

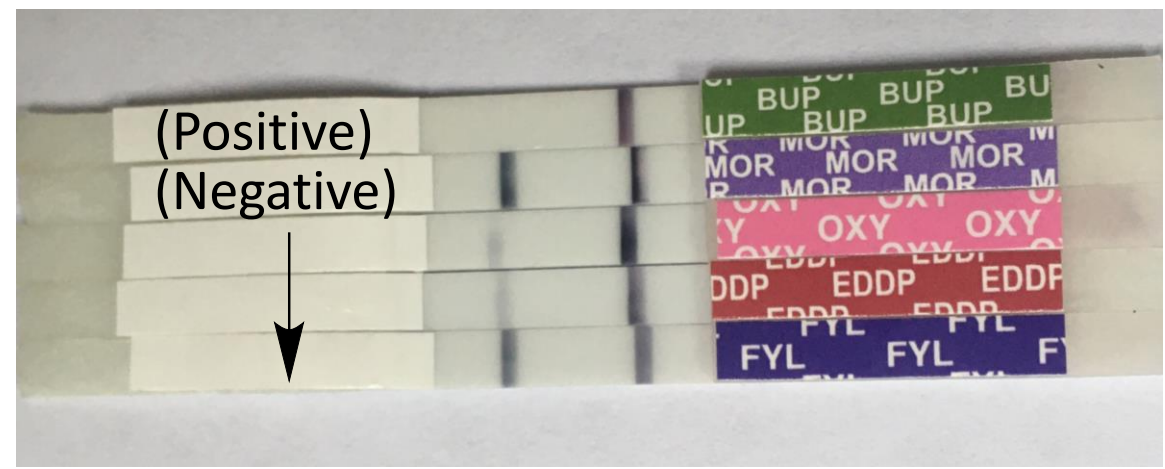
# Urine Drug Screening

Claire Snelgrove

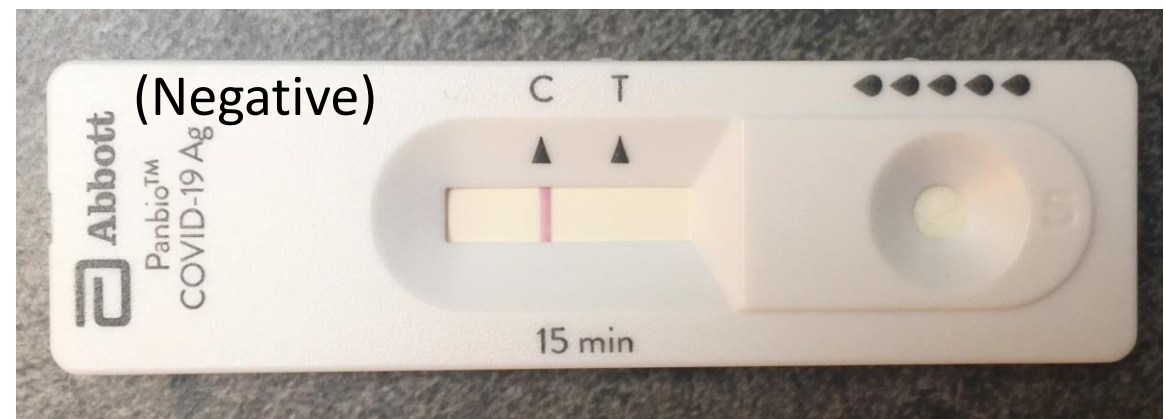
## Today's Goals:

1. How urine drug screens (UDS) work
2. Questions, unexpected results, oddities
3. Potential impact of incorrect results

# Point of Care Testing: Lateral Flow Immunoassays (LFA)

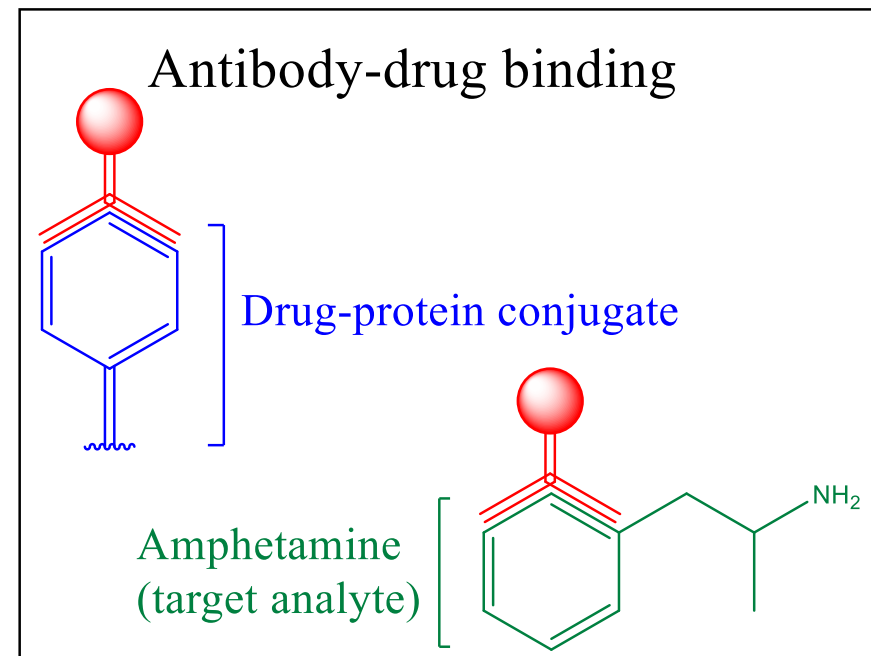
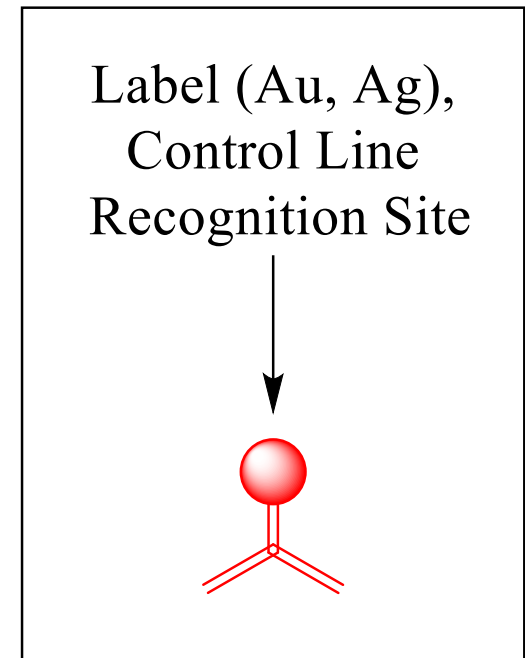
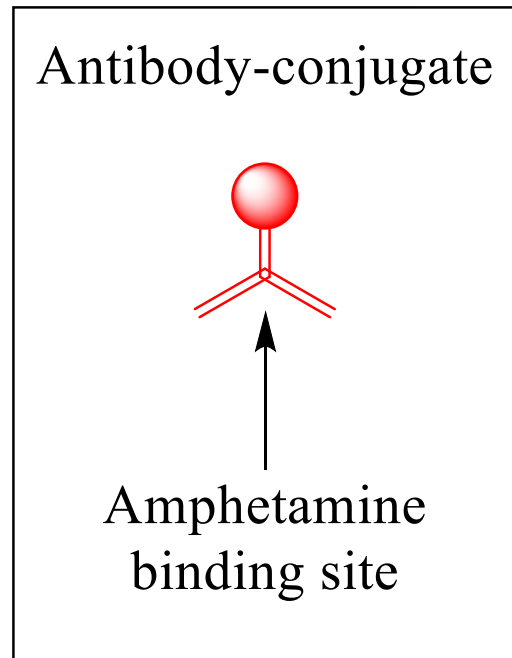
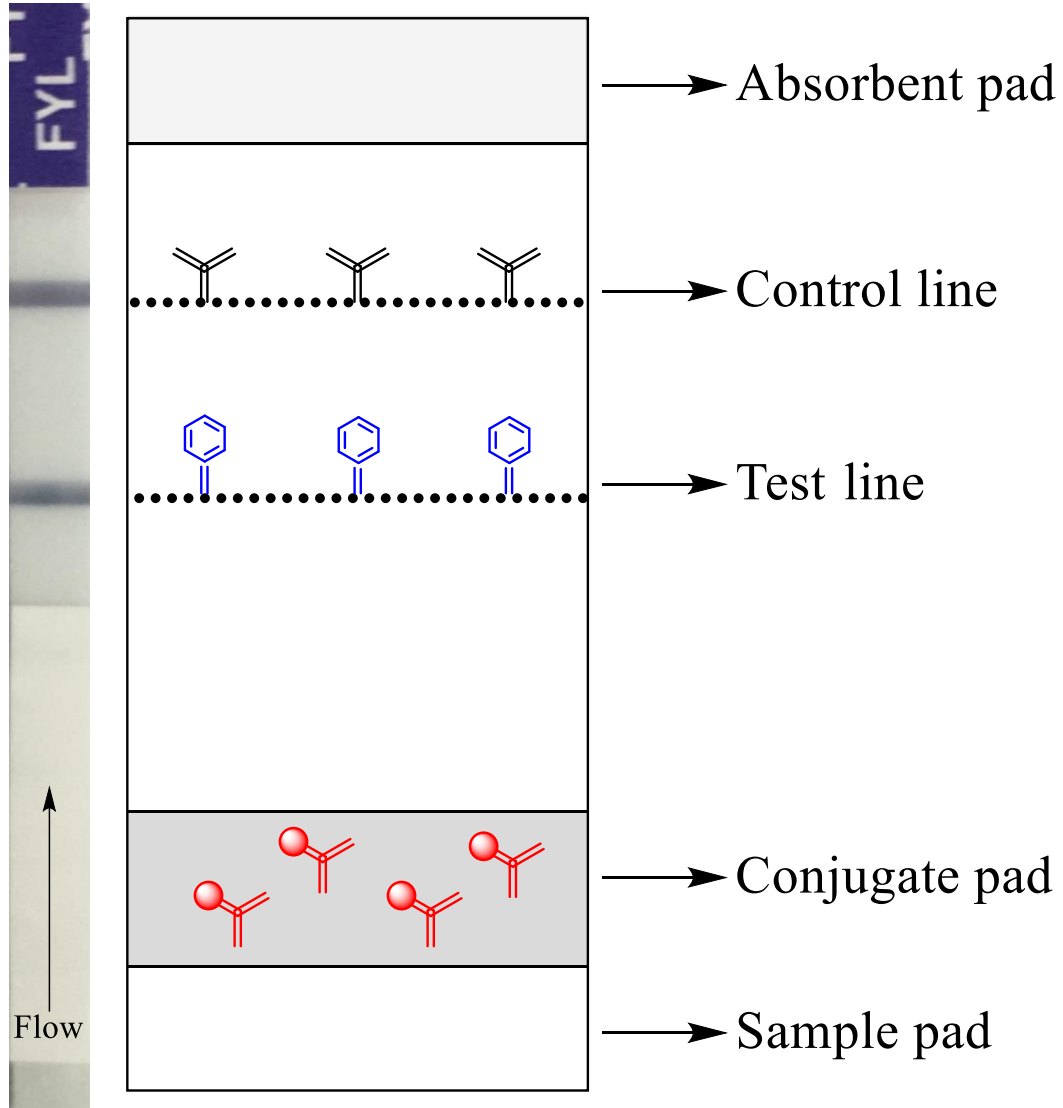


Competitive LFA

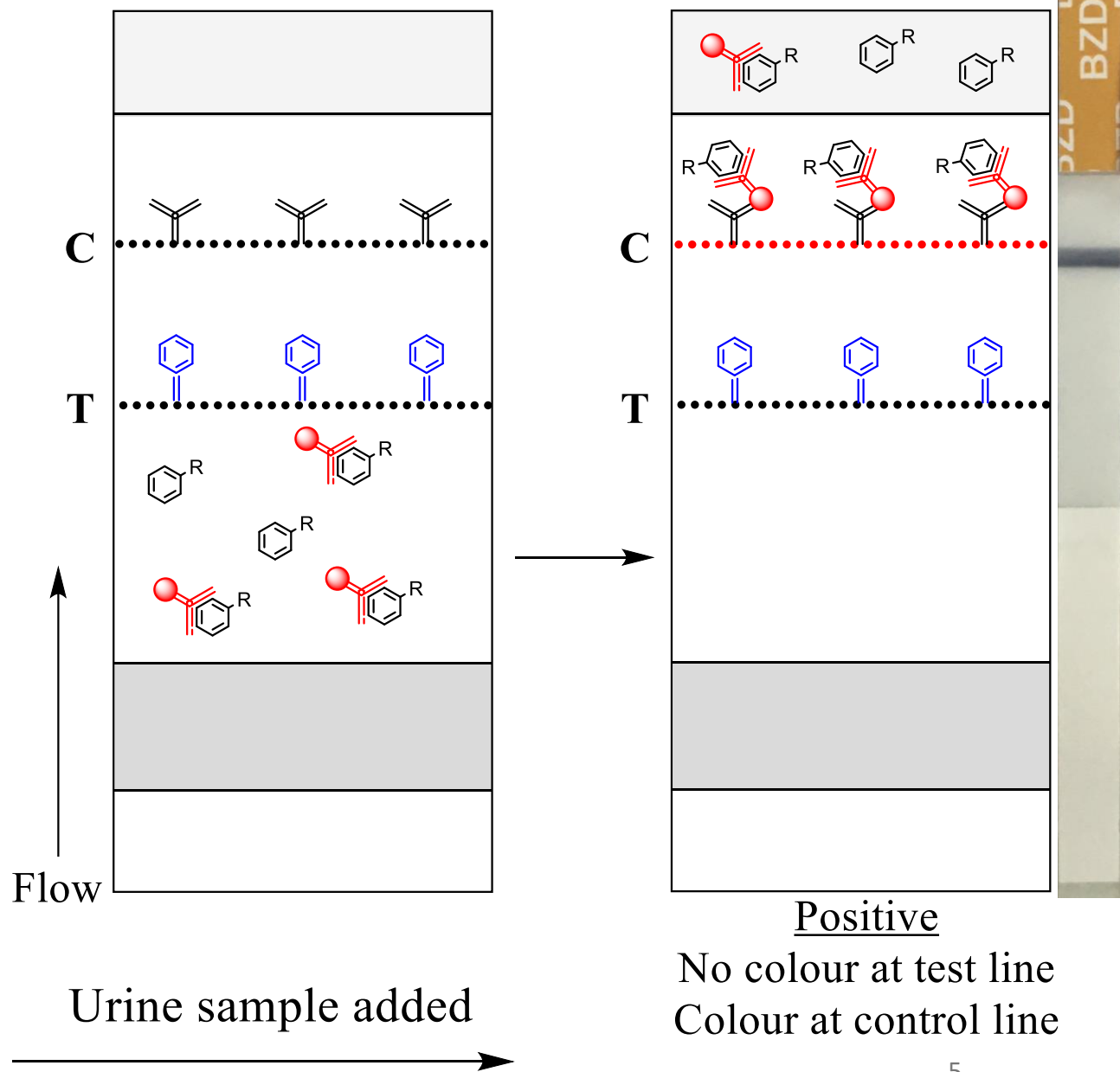
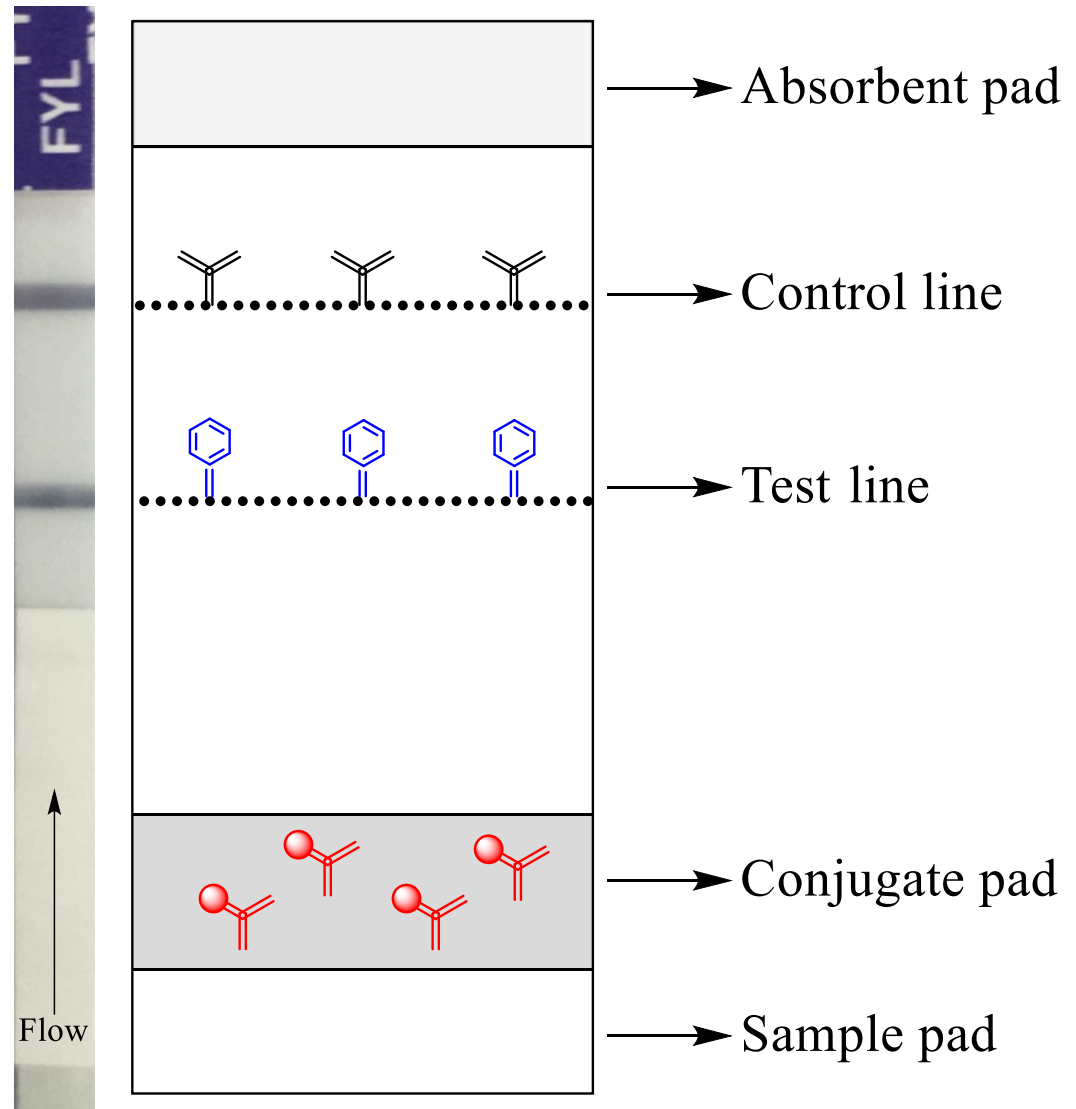


Sandwich LFA

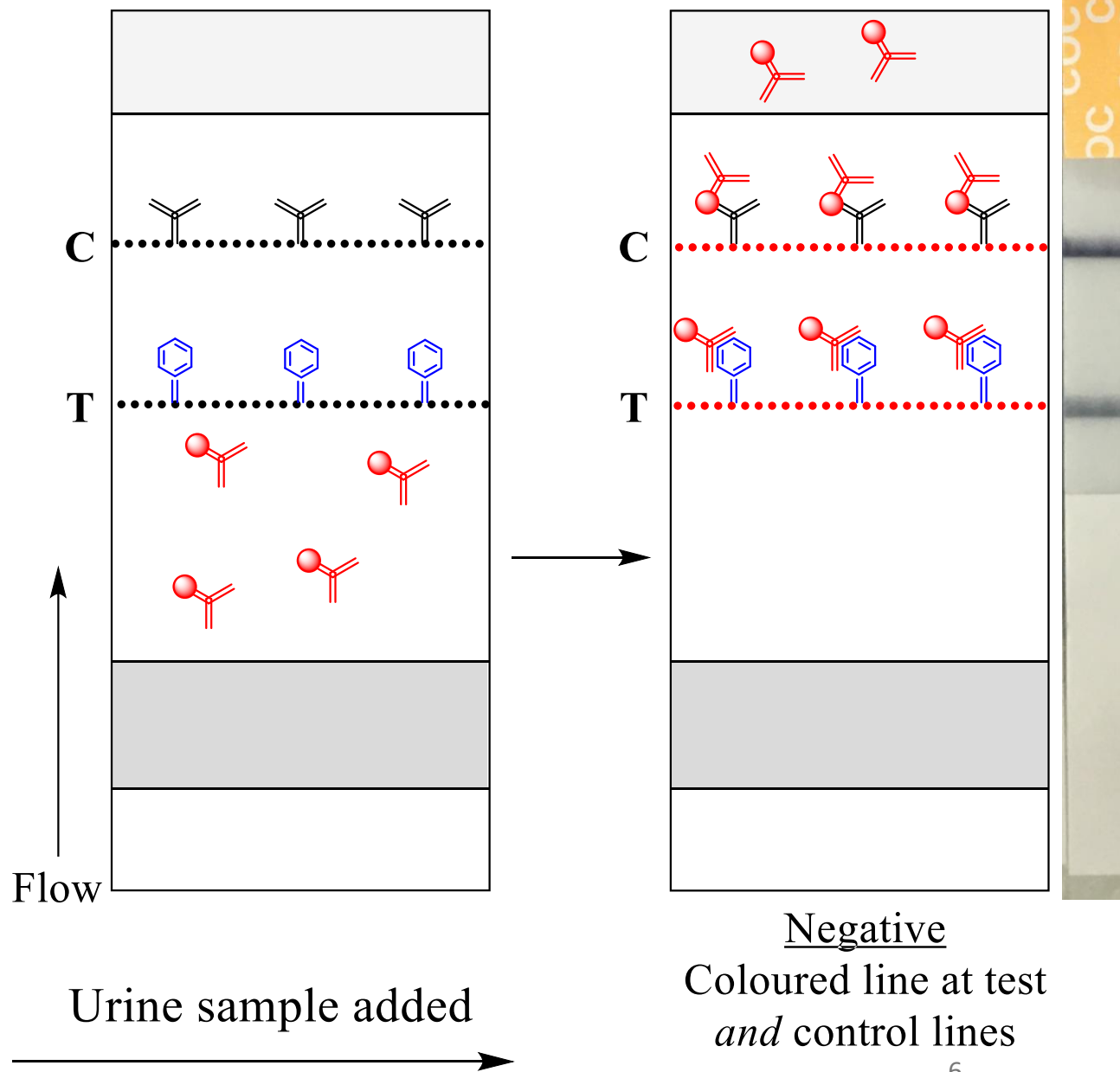
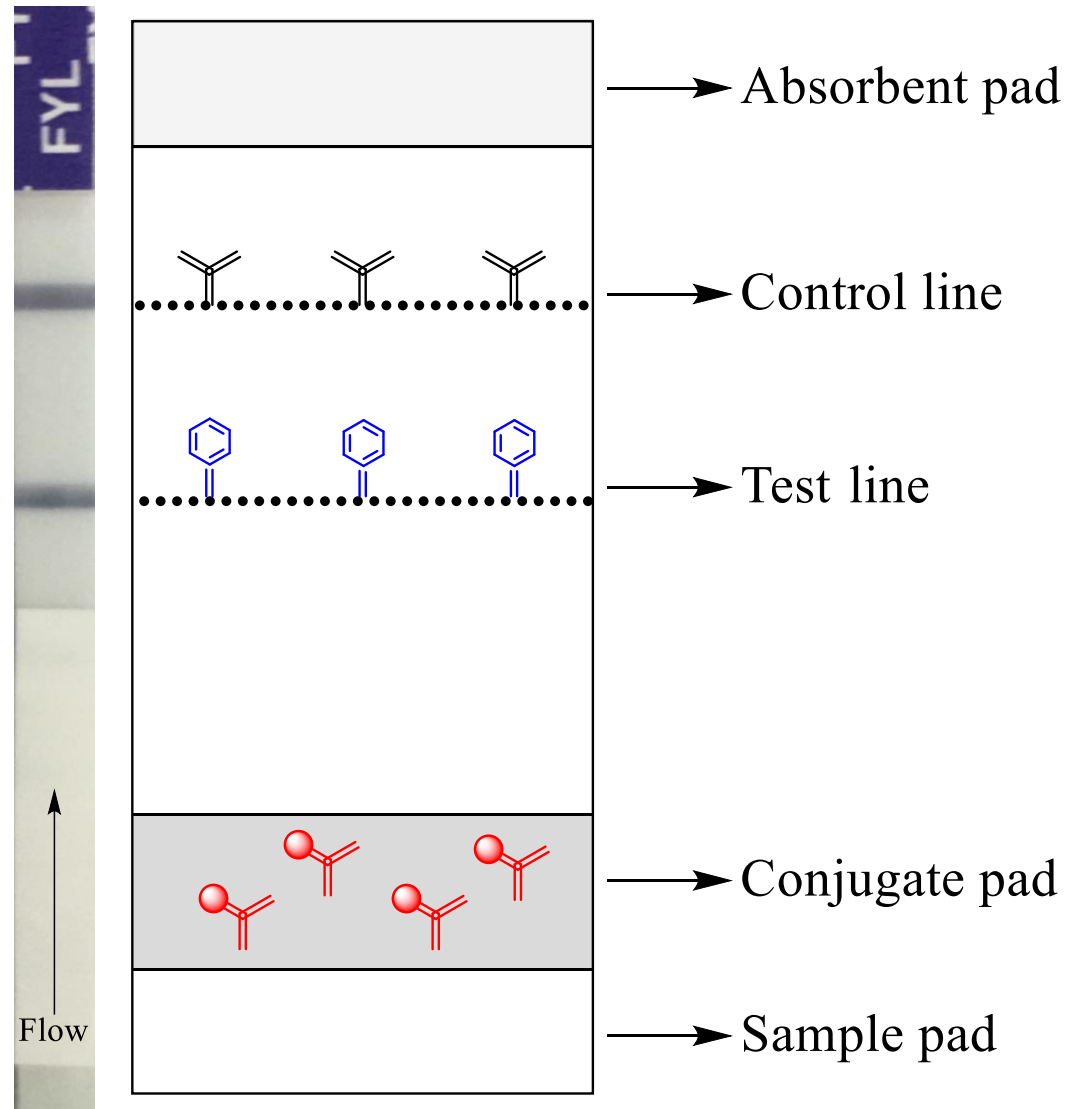
# Anatomy of an Immunoassay



# Mechanism of Positive LFA



# Mechanism of Negative LFA



# Questions, Unexpected Results, Other Oddities

- I'll be going over
  - Some common questions I've been asked
  - Things to look out for/be aware of
  - The impact of UDS on patients



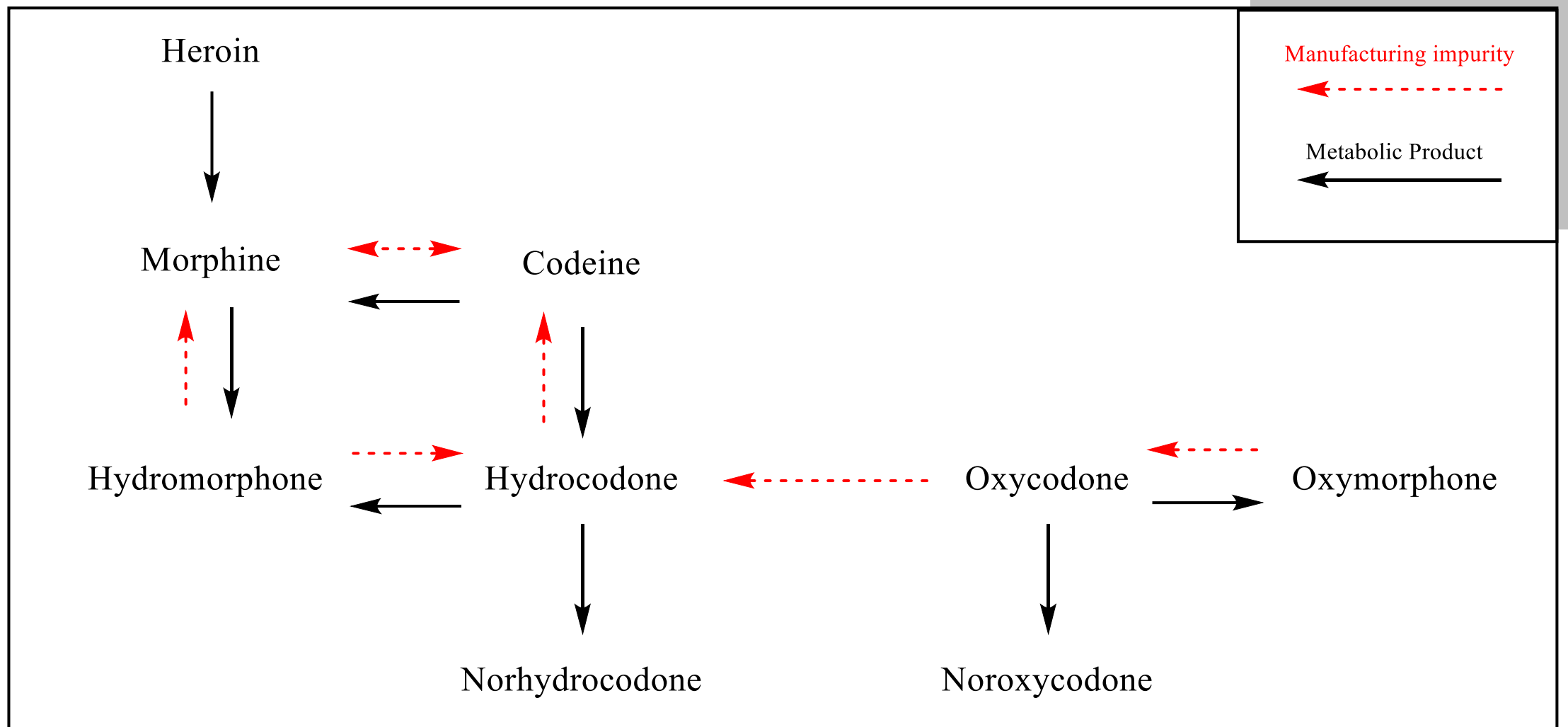
# False Positives

- Manufacturing impurities
- Common- lots of crossover
- Metabolism?
- (common metabolites)
- Cross-reactivity?

Drug	Manufacturing Impurity (Limit %)
Morphine	Codeine (0.04 % - 0.5 %)
Oxycodone	Hydrocodone (<0.1 %)
Codeine	Morphine (0.15 %)
Hydromorphone	Morphine (0.15 %) Hydrocodone (0.1 %)
Hydrocodone	Codeine (0.15 %)
Oxymorphone	Hydromorphone (0.15 %) Oxycodone (0.5 %)

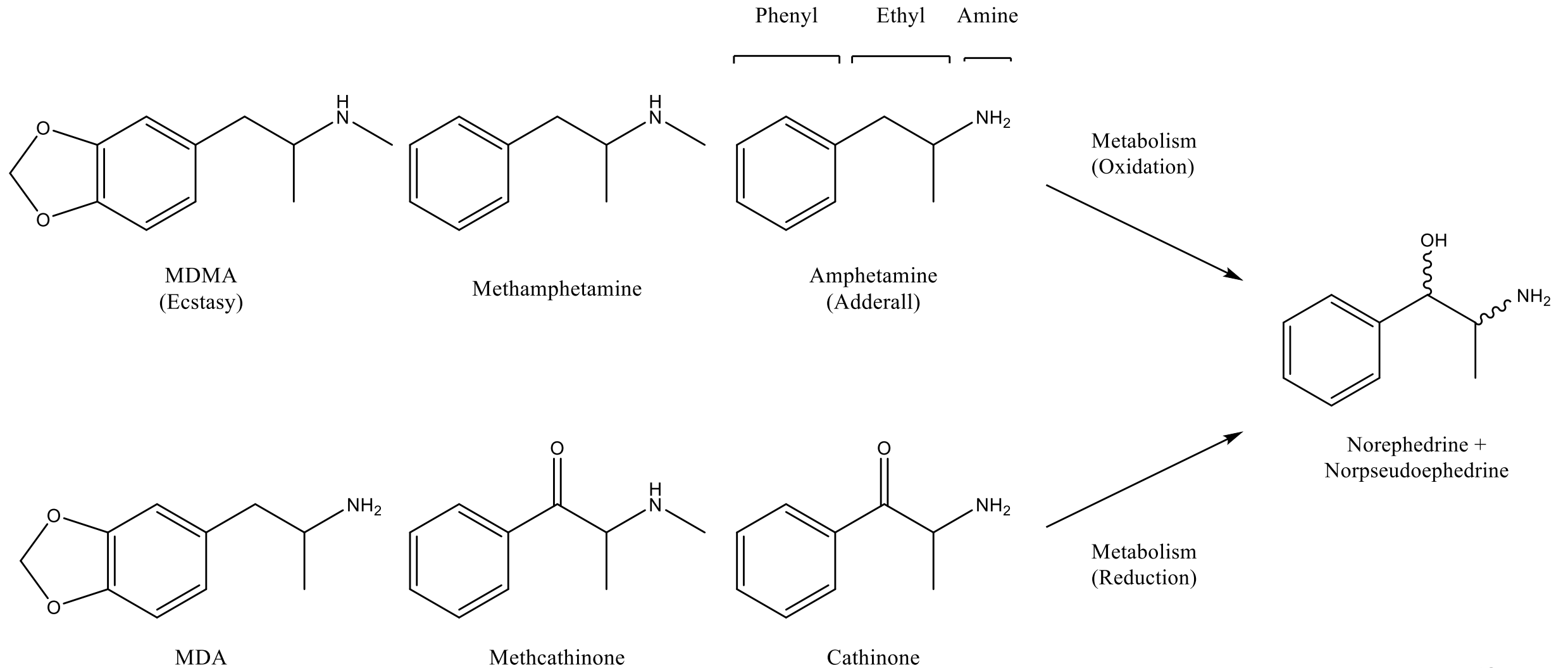


# Metabolic Pathway: Opioids



*Metabolic crossover of some opioids*

# Stimulant Metabolites: Amphetamines, MDMA, Cathinones



# Cross-Reactivity

- Unintended medications can sometimes cause false positive

- The amphetamine test is particularly notorious for this

- SOME Possible Amphetamine Interferences:

- Bupropion

- Trazodone

- Labetalol

- Ritodrine

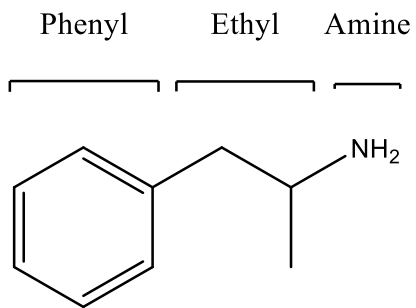
- Ranitidine

- Trimethobenzamide

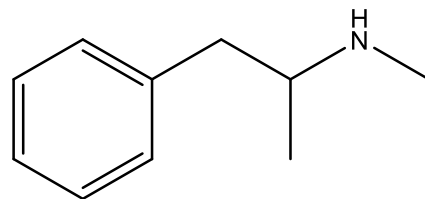
- Ofloxacin  
(an antibiotic)

- Tricyclic Antidepressants  
(ex – desipramine, doxepin)

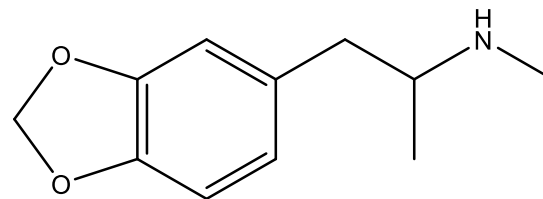
- Phenothiazines  
(ex – chlorpromazine, promethazine, thioridazine)



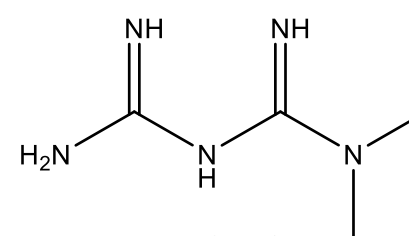
Amphetamine  
(Adderall)



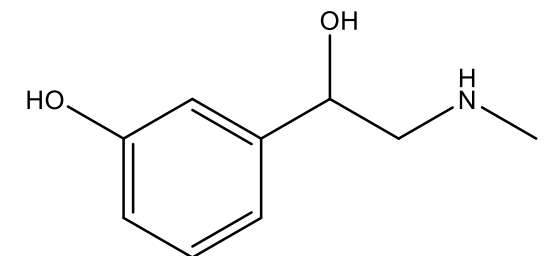
Methamphetamine



MDMA  
(Ecstasy)



Metformin



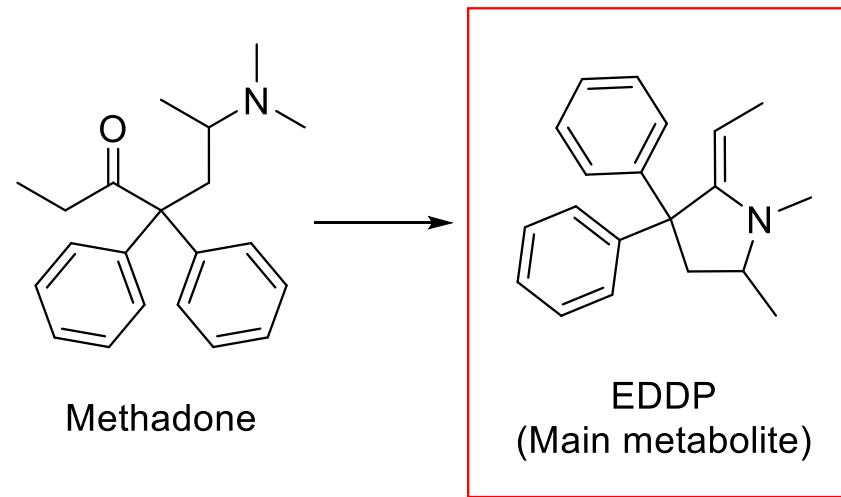
Phenylephrine

# False Negative

- Metabolism, water, exercise?
  - Individual variance may play a role
- Short (elimination) half life?
  - Shorter detection duration
  - 5 half lives until ~97% eliminated
- Dose, duration of use, duration since use?
  - Lower dose, longer timeframe = less likely to be positive
- Poor test compatibility?
  - Detecting class of drugs vs one specific drug?

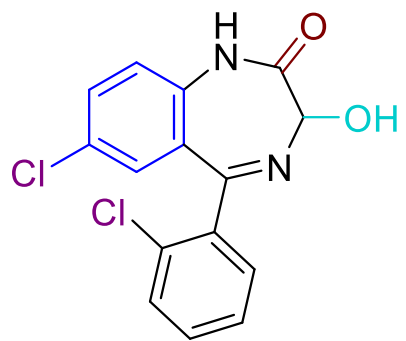
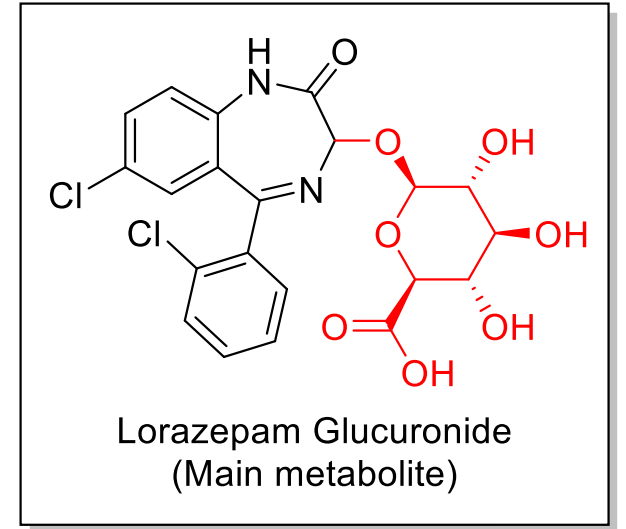
# Poor Test Compatibility (A)

- Many tests are made to identify only one specific drug
  - Methadone test – usually calibrated with EDDP
  - Not 'known' for false negatives
  - Example of good compatibility with its one intended metabolite

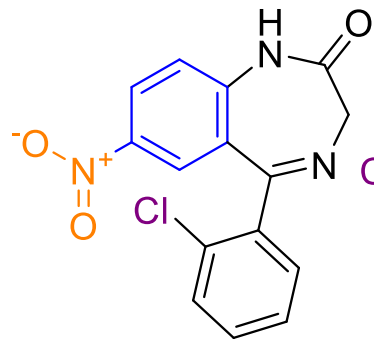


# Poor Test Compatibility (B)

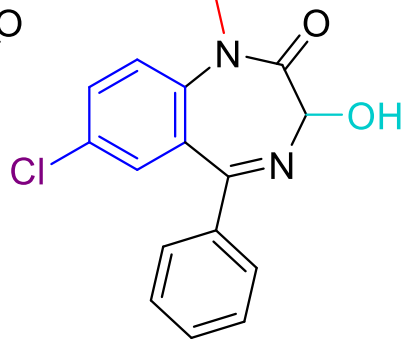
- Some tests are *intended* for an entire drug class
- Is this fixable?
  - Dilemma: sensitivity vs specificity
  - Monoclonal or polyclonal antibodies?
- Generic opioid, amphetamine, benzodiazepine



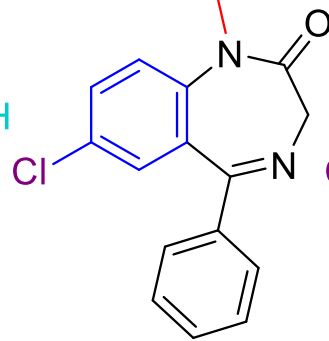
Lorazepam  
(Ativan)



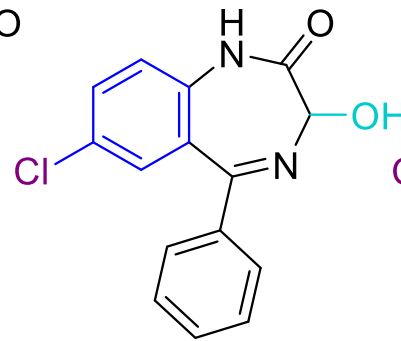
Clonazepam  
(Klonopin)



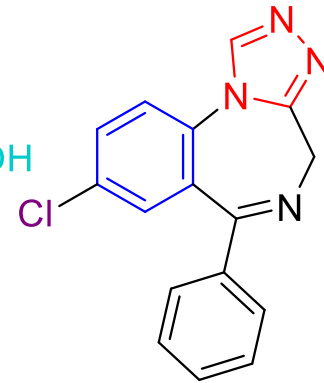
Temazepam



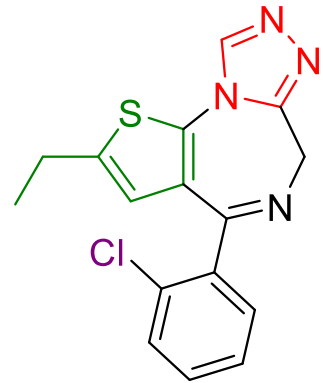
Diazepam  
(Valium)



Oxazepam  
\*Calibration\*



Alprazolam  
(Xanax)



Etizolam

# “Is a more sensitive test always better?”

- Not always! Can be *too* sensitive-
- More prone to cross-reactivity (interference)
  - False positives
  - Other medications, diet
- Interference may otherwise be negligible at lower sensitivity

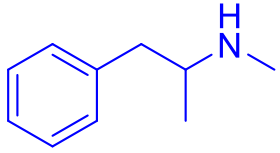
# “Is My Patient Lying?”

- Open, honest communication = more accurate and reliable than any UDS
- People usually don't lie for fun
  - Consider *why* they feel the need to evade detection
- Even people who tested negative for illicit drugs are more likely to stop showing up compared to those who do not get tested
  - Drug testing in general may hurt patient-prescriber relationship
- Methadone-style carry systems
  - Can make it hard to participate in life
  - Work, school, commitments



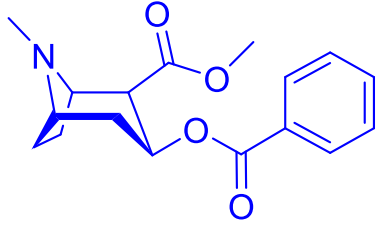
# Impacts of Incorrect Results:

- Case study:
  - A 36-year-old woman was confirmed brain dead after short hospital stay
  - Initially tested negative for methamphetamine at intake
  - While being processed to be an organ donor, tested positive for methamphetamine (36 hours later)
  - Confirmatory lab test indicated IV phenylephrine likely reason for false positive
  - Denied as an organ donor
- *Immunoassay results that change the management of a patient/their condition should always quickly be verified with confirmatory lab testing*

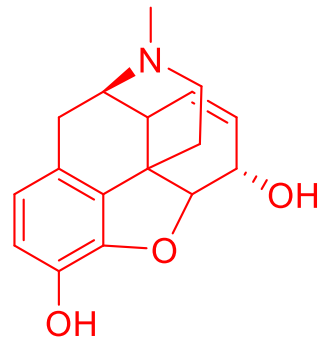


Methamphetamine

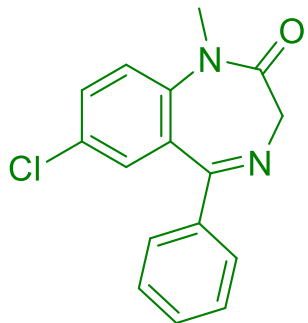
# Thank you!



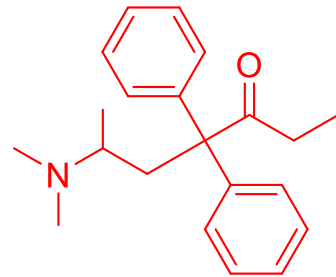
Cocaine



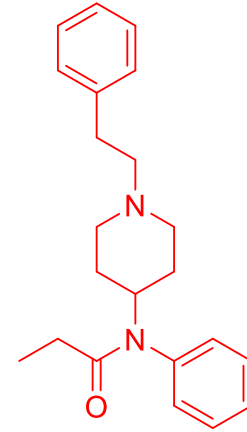
Morphine  
(Kadian)



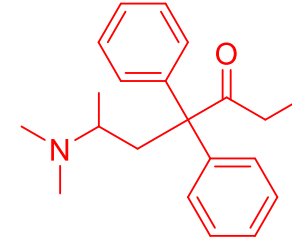
Diazepam  
(Valium)



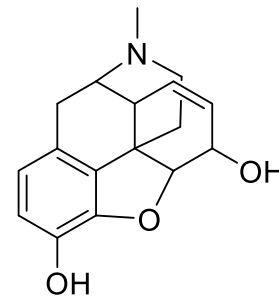
Methadone



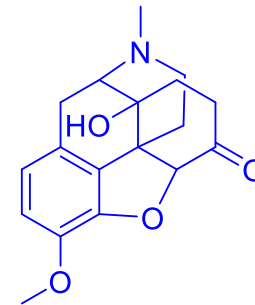
Fentanyl  
FYL Test



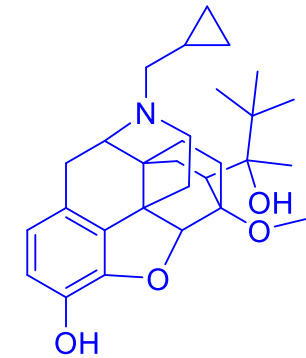
Methadone  
MTD, EDDP Tests



Morphine  
(Kadian)  
MOR, OPI Tests



Oxycodone  
OXY Test



Buprenorphine  
(Suboxone)  
BUP Test

# Mass Spec Spectra

