

Forensic Evidence in Civil & Criminal Trials

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Chemical Examiner's Laboratory:1849

- In 19th century, deaths occurring due to poisoning became a problem to the law enforcement agencies
- A need to isolate, detect and estimate various poisons absorbed in the human body was felt
- The Madras Presidency under the health department established the first Chemical Examiner's Laboratory in 1849.

Chemical Examiner's Laboratory - Set up

- Similar Laboratories capable of handling toxicological analysis of viscera, biological analysis of blood stains, semen were setup at Calcutta, Agra and Bombay.
- These laboratories were using chemical methods of analysis for drugs & chemicals
- Analysis of food were also done

Department of Explosive: 1898

- Unlawful use of explosive substances gave rise to the establishment of Explosives Department nearly after five decades
- Chief Inspector of the Explosives Department was appointed in 1898 with HQ at Nagpur.
- Chemical tests were used for detecting the explosives

Questioned Document: 1904

- To identify the secret documents of Indian Independence Movement
- British Government established the questioned document department to verify the handwriting
- First handwriting expert was appointed in 1904 at Bengal and in 1906, the department was shifted to Shimla
- Methods or Instruments used for examination:
 - Magnifying Glass
 - Microscope
 - Various Light Sources

Advanced Technologies

- Audio Video Enhancement System
- Voice Identification System for speaker identification
- Computer Forensics for Cyber crime
- Damaged Hard Disk Analysis System
- Damaged SIM Card Analysis
- Automated Fingerprint Identification System
- Computerized Petroleum testing equipments for total automation of testing
- Computerized Currency / Stamps testing technique
- Video Spectral comparator for examination of forged documents , Passport , Cheques, Drafts.

Central Forensic Science Laboratories:1958;

- First CFSL established in 1958 at Calcutta followed by CFSL Hyderabad and Chandigarh. Later on CFSL Delhi was established under CBI



CFSL's under DFSS

- *DFSS was established in 2002.*
- *Subsequently ,CFSL, Kolkata grew as Centre of Excellence in Forensic Biological Services:*
- *CFSL, Hyderabad grew as Centre of Excellence in Forensic Chemical Sciences &*
- *CFSL, Chandigarh grew as Centre of Excellence in Forensic Physical Sciences*
- *CFSL Bhopal, CFSL Guwahati, CFSL,Pune established in 2011*

State Forensic Science Laboratory

- The awareness of scientific aids to crime investigation grew in Law enforcement agencies. Thus state Forensic Science Laboratories were established under Home department along with Regional Forensic Science Labs & Mobile Forensic Science Lab units in 27 states.

Existing Disciplines

- **Chemistry:** chemistry, toxicology, narcotics & explosives, prohibition - possession and blood alcohol
- **Biology:** Biology, Serology, DNA fingerprinting
- **Physics:** Physics, Ballistics,
- **Handwriting & and Photography:** Document examination and crime scene photography
- **Fingerprinting :**
- **Psychology:** lie detection
- **Computer Forensics:**

Advanced Technologies

- Integrated Ballistic Identification System
- Ballistic Data Acquisition System
- Bullet Proof Material Testing System
- Forensic Narcoanalysis
- Brain Fingerprinting & BEOS
- Suspect Detection System
- Layered Voice Analysis
- Forensic Statement Analysis

Functions of Forensic Science Laboratory

- Three tier functions:
 - 1. Crime scene management: Collection and preservation of the clues
 - 2. Examination, analysis and reporting
 - 3. Appearing in the court as expert witness
- To provide answers to :

Is crime committed? If so how, when and who

Mobile Investigation Van



Crime Scene Management



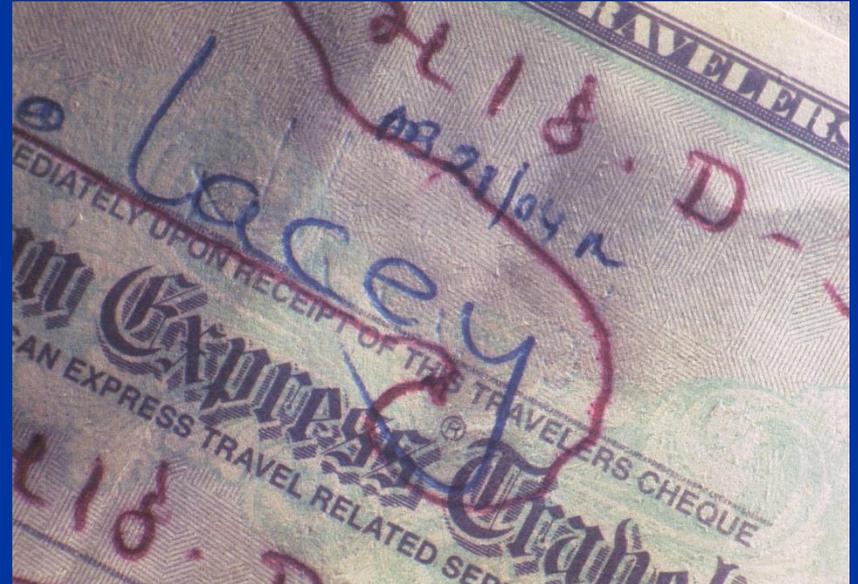
Gir Lion Poaching Case, the Forensic Mobile team collected important evidences from crime scenes & habitats of the criminals that helped in conviction

Cow Meat Testing Mobile Laboratory



The First State in the country to create such facility in four locations

HPB / CEQD



Automated Fingerprint Identification System



Forensic Photography



Computer Forensic Lab



Computer Forensics /Ballistics



Damaged SIM Card
Analysis System



Integrated Ballistics Identification System

Integrated Ballistics Identification System (IBIS)



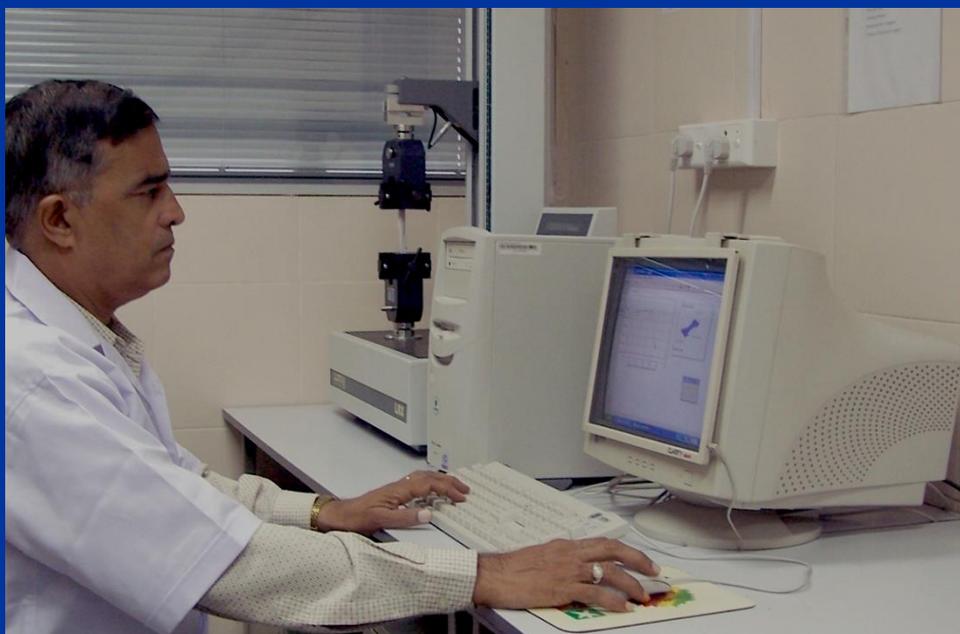
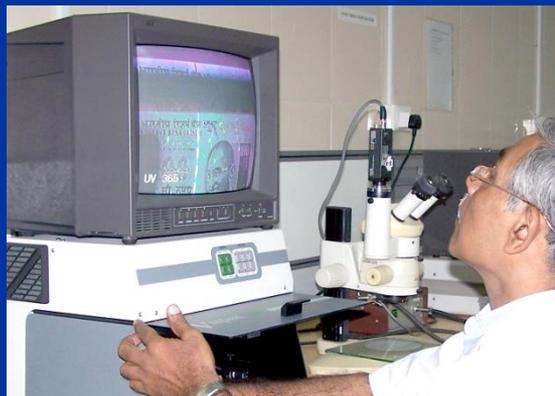
Voice Identification System



Audio - video authentication system



Physics Division



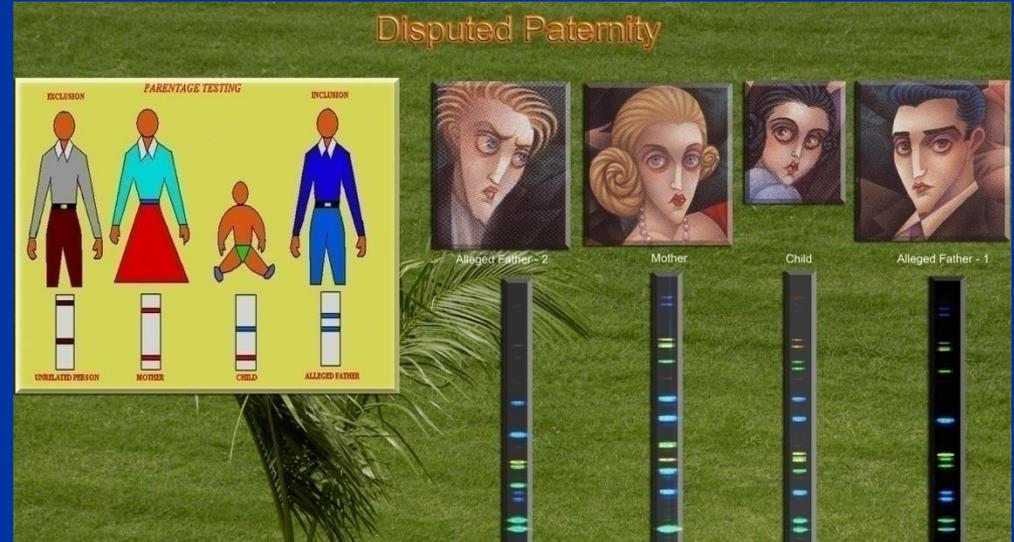
Chemistry Division



Blood Alcohol Analysis



DNA Fingerprinting



Forensic Psychology



Minor O.T. for Narcoanalysis



Starting of Narco in O.T



Informed Consent and Anesthetist inducing Narco



Narco interview in progress



Narco-Free association in progress



Free association in Narco trance



Polygraph Instrument (Lie Detector)



Polygraph Instrument (Lie Detector)



Polygraph Attachments



B.E.O.S.P.Laboratory



BEOS Recording in progress



BEOS Recording in progress



Recording in Progress (B.E.O.S Subject Lab)



Brain wave Science Technology at RSU

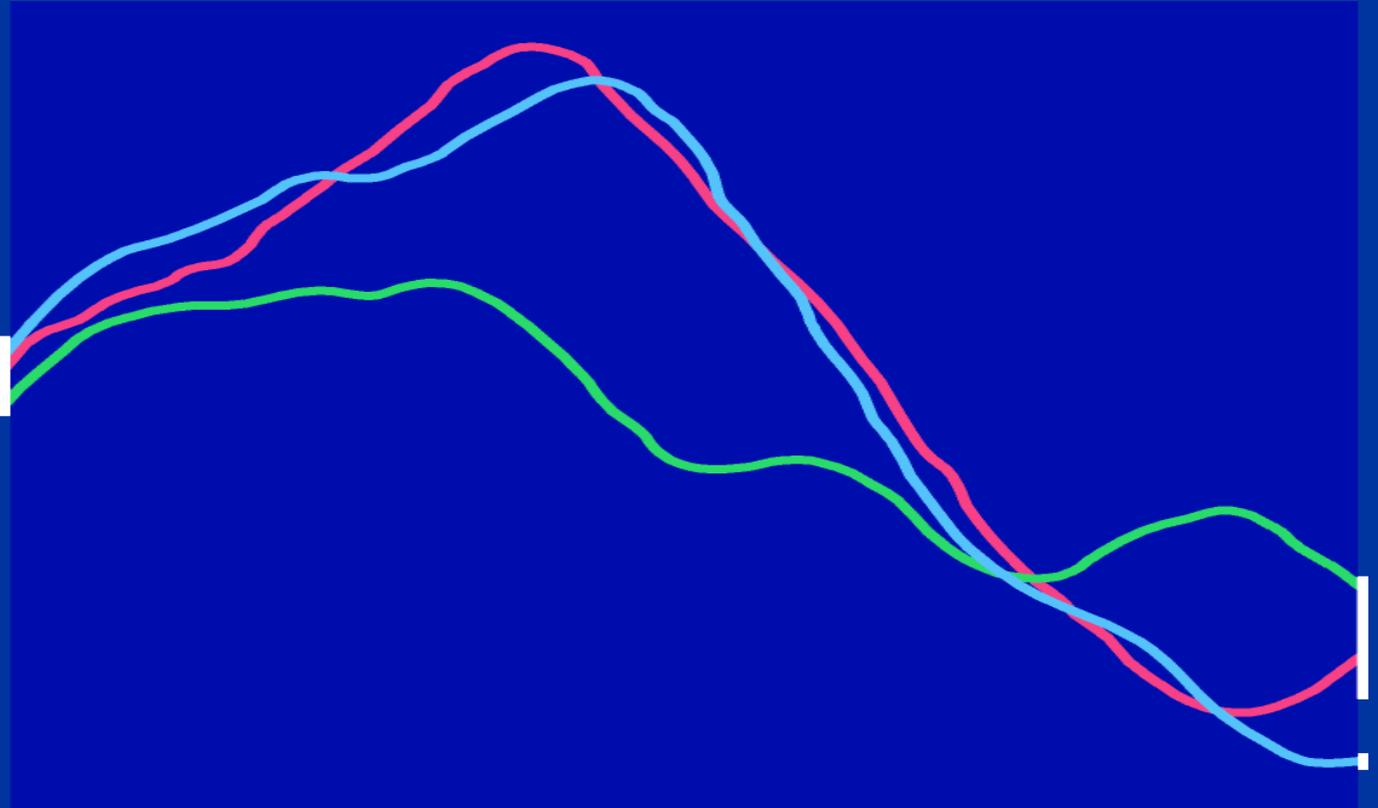
- First Brain Fingerprinting Lab of India was set-up at Institute of Research & Development of Raksha Shakti University for carrying out validation in Indian setup

How this technology works?

- ✓ Brain Fingerprinting lies in its technological ability to pick up the brain's electrical signals known as P300 MERMER.
- ✓ This split second bump in electrical activity starts anywhere from 300-1200ms after recognized stimulus.

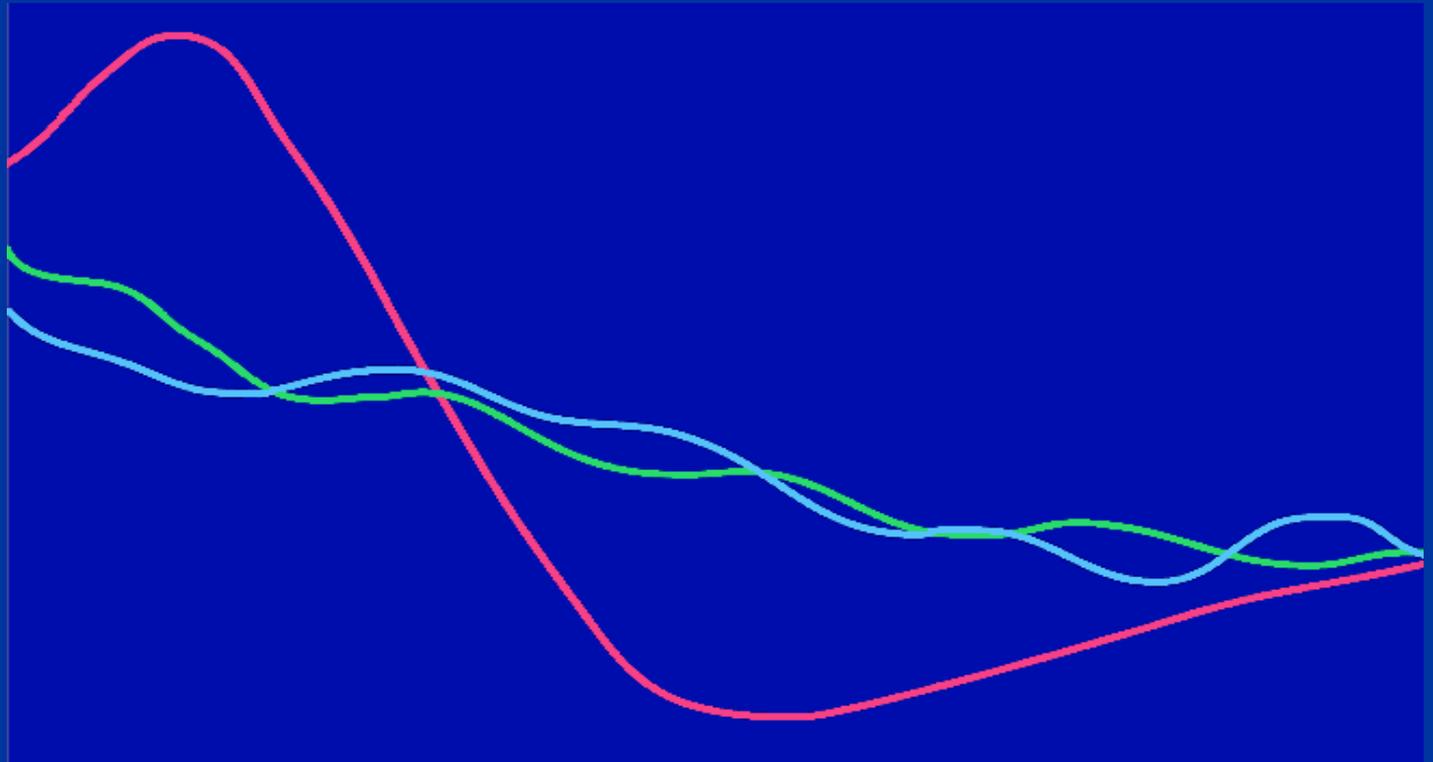
MERMER METHODOLOGY

- SUBJECT IS GUILTY:

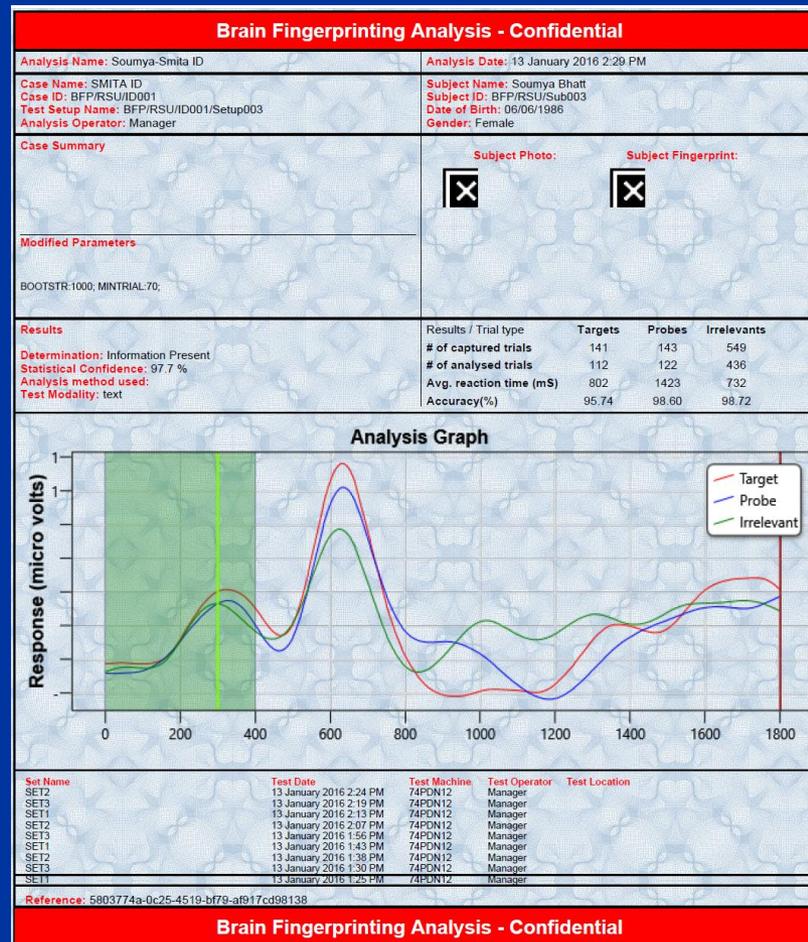


MERMER METHODOLOGY

- SUBJECT IS NOT GUILTY:



Result Generated in Few Seconds.



Graph with Information Present

Results

Determination: Information Present

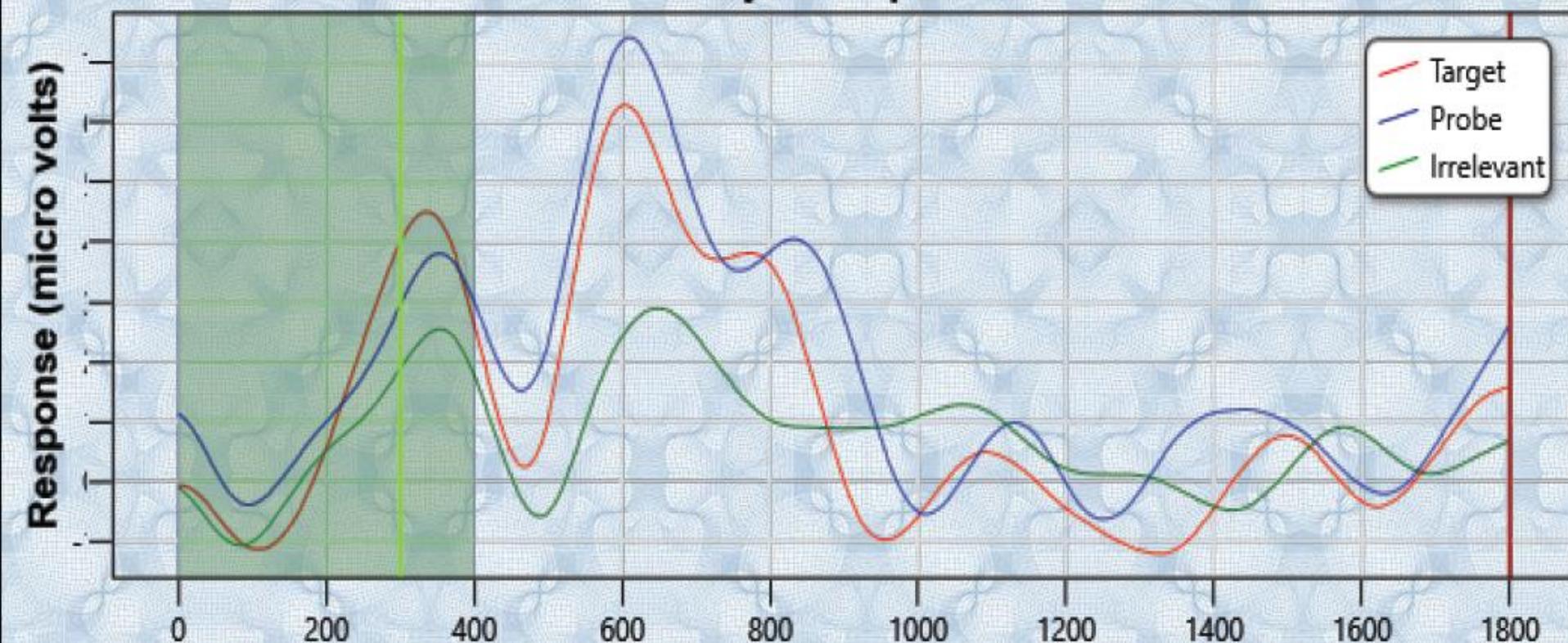
Statistical Confidence: 99.9 %

Analysis method used: VOTING

Test Modality: text

Results / Trial type	Targets	Probes	Irrelevants
# of captured trials	93	97	374
# of analysed trials	87	90	353
Avg. reaction time (mS)	436	429	447
Accuracy(%)	73.12	19.59	45.72

Analysis Graph



Graph with Information Absent

Results

Determination: Information Absent

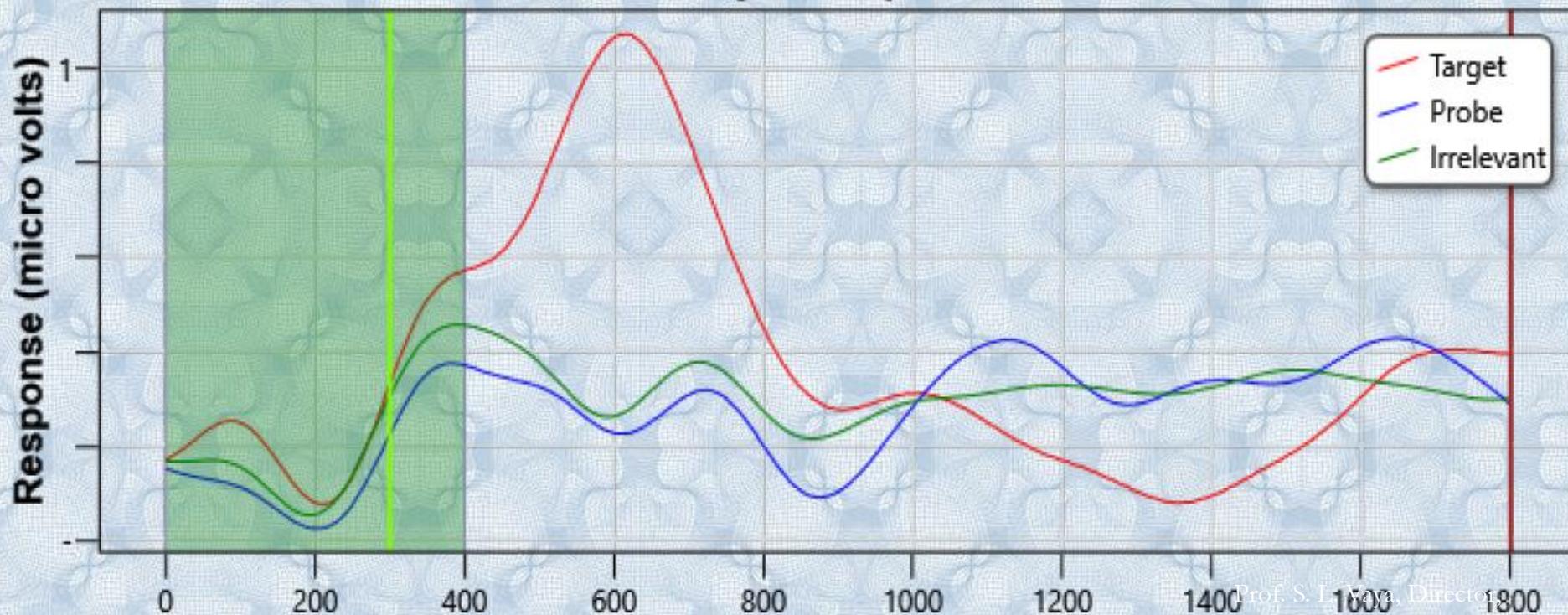
Statistical Confidence: 99.9 %

Analysis method used:

Test Modality: text

Results / Trial type	Targets	Probes	Irrelevants
# of captured trials	133	133	527
# of analysed trials	109	123	479
Avg. reaction time (mS)	559	495	493
Accuracy(%)	60.15	97.74	98.67

Analysis Graph



Suspect Detection System

- Automated system based on combined analysis of Psycho-Physiological indications and unique interrogation methods for:



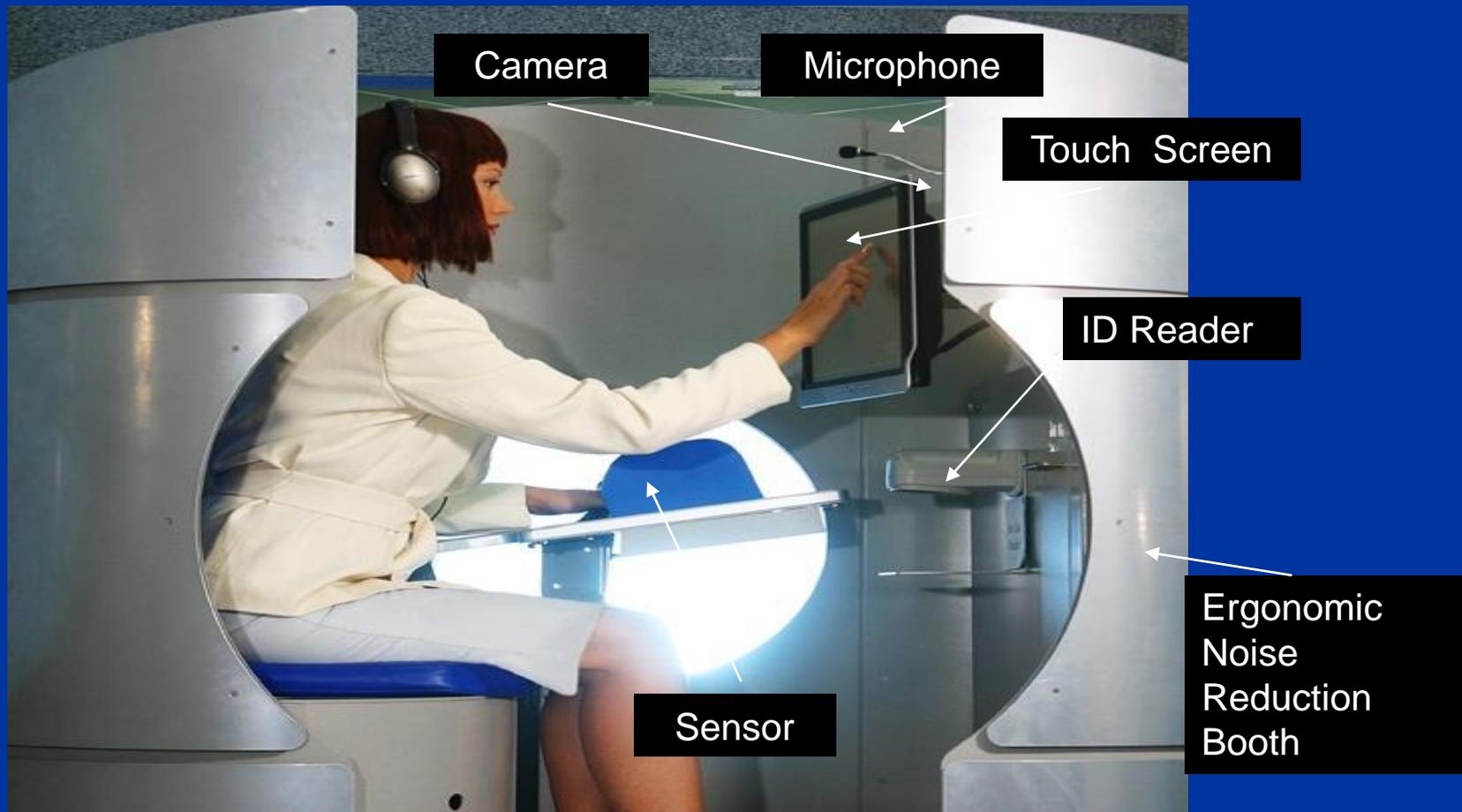
- Flagging suspects at checkpoints
- To identify the concealed information
- Examinee is selected to be tested by the system from the checkpoint

AUTOMATED DECISION MAKING TOOL

Enables screening and investigation of isolate terrorists, criminals and hostile employees at check points, border crossing, crime scene, combat zone and field operation



Fully Automated Fixed System for Mass Screening



Mobile System (1)

Camera

Scanner

Sensors

Biometric



Mobile System (2)



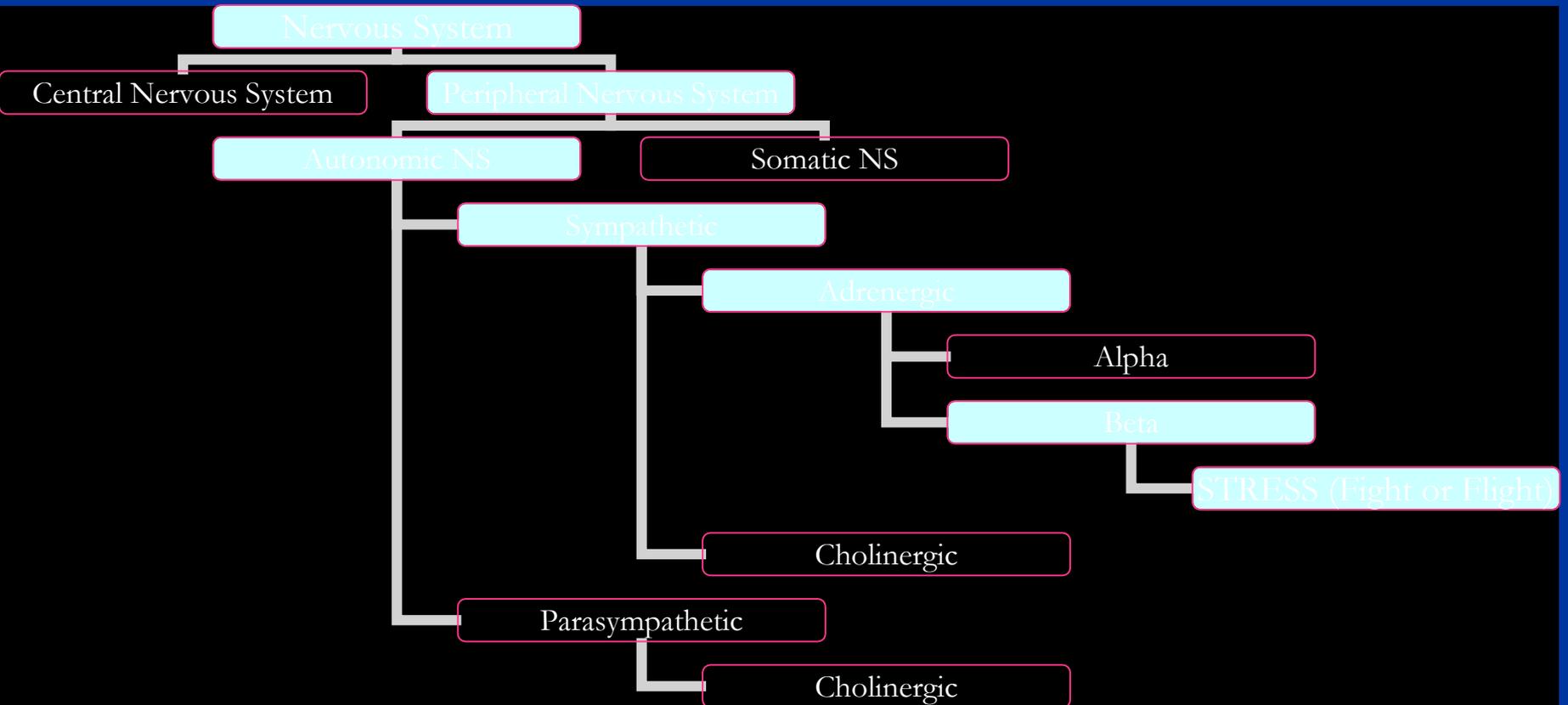
Military grade man pack rigid system

Layered Voice Analysis (LVA)

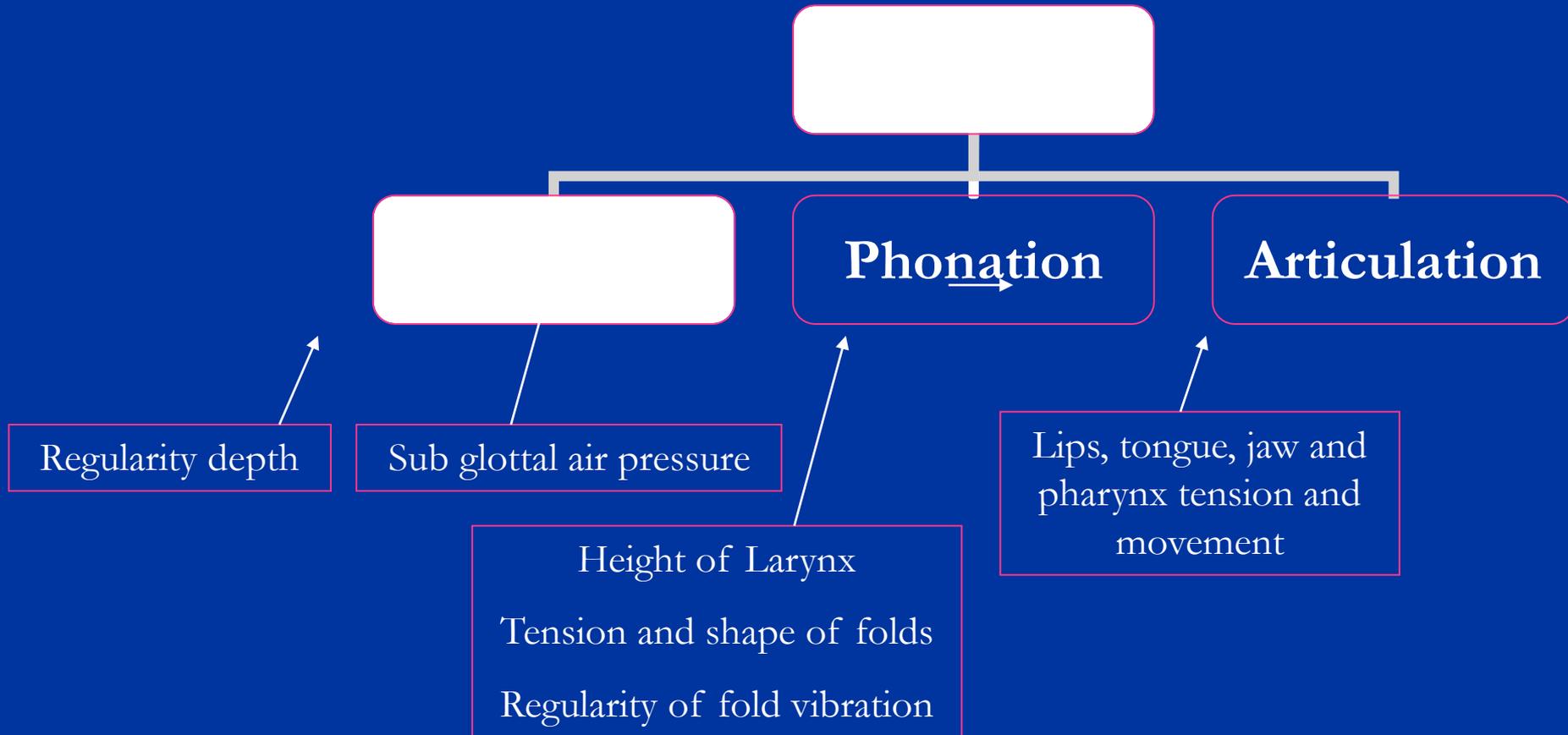
The Latest and the Future

- In 1998, Amir Liberman, Israel, developed “Layered Voice Analysis” for research, looking at the whole “hearable” spectrum of the voice. It does not depend on any micro tremors and can use any microphone and telephone line for data gathering.
- At present, polygraph, and LVA are the most commonly used psycho physiological veracity assessment tools, world wide.

Stress



Effects of stress on speech



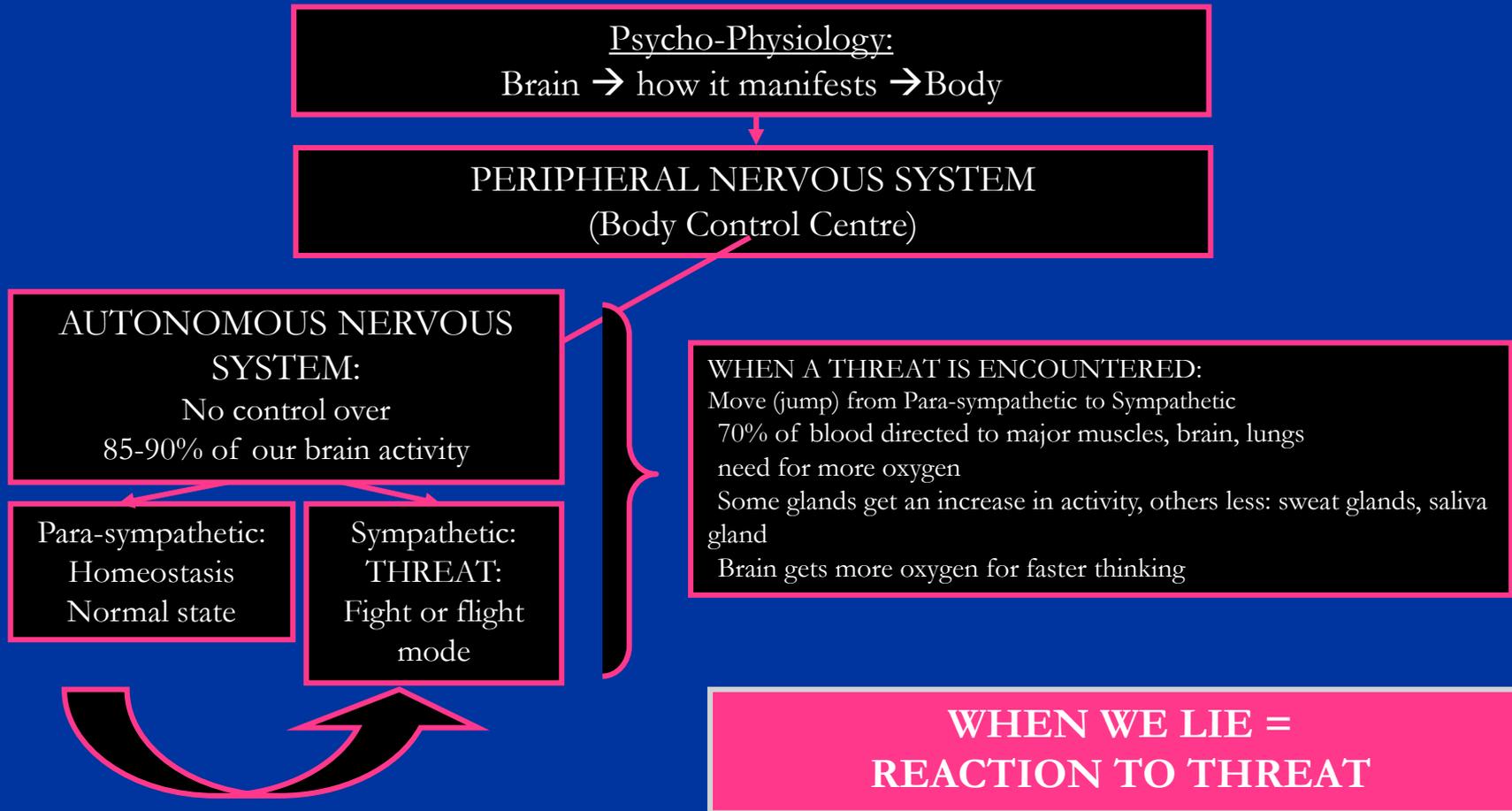
Analyzable variables found in voice

- As in hand writing analysis, analyzable variables can be found in the voice:
- F0 mean: Fundamental frequency
- Pitch range: Difference between highest and lowest pitch in an utterance
- Pitch variability dispersion of Pitch (e.g. standard deviation)
- Pitch perturbation or jitter
- Slight variations in the duration of glottal cycles
- Pitch contour: Fundamental frequency values plotted over time (intonation)
- F1 mean: Frequency of first (lowest) formant
- F2 mean: Mean frequency of the second formant

Contd-

- Intensity mean: Energy values for a speech sound wave averaged over an utterance
- Intensity range: Difference between highest & lowest intensity value in an utterance
- Intensity variability: Measure of dispersion of the intensity values (e.g. standard deviation)
- High frequency energy: Relative proportion of energy in the upper region
- Speech rate: Length of an utterance
- Spectral noise: A-periodic energy components in the spectrum
- Zero Crossings: Number of times a sound wave graph crosses the zero line [Scherer '89]

Summary of the Psycho-physiology



Criminal Case Examples

- Malegao bomb blast 2006
- Delhi High court bomb blast case
- Sushma vaidya murder of Ahmedabad
- Nitari Serial killing
- Ujjain Serial Killing
- Ranchi mass murder
- Aarushi-Hemraj double murder
- Mujib Ahmed in arms acts case
- Godhra train carnage
- Gulistabanu rape judgment (civil case)



Thank You