



Forensic Science In Sexual Offence Investigations

Overview of Presentation

- Forensic Examinations
- Case Assessment and Interpretation

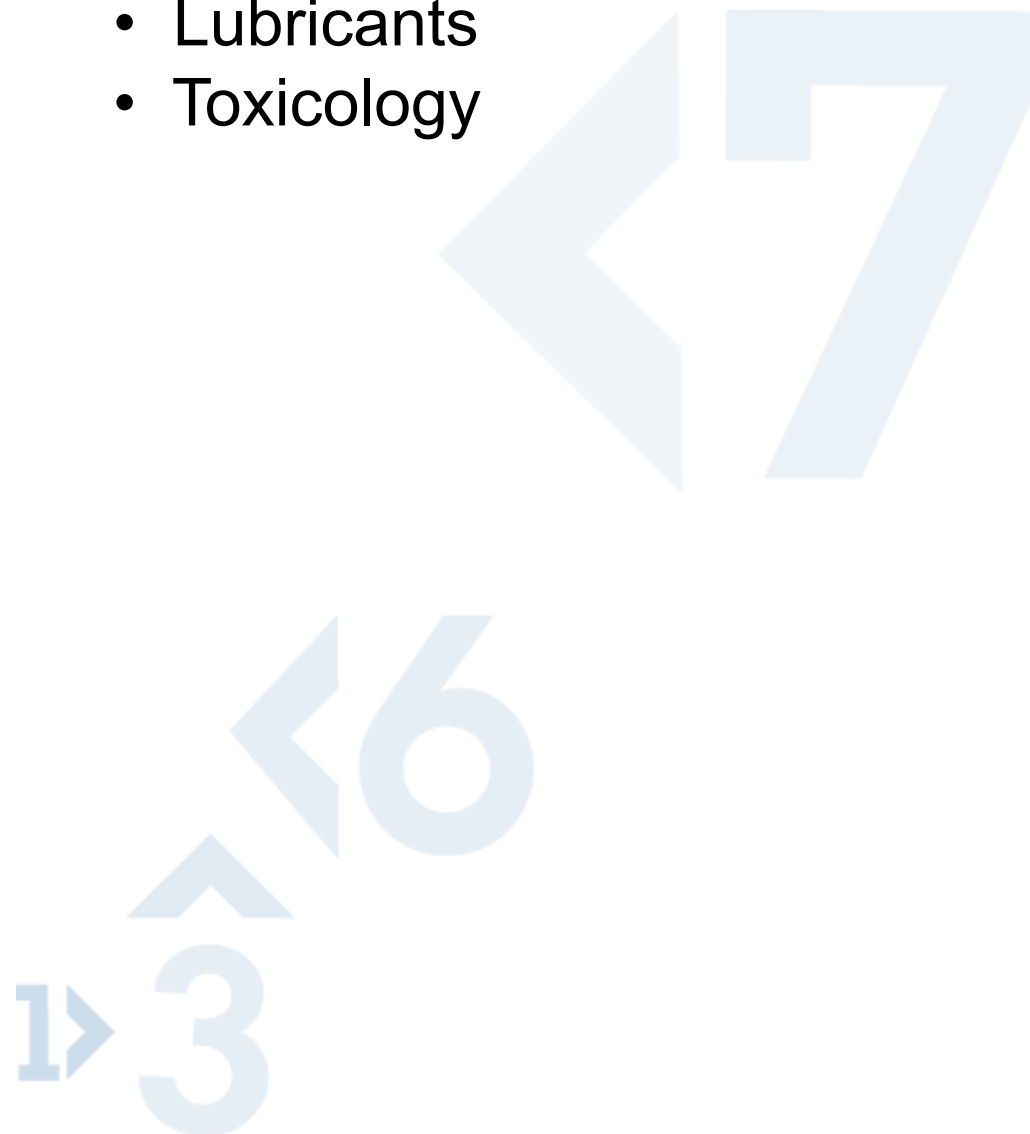




➤ Forensic examinations

Evidence types

- Semen
- Vaginal cells
- Saliva
- Faecal material
- Urine
- 'touch' DNA
- Hairs
- Damage
- Blood
 - Menstrual
 - Assault
- Lubricants
- Toxicology



Detection of semen

Visual

Dry – white and crusty

Liquid – opaque, highly viscous solution

Crimescope – semen stains can fluoresce

Presumptive chemical test:

AP reagent

Confirmatory test:

Microscopic examination and identification of sperm

Acid Phosphatase

- high levels in seminal fluid.

AP test:

- Sensitive
- Can detect invisible stains
- Water soluble
Washing removes AP activity

Forensic Examinations

- Blotting paper pressed onto items – wetted and sprayed with chemical reagent used to detect acid phosphatase

- AP hydrolyses sodium α -naphthol phosphate

Naphthol + Brentamine black K
Salt

→ = **purple colour**

- colour change within 2 minutes
- Area testing positive is cut out and extracted.



False Positives

Vaginal fluid

- pink
- bacteria – blue/grey

Faeces and urine

- purple

Vegetable extracts

- Cauliflower, sprouts –pink/brown

Tea

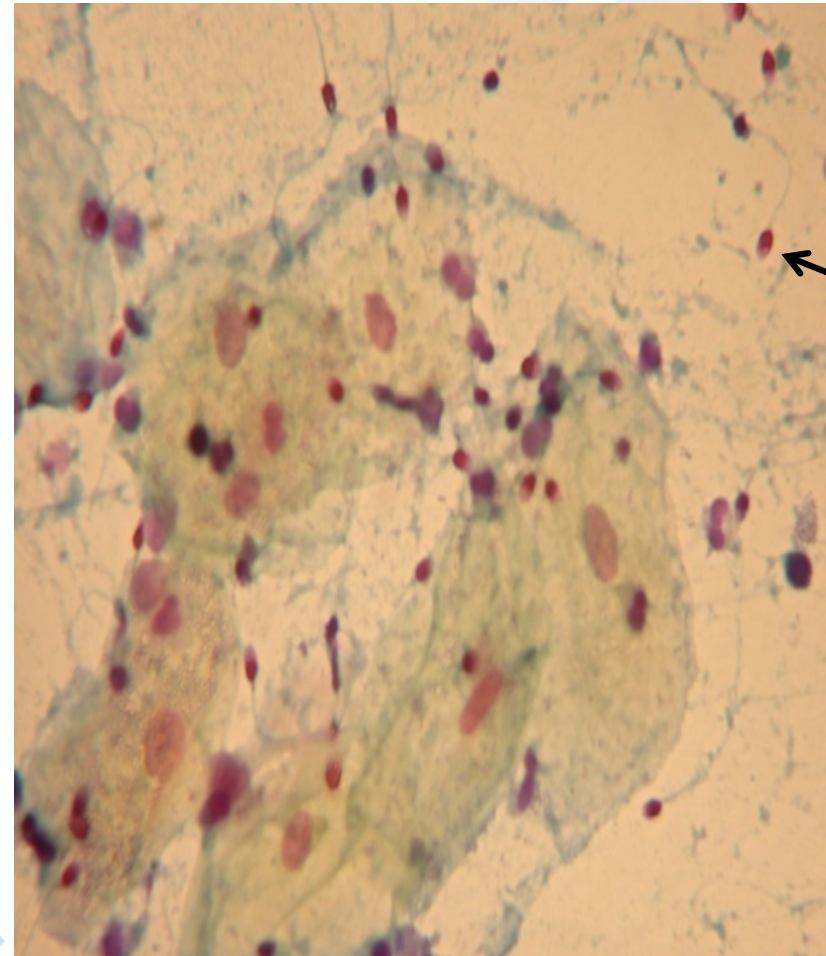
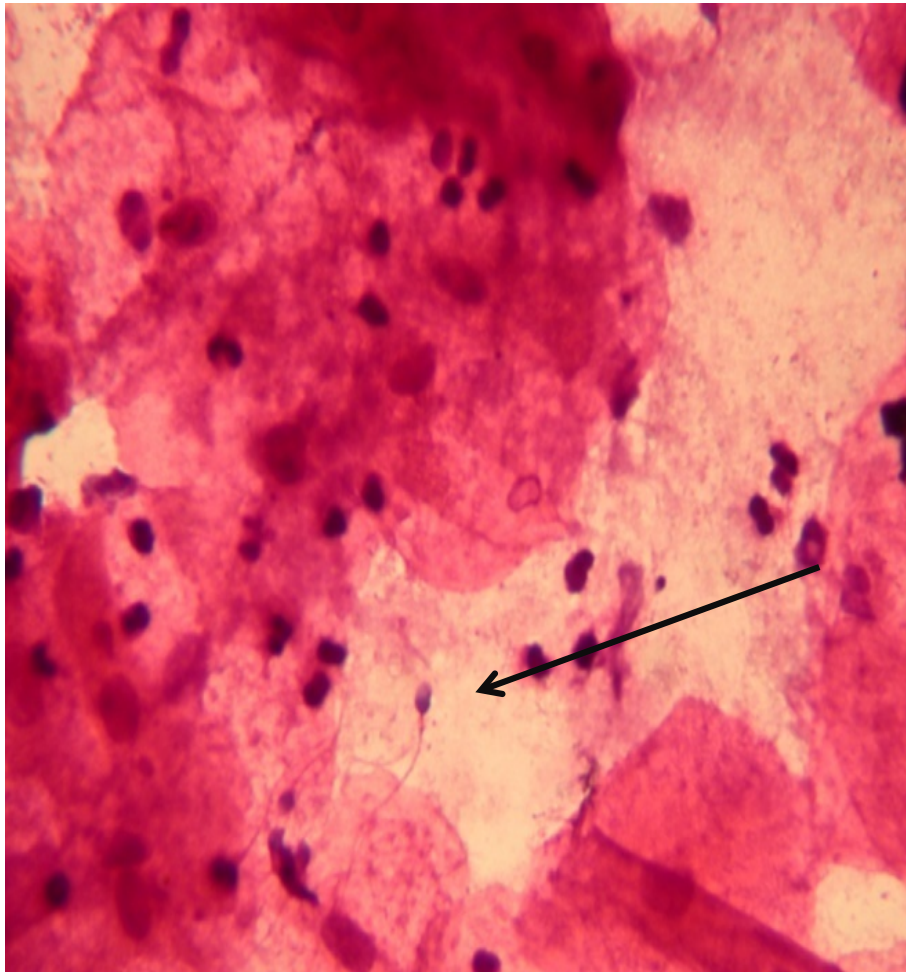
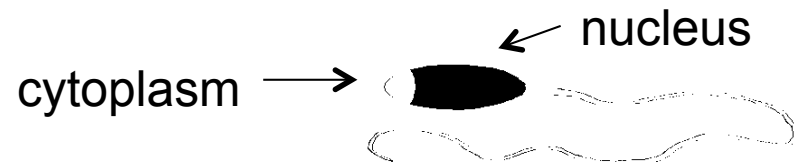
- strong purple

Perfumes

- strong purple



Microscopic examination



Sperm density scores

- Trace (less than 10 spermatozoa found)
- + (spermatozoa are difficult to find)
- + + (some spermatozoa in some fields – easy to find)
- +++ (some spermatozoa in every field – easy to find)
- ++++ (large quantity of spermatozoa in every field)

Also note presence of tails



No sperm heads - Why?

Positive AP

- Aspermic (no sperm cells)
 - Oligospermic (low sperm count)
 - Use of spermicide
 - Use of a contraceptives e.g. Condoms
-
- **Negative AP**
 - No ejaculation onto area examined
 - Incident did not occur as alleged

Florence Iodine

- Identifies presence of choline found in high levels in seminal fluid
- Choline is water soluble – not detected after washing
- Not as sensitive as AP & cannot be used for screening

False Positives

Small number of food stuffs

Did not react with any other body fluid

**STRONG
POSITIVE**



POSITIVE



NEGATIVE



Persistence of semen following vaginal intercourse

Semen on vaginal swabs following full internal ejaculation:

- Should be found within 24 hours after intercourse
- May be found up to 3 days
- Occasionally found up to 7 days
- Can persist longer in cervix
- Samples taken up to 7 days

Depends factors such as degradation, activity accelerates vaginal drainage, washing, injuries etc

Persistence of semen following anal intercourse

Semen on anal swabs following full internal ejaculation:

- Should be found within 24 hours after intercourse
- Occasionally found up to 3 days
- Samples taken up to 3 days

Depends on factors such as degradation, activity, injuries, defecation

Also want vaginal swabs to address anal intercourse

Persistence of semen following oral intercourse

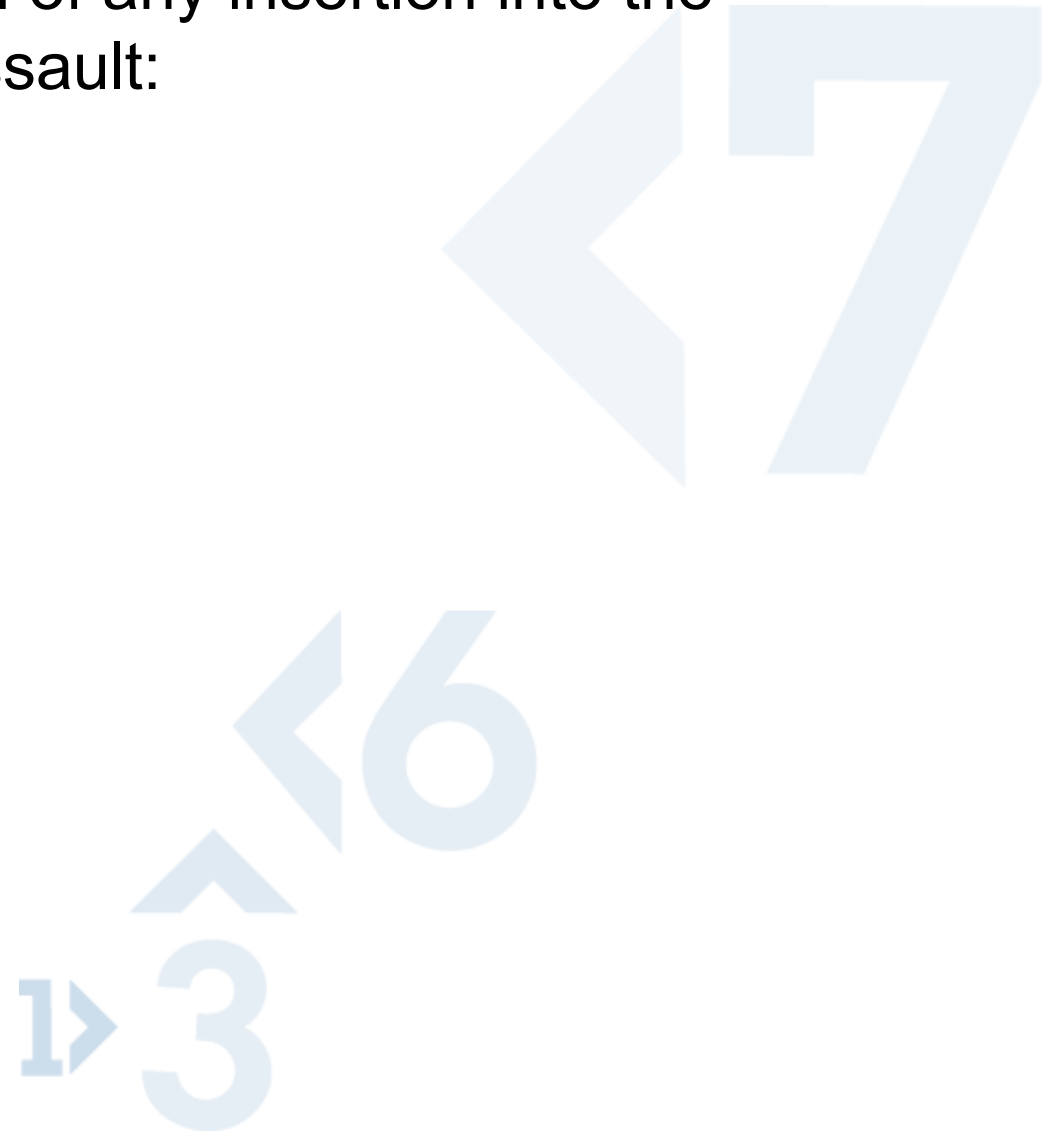
- Samples taken up to 2 days
- Unlikely to detect semen on oral samples after about 12 hours
- **Early Evidence Kits!!**

Depends on factors such as eating, drinking, swallowing



Vaginal Material

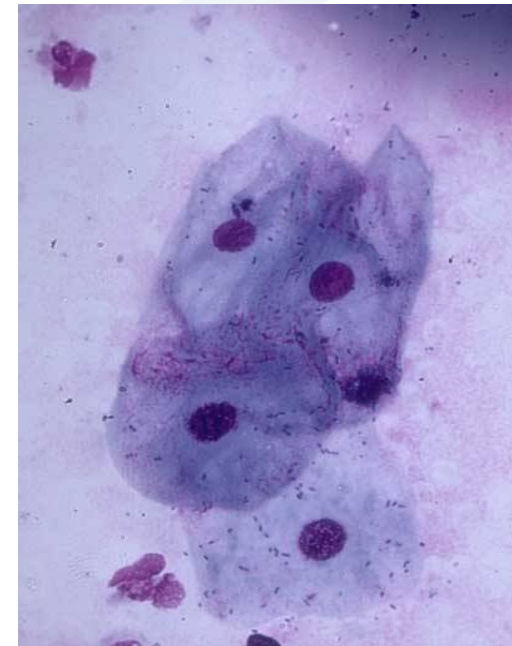
- Important when allegation of any insertion into the vagina during a sexual assault:
- Penile
 - Penile swabs
 - Underwear (>24hrs)
- Digital
 - Finger/hand swabs
- Inserted items
- Condoms



Forensic Examinations

Vaginal cells

- No screening or confirmatory test
- Can carry out a microscopic examination for cells of the type lining the vagina, on items such as penile swabs, underwear and condoms
- However, vaginal cells look similar to cells lining other body orifices such as mouth, anus, urethra
- Needs to be interpreted within context of case



Saliva

Important in oral intercourse allegations

Chemical presumptive test for presence of amylase – component of saliva – **Phadebas test**

False positives

- Faecal material
- Vaginal secretions
- Urine
- sweat

False Negatives!!!

No confirmatory tests at present – cells appear identical to vaginal, anal, urethra cells

Forensic Examinations

Phadebas paper

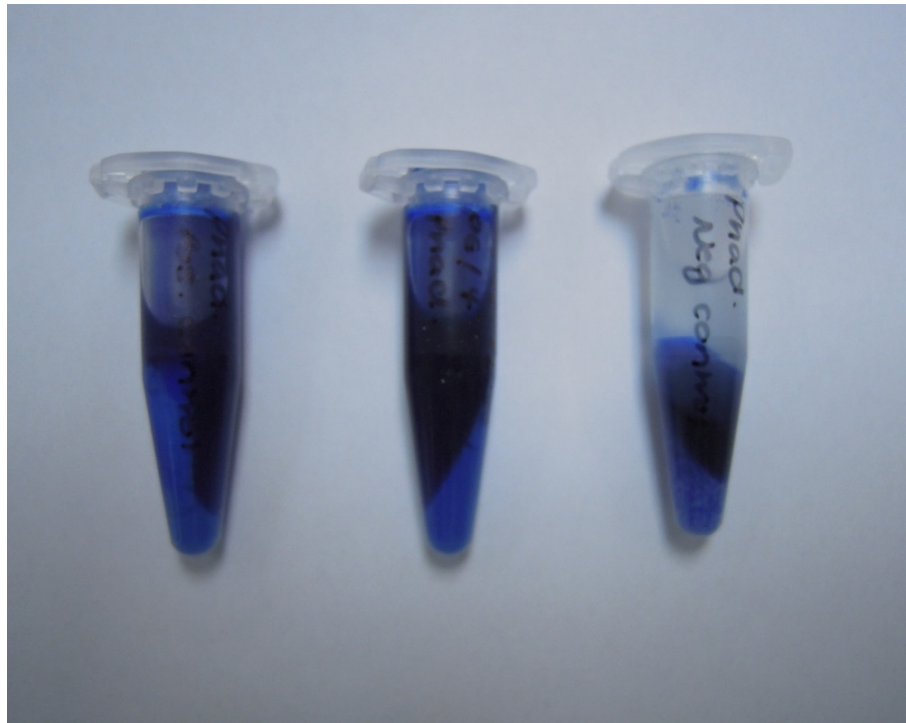
Starch cross-linked to a blue dye

Amylase breaks down the starch and releases the blue dye

Blue colour developed within 5 minutes -
“In my opinion saliva most likely present”



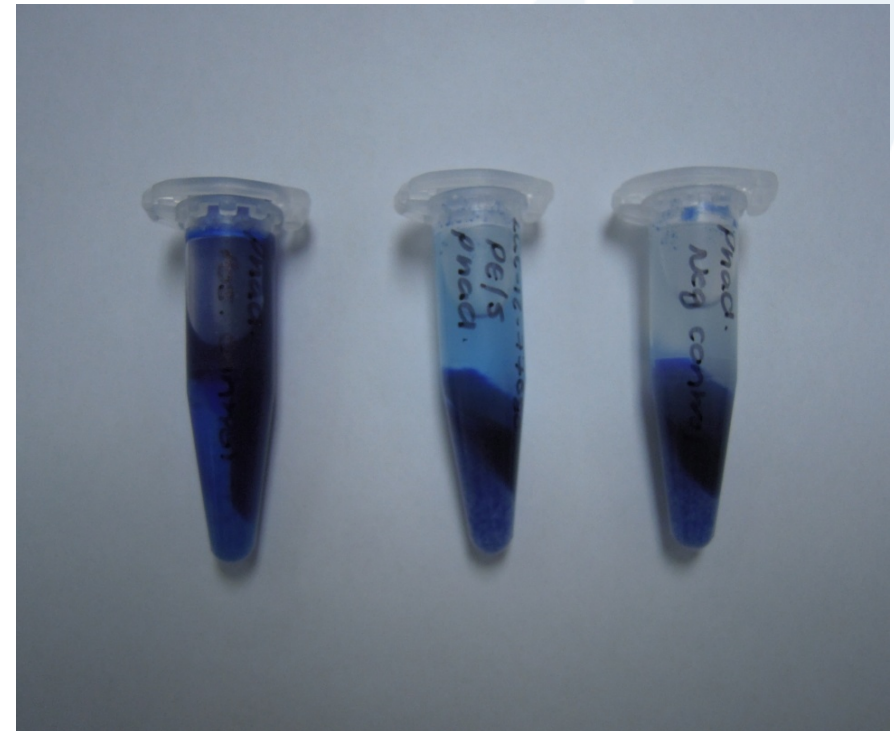
Phadebas tube test



Positive control

Strong positive sample

Negative control



Positive control

Weak positive sample

Negative control

Persistence of Complainants DNA on Penile swabs



- Samples taken up to 3 days
- Most likely to obtain a DNA profile from the complainant within the first 12 hours of oral/vaginal intercourse
- After this, we would consider suspect's underwear
- Depends on factors such as washing, wiping, degradation
- Low expectation of cells transfer following anal intercourse



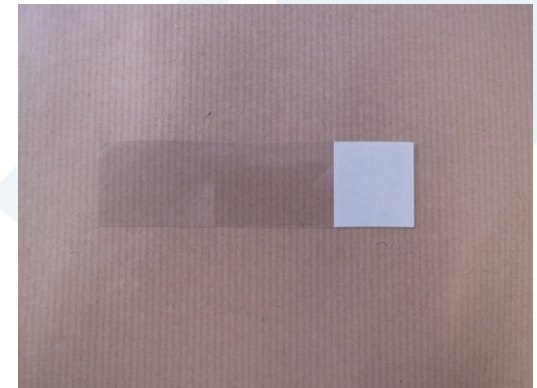
Faeces & urine

- Faeces important for anal allegations
- Urination onto victim by offender
- Visual – ‘Sniff’ test – Chemical test
- Low DNA yield



'Touch' DNA

- Transfer of DNA to an item or person through skin contact
- Tape lifts, minitapes & swabs
- Areas to target?
- Detection of DNA through touch depends on
 - Retention capabilities of item
 - Duration and nature of contact
 - 'Shedability' of offender
- Direct v's secondary transfer



Detection of male DNA on IP vaginal swabs

- Y-STR profiling
- Targeting male DNA on the Y chromosome
- Digital and penile penetration without ejaculation
- Time limit increase up to 48 hours
- Not compatible with NDNAD
- Lower evidential value



Damage

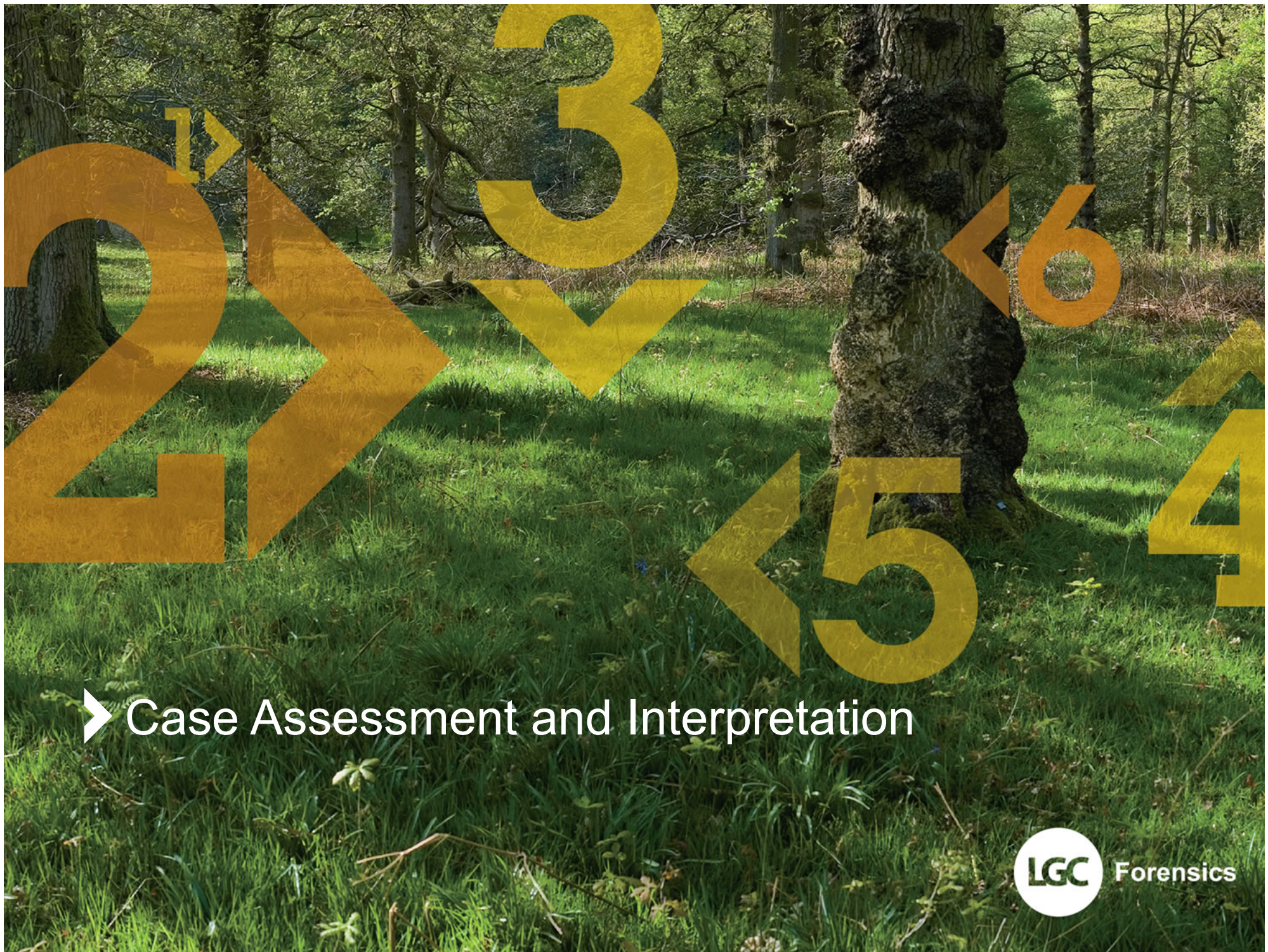
- Cause? Torn/ripped, cut or general wear and tear? Force?
- Recent? Wearable?
- Characteristic features under low power microscopy
- Target for 'touch' DNA



Blood

- Visual examination for red/ brown staining
- Chemical testing:
Kastle-Meyer (KM) – two stage reaction, pink
- Menstrual blood cannot be distinguished from traumatic blood.





▶ Case Assessment and Interpretation

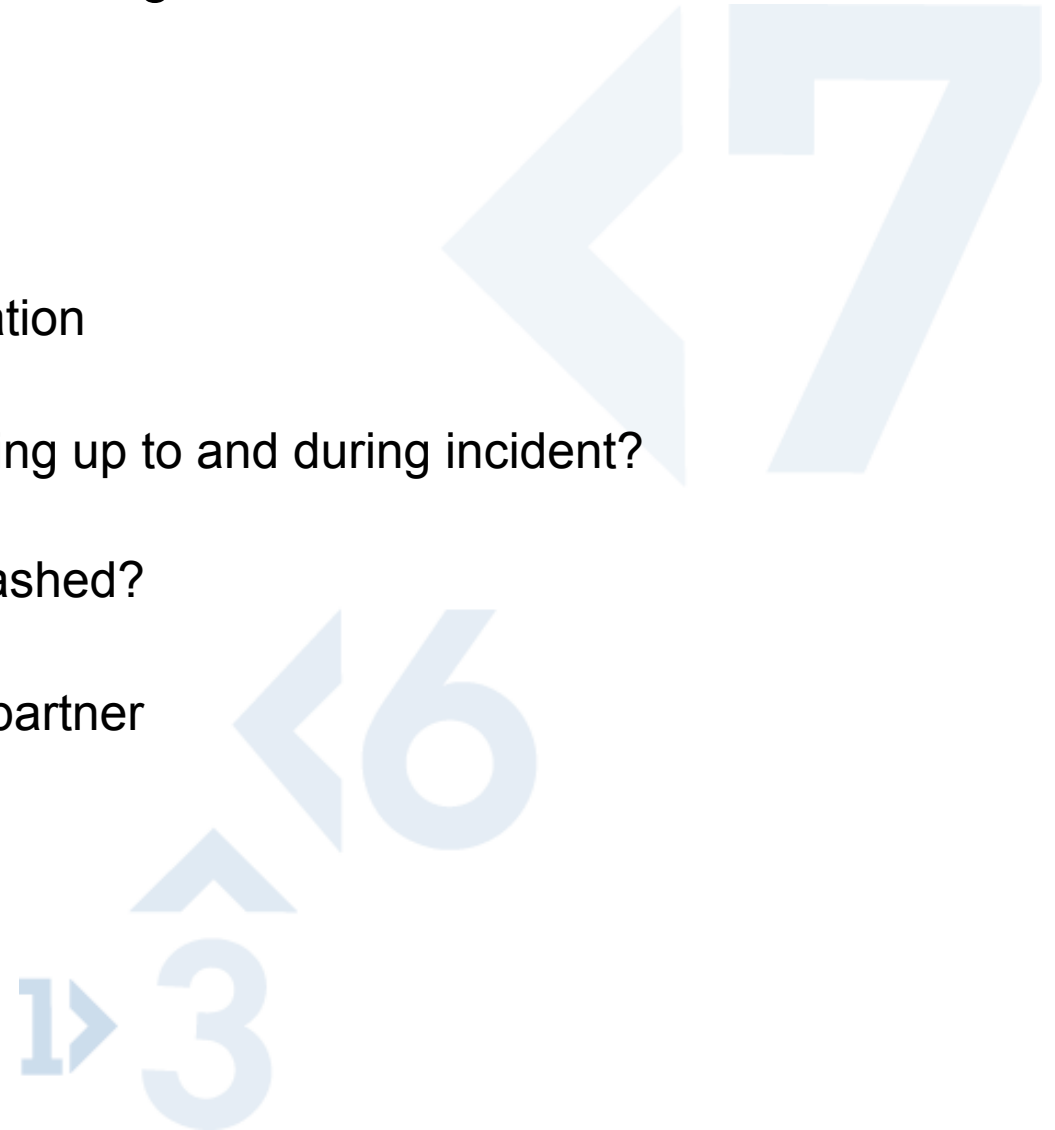
Case Assessment

- Important to carry out for EVERY case
- From information received we can determine:
 - Expectations of findings
 - What is your aim/purpose of examination
 - What findings would you would expect given the victim and suspect versions of events
 - Ensures that evaluation of the case is not findings led
 - Staged examinations
 - Exhibit likely to provide best evidence
 - Saving time and money

Information

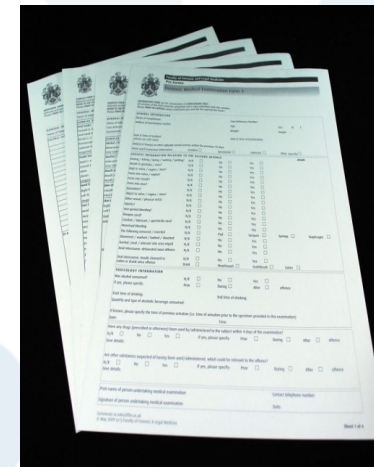


- Our case assessment can only be as good as the information we receive
- Information required
 - Precise circumstances of allegation
 - Suspect version of events
 - Consensual/social contact leading up to and during incident?
 - Post incident actions
 - Clothing or bedding seized? Washed?
 - Menstruation/Injury?
 - Previous intercourse eg with a partner
 - Time of allegation
 - Time of medical



Medex forms

- All questions have a Y/N or N/A option so all should be answered
- Previous intercourse
- Shows all samples taken, not just those received
- Time and date
- Actions since alleged incident
- General injuries
- Body charts
- Use of speculum / proctoscope



Previous social contact



- DNA can be transferred through social contact
 - Allegation of digital penetration
 - Previous social contact including kissing,
 - suspect denied allegation but said he had cuddled her
 - Hand swabs from suspect and complainant's knickers recovered
 - Is it worth examining them?
 - What is the significance of finding a DNA transfer?



Post Incident actions

Washing

- People:
 - Removes body fluids and DNA from skin, orifices and from under fingernails
 - But...showering, bathing or douching etc may have different effects
- Clothing:
 - AP is water soluble – removed by washing
 - We can still find sperm cells even if washed in a machine & redistribution can occur
 - Hand washing/no detergent is less effective

Sperm transfer in washing machine

- Child alleges step father has been having vaginal intercourse with her
- All underwear has been washed
- AP test for 10 mins – negative
- Extracted crotch area – trace semen – profile matches S

From drainage? Crime related???

- Extracted other areas of the knickers – trace semen – profile matches S

Unable to attribute trace of semen to criminal activity

Post Incident actions

Urination/defecation

- Allegations of anal intercourse
- Wiping

Eating/drinking

- Oral intercourse

Active?

- Drainage



Recent sexual history

- Semen / DNA can persist for days
- May decide a different strategy:
 - Separating swabs
 - Sex since the alleged rape – look at the knickers worn directly after incident not the swabs?
 - Could look at penile swabs / underpants of partner for offender's semen and vice versa
 - Bedding
- If previous sexual history is known can eliminate previous partner (if reference sample provided)

Partners semen on suspects penile swabs



- IP alleged vaginal intercourse without her consent – ejaculation unknown.
- Suspect no comment
- Vaginal swabs taken within five hours
- IP had vaginal intercourse with partner three days prior to incident
 - Internal ejaculation
 - Has showered twice
- Expectation of getting semen from partner on vaginal swabs – moderate
- Expectation of getting semen from suspect on vaginal swabs – unknown
- Found semen from partner
- Penile swabs from suspect taken within 6 hours – trace semen – **matched victims partner**

Time Since Intercourse

The interval between intercourse taking place and when the evidence is seized eg time of medical examination

- The greater the time delay the less likely you are to find semen
- Factors that affect TSI findings:
 - Anything that accelerates drainage
 - Washing – external swabs, clothing
 - Natural degradation
- Effectiveness of sampling plays a role

Time Since Intercourse

- we need to consider the persistence of seminal components:

acid phosphatase

- Vagina – 2-3 days
- Anus – 1 day
- Mouth – less than 1 day
- Clothing – until washed

spermatozoa

- Vagina – up to 7 days
- Anus – up to 3 days
- Mouth – up to 24 hours
- Clothing – indefinitely?? Washing may not remove all sperm.

Time Since Intercourse

- **Longer TSI the less the concentration of sperm**

Trace	(less than 10 spermatozoa found)
+	(spermatozoa are difficult to find)
+ +	(some spermatozoa in some fields – easy to find)
+++	(spermatozoa in every field – easy to find)
++++	(large quantity of spermatozoa in every field)

Time Since Intercourse case example

- IP alleges that her partner has had vaginal intercourse with her against her consent on 18.8.15 (Tuesday)
- Suspect states he had vaginal intercourse with her on the 15.8.15 with internal ejaculation (Saturday)
- Vaginal swabs taken on the 19.8.15 – less than 24 hrs after the alleged incident and up to 96 hours after ‘consensual’ activity

Findings

HVS – AP positive & 4+ heads

LVS – AP positive & 4+ heads

Vulval – AP positive & 2+ heads

- In my opinion the findings are what I would expect if intercourse with ejaculation took place on the place 18.8.15 rather than on the 15.8.15
- Swabs taken in correct order?
- Speculum used?

Findings

HVS – AP negative & trace heads

LVS – AP negative & 1+ heads

Vulval – AP negative & no heads

- In my opinion the findings are what I would expect if intercourse with full ejaculation took place on the place 15.8.15 rather than on the 18.8.15
- Can't discount that intercourse also took place on the 18.8.15 but without internal ejaculation

Case Assessment and Strategy setting

Case Assessment and strategy setting



Allegation

Suspect had vaginal i/c without victim's consent on 11 June at 23.00 hours

Suspect's version

He had consensual vaginal i/c with complainer on the evening of 3 June, no intercourse occurred on 11 June

Samples

High vaginal swabs – taken 14 hrs after alleged incident

Penile swabs – taken 15 hours after alleged incident

Questions and Answers

- Did V say S ejaculated? **No**
- Does S state ejaculation occurred on 3rd June? - **Yes**
- Condom worn? **No**
- V and/or S washed prior to samples taken? **No**
- Underwear from either party seized? **Yes both**
- Recent intercourse? **No**
- V menstruating? **No**
- Injuries to either party? **No**
- Does S admit to any other contact with V after the 3rd June? **No**
- Has V been active? **Yes**

Expectations of detecting suspects semen on vaginal swabs?

- $LR = H_p/H_d$ (prosecution/defence)

H_p = vaginal intercourse w/o ejaculation on 11th June

H_d = vaginal intercourse with ejaculation on 3rd June

Expectations of finding semen from S on V vaginal swabs taken on the 12th June is approaching zero for both H_p and H_d (very low expectations)

$$LR = 0.000000001/0.000000001 = 1$$

If LR same given H_p and H_d is there any point in examining?

Expectation of finding V DNA on S penile swabs?



Forensics

Hp = vaginal intercourse on 11th June

Hd = vaginal intercourse on 3rd June

Swabs taken 15 hrs later – not washed, V not menstruating, no recent intercourse (other than incident)

Hp = 0.8 (moderately high expectations)

Swabs taken 9 days later – no recent contact

Hd = 0.00000000000001 (very low expectations)

LR = 0.8 / 0.00000000000001 = 80000000000000

If V DNA found on S penile swabs then the findings are **80000000000000** more likely given Hp rather than Hd

Extremely strong support for Hp rather than Hd

Strategy

- Examine penile swabs 1st
- If V DNA present – good result could stop here
- If V DNA not present consider
 - examination of S underwear
 - examination of vaginal swabs
 - Semen
 - Y-STR's

Thank you for listening

Questions???

1>

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7