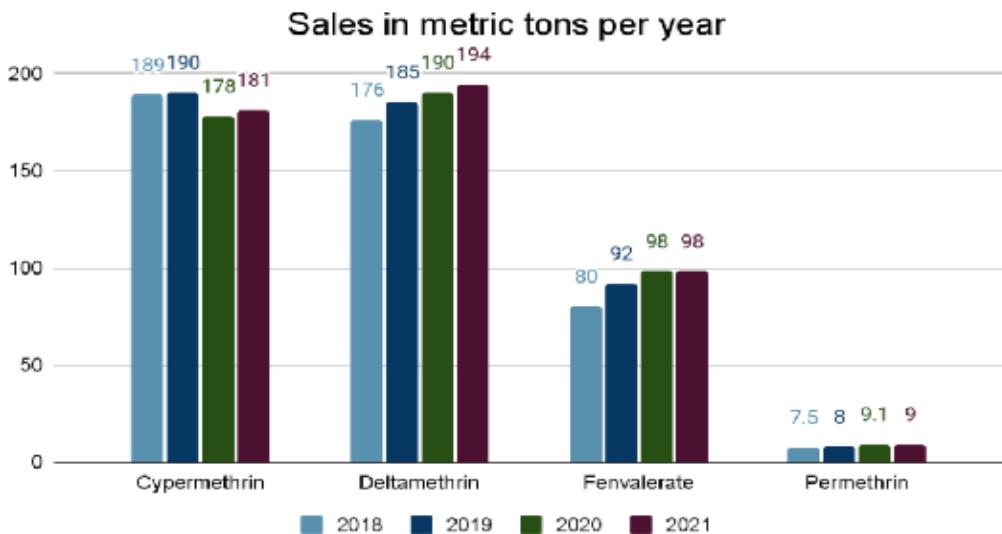
The details on fatalities by pyrethroid poisoning were collected from medical hospital records across India. Different databases were reviewed, and written communications were employed to collect this information. For the last 2 parameters, the region-wise zone was tabulated for comparison to ensure easy understanding of the data. For the purposes of this study, India was split into 6 regions.

FINDINGS AND ANALYSIS

Production of pyrethroids in India

- Cypermethrin - The installed production capacity of cypermethrin across India was around 24 thousand metric tons in the fiscal year 2021. Since 2009, the general public has not been able to access the chemical.
- Deltamethrin - Mostly imported. 20 thousand metric tons were imported in 2018. The data of import since then is not available.
- Fenvalerate - 200 metric tons (2019)
- Permethrin - 1000 kilograms per year (as in 2019)

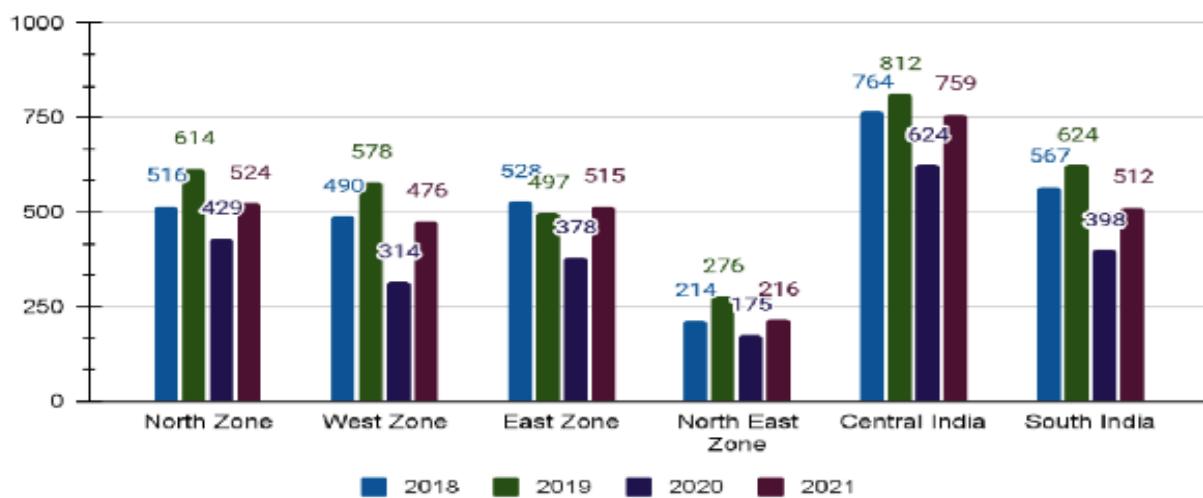
Sale in metric tons per year in India



	2018	2019	2020	2021
Cypermethrin	189	190	178	181
Deltamethrin	176	185	190	194
Fenvalerate	80	92	98	98
Permethrin	7.5	8	9.1	9

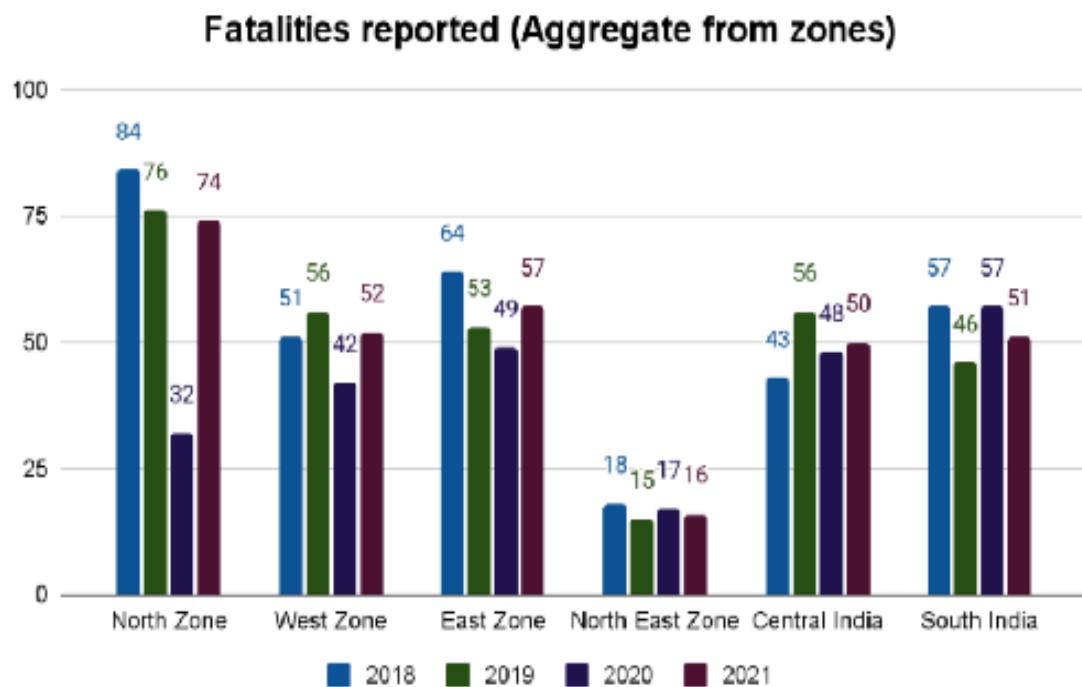
Poisoning cases reported (zone-wise data) in India

Poisoning cases reported (Aggregate from zones)



	2018	2019	2020	2021
North Zone	516	614	429	524
West Zone	490	578	314	476
East Zone	528	497	378	515
North East Zone	214	276	175	216
Central India	764	812	624	759
South India	567	624	398	512

Fatalities reported (zone-wise data) in India



	2018	2019	2020	2021
North Zone	84	76	32	74
West Zone	51	56	42	52
East Zone	64	53	49	57
North East Zone	18	15	17	16
Central India	43	56	48	50
South India	57	46	57	51

CONCLUSION AND FUTURE SCOPE

The study shows a steady rise in the import, production, sales, and incidences of poisoning involving pyrethroid pesticides in India. The Covid pandemic served as a disruption to the study's findings. Therefore, the trend of production, sale, poisoning, and fatalities is not clearly presented due to the disruption. But it is safe to say that overall, there seems to be an increasing dependence by the farming community on pyrethroid pesticides. There is also an overall increase in poisoning and fatality cases involving pyrethroid pesticides in India.

The thought that pyrethroid pesticides only cause environmental pollution is no more true if this trend continues. Pyrethroids have

been thought of as environmental poisons, more than animal and human poisons in the past. Many studies have an environmental concern in their objectives. This preliminary study shows the impact of pyrethroid use and abuse among humans in India.

The trend is not clear due to the pandemic disruption in the period of study. But overall there seems to be an increase in the number of poisoning and fatalities of pyrethroids in India. This trend is indicative of the rise of pyrethroid pesticides as the new class of toxins - for both suicidal and homicidal purposes.

This study can further be strengthened by taking into consideration the number of suicidal poisonings, homicidal poisonings, and accidental poisonings. This can give an indication as to its abuse pattern. A more definite statistical study can provide insights as to whether the pattern is similar in other countries or if it is in India alone. This can give an indication of regional use/abuse.

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DEVELOPMENT OF LATENT FINGERPRINT USING MASALA POWDERS AND FLOURS

Veritas Volume: 2, Issue: 2, Pages:70-72

Ms. A Sherlin Gomez

Usually, latent fingerprints are developed using the powder method on non-porous smooth surfaces. The powders employed are specific for certain surfaces and their color. Here I have used basic, easily available powders and flours in a typical Indian household, these range from chilli powder to all-purpose flour. Conventional powders are hard to get and expensive and toxic when compared to the food powders that we use. The importance of such an alternative is when the conventional is limited or not available.



THE PROCESS

A total of 8 finely grounded powders and flours were used: Kashmiri Chili powder, Coriander powder, Pepper powder, Turmeric powder, Rice flour, Wheat flour, Corn flour, and All-purpose flour. A blush brush and glassware were used for the development of latent print.

The powder was not treated in the oven or heated prior, they were used as stored. For a clear print, the fingertips were rubbed on the forehead to get the sebum which was later deposited on the glass-ware surface. The process of development remained the same as the development of latent prints using conventional powders, The brush tip with powder was carefully dusted on the top of the print, perpendicular making sure not to touch and disturb the print. The development was done multiple times and the best one was chosen. The following are the results obtained:



Kashmir Chilli Powder



Corn Flour



All- Purpose Flour



Rice Flour



Turmeric Powder



Coriander Powder



Wheat Powder



Pepper Powder

CONCLUSION

The latent fingerprint developed using the above powders can be used for studying and comparison considering them to be a good alternative. The usage of coffee powder, fenugreek powder, tea, and asafoetida powder for latent print development gave negative results. This experiment worked on the principle of the conventional powders, the mechanical adherence or adsorption of powder to the sweat residue. The development was not done in aged prints.

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GLOBAL NEWS

UPDATES RELATED TO FORENSIC SCIENCE

- **Crime-Lite® Auto – The Comprehensive Forensic Digital Documentation Tool**
- **Steam Thermography**
- **Blowflies: An Agent for Chemical Pollutants**

CRIME-LITE® AUTO – THE COMPREHENSIVE FORENSIC DIGITAL DOCUMENTATION TOOL

Veritas Volume: 2, Issue: 2, Pages:74-77

Ms. Arsha Sahadevan

“Succinctly put, a crime scene is like an archeology site. If an excavation is botched or bulldozed away, there’s no going back.” says the American crime writer Patricia Cornwell. The quote rightly points to the importance of crime scene examination, timely collection of evidence, and the testing of this evidence. If evidence gets overlooked and the crime scene is wiped clean, the investigator or forensic expert would permanently lose out on crucial incriminatory evidence at the scene. Such scenarios highlight the need for state-of-the-art equipment to conduct crime scene searches, evidence detection, and documentation of evidence.



Image Courtesy : Foster + Freeman

One such piece of technology designed for effective crime scene search, evidence identification, and documentation in crime scenes and laboratories is Crime-lite® AUTO. Developed by Foster+Freeman, the equipment is stated to be “the most integrated, complete, and compact forensics digital camera solution in existence”.

Conventional crime scene searches employ DSLR (Digital Single-Lens Reflex) cameras that require investigators to carry alternate light sources, image filters, and goggles separately. Crime-lite® AUTO proves an exception as the device comprises a 20MP (Megapixel) multi-spectral UV-Vis-IR (Ultraviolet-Visible-Infrared) camera with about 55 waveband combinations to document and examine all types of evidence in the crime scene. Apart from the above features, the device offers the following:

- 7” multi-touch display interface that helps capture high-resolution live crime scene images and videos and preview captured images
- Autofocus macro lens to help effectively process the crime scene faster
- Wide-angle illumination to help cover a wider area of the crime scene instantaneously
- HDMI (High-Definition Multimedia Interface) port to enable connection to an additional viewing monitor for enhanced visualisation
- Internal storage of images and videos using micro SD (Secure Digital) and USB (Universal Serial Bus) ports
- Export of images and videos to an external device when in need of immediate digital transfer to forensic labs through the companion app
- Motorised filter wheel that enables both automatic filter selection and complete manual control aiming to help visualise

evidence better

- Wi-Fi (Wireless Fidelity) and Bluetooth connectivity

The handheld device has an interface that requires minimum personnel training for use. The device was introduced in 2021. Ocean county sheriff's office in New Jersey (United States) and Gloucestershire Constabulary (United Kingdom) are among the few offices utilising the equipment for better policing. The latter obtained the device for £22,000 through a bid. Owing to the futuristic and sci-fi-like technology, Crime-lite® AUTO also found its way to the popular BBC show Silent Witness. The device helps reveal evidence like body fluids (including saliva, semen, blood, urine, and vaginal secretions), fingerprints, and trace evidence (including gunshot residue, glass shards, hair, and fibre). The equipment weighs around 1.6 kilograms with the battery included. Crime-lite® AUTO is equally suited to the crime scene and laboratory.

Foster+Freeman, being the leading innovators in forensic equipment, has recently introduced DISCOVER®, a two-part workstation to be used in combination with Crime-lite® AUTO for particularly visualising and examining fingerprint marks on crime scene exhibits.



Image Courtesy : Foster + Freeman

The equipment holds immense potential to reduce the workload of forensic examiners and crime scene investigators while at the same time ensuring effective and swift crime scene processing. Such

technologies help prevent overlooking evidence at the scene and
and negligent disposal of cases, reducing successful convictions.

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STEAM THERMOGRAPHY

Veritas Volume: 2, Issue: 2, Pages:78-79

Ms. Keerthi Anupama

Bloodstains are one of the most crucial forms of evidence in a forensic examination. Examining the pattern and quantity of blood found at a crime scene could provide details on the nature of the crime. Its in-depth analysis can reveal absolute pieces of information such as the identification of a victim or the culprit responsible for the crime, the nature of the injury, the weapon used to inflict the injury, etc.

When entering a scene of the crime, the investigating officer must be able to detect and record their findings by means of sketching, video, and photographing evidence. For evidence pertaining to bloodstains, the application of luminol and other blood detection techniques can be employed. Luminol is a widely used chemical for the detection of blood stains at a scene of crime. It basically reacts with the iron components of the blood and fluoresces when viewed in the dark. Apart from the dramatic flair it provides, it is accompanied by a few setbacks. The technique improvised to counter the setbacks of luminol tests is ‘Steam Thermography’.

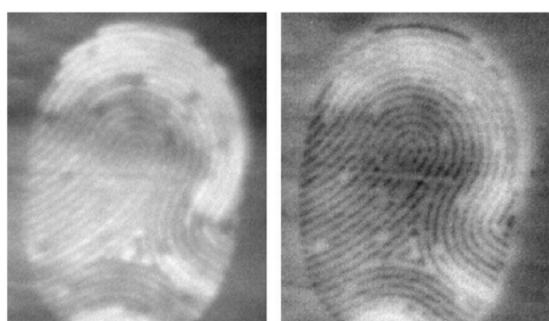


Fig 1. Fingerprints developed using steam thermography

Developed by a team led by chemistry professors Michael Myrick and Stephen Morgan from the University of South Carolina, it is a technique that enhances the chemical contrast in thermographic images by exposing the said questioned surface containing blood to water vapour i.e., steam during imaging. This exposure generates heat, aiding the increase of the thermographic ally-measured temperature of the imaged surfaces. This can result in thermographic contrast between surfaces with different chemical properties. For blood stains, the enhancement capacity is measured by the radiant heat transfer which warms up the blood and its backdrop.

REQUIREMENTS:

The use of a portable steamer is advised along with the heat imaging IR-sensitive cameras. The thermal images are recorded through a sodium chloride salt window by a FLIR Systems A315 microbolometer-based camera (16-bit digitization, 240 x 320-pixel resolution, 30 Hz frame rate) which helps in the detection of even minute amounts of blood.

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BLOWFLIES: AN AGENT FOR CHEMICAL POLLUTANTS

Veritas Volume: 2, Issue: 2, Pages:80-83

Ms. Baavnai K

Ms. R Bhavitha Sri

Ms. Anumita Mazumdar

INTRODUCTION: WHAT ARE BLOWFLIES?



Fig. 1: Blow Fly

The Calliphoridae family of insects, which is part of the Diptera order, includes blow flies (insects that have two wings). They belong to the genera *Calliphora*, *Lucilia*, and *Chrysomya*. Despite being generally bigger than house flies, they have many of the same behaviours. They are coloured green, blue, copper, and purple. Blow flies may also go by the names blue bottle, green bottle, or screw-worms. Warm, muggy weather is ideal for blowflies to flourish.

When it is windy, extremely dry, and hot, or when it is chilly outside, they struggle. These circumstances are crucial to the blow fly's life cycle.

LIFE CYCLE OF A BLOWFLY!

The female blow fly deposits eggs to start the life cycle. A single female is capable of depositing between 250 and 300 eggs, mainly throughout the winter. Two to three weeks are needed to complete the life cycle. The male blowfly is sexually mature when it is born, however, the female blowfly must ingest some protein before she may mate. The holes of a corpse or wounds are where the eggs are often placed. The rotting material is subsequently consumed by the larvae. The eggs subsequently hatch after 24 to 48 hours.

FORENSIC SIGNIFICANCE IN REGARD TO BLOWFLIES

Blow flies are indeed the organisms that first get attracted to the corpse. That is why they are considered to be of very great forensic significance. These flies are influenced by a wide range of factors that make them both, attract and repel. The legs, cerci, and antennae of blow flies have receptors that have the potential to respond to the attractants around them. They usually tend to prefer filthy areas and attract the odour of animal excretions and secretions, ammonia, and fatty acids. The fumes released by the burning of eucalyptus oil in a simmering pot will repel these flies away. They have a tendency to fly almost up to 10 to 12 miles away from their origin by carrying traces of decay and searching for an appropriate dead corpse to lay their eggs whose life cycle is very significant in determining the time since the death of the body. Not just on dead bodies, rather they also lay eggs on meat, garbage, poorly managed compost files, and other unhygienic areas. They are not capable of harming you through a bite or a sting. But, yet they are way too dangerous as they act as vectors and may cause health-related diseases

like cholera, food poisoning, and dysentery. Geographically, blow flies are found almost everywhere and are richly found in temperate or tropical areas where they can thrive. During the fall, there are chances of these flies entering our houses so as to find a warm place. This is to support their lives in the winter. And in the spring, they come into play thereby appearing in the houses.

HOW ARE THEY USEFUL IN DETECTING CHEMICALS AND OTHER POLLUTANTS IN THE ENVIRONMENT?

Throughout the generations, different wars have taken place between various countries and regions. The use of weapons, especially chemical weapons, was rampant during war times. These chemical pollutants remain in the environment and affect human health. In a study conducted at Indiana University, blowflies can be used to detect various chemical pollutants present in the environment. This study has been published in a journal titled ‘Environmental Science and Technology’.

According to Christina Picard, Associate professor of biology at Indiana University, “There are always blowflies about, and they are excellent at sampling our surroundings. They will taste the environment as they fly through it, and their stomachs will preserve the knowledge. To ascertain which substances were present in the blowflies’ stomachs, researchers employed a mass spectrometer. Simulants of chemical warfare agents as well as some of the by-products that chemical agents break down into when exposed to the environment were both detectable. We would discover it on the fly if it came across a water source with a chemical agent hydrolyzed in the water.”

The researchers discovered that while chemical warfare weapons do not last for very long in the environment, they are sufficiently conserved in the fly’s intestines for chemical analysis. Additionally, they were able to detect the chemical warfare agent imitators

up to 14 days after a fly had first been exposed to them, showing that there are safer ways to collect samples without endangering people's lives.

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CASE STUDIES

- Shraddha Walker Murder Case
- Incest Story of the Captivated
- The Muswell Hill Murderer
- Rojas Murder Case

SHRADDA WALKER MURDER CASE

Veritas Volume: 2, Issue: 2, Pages:85-88

Ms. Ananya Subramanian
Ms. Ananya Keshav

Shraddha Walker, a 27-year-old woman, was strangled and chopped brutally by her live-in partner, Aftab Poonawalla, and was thrown off into the Mehrauli jungle in the national capital, Delhi. He killed her on May 18, 2022, and the case came to public attention on November 11.

Aftab and Shraddha met each other on a dating app called Bumble; both of them are from Maharashtra, and after getting into a relationship, they shifted to Delhi in 2022. Shraddha's parents were against this relationship between Shraddha and Aftab since both of them belonged to different religions. Shraddha and Aftab had a toxic relationship from the start, and he used to physically abuse her. Shraddha wanted to leave Aftab but was not able to do so. On May 18th they shifted into the rented apartment in Mehrauli, and three days later, she was killed. Shraddha's friend noticed her missing due to the lack of contact and informed her father. Her father filed a missing person complaint on October 6th.

The police launched an inquiry into her live-in partner Aftab, and he claimed that Shraddha had left the house after an argument in May. He was still using Shraddha's Instagram handle even after her death, and he was also active on other dating apps. There is also a record of transferring money from Shraddha's account to Aftab's. On November 8th, following further investigation, Aftab allegedly broke down and confessed.



Fig1: The victim Shraddha Walker and the accused Aftab

Aftab revealed that he strangled her to death and then chopped her into 35 pieces and kept it in polyethylene bags. He bought a 300-litre fridge to store her body parts and disposed of them in the Mehrauli forest in several days. While analysing his transaction details, it was seen that he spent a lot of money to buy room fresheners and incense sticks to mask the stench of the rotting body. Aftab told the police that he was a trained chef and disposed of her liver and intestine by mincing them.

**Shraddha murder case: Delhi Police takes accused
Aftab Poonawalla to Mehrauli Forest for investigation**

Fig2: Delhi Police takes Aftab Poonawalla to Mehrauli for investigation

Until now, 10 to 13 bones have been recovered from the forest. The blood samples obtained from Aftab's kitchen have been sent to the forensic lab for examination and have been confirmed to belong to Shraddha. The DNA (Deoxyribonucleic acid) sample of Shraddha's father was taken for reference. Police are searching for CCTV (Closed-Circuit Television) footage in order to check whether Aftab received any help from outside and to corroborate his statements. Shraddha's phone, her skull, and the murder weapon are yet to be found. Forensic analysis of the bones found so far revealed that they belonged to Shraddha. The clothes worn by Shraddha and Aftab were thrown in the civil garbage and are yet to be found. The forensic science laboratory in Rohini submitted Aftab's narco-analysis test report where he confessed that it was a pre-planned murder. The autopsy report reveals that she was dismembered using a saw.

Even though the case is only 80% complete to date, justice should be served to Shraddha Walker. According to the reports, Aftab is lodged at Tihar jail number 4 and is kept in a separate cell for security reasons which will be monitored 24 hours through CCTV cameras.

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INCEST STORY OF THE CAPTIVATED

The girl who spent 24 years of her life imprisoned by her father

Veritas Volume: 2, Issue: 2, Pages:89-94

Ms. Aarti Dabade

Ms. Kinjal Gadkari



Fig. 1: Elisabeth Fritzl

A case that shocked the conscience of the world was brought to light when Elisabeth Fritzl was able to escape from her captor, her father, in April 2008. This is a story of 24 years of cruel, inhuman, and sadistic exploitation which began when she was barely 11 years old.

Elisabeth Fritzl lived with her parents Josef Fritzl and Rosemarie Fritzl and her siblings. In 1977, when she was just 11, her family and siblings had gone to Italy for vacation with their family friends. Josef was alone at home with Elisabeth at the time and this was when he first raped her.



Fig. 2: The house of Josef Fritzl

On August 28, 1984, Josef strategically brought her down to a basement he had modelled and designed in their home, which was kept hidden behind a hinged door. Soon after fixing it, he pushed Elisabeth inside after making her unconscious with an ether-soaked towel.

When Elisabeth went missing, Rosemarie and Josef filed a missing report. While the investigations were going on, Josef claimed to remember her talking about joining some religious cult. When there was no evidence of her disappearance, the case went cold and police stopped further investigations due to a lack of any leads.

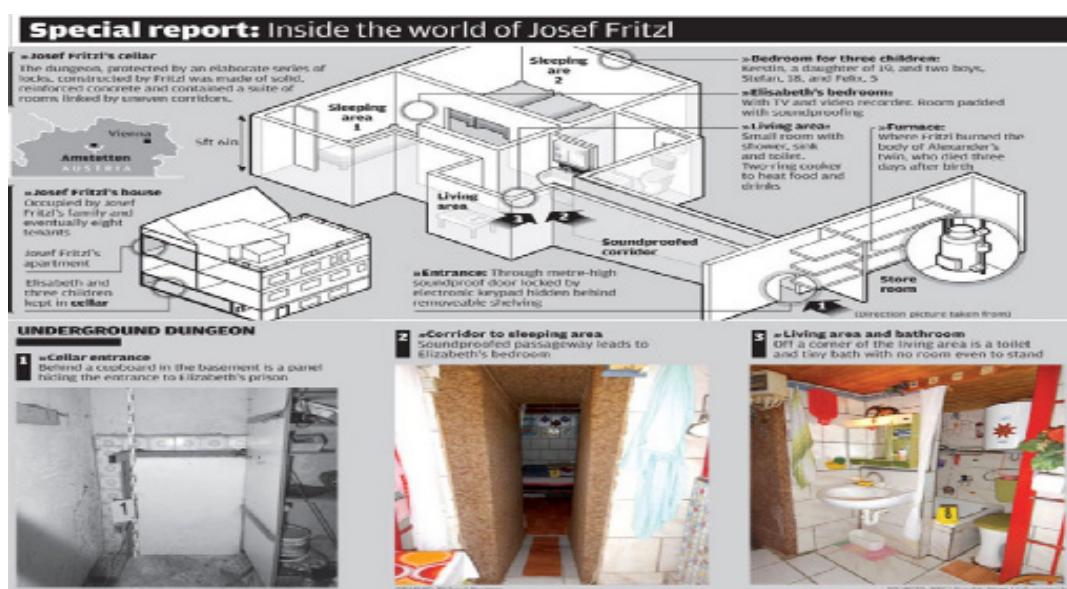


Fig.3 : Inside the world of Josef Fritzl

Meanwhile, Josef, held her captive for the next two years, in a tiny dark basement room with just the basic amenities which were required. The continued violent sexual abuse led to Elisabeth having to conceive his child but 10 weeks later she had a miscarriage.

After two years she became pregnant and gave birth to Kerstin. And later, her second child Stefan. Over the years, she birthed seven children in total. One baby died merely a few days after birth, and three were sent upstairs to Josef. The other three children lived underground with Elisabeth and never saw the outside world until their rescue in 2008.

Josef claimed he found notes with babies found at the doorstep or hidden among bushes that these kids belonged to Elisabeth and that she was sending her children to her parents to take adequate care of them as she couldn't give.

The cell never got hot water neither a heating system nor air circulation. Yet, Elisabeth tried giving her children the most normal life she could and even taught them how much she knew in the dark basement.

The children grew up in unhealthy conditions and had to witness terrors from a young age as Josef raped their mother in front of them. This led to lasting physical and psychological damage in all of them.



Fig.4 : Modelled basement Elizabeth was kept in.

Fritzl's family complained to Josef about the sounds they all occasionally heard, but he excused them as damaged pipelines and noisy heaters, those were the miserable yelps of Elisabeth.

In 2008, Kerstin, the eldest child who was 19 years old by then, fell severely ill. Elisabeth begged her father to give medical attention to her sickly daughter. He had a change of mind and took her to the hospital where the horrifying truth of Elisabeth's ordeal over the past years finally came to light.

For a week, Kerstin was in the hospital and was being questioned by police regarding her family, but no one came to endorse her. She had bruises and a discoloured body, as Josef had physically abused her too and she'd never seen sunlight in her lifetime.

Police got suspicious and questioned Josef regarding her sudden appearance. They reopened the case and went through the notes allegedly sent by Elisabeth and noticed an irregularity in them. Being pressured by police, Josef finally released Elisabeth from her cell on 26 April 2008, 24 years after her imprisonment.

Elisabeth rushed to the hospital Kerstin was in. Her presence at the hospital startled the police. They interrogated her regarding what the truth was. Elisabeth made a deal with them first claiming to never come face to face with her father Josef ever again. After this, she revealed everything he had done to her in the last 24 years of her captivity.

The police filed charges of rape, manslaughter, false imprisonment, and incest based on the evidence provided by Elisabeth. Her family was questioned subsequently but everyone claimed to not know anything.



Fig5 : Josef Fritzl

Josef showed up at the court covering his face for the first two days. He claimed to be not guilty. As the case went on, he was charged with murder and rape. Ultimately, Josef suddenly changed his claims and admitted to his guilt.

When the details of this sordid case came to light years later, the rest of the family was horrified to know what had occurred beneath the roof of their home. Josef went on to mastermind a plan to keep his daughter under his custody for 24 years.

In Austria, judgement is not based on all the claims collectively but on the highest punishment. Hence, he was sentenced to life imprisonment for captivating his daughter and using her as a sex slave for 24 years.

Now Elisabeth and her children live in a designated location with full police protection and new identities. This case horrified the authorities and the rest of the world.

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THE MUSWELL HILL MURDERER

Veritas Volume: 2, Issue: 2, Pages:95-98

**Ms. Anashwara Pramod
Ms. Keziah Angel**

INTRODUCTION

Dennis Andrew Nilsen aka The Kindly Killer was a serial killer, necrophile, and an ephebophile who was active in London between 1978 and 1983. He was also known as The British Jeffrey Dahmer because of the similarities in their victimology and modus operandi.

BACKGROUND

Dennis Nilsen was born on November 23, 1945, in Fraserburgh, Scotland. He had a somewhat difficult childhood. His parents had a troubled marriage and divorced in 1948. As a result, their grandfather took care of the children. As a young child, Nilsen was close to his grandfather who unfortunately died of a heart attack. The loss of his grandfather, and seeing the body before burial, had an effect on Nilsen's personality. He became quiet and reserved.

During puberty, Nilsen realised that he was homosexual, but he was unsure if he was gay or bisexual, because the boys he was attracted to looked suspiciously like his sister. Nilsen was bullied by his brother.



Fig.1: Dennis Andrew Nilsen

At 14, he joined the Army Cadet Force. In Osnabrück, West Germany, he drank high quantities of alcohol to reduce his shyness and socialise. One time, he passed out and woke up at the apartment of a German friend. Though there was no sexual activity, this incident became a source of Nilsen's fantasy about the sex. His fantasies became unambiguously necrophilic after he discovered the painting *The Raft of the Medusa*. He went back to Germany and hired a prostitute to have intercourse with a woman for the first time. He found it "overrated" and "depressing" and concluded that he was homosexual.

His mother voiced concern about Nilsen's lack of interest in female companionship and a few months later, Nilsen and his brother attended a group – watching a documentary on male homosexuality. When everyone spoke about this subject derisively, a fight broke out between Nilsen and his brother, as he defended gay rights. It concluded with his brother telling their mother about Nilsen's homosexuality.

After he graduated from the Metropolitan Police Academy in London, he began visiting gay pubs. Nilsen had several brief, sentimental relationships that ended in failure and hence believed that he was unfit for long-time relationships.

MURDER

Dennis began to actively seek out sexual encounters but he felt lonely each time his partners left. So he decided to force men to stay by killing them. He found his victim's dead naked bodies fascinating. His first victim was a 14-year-old boy whom he had met at the pub. The boy accompanied him to his apartment and promised to supply alcohol for the night. Eventually, he fell asleep. Fearing that the young boy would leave him if he awoke, Nilsen strangled him with a necktie and drowned him in water. He then washed the boy's body and took him to his bed, where he attempted a sex act and then fell asleep next to the corpse. Eventually, he hid the boy's body underneath the floorboard of his apartment. He would stay there for several months until Nilsen buried him in the backyard. Meanwhile, he continued to seek out new victims.

Some of his victims were homeless or sex workers while the others were tourists who had visited the wrong bar. No matter who they were, Nilsen wanted to keep them with him forever.

He had been hiding his corpses underneath the floorboard, however, the smell eventually became too much to bear so he started burning and burying his victims in the garden. He often saved his victim's skin and bones. He often dressed them up, took them to bed, watched TV, and performed sex acts with them.

ARREST AND DEATH

In 1981, his landlord decided to renovate his apartment and he moved to a new location. He didn't have enough outdoor spaces to burn the body parts and hence he began flushing human remains

down his toilet. But the building's plumbing was old and eventually, the other residents complained and called in the plumber.

Upon investigation of the apartment building's pipes, the human remains were easily tracked back to Nilsen's apartment. When the police asked him where the rest of the body was, he calmly showed them the garbage bag of body parts he kept in his wardrobe. On further investigation, it was revealed that there were body parts stashed all over Nilsen's apartment. Though he admitted to committing between twelve and fifteen murders, he was formally charged with six counts of murders and two attempted murders.

He was found guilty on all counts in 1983 and sentenced to life imprisonment which he spent translating books to Braille.

In 2018, Dennis Nilsen died in prison at the age of 72 after suffering a ruptured abdominal aortic aneurysm. He spent his final moments laying in his own filth in his prison cell.

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ROJAS MURDER CASE

Veritas Volume: 2, Issue: 2, Pages:99-103

Mr. Deva Nandan Joshy

Rojas Murder Case known by the name of the culprit “Francisca Rojas” is believed to be the first criminal found guilty through fingerprint evidence in the world.



Fig.1: Francisca Rojas (to the left)

On 29 June 1892, 27-year-old Rojas murdered her two children in Necochea, Buenos Aires Province, Argentina. Her six-year-old son, Ponciano Carballo Rojas, and his four-year-old sister Feliza were found brutally murdered in their home.

Before diving deep into the case study , we will look forward to the science behind fingerprints which played a

WHAT IS A FINGERPRINT?

A fingerprint is an impression left by the friction ridges of a human finger. Human fingerprints are detailed, nearly unique, difficult to alter, and durable over the life of an individual, making them suitable as long-term markers of human identity. They may be employed by police or other authorities to identify individuals who wish to conceal their identity or to identify people who are incapacitated or deceased and thus unable to identify themselves,

as in the aftermath of a natural disaster.

The scientific study of fingerprint and palm patterning is referred to as “dermatoglyphics,” a term that was invented in the 1920s.

There have been many classifications that were put forward by scientists on fingerprints. But in this case study it was Juan Vucetich and his famous Argentine classification which played a crucial role.

JUAN VUCETICH AND THE ARGENTINE SYSTEM

Juan Vucetich was born in Croatia and immigrated to Argentina in 1882. Within four years, he was working at the Buenos Aires Police Department, collecting arrest and crime statistics. Within a few more years, Vucetich became head of the Office of Identification. Concern regarding the mobility of criminals in and out of Argentina prompted him to search for a more effective method of identification. His search ended when he read the French journal *Revue Scientifique* (1891) detailing Galton's research into the scientific use of fingerprints as a means of individualization. After reading this article, he began his campaign to incorporate the use of fingerprinting into the criminal justice system of Argentina. His campaign paid off, and that same year (1891), fingerprints replaced Bertillonage at the Office of Identification. This was the first occurrence of fingerprint individualization officially usurping anthropometry.

Working from Galton's overly general three-pattern classification system, he quickly created a classification.

The classification consisted of four single letters, representing the pattern on the thumb, and four single numbers, representing the patterns on the remaining fingers. Vucetich's system started with the right-hand thumb and ended with the left little finger.

Vucetich's secondary classification.

Pattern	Superscript	Description
Arch	5	Vaulted/Normal
	6	Left-inclined
	7	Right-inclined
	8	Tent-shaped
	9	All others
Internal loop	5	Normal flow
	6	Invaded
	7	Interrogatory
	8	Hooked
	9	All others
External loop	Designation same as Internal loop	
Whorl	5	Normal
	6	Sinuous
	7	Ovoid
	8	Hooked
	9	All others

Fig.2: Vucetich's secondary classification

The Vucetich classification system consisted of a basic classification (called the primary) and a more descriptive secondary classification using extensions. The primary classification was divided into two groups: the numerator and the denominator. The numerator was termed the series and represented the right hand. The denominator was termed the section and represented the left hand. The right thumb (called the fundamental) and the remaining right-hand fingers (called the division) represented the series. The

left thumb (called the subclassification) and the remaining left-hand fingers (called the subdivision) represented the section.

The secondary classification further subdivided the fingerprints into five subtypes: 5, 6, 7, 8, and 9. Each number represented a further description of the pattern, applied to either hand, and was placed as a superscript in parentheses. When the pattern type was a normal loop variety, the superscript defaulted to ridge count values.

The first case in the world in which fingerprints were used to identify a murderer occurred in the coastal town of Necochea in Argentina on 29 June 1892. It was actually a double murder, of the two young children of Francisca Rojas who had been found killed in their beds. Unfortunately, when you research this case online, there are numerous versions of the story with often conflicting details and very little primary

evidence available.

The two children (either two boys, or a boy and a girl, named Ponciano and Feliza aged 6 and 4) were killed in their home, possibly by blunt force trauma or having their throats cut.

It was said that Rojas was either unmarried or separated from her husband whose surname may have been de Caraballo, as she is sometimes called Francisca Rojas de Caraballo. She either found the children, or was found with them with a superficial cut to her own neck and she quickly blamed a local man, Pedro Velasquez, who she said had killed her offspring either because she rejected his advances, or because she prevented him from taking the children to give to their father.

He was arrested and interrogated and some secondary sources even claim he was locked in a room overnight with the children's bodies to try to force a confession, but he refused to budge. Furthermore, it soon emerged that he had an alibi. Progress was only made in the case when an outside detective was brought in.

This was either a Croatian immigrant named Juan Vucetich, who was then pioneering the use of fingerprints for identification, or one of his associates named Edward Alvarez. When the new detective went to look at the murder scene, despite it being several days old, he noticed a bloody fingerprint on the doorway of the room in which the children had been found. This double child murder now took a shocking twist. He had the piece of wood cut out and the fingerprint examined and when it was compared to the prints of the children's mother (who said that she had not touched the bodies and so couldn't have had their blood on her), it was a match.

When confronted with the evidence, Francisca broke down and admitted that she had killed her own children and faked her injuries because her lover did not want to marry a woman who already had children (this is another reason I think she was unmarried, or separated, despite what some of the secondary sources claim).



Fig.3: Fingerprints collected of Francisa Rojas

An image of her original fingerprint card can be found in the US (United States) National Library of Medicine and is seen here.

Rojas was convicted in 1894 and sentenced to a lengthy stay in prison. The Rojas case had opened the door (albeit slowly) for other murder cases around the world to be solved using the perpetrators' fingerprints and in 1905, the United Kingdom used this new technique in a case known as the Mask Murders.

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Arrange the words in right sequence

1. CENTRAL DOGMA

Protein, RNA, Transcription, Translation, DNA

2. CHANGES AFTER DEATH

Corneal clouding, Rigor mortis, Cadaveric spasm, Algor mortis, Livor mortis, Adipocere formation, skeletonization, mummification, Pallor mortis

3. CRIMINAL INVESTIGATION PROCEDURE

Inquest, FIR, Autopsy, SOC Investigation, Cross examination, Evidence analysis, Examination in chief, Re-examination, Sentence, Judgement

4. PHARMACOKINETICS

Absorption, Administration, Distribution, Re-absorp- tion, Metabolism, Excretion

5. MASS SPECTROMETRY SEQUENCE

Detection, Ionisation, Deflection, Acceleration, Vacuum creation

1. DNA, Transcription, RNA, Translation, Protein, 2. Corneal clouding, Cadaveric spasms, Algor mortis, Livor mortis, Rigor mortis, Pallor mortis, Adipocere formation, Mummification, Skeletonization, 3. FTR, Inquest, SOC Investigation, Autopsy, Evidence analysis, Examination in chief, Cross examination, Re-examination, Judgment, Sentence, 4. Administration, Absorption, Distribution, Re-absorption, Metabolism, Excretion, 5. Vacuum creation, Ionisation, Acceleration, Deflection, Defecition

FEATURE ARTICLES

- Occupational Toxicology
- Self-Automated Cars and Their Forensic Challenges
- Cloud Forensics
- Biometrics in Forensic Science
- Digital Vehicle Forensics
- Asphyxia
- Forensic Ballistics
- How Can DNA Database Help In Solving Crimes?
- 3D Forensic Facial Reconstruction

OCCUPATIONAL TOXICOLOGY

Veritas Volume: 2, Issue: 2, Pages:106-109

Ms. Shreya Katti

INTRODUCTION

Occupational toxicology is the study of adverse effects of chemical or physical agents that are encountered in the course of employment at particular workplaces. Occupational toxicology is a class term used to refer to the application of toxicology in all fields of work, ranging from a simple photocopy machine in an office to pesticides in agriculture. The range of hazards in certain occupations is exposed to employees through mediums of inhalation, dermal exposure, or even ingestion. Toxicology is intertwined with making decisions on what levels of chemical exposure are acceptable to humans on the field. The goal of occupational toxicology is to protect the health of workers. The ever-growing recognition of workplace exposure has increased public awareness of the health effects of toxic workplace exposure.

BRIEF ON INTERFACING FIELDS

Various other fields work hand-in-hand with occupational toxicology. Fields like occupational health, medicine, and epidemiology interface with this field to derive solutions to the multiple issues faced by workers.

- Occupational health is a field of public health that deals with promoting and maintaining the highest degree of physical, mental, and social well-being of workers in all occupations.
- Occupational medicine is a subject whose core revolves around the prevention, diagnosis, and management of occupational diseases. Such specific medical examinations involve pre-exposure examinations and periodic examinations of workers.

- Occupational epidemiology involves studies that determine whether occupational exposures are the reason for the risk or cause of adverse health outcomes. It involves observation of the vulnerability of workers to chemical, biological, or physical agents present in their respective work environments.

COMMON OCCUPATIONAL DISEASES IN INDIA

According to Schedule 3, sections 89 and 90 of the Factories Act, 1948, some notable occupational diseases in India include:

- **Lead Poisoning:**

The heavy metal is absorbed primarily through the respiratory and gastrointestinal systems and negligibly through cutaneous exposure. The respiratory pathway primarily depends on particle size, allowing 30-40% of inhaled lead into the bloodstream, whereas gastrointestinal absorption allows about 10-15% of ingested lead into the bloodstream. General signs and symptoms can range from irritability, headaches, and vomiting to coma, seizures, and motor neuropathy.

- **Chrome Ulceration:**

The ulceration of skin due to contact with hexavalent chromium was described by Cummings as early as 1827. This disease is common among workers processing chrome ore, chromic acid, potassium, sodium, and ammonium bichromate. Acute poisoning takes place through the oral route, whereas chronic exposure is via inhalation or dermal contact. Chronic poisoning can lead to diseases ranging from eczematous dermatitis with edema to deep-seated ulcers [in areas having a break in the epidermis].

- **Asbestosis:**

Asbestosis is a type of interstitial pulmonary fibrosis. It is caused by the inhalation of asbestos fibres over a long period of time. It develops as scarring takes place in your lung tissue, restricting breathing and reducing oxygen levels in the bloodstream.

- **Byssinosis:**

It is a collection of respiratory conditions that arise due to exposure to raw non-synthetic textiles like cotton, hemp, jute, or flax. The release of an endotoxin from the cell wall of bacteria within textile fibres contributes to the symptoms. Symptoms manifest in the form of frequent cough and wheezing within a few hours of exposure.

- **Musculoskeletal injuries, noise-induced hearing loss,** and other major risks are also a result of unsafe and unregulated proceedings in a workplace, especially in workplaces relying on the hard-working lower class.

These examples cite some of the 29 ‘notable’ diseases and risks of occupational exposures, therefore deeming this specialised field extremely important. A vast percentage of the Indian population relies on labour work in various fields to provide for and survive. The health and safety of these workers have a positive impact on productivity and social development. The Indian law has many provisions for the specific working-class prone to frequent exposures to harmful toxins because the field of toxicology was used to determine the causation of deterioration of the workforce. In conclusion, occupational toxicology is a field that will help prevent irreparable damage and sustain the national economy.

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SELF-AUTOMATED CARS AND THEIR FORENSIC CHALLENGES

Veritas Volume: 2, Issue: 2, Pages:110-115

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INTRODUCTION

We, humans, have been constantly evolving with the help of technology. In the current era of digitalisation, this process is taking place at a rapid rate. There are multiple innovations taking place in all fields, including the medical and pharmaceutical industries, banking sectors, and automobile industries. One such innovation of the automobile industry is Self-Automated Vehicles (SAVs) which is witnessing constant upgradation with the improvement of technology.

KEYWORDS: Working of Self-Automated Vehicle (SAV); Progression by leading companies; Forensic challenges



Fig 1. An illustration of a self-driving car

An autonomous car is a vehicle capable of sensing its environment and operating without human involvement. A human passenger is not required to take control of the vehicle at any time, nor is a human passenger required to be present in the vehicle at all.

An autonomous car can go anywhere a traditional car goes and does everything that an experienced human driver does.

The Society of Automotive Engineers (SAE) currently defines 6 levels of driving automation ranging from Level 0 (fully manual) to Level 5 (fully autonomous). These are:

- **NO AUTOMATION:** The human performs all driving tasks (steering, acceleration, braking, etc.).
- **DRIVER ASSISTANCE:** The vehicle features a single automated system (e.g., it monitors speed through cruise control).
- **PARTIAL AUTOMATION:** The vehicle can perform steering and acceleration. The human still monitors all tasks and can take control at any time.
- **CONDITIONAL AUTOMATION:** Environmental detection capabilities. The vehicle can perform most driving tasks, but human override is still required.
- **HIGH AUTOMATION:** The vehicle performs all driving tasks under specific circumstances. Human override is still an option.
- **FULL AUTOMATION:** The vehicle performs all driving tasks under all conditions. Zero human attention or interaction is required.

WORKING OF SELF-AUTOMATED VEHICLES (SAVs)

Autonomous cars create and maintain a map of their surroundings based on a variety of sensors situated in different parts of the vehicle. Radar sensors monitor the ultrasonic sensors in the wheels to detect curbs and other vehicles when parking position of nearby vehicles. Video cameras detect traffic lights, read road signs, track other vehicles, and look for pedestrians. LiDAR (Light Detection and Ranging) sensors bounce pulses of light off the car's surroundings to measure distances, detect road edges, and identify lane markings.

Sophisticated software then processes all this sensory input, plots a path, and sends instructions to the car's actuators, which control acceleration,

braking, and steering. Hard-coded rules, obstacle avoidance algorithms, predictive modelling, and object recognition help the software follow traffic rules and navigate obstacles.

PROGRESSION BY LEADING COMPANIES

- A. Cruise: Cruise is a self-driving automobile firm based in the United States. Cruise introduced Origin, a completely autonomous automobile with no steering wheel or pedals, in January 2020.
- B. Waymo: Waymo was started in 2009 as a driverless car technology business. The initiative, developed by the internet giant Google, aims to offer driverless automobiles. Its self-driving cars have travelled 20 million miles and are close to Level 5 autonomy. One billion simulated miles of test driving were done by Waymo cars in 2016.
- C. Ford aimed to have a fully autonomous vehicle on the road by 2021. Ford planned to launch its self-driving business in 2022 with vehicles based on the Ford Escape Hybrid crossover.
- D. Audi stated that it would deploy a level 3 vehicle by the end of the year 2017 and a highly automated vehicle by 2020. According to the corporation, the company's autonomous automobile would make use of NVIDIA's AI (Artificial Intelligence) technology. The new system, known as Autonomous Intelligent Driving, is used across the whole Volkswagen brand. In 2018, Audi unveiled the second-generation Q3, a larger, more comfortable vehicle with the ability to operate partially autonomously. Audi then partnered with Cognata Ltd, a maker of systems for autonomous vehicle simulation, to hasten the development of autonomous vehicles.
- E. Huawei: The Chinese telecom giant, Huawei, has shifted resources in recent years to the creation of autonomous vehicles. In October 2018, Huawei declared that it would work with Audi to create self-driving technology for cars sold in China. The partnership will concentrate on creating so-called Level 4 technology, which is a car that drives itself from beginning to end inside a specific area as specified by the

Society of Automotive Engineers.

F. In 2016, Apple revealed for the first time that it is developing autonomous automobiles. In California, Apple boasts the third-largest fleet of self-driving test vehicles.

G. By 2030, Kia, a division of Hyundai Motors, wants to market a completely autonomous vehicle.

FORENSIC CHALLENGES



Fig 2. Image shows the various possible entities that could be liable when an accident occurs by an SAV

AV forensics framework imposes several unique challenges for forensics investigation. The significant challenges of AV forensics are:

- Huge amount of data: An AV generates a huge amount of data each day. In each second, radar and ultrasonic sensors generate 10-100 KB (Kilobyte), GPS (Global Positioning System) generates 50 KB, cameras generate 20-40 MB (Megabyte), and LiDAR generates 10-70 MB data. On average, an AV generates 4000 GB (Gigabyte) of data each day. Such massive amounts of sensor data impose challenges in AV forensics.
- Log accessibility: Proper access control of information and logs collected from AV is essential. The developers of AD (Autonomous Driving) systems and the investigators should be able to access the low-level information. However, any third-party malicious entity should not

be able to extract any meaningful data from the logs.

- Evidence Examination: An AD system may generate a considerable number of logs due to dynamic road scenarios. The investigator may face challenges in correlating the logs of different AD modules to extract crucial information as all the AD components work together. The investigator also must be able to construct the proof in front of the court.
- Evidence integrity: Current event data recorder systems installed in the AVs do not ensure the integrity of the collected data. A dishonest party can manipulate the data before presenting it as evidence. Hence, the integrity of the collected data is essential and challenging in AV forensics.

CONCLUSION

As technology expands throughout the world, self-driving cars will become the future mode of transportation universally. The legal, ethical, and social implications of self-driving cars surround the ideas of liability, responsibility, and efficiency. Autonomous vehicles will benefit the economy through fuel efficiency, the environment through reduced carbon emissions, society through more togetherness, and the legal system through a simpler system. As technology advances, the security technology regarding self-driving cars will also continue to grow to combat hackers, improve the accuracy of internal systems, and prevent accidents.

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CLOUD FORENSICS

Veritas Volume: 2, Issue: 2, Pages:116-117

Ms. Angela P Johny

Cloud Computing: It is the technology that provides a variety of on-demand computing services to users over the Internet. These services include applications, databases, servers, networks, and more.

Cloud forensics refers to investigations that focus primarily on crimes that occur in the cloud. This could include data breaches and identity theft. With cloud forensics in place, owners are protected, and evidence is better protected. When illegal or criminal activity occurs using the cloud as a medium, cloud forensics professionals use their skills and knowledge to identify the responsible individuals or groups. Cloud forensics involves cloud users, both victims and perpetrators. For example, companies using cloud servers can become victims of data breaches and denial-of-service incidents. Criminals themselves can also use the cloud to launch attacks.

Like other subfields of forensics, cloud forensic scientists must follow strict regulations in order for their work to be admissible in court. This may include obtaining court orders to search cloud servers, verifying that evidence has not been tampered with, and taking other necessary. Digital forensics is a branch of forensics that uses electronic devices and data to uncover crimes, trace criminal paths, and analyse and protect evidence for use by law enforcement and prosecutors.

The area of digital forensics includes various components of the IT (Information Technology) environment; Internet and other networks, email, mobile devices, databases, operating systems, computer memory, etc.

CHALLENGES OF CLOUD FORENSICS

- The storage system is no longer local and may violate jurisdictional law.
- Each cloud server contains files from many tenants.
- Even when data from a particular suspect is identified, it is difficult to distinguish it from his data from other tenants.
- Recovery of deleted data poses problems.
- There is usually no evidence outside of the cloud service provider that a particular file is linked to a particular suspect. In digital forensics, it is difficult to identify information, and if it cannot be identified, it is difficult to acquire it, and without acquisition, there is no analysis.

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BIOMETRICS IN FORENSIC SCIENCE

Veritas Volume: 2, Issue: 2, Pages:118-123

Ms. D Veda Samhitha

INTRODUCTION:

Biometrics is one of the most interesting works or a way to solve crimes happening in day-to-day life. It's a science based on the identification of a person by physical and behavioural attributions. The relation between forensics and biometrics is mainly concerned with the identification of a person based on characteristics that include voice recognition, facial recognition, fingerprint, iris, palm prints, ear prints, etc.

Biometric systems make use of characteristics like fingerprint patterns, geometry of hands, iris and facial arrangement, voice prints, etc. Due to these advancements, biometrics is said to be a strong alternative for crime detection. It makes an endowment in crime detection by analysing traces of persons stored in databases, those which rank in identifying persons and result in comparison.

HOW DOES BIOMETRICS WORK?

Biometrics is a solely adopted automated system for identification purposes based on the physical and behavioural characteristics of a person. It extracts a salient feature set from the data and compares the acquired feature set from the crime scenes to the stored data set in databases. A biometric system includes analysis and verification steps.

ANALYSIS: This includes the identification of a person by comparing templates of individuals present in the databases; it conducts many analysing steps to prove the identity of a person.

VERIFICATION: This step includes verifying the person's identity by comparing his own templates in the stored databases.

TYPES OF BIOMETRICS

- **FINGERPRINT BIOMETRICS:** Fingerprints are the most important evidence that plays a crucial role in crime detection because of their robustness and uniqueness. Fingerprints are the patterns formed by the friction ridges on the fingertips. When a latent fingerprint is collected from the crime scene, these are scanned, and all the minutiae and patterns are noted down by the biometric system and compared with the information stored in the database.



Fig. 1: Fingerprint scanner

- **FACE BIOMETRICS:** Face biometry-based identification is a technology where a person is identified based on his/her facial characteristics. A picture or a video of a person is collected and matched with a stored copy in the database. The extracted features from this biometric system are based on facial alignment, facial landmarks, etc. When they are compared with the biometric database, it gives the calculated similarity score.



Fig.2: Facial biometric scanning device

- **DNA BIOMETRICS:** DNA, standing for deoxyribonucleic acid, is an organic biochemical compound that holds all the genetic information of a person. Due to its individuality and uniqueness, it plays an important role in identification. DNA biometrics is done using the biological samples left at the crime scene. The biological samples can be the hair strands of a person, saliva, semen, or anything else that holds biological information about a person. The usage of DNA for analysis is said to be DNA profiling in forensic science.

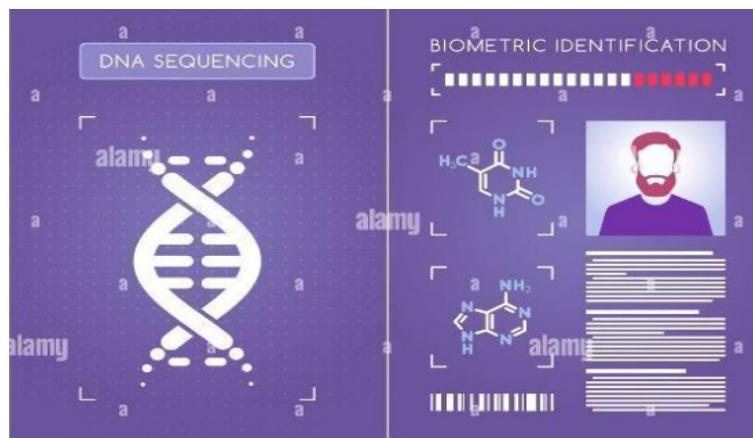


Fig.3: DNA sequencing

- **PALMPRINT BIOMETRICS:** Besides fingerprints, palm prints also play an important role in forensics. They have the same patterns, valleys, and ridges as on fingertips. They do play an important role in identification. The area of the palmar region is much higher and broader than that of the fingers, so the palm print databases in palm print biometrics provide a positive identification for investigators.

In palm print biometrics, high-resolution palm prints are captured, and all the minutiae characteristics are collected and stored in the databases



Fig.4: A palmprint biometric scanner

VOICE BIOMETRICS: Voice biometrics deals with the voice identification of a person because the voice is also a kind of trait available to a person. If the voice is the only available evidence found related to a suspect, then it is extracted from sources like gadgets (telephones, mobiles, etc), and it is compared with the available recordings or databases.

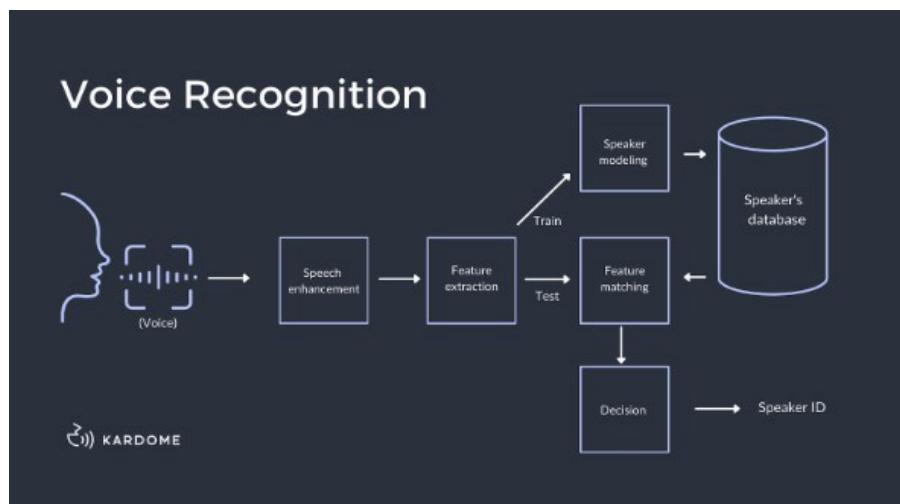


Fig.5: Working of a voice biometric detector

IRIS BIOMETRICS: It is a kind of identification based on the patterns of the iris of an eye. The iris is an annular white region bounded by the pupil. So, when the suspect is under custody, his/her iris features are compared with the available iris databases, and the similarity score is calculated.

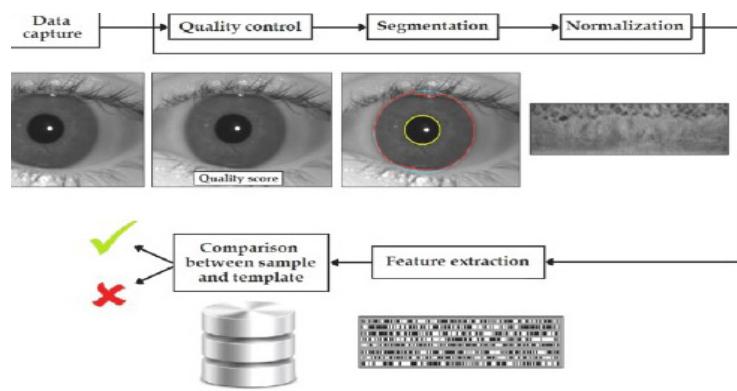


Fig 6: Iris recognition base algorithm

BIOMETRICS AND FORENSICS

Biometrics and forensic science make a good combination in crime detection. In spite of having similarities, they also have differences among them. They work on different approaches. Forensic science works after the event occurs, whereas biometric technology works before. The evidence found by forensics is unknown, but in biometrics, the information of the data is already known and needs to be verified.

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DIGITAL VEHICLE FORENSICS

Veritas Volume: 2, Issue: 2, Pages:124-126

Ms. Savannah Pieaded Lobo

INTRODUCTION

Digital Vehicle forensics is an upcoming field of forensics that deals with recovering digital evidence or data which is stored in a vehicle's modules, network, and messages sent across an operating system. In today's world, almost everything is digitalized including vehicles and with this increasing digitalization, smart and driverless cars have become much more popular due to the advancement in technology.

Nowadays, most cars have built-in GPS (Global Positioning System) or other features such as digital multimedia and/or internet connectivity. It also gives us a vast range of data such as favourite locations, home addresses, etc. and other personal data such as contact numbers, pictures, and SMS (Short Message Service) messages, and such information helps in forensic investigations since vehicle investigations mainly focus on the make and model of a particular vehicle.

EVIDENCE FOUND IN DIGITAL VEHICLE FORENSICS

- Black boxes of the vehicle/ Event Data Recorder (EDR).
- Dash Cameras.
- Data can be stored on an app on the owner's phone.
- Key Fobs.
- GPS Systems.
- Electronic Control Unit (ECU) of self-driving cars.

BERLA

Berla is software that is used during the process of forensic investigation to read and understand the data vehicle stores. This software allows forensic investigators to “identify, acquire, and analyse critical information stored within vehicle systems to uncover key evidence that determines what happened, where it occurred, and who was involved.”

Berla is able to retrieve logs such as odometer readings, gear shifts, speed logs, ignition cycles, etc. which creates a timeline of an event before and immediately after an incident that can be used as evidence in a court of law.

iVe is an ecosystem consisting of multiple tools to help investigate an entire vehicle with a mobile application to identify vehicles and a hardware kit to acquire systems and analyse data. As of August 22, 2022, version 4.0 has been released, which is able to uncover more data and provide investigators with key information which can be used as evidence by accessing the electronic control units of cars.

they are compared with the biometric database, it gives the calculated similarity score.

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ASPHYXIA

Veritas Volume: 2, Issue: 2, Pages:127-129

Ms. Sanjana Shri. M

Asphyxia is a medical term used for death due to a lack of oxygen supply to the lungs. In other words, it is a condition where oxygen is replaced by other gases such as carbon monoxide, CO₂ (Carbon dioxide), etc. Asphyxia is found in cases such as hanging, suffocation, strangulation, traumatic asphyxia, choking, gagging, and drowning. The lack of oxygen partially is known as hypoxia and the complete lack of oxygen is known as anoxia these conditions can cause death. In a properly ventilated room, the oxygen concentration is 21%, when the oxygen level decreases to 10-15% a person's motor function manifests. When the concentration reaches below 10% a person loses consciousness, whereas death usually occurs at a concentration level of less than 8%. The tolerance to asphyxia varies with an individual's age, adaptation to the environment, and medical history. People having a history of cardiovascular pulmonary or lung diseases are more vulnerable to dying soon compared to a normal healthy individual. The respiratory, vascular, and the nervous mechanism are affected mainly.

Fig.1: Asphyxia



STAGES OF ASPHYXIA:

1. Decrease the amount of oxygen availability
2. Reduced transfer of air to blood
3. Reduced transport from lungs to tissue
4. Reduced transfer across the cell membrane

GENERAL POST-MORTEM FINDINGS:

1. Cyanosis: It is a condition in which a bluish coloration of the skin occurs due to poor circulation as a result of a lower concentration of oxygen in the blood. The colour change can be noticed within 24-48 hours. The colour saturation will be high in regions that are rich in blood capillaries.
2. Petechial haemorrhage: It is rupturing of the blood capillaries that results in a reddish rashes-like appearance.
3. Cardiac dilation: Due to the unavailability of O₂ (oxygen) tissues in the heart begins to stop functioning. The condition in which the left ventricle (main pumping chamber) is enlarged, affects the ability to pump resulting in heart failure.
4. Fluidity in blood: Increased capillary permeability results from a combination of stasis and hypoxia. Stasis refers to the reduction in the viscosity of blood. This results in fluidity in the blood.

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FORENSIC BALLISTICS

Veritas Volume: 2, Issue: 2, Pages:130-134

Mr. U Udaykanth Reddy

INTRODUCTION

Forensic ballistics is the area of forensic science concerned with the investigation of firearms and any other relevant evidence found at the scene of shooting, their connection to the firearm, and the identification of the shooter.

HOW A FIREARM FUNCTION

The gunpowder is set ablaze by the small fire from the priming compound; the gas created by the powder burning expands quickly inside the cartridge. The bullet is forced to exit from the cartridge and down the barrel by the expanding gas the bullet spins as it exits the barrel due to rifling imparted to the barrel.

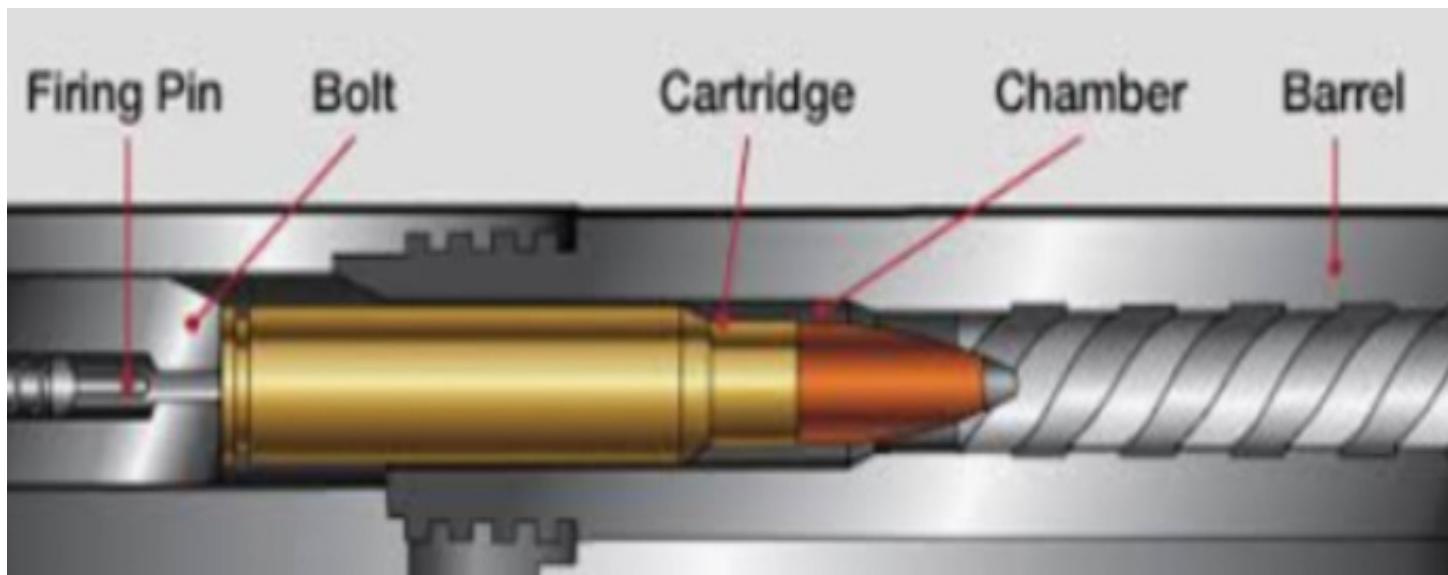


Fig 1: Image shows the internal working of a firearm

ASSORTMENT OF WEAPONS

There are numerous methods and locations for recovering firearm evidence. Guns can be found at shooting sites by crime scene investigators and transported to the lab. Typically, following adequate documentation or photography, each bullet, bullet fragment, cartridge case, shotshell wadding, etc., is collected separately and submitted to the lab. Obtaining bullet evidence in an emergency hospital setting is another option. In these situations, the material should be identified as a biohazard before being delivered to the lab. Each lab has written guidelines pertaining to the packing of evidence and its submission.

Bullets and slugs that miss their target sometimes embed themselves in surrounding materials, such as a wall or wood.

The easiest way to collect this evidence is to carefully cut out a bit of the substrate and submit it to the lab so that a weapon examiner can carefully extract it. This stops incorporating or eradicating any indications that might be essential for locating and matching the allegedly used firearm. When packing a firearm, the firearm may be recovered in the following conditions:

- Condition 1: Hammer down, safety on, empty chamber, no magazine in the weapon.
- Condition 2: Empty chamber, loaded magazine, hammer down, safety on.
- Condition 3: A chambered round, a full magazine, hammer down, and safety on.
- Condition 4: A chambered round, a loaded magazine, a cocked hammer, and safety engaged.

FORENSIC INVESTIGATIONS

The forensic experts in firearm examination study firearm features and ballistics to connect particular bullets or rounds to a particular firearm. From then, additional research aims to link the gun to a specific individual. A serial number on a gun may frequently be erased.

In some cases, the gun will be missing or stolen but other pieces of evidence such as prints, blood splatter, fibres of clothes, etc., may still be there. Additionally, scratches of serial numbers can frequently still be retrieved using an etching procedure that uses fluids or gels , potentially bringing the digits back to a readable state.

A bullet or a round leaves the muzzle of the rifle and descends the barrel. The barrel contains internal rifling. A gun's barrel has set grooves and landmarks called rifling that force the bullet to spin when it leaves the barrel. The raised portion in the rifling is land markings, while the depressions are the grooves.



Fig 2: Image shows the cross-section of a cartridge

Similar to imparting spin to a football, this spinning action makes the round move in the exact and extended course. In their rifles, various manufacturers use varying measurements and quantities of rifling. This enables forensic investigators in identifying particular gun makes and models.

The round acquires distinctive striations or marks as it passes through this rifling. The different marks on the cartridge formed as it leaves the pistol function much like a fingerprint.

In an effort to compare the shots fired in a controlled setting with those discovered at the crime, the shots will be fired into gelatin or any other material if the weapon used at the crime scene is recovered. Investigators utilise a substance called ballistic gelatin to ascertain the behaviour of a bullet being fired. Gelatin is a replica of human flesh that lacks any skeletal structure.

Going back to the gun that was found around the crime scene, you use the recovered weapon to contrast projectiles discharged from it with those discovered at the crime scene. This procedure will either confirm or refute the validity of the handgun. Given that bullet B has five marks and bullet A has four, the gun that fired bullet B will not have been used in the crime scene where bullet A was found.

When comparing firearms, cartridges are crucial pieces of evidence to take into account. A gun ejector or extractor marks as well as firing pin imprints can indicate whether it was the same weapon used in a crime scene.

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HOW DNA DATABASES CAN HELP IN SOLVING CRIMES

Veritas Volume: 2, Issue: 2, Pages:135-137

Ms. Sasha Vassula Fernandes

Ms. Chothe Samruddhi R

The DNA (Deoxyribonucleic acid) database plays a major role in Forensic science and the legal judicial system. From not more than a decade ago forensic scientists have been working tirelessly on making advances in DNA databases which is a dominant weapon used to solve crimes.



Fig.1: Deoxyribonucleic Acid

DNA is the hereditary material in the human being which is individual for every human being. DNA evidence being the most popular evidence to be found on the crime scene, it has become a major concern to developing a DNA database that assists the investigating team to solve the crime. Forensic DNA databases have become increasingly common since DNA evidence helped solve a double homicide in England in the middle of the 1960s. There have been triumphant narratives where DNA evidence did help solve crimes. For example, according to the

‘Advancing Justice Through DNA Technology’ research article by National Criminal Justice Reference Services (NCJRS) in 1999, in New York, authorities linked a man through DNA evidence to at least 22 sexual assaults and robberies that had terrorised the city.

In 2002, authorities in Philadelphia Pennsylvania, and fort, Collins, Colorado, used DNA evidence to link and solve a series of crimes (rapes and murders) perpetrated by the same individual.

HOW PRECISELY DOES A DNA DATABASE WORK?

Once DNA is recovered from the scene of the crime it can be compared to the data available in the database or a sample of the suspect’s DNA can be compared to the evidence found at the crime scene. When a suspect has been identified, The comparison finding and then could be used to determine if the suspect committed the crime. Biological evidence from the crime scene can be studied and compared to the offender’s profiles in the DNA database to identify the culprit in situations where a suspect has not been identified.

HOW EXACTLY IS THE DNA DATABASE CREATED?

For illustration let us assume a man is found guilty of sexual assault, at the time of investigation and criminal proceedings he is asked to submit his DNA samples and the resulting DNA profile was added to the DNA database created. Similarly, another attack occurred a few years later and the sexual assault nurse examiner working with the victim managed to collect biological evidence. This data is then evaluated against the existing data in the database. If in case the offender had committed crimes before this one, he will be captured, put on trial, and given a term for all the offences he has committed. In such situations, the DNA database helps in capturing the culprit in a very short amount of time and restrains his ability to engage in other illegal activities.

DNA databases are typically used to correlate DNA evidence to the DNA of an offender’s profile. A system of national, state, and municipal

DNA databases for the storing and interchange of DNA profiles was established by the federal government in the late 1980s. “The Combined DNA Index System” (CODIS) is the system that stores DNA profiles collected through federal, state, and municipal systems in several databases that are accessible to law enforcement organisations all over the nation for use in conducting an investigation. The crime scene evidence can be compared to a database of DNA profiles collected from convicted offenders by CODIS. To identify serial criminals, CODIS may also convert DNA evidence gathered from several crime scenes.

Hence, it is observed that DNA databases will continue to be very beneficial for law enforcement agencies in the long run. It is recommended that a database should contain the most samples possible and be able to retain the biological sample for future DNA testing to get the most out of it.

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3D FORENSIC FACIAL RECONSTRUCTION

Veritas Volume: 2, Issue: 2, Pages:138-142

Ms. Riya Ghosh

INTRODUCTION

Have you ever thought about what comes into effect when a skull is accidentally recovered from a nearby forest or a mass disaster? We know definitely what comes into play for the positive identification of the skull which remains unidentified. But what if traditional and conventional techniques of DNA (Deoxyribonucleic acid) analysis and dental record examination fails in that regard. In such scenarios, a methodological technique is being applied which constitutes a part of Forensic Anthropology and a part of Archaeology. Forensic Facial Reconstruction is a tool that is helpful in recognising the skull when problems like lack of information, cost management, and condition of the remains becomes an obstacle. Forensic Facial Reconstruction is a combination of artistic skills and scientific techniques. There is a controversy going on among the reviewers; some say this reconstruction method is just a technique of approximation that says a single skull can give different facial structures while the others say that a single skull can give its only single form of facial construction. But as time passes with the advent of knowledge and technology scientific forms have evolved to make this method more powerful through means of 3D (Three-dimensional) techniques i.e., what we call now as 3D forensic facial reconstruction.



Fig 1.1 Showing the recovery of an unidentified skull

IMPORTANCE OF 3D FORENSIC FACIAL RECONSTRUCTION:

It is an alternative tool that plays a significant role when there is no or very little trace of evidence or its extract is being present for identification of the recovered skull. Now the question arises as to how to identify the victim when the only body part left is the skull which is already being destroyed or decayed by animals, insects, or any other environmental factors. Earlier manual-based reconstruction techniques of the 2D (Two-dimensional)-based mode used to be applied but now with the very fast pace of time, advancement has been done in this field to make the manual-based techniques more efficient and error-free. In the midst of the 21st century where every aspect has its technological dynamics, the Forensic Reconstruction technique is nowhere less. Many techniques and methods have been introduced that keep aside the manual reconstruction, 2D drawings, and clay model techniques and relies upon the computerised 3D techniques for a positive identification of the skull.

Methods of 3D Forensic Facial Reconstruction: The methods include both manual 3D construction as well as some computerised techniques. But both techniques need artistic skills as well as forensic aspects of Anthropology. The conventional techniques were based on clay models, wax, and plastic using depth of tissues. But now many software programmes like CARES (Computer-Assisted Recovery Enhancement System) and FACES (Forensic Anthropology Computer Enhancement System) quickly produce 3D reconstructed images using scanned and stock photographs. The following methods have been used in the facial recognition:

- **Anthropometrical American Method:**

This method is called the Tissue depth method. The method shares common features like the 2D reconstruction of images. The method was developed by Krogman in 1946. It involves techniques that require highly professional skills and training. So, it is not performed nowadays as man-

The method is based on the principle of measuring tissue depth using X-rays or needles and then recording.

- **Anatomical Russian Method:**

This method was discovered in 1971 by Gerasimov. In this process, the total replacement of the classical use of tissue depth with facial muscle for measurement takes place. This method gives shape to muscles, glands, and cartilages by placing them in a layer-by-layer style. Reconstructing the fossilised skulls using this method can be done. But the drawback of this method is that it takes more time than the Anthropometrical method.

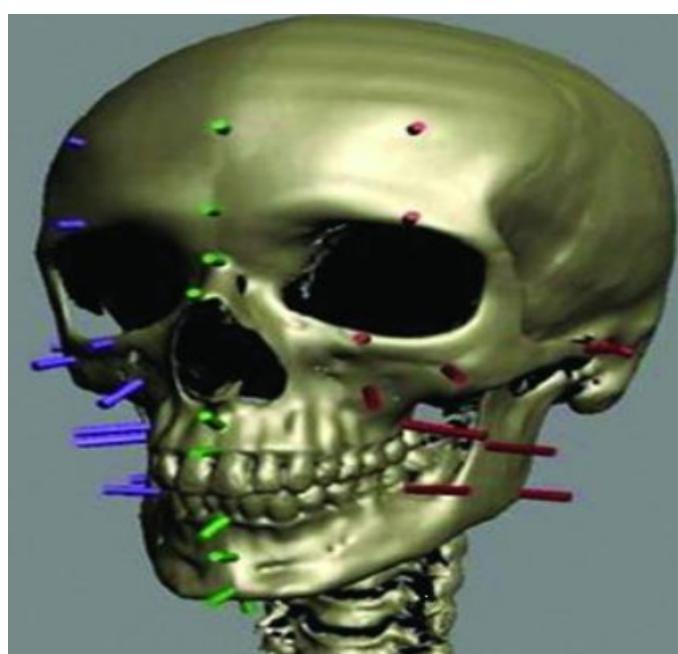


Fig 1.2 Photograph showing tissue-pegs attached to the surface of the skull at the anatomical landmarks

- **Combination Manchester Method:**

It is also known as the British method developed in 1977 by Neave. It is the most accepted method. Unlike the previous methods, this method takes into account measures of both soft tissue and facial muscles. The cranium and the mandible are articulated into the skull and then adjusted on a stand by placing them at 90 degrees on drilled holes. The depth is determined by age, gender, etc. The muscle is constructed by position based on the origin and insertion of the skull.

- Computerised 3D Forensic Facial Reconstruction:

These are effective and the first computer-based method. They involve the use of 3D animation software that has sensible technology to model the face on the skull. Unlike the manual techniques, when the same input was given, it would always result in producing the same output. Furthermore, it was possible to generate many faces with little variations from the same skull. Capturing of images is done by MRI (Magnetic Resonance Imaging) and CT (Computed Tomography) scanners, but recent pictures are taken by ultrasound that have the facility of giving an upright position.

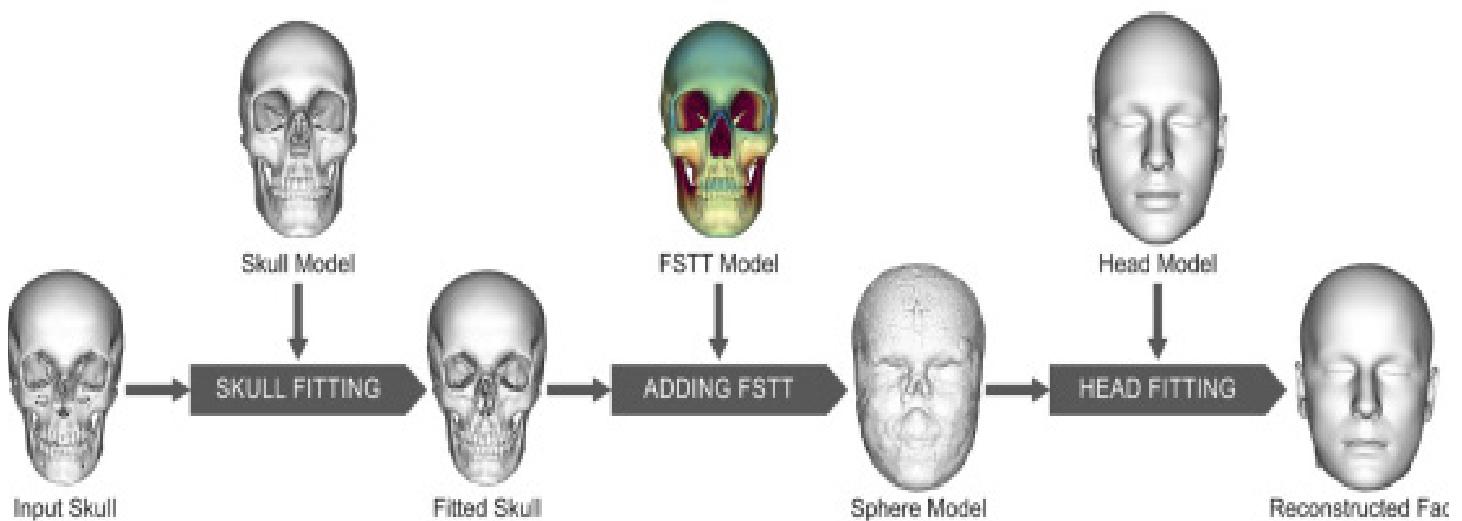


Fig 1.3 Facial reconstruction using computer software

The major disadvantage is that it causes health hazards caused by the radiation.

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LITERATURE REVIEWS

- **Interpol and Metaverse:Virtual World, Real Challenges**
- **The Significance of DNA Profiling by Short Tandem Repeat Analysis in Identifying Mass Casualties**
- **Strangulation**

INTERPOL AND METAVERSE: VIRTUAL WORLD, REAL CHALLENGES

Veritas Volume: 2, Issue: 2, Pages:144-147

Ms. Siddhi Pant

METAVERSE

A three-dimensional virtual world is termed the next frontier of the internet. It could constitute a new world with limitless possibilities. It is well defined as a world where people interact through an avatar to enjoy entertainment, make transactions, etc.

FEATURES OF METAVERSE

- Persistent and massive

The metaverse is not restricted by physical boundaries and continues indefinitely, feels real and serves as a global stage for interaction.

- Economy

Individuals, owners, businesses can produce, sell their products which will be globally accepted by the others thus helping to monetize and allocate our financial resources.

- Digital and real

It is an experience that spans both the digital and real world

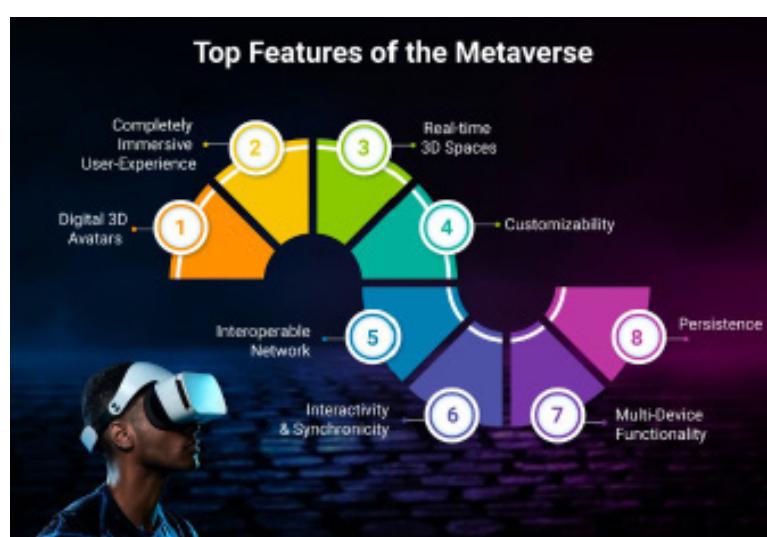


Fig.1: Features of the metaverse

INTERPOL ON METAVERSE

At the 90th Interpol general assembly at New Delhi, the first ever metaverse specifically designed for law enforcement was unveiled .It allowed the users to virtually tour the Interpol headquarters located at Lyon, France without any geographical boundaries.

THE NEED ONE ENTERING METAVERSE

Interpol's Global Crime Trend report listed money laundering, ransomware, phishing, and online scams as serious threats and said that the crimes are increasingly moving online. Previously, concern about social engineering attacks, extremism, and misinformation spreading through metaverse social settings, potential crimes against children, financial crimes, cyberattacks, sexual assault, and harassment were raised by the Interpol.



Fig.2: Statistics showing the most common cyber crimes

METAVERSE NUANCES

- Cases of assault
- Sexual violation of digital avatar
- Issues such as privacy protection, hate speech, polarisation, addiction, market gatekeeping etc continue to raise concerns
- Questions of control, content moderation, copyright infringement, political destabilisation etc will assume greater importance with growing metaverse
- Social inequalities, identity theft, psychological effects

PRIMITIVE SOLUTION

Interpol aims at deploying its metaverse technologies to remotely sensitise its affiliates and other police organisations around the world in this dynamic new virtual world.

It has real-world benefits for the police including through better remote work, networking, modelling crime scenes to preserve evidence and delivering training.

During a demo in New Delhi, experts delivered a training course on travel document verification and passenger screening in a metaverse classroom, with students then teleported to a virtual airport where they could put the new skills into direct practice at a virtual border point.

INSUFFICIENT IMPLEMENTED MEASURES

- Meta has various functions to protect the safety of people in the virtual environment. For example, it has developed a “safe space” option, called Personal Boundary, which imposes a distance between avatars of 1.2 metres; if this distance is exceeded, the platform stops the movement of the avatars.
- It is also possible to activate the recording of an event, which may persuade potential criminals, since they would know that their crimes would be recorded on video.
- The international police organisation has consolidated an alliance with the World Economic Forum, Microsoft, Meta and other com-

panies to carry out the initiative called Defining and Building the Metaverse which seeks to establish the “rules of the game” of this virtual universe: laws, standards, protocols and ways to investigate, prosecute, judge and penalise criminal behaviour that occurs in the metaverse

CONCLUSION

It is expected that the growing number of active users in virtual environments will increase the number and type of crimes in these platforms. By 2026, it is expected that 25% of the population will spend at least one hour a day in the metaverse, making it increasingly urgent to design a regulatory framework to ensure the safety and integrity of people

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THE SIGNIFICANCE OF DNA PROFILING BY SHORT TANDEM REPEAT ANALYSIS IN IDENTIFYING MASS CASUALTIES

Veritas Volume: 2, Issue: 2, Pages:148-151

Ms. Blessy John Kaalla

Disasters are unpredictable; they can be natural, accidental, or man-made events that occur with or without a warning and cause or threaten to cause death, injury, or damage to property, the environment, or lives. Disaster Victim Identification is a process for recovering and identifying deceased people or human remains in mass casualty incidents. The establishment of the victim's identity is critically necessary on humanitarian grounds for all the grieving relatives and legal issues to achieve closure.

Identification is done by primary identifiers like comparative dental analysis, fingerprint, and DNA (Deoxyribonucleic acid) analysis, or by secondary identifiers like personal description, medical findings, records, clothing, and evidence found on the body.

Body identification in fire disaster incidents becomes more difficult because the bodies are in poor condition, being extremely charred and having only remnant burnt soft tissues and bones.



Fig.1:Deoxyribonucleic acid

Deoxyribonucleic acid, or DNA, is a molecule that can only be found in nucleated cells and codes for a protein called a gene and is located on each segment of a chromosome. The human genome contains polymorphism in which the position of nucleotide sequences are different. It uses polymorphisms called short tandem repeats (STRs), which are regions of non-coding DNA that contain repeats of the same nucleotide sequence present at different genetic loci, for identification.

In this study, Byramjee Jeejeebhoy Government Medical College and Sassoon General Hospital, Pune used DNA identification by polymerase chain reaction (PCR) technique involving STR analysis to identify 17 charred burnt bodies from a tragic fire incident that occurred in a sanitizer manufacturing factory.

MATERIAL AND METHODS

The autopsy included all 17 of the charred and completely burned bodies, it was difficult to identify them using secondary identification techniques as the bodies were deformed.

The complete autopsy was performed by labelling the bodies with serial numbers. The following bones were preserved and sent to regional forensic science laboratory:

- Piece of sternum - 09 cases
- Part of humerus bone - 02 cases
- Part of femur bone - 04 cases
- Part of tibia - 01 cases
- Part of fibula - 02 cases
- Teeth - 08 cases

Blood samples of next of kin were drawn for comparative DNA analysis. They were typed by PCR at 15 STR loci and one amelogenin locus distinct to each gender.

OBSERVATION

On external examination, it was observed all bodies showed superficial to deep burn injuries with charring, complete blackening, and heat ruptures exposing internal organs. Sex could be determined only of 4 bodies, 2 males and 2 females.

On internal examination, uterus and ovaries were observed in 14 cases and prostate in 2 cases with the help of which preliminary sex allocation was done.

DNA from bone and tooth was analysed at 15 autosomal STR markers, D7S820, D19S433, CSF1PO, D13S317, D8S1179, VWA, TPOX, D3S1358, D19S43, D5S818, TH01, FGA, D16S539, D2S1338 and D18S51, which helped to establishing identity of 16 victims. X/Y specific amelogenin gene markers were used for sex determination.

DISCUSSION

Meticulous planning and execution by police personnel and medical experts are required to establish identity in a mass casualty incident. In this study, the bodies were charred causing both autolytic and deleterious changes, degrading the DNA. The advantage of using STR is it resolves the DNA fragment by polyacrylamide gel, differing by as little as one nucleotide in length allowing precise allele designation.

PCR provides better sensitivity and specificity for phenotyping and genotyping techniques by enabling analysis of extensively degraded samples.

DNA samples are often extracted from the pulp tissue of the teeth (molar and premolar) as they are resistant to microbial action, incineration, decomposition and weather changes. They are less likely to get contaminated as they are protected by dentin—the hardest structure of the human body.

In this study, it was seen both internal and external examination helped in sex determination but identifying the victim was not possible. Identification of all the seventeen victims was done by performing DNA analysis by typing at 15 STR loci for each victim.

CONCLUSION

DNA profiling serves as vital evidence enhancing the criminal justice system's accuracy by identifying potential suspects, linking suspects to the crime, identification of the unidentified body or human remains, etc. It serves as the gold standard for individualising victims even when the body is highly fragmented, degraded, and extremely damaged, as in fire incidents.

This study demonstrated the utility of PCR amplification of STR loci when involved in the investigation of mass casualties when reference DNA samples are available, providing rapid potential identification of human remains.

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STRANGULATION

Veritas Volume: 2, Issue: 2, Pages:152-154

Ms. Sreelakshmi NM

Strangulation is a form of death where constriction of the neck by a ligature or any material without suspension of the body.

1. Ligature strangulation
2. Manual strangulation by hands (throttling)
3. Garrotting (ligature strangulation by approaching the victim from behind)
4. Mugging (compression of neck by elbow, foot or wrist)
5. Bansdola (compression of necks by using stick)
6. Accidental strangulation

Cause of death in strangulation:

Combination of asphyxia and venous congestion is the usual cause of death. Vagal shock may occur in case of manual strangulation. Cerebral ischemia and injury to cervical vertebrae is sometimes seen.

POSTMORTEM FINDINGS

- External Findings

Ligature mark is normally horizontal, situated below the thyroid cartilage and encircles the neck completely and reaches the occipital region. Multiple ligature marks are suggestive of homicidal strangulation. If the victim is dragged by the ligature, the ligature mark may be oblique and upwards. Ligature marks may be faint or absent if soft fabric is used and released quickly after death. Fingertip bruises, nail scratches, abrasions over the neck indicate possibility for homicide. Presence of ligature material on the neck indicates strangulation. A transparent adhesive tape can be used to lift and collect the ligature material from the body.

Scratch abrasion may be present under the ligature mark, which indicates the victim had struggled to remove the ligature. Fingernail scrapings of the victim may show skin fragments and blood. In manual strangulation, multiple fingertip bruises may be present over the neck, along with the windpipe, depending on whether one or both hands are used by the assailant. Various sized contusions of fingertip around the neck muscles more towards the nape of neck are homicidal. If two sticks are used for strangulation, there will be horizontal marks on the front and nape of the neck. Severe internal damages or injuries are also seen in these cases.

- Internal Findings

Neck structures are examined after the examination of the cranial and thoracic cavities. Laceration of the carotid artery and internal coats with extravasation of blood into their walls. Fracture of cornu of hyoid bones and superior cornu of thyroid cartilages is mostly observed in adults above 40 years of age. Frothy blood will be present in the upper respiratory tract and will be congested. The lungs will be congested with petechial and exude dark fluid blood on the cut section. The right side of the neck will be filled with dark blood and the left side will be empty. The brain and the abdominal organs will be congested.

MEDICO LEGAL QUESTIONS RELATED TO STRANGULATION

1. Whether death occurred by strangulation?
2. Whether the strangulation was suicidal, homicidal or accidental?

WHETHER THE DEATH WAS DUE TO STRANGULATION?

The injury caused by neck structure, ligature material present, number of ligature marks etc. indicates the possibility for strangulation. Presence of ligature mark is not a conclusive proof of death by strangulation, as skin fold and necklines may also look like ligature mark.

WHETHER STRANGULATION WAS SUICIDAL, ACCIDENTAL OR HOMICIDAL?

Suicidal throttling is not possible as the victim cannot pressure himself for duration needed to cause death by compression of neck. A ligature tied around the neck and twisted by a stick below the mandible, may cause suicidal death by the ligature. In homicidal strangulation, the ligature may be tied with one turn and one or more knots may be present. When there are multiple turns present, each turn will be tighter than the previous one. Evidence of struggle, injuries, violence, intoxication or the hands and feet may be tied. Accidental strangulation may occur in case of the neck tie or dupatta caught inside a machine or vehicles. Tightening of the umbilical cord around the neck may cause death of infants in utero or childbirth stage.

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STATISTICAL DATA

- **Modus Operandi of Theft, Dacoity, and Rape Crimes in Karnataka**
- **A Study on the Relation of Speed, Pressure, and Legibility in Handwriting Using Three Distinctive Pens**

MODUS OPERANDI OF THEFT, DACOITY, AND RAPE CRIMES IN KARNATAKA

Veritas Volume: 2, Issue: 2, Pages:156-162

Mr. Abhishek A G

Mr. Timothy K Sam

Ms. Jiby Joy

INTRODUCTION

Criminology is the scientific study of crime and criminals and their motivations for criminal behaviour. Criminology is a branch of social science, traditionally examining human behaviour, communication, and organisation. However, it also connects research and theories from other fields of study, such as philosophy, anthropology, biology, and psychology. Crime experts explore a variety of topics related to crime. They are committed to studying not only the causes of crime but also the social background and impact. The ultimate goal of crime is to clarify the causes of criminal behaviour and to develop effective and humane ways to prevent it. These objectives have produced a number of schools of thought within discipline, each looking at the different aspects involved in misconduct and reaching different conclusions about how best to deal with problems.

When it comes to the manner and extent of data collection differs considerably from country to country and also even within countries that have federal systems, it may vary accordingly. The variables include how often the data are collected and published, also it would have the date on what items are given importance, whether the choice is between complete listings or the surveys, and also on what the ratio between governmental and the private research are.

These differences are combined with differences in law and legal system and administration also in the popular views and its habits have also made it difficult to devise a meaningful system of the international

criminal statistics and to also compare the national statistics that are collected separately as well.

One of the most common data used in criminological research are official statistics which are collected and analysed as part of the operation of criminal justice agencies or organisations. For example if a police collect the data on the crimes they know about and on the people they have arrested for committing those crimes, the courts collect the data on the cases that are brought to them and also on the outcomes of those cases, including prisons, jails and convictions as well.

Modus operandi is a Latin word that describes the individual or group way of working, which makes a visible pattern. The word is used primarily when discussing criminal behaviour, but is not limited to this context. Modus operandi can also be defined as a specific operating system. Understanding Modus Operandi Different groups of people or communities often display patterns of thought or behavioural patterns that are specific to those cultures.

AIM

To study various modus operandi used in crimes particularly theft, dacoity and rape and to analyze the pattern of crime and influencing factors.

METHODOLOGY

The analysis of Modus Operandi is done using the crimes, taken place in the State of Karnataka and that has been Reported in Police Records. A set of fifty such cases were taken into consideration for the Research. All Fifty cases are taken from the official website of Indian Kanoon. These cases are referred to understand the methods of Operations and Summarise the case study.

Later the study was done by tabulating the details such as year and time of crime, the location, no. of persons involved, their physical attire, means of transportation, missing property and whether the cases are

reported or not and if reported which court did the judgement etc. After tabulating the data, calculating the percentage of weapons used as well articles or property that has been stolen.

FINDINGS

- Theft

Percentage of weapons used

S.NO	TOOLS/WEAPONS USED	NO. OF CASES	PERCENTAGE
1	Iron rod	4	8%
2	Duplicate keys	4	8%
3	Ransom virus	1	2%
4	Riggers	1	2%
5	Pipes	1	2%
6	Containers	1	2%
7	Tool kit	1	2%
8	Hammers	2	4%
9	Drillers	2	4%
10	Axe	2	4%
11	Stock	1	2%
12	Stone	2	4%
13	Chloroform liquid	2	4%
14	Computer system	1	2%
15	Ropes	1	2%
16	Bag	1	2%
17	Boxes	1	2%
18	Shovel	1	2%
19	JCB	1	2%
20	Knife	5	10%

Percentage of missing property

S.NO	MISSING PROPERTY	NO. OF CASES	PERCENTAGE
1	Jewellery (gold, silver, diamond)	16	32%
2	Food (Areca nut)	1	2%
3	Cell phones	2	4%
4	Home appliances	2	4%
5	Cosmetics	1	2%
6	Cars	4	8%
7	Crypto currency	1	2%
8	UBBP Cards from mobile towers	1	2%
9	Cash	8	16%
10	Watch	1	2%
11	Bikes	1	2%
12	Utensils	1	2%
13	Mining (sand, iron ore)	5	10%
14	Documents	3	6%
15	Electronic Gadgets	1	2%
16	Liquor bottles	1	2%
17	Cheque	1	2%
18	Minerals (coal, diesel)	2	4%
19	Gold Idols	1	2%
20	Electricity	2	4%
21	Sandalwood	1	2%

As per the above percentage calculation knife is the most used weapon in theft crime and jewellery items are the most stolen property this sequential year.

From the analysis, we can find that during lockdown periods the number of cases were lesser than that of the previous years.

- Dacoity

Percentage of weapons used

S.NO	WEAPONS USED	NO. OF CASES	PERCENTAGE
1	Knife	23	51.11%
2	Rod	4	8.88%
3	Chopper	2	4.44%
4	Chilly powder	3	6.66%
5	Stick	3	6.66%
6	Chain	1	2.22%
7	Petrol	1	2.22%

Percentage of missing property

S.NO	BOOTY ITEM	NO. OF CASES	PERCENTAGE
1	Gold	20	44.44%
2	Cell phone	13	28.88%
3	Car	4	8.88%
4	Bike	5	11.11%
5	Money	20	44.44%
6	Silver	1	2.22%
7	Diesel	1	2.22%
8	Laptop	1	2.22%
9	Bank card	1	2.22%
10	Spare parts	1	2.22%
11	Cloths	1	2.22%
12	Autorickshaw	1	2.22%
13	Tractors	1	2.22%

Demographic data of accused

AGE GROUP	MALE	FEMALE
18-24	7	0
26-30	14	1
31-35	12	0
36-40	7	0
41-45	3	0
46-50	1	0

- Rape

Age groups of victims

S.NO	AGE OF VICTIME	NO. OF CASES	PERCENTAGE
1	11	7	15.56%
2	12	4	8,89%
3	13	1	2.22%
4	14	1	2.22%
5	15	2	4.44%
6	17	5	11.11%
7	18	6	13.33%
8	19	10	22.22%
9	20	6	13.33%
10	21	2	4.44%
11	22	1	2.22%

CONCLUSION

The study shows the common modus operandi and victim choice in certain crimes in the region of Karnataka.

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A STUDY ON THE RELATION OF SPEED, PRESSURE, AND LEGIBILITY IN HANDWRITING USING THREE DISTINCTIVE PENS

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INTRODUCTION

Handwriting is an acquired skill and a neuro-muscular process and it is unique to each individual. Handwriting involves 27 bones and 40 muscles to work. To determine the proper writing speed, the slow speed is indicated by writing with heavy pen pressure, blunt starts, blunt terminals, and pen lifts. Whereas fast speed is indicated by well-defined rhythmic strokes and tapering terminals. Tremors, retouching, and pen pauses in the strokes all indicate slow speed.

Questioned document examination (QDE) is a forensic science discipline that examines documents that may be contested in court. The primary goal of the examination is to provide evidence about suspicious or questioned documents by employing a variety of scientific principles and methods. Document examination may include alterations, by, paper analysis, forgery, origin, determining authenticity, and other issues. Documents related to a criminal or civil case can provide a wealth of critical information.

AIM

This study aims to describe the relation of speed, pressure and legibility as well as the impact of different pens used namely ball point pen, ink pen and gel pen.

METHODOLOGY

One hundred adults between the ages of 18-24 participated in the study. Subjects were told that samples were required of normal handwriting and they were unaware of the purpose of the study. The subjects were given three pens for this study: an ink pen, a ball point pen and a gel pen. To measure the pressure, carbon paper was provided. Writing pad, three distinctive pens and A4 sheets were used as writing instruments. To quantify the pressure, the indent writing must be visible on the next sheet. For all the four speeds, comparable arrangements were produced in collection. The subjects are instructed to pay close attention to the provided audio clip and compose the sentence while listening to the recorded audio because this can be used to determine handwriting speed. The speeds that are taken into account are slow speed, normal speed(which they usually write), speed and high speed. The ball point pen was solely used for the purpose of measuring pressure. The ink pen, ballpoint pen and gel pen were used to determine the legibility. Each pen was given three different sentences and also each of the given sentences had the words mixed or jumbled for each speed, so that the person does not foresee or think of the next word.

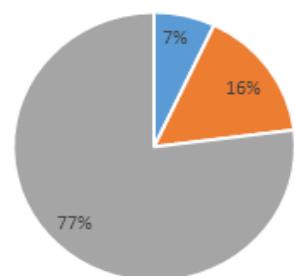
The individuals were given A4 sheets with carbon paper sandwiched between them in order to gather samples containing pressure. The sentence given for each speed to check the pressure was fixed.

Similarly, the sentences given to check the legibility of ink pen and gel pen also were fixed.

FINDINGS

The results of pressure applied by 100 subjects while writing using a ball point at different speed is depicted in the graph provided below in the figure 1.1; figure 1.2; figure 1.3 and 1.4

Figure 1.1: slow speed S1



The slow speed S1 writing of 100 individuals is depicted in the figure 1.1. It was shown that 77% of the subjects while writing in slow speed used heavy pressure, 16% used medium or moderate pressure and only 7% used low pressure. So the pressure has increased at slow speed S1.

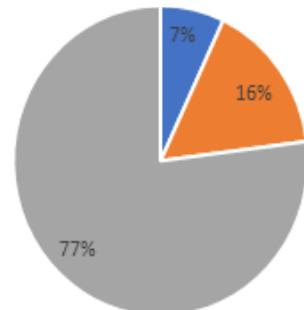


Figure 1.2: normal speed S2

The normal speed S2, writing of 100 individuals, which is the usual way the subject writes is depicted in the figure 1.2. It was shown that only 7% of the subjects used heavy pressure while writing, 54% used medium or moderate pressure and around 39% used low pressure.

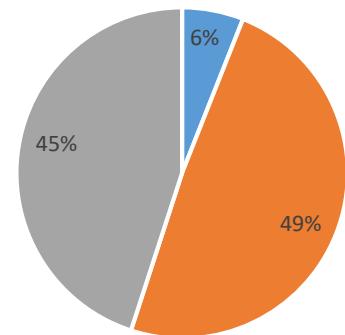


Figure 1.3: speed S3

The speed S3, writing of 100 individuals is depicted in the figure 1.3. It was shown that only 6% of the subjects while writing in fast speed used heavy pressure 49% used medium or moderate pressure and only 45% used low pressure.

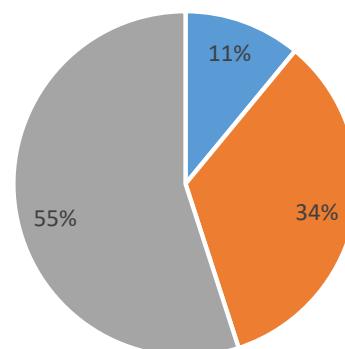


Figure 1.4: high speed S4

The high speed S4 writing of 100 individuals is depicted in the figure 1.4 . It was shown that only 11% of the subjects while writing in very fast speed used heavy pressure, 34% used medium or moderate pressure and only 55% used low pressure

LEGIBILITY

- **Ball pen-** The results of legibility in relation to speed was obtained for 100 subjects when ball pen was used for writing and shown in the figure 2.1; figure 2.2; figure 2.3 and 2.4

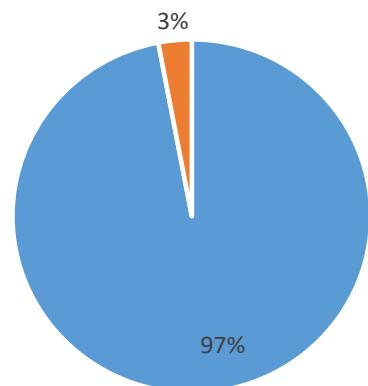


Figure 2.1: slow speed S1

According to figure 2.1, 97% of the subjects' writing samples were clearly visible, indicating that the writing is legible when done in a slow speed S1. Only 3% of the subjects' writing had some words that were unclear, which were subsequently classified as moderately legible.

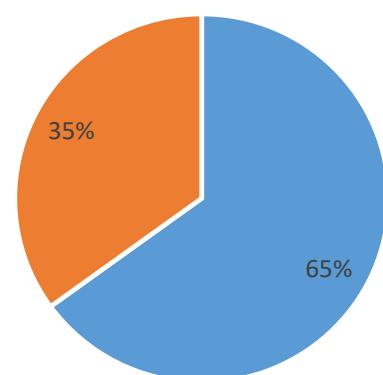
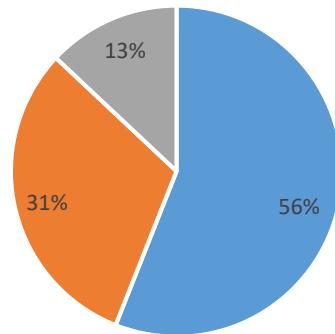


Figure 2.2: normal speed S2

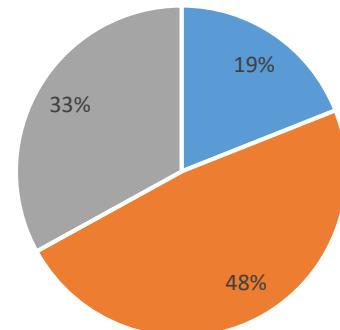
From the figure 2.2 it was depicted that 65% of the subjects' writing was clearly visible indicating that the writing is legible when the samples were written in normal speed S2. And around 35% of the subjects' writing were unclear, which then classified as moderately legible.

Figure 2.3: speed S3



From the figure 2.3 as the speed changed to fast speed S3, 56% of the subjects' writing was clearly visible, indicating that the writing is legible, 31% of the samples had few words unclear while writing in fast speed S3. And around 13% of the subjects' writing none of the words were clear so it is then classified as illegible.

Figure 2.4: high speed S4



From the figure 2.4 when the samples were written in very fast speed S4, the legibility reduced. That is only 19% of the subjects' writing were clearly visible indicating the samples were legible, 48% of the writing samples had few words that were unclear so it was classified as moderately legible. And also 33% of the subjects' writing none of the words were clear so it was classified as illegible.

Overall, it was discovered that when the subjects wrote the samples with ball point pen, the subject's writing legibility decreased as the speed rose. Only few words were unclear in the majority of the samples, which is moderately legible; few samples were illegible since none of the words were clear.

- **Ink pen-** The results of legibility in relation of speed when written using ink pen is depicted in the figure 3.1; figure 3.2; figure 3.3; figure 3.4

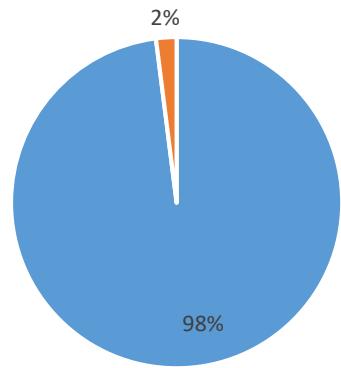


Figure 3.1: slow speed S1

From the figure 3.1, 98% of the subjects' writing samples were clearly visible, indicating that the writing is legible when done in a slow speed S1. Only 2% of the subjects' writing had some words that were unclear, which were subsequently classified as moderately legible.

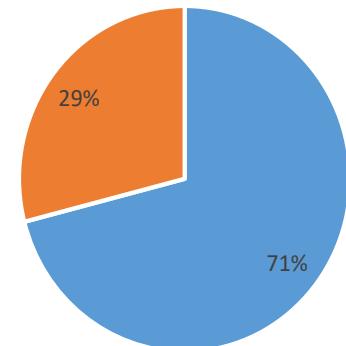


Figure 3.2: normal speed S2

From the figure 3.2 it was depicted that 71% of the subjects' writing was clearly visible indicating that the writing is legible when the samples were written in normal speed S2. And around 29% of the subjects' writing was unclear, which then classified as moderately legible.

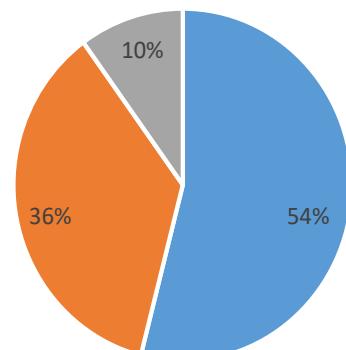


Figure 3.3: speed S3

From the figure 3.3 as the speed changed to fast speed S3, 36 % of the subjects' writing was clearly visible, indicating that the writing is legible, 54% of the samples had few words unclear while writing in speed S3. And around 10% of the subjects' writing none of the words were clear so it is then classified as illegible.

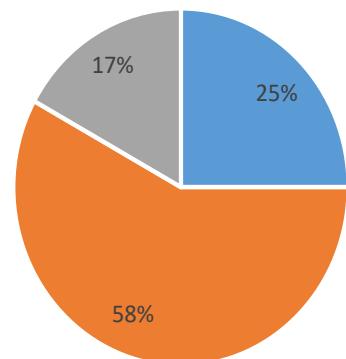


Figure 3.4: high speed S4

When the samples were written in very fast speed S4 Shown in the figure 3.4, the legibility reduced. That is only 17% of the subjects' writing were clearly visible indicating the samples were legible, 58% of the writing samples had few words that were unclear so it was classified as moderately legible. And also 25% of the subjects' writing none of the words were clear so it was classified as illegible.

Overall it was observed that when the subject used an ink pen for writing at different speeds, the writing legibility decreased comparatively. Majority of the samples were moderately legible and few samples were illegible.

- **Gel pen-** The results of legibility in relation to different speeds of 100 subjects, using a gel pen to write are shown in the figure 4.1, 4.2, 4.3 and 4.4

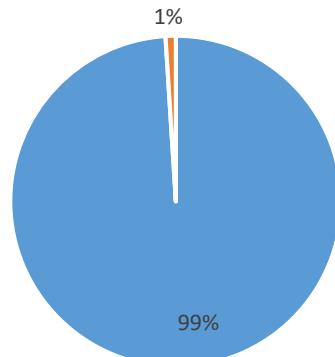
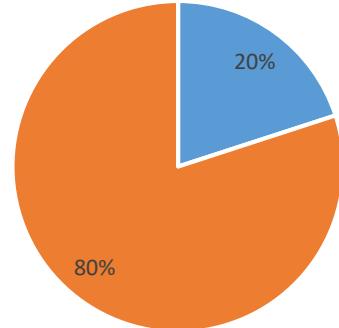


Figure 4.1:slow speed S1

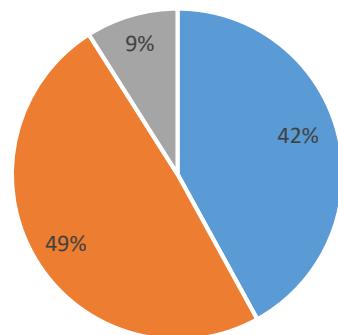
From the figure 4.1, 99% of the subjects' writing samples were clearly visible, indicating that the writing is legible when done in a slow speed S1. Only 1% of the subjects' writing had some words that were unclear, which were subsequently classified as moderately legible.

Figure 4.2: normal speed S2



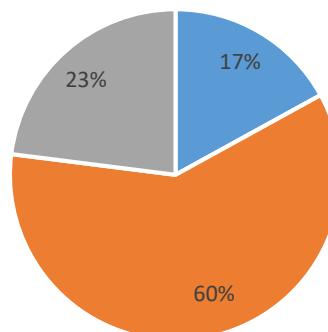
From the graph it was depicted that 80% of the subjects' writing was clearly visible indicating that the writing is legible when the samples were written in normal speed S2. And around 20% of the subjects' writing was unclear, which then classified as moderately legible.

Figure 4.3: speed S3



As the speed changed to increased speed S3, 42 % of the subjects' writing was clearly visible, indicating that the writing is legible, 49% of the samples had few words unclear while writing in fast speed S3. And around 9% of the subjects' writing none of the words were clear so it is then classified as illegible.

Figure 4.4: high speed S4



When the samples were written in high speed S4, the legibility reduced. That is only 17% of the subjects' writing were clearly visible indicating the samples were legible, 60% of the writing samples had few words that were unclear so it was classified as moderately legible. And also 23% of the subjects' writing none of the words was clear so it was classified as illegible.

Overall it was discovered that when the subject wrote samples with gel pen, the subject's writing legibility decreased as the speed increased. Majority of the samples were moderately legible and few illegible but the percentage of the samples with legible reduced comparatively.

CONCLUSION

From this study it was observed that there is an influence of pen on handwriting which is aligned with the expected outcomes, that is as the speed increases the pressure decreases; as the speed increases the writing legibility may decrease and also give a positive effect of pen on different speeds.

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Find the odd one out in each sequence

1. Wavelength, Frequency, Microwave, Wave number, Absorbance, Radiowave.
2. Tool, Glass, Paint, Soil, Fibre, Fur
3. Glass, Arsenic, Marking nut, Cyanide, Snake venom, Lead, Asbestos
4. Refractive index, Pattern match, Layer arrangement, Edge thickness, Radius of curvature, density, IR spectra
5. Hyperdontia, Macrodontia, Gingivitis, Dens invaginatus

Answers:: 1. Absorbance (Rest are electromagnetic wave characters), 2. Tool (Rest qualify as physical evidences), 3. Cyanide (Rest are irritant poisons), 4. Layer arrangement (Rest are physical parameters of glass evidence), 5. Gingivitis (Rest are dental anomalies)



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