

Forensic Toxicology in a Public Health Lab

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Overview For Current Drug Trends



- Forensic Toxicology Overview
- Novel Psychoactive Substances
 - THC isomers
 - Opioids/stimulants
 - Kratom





- Public Health Laboratory for the State of WI
 - PT program, CDD, NBS, Environmental testing, Chemical Emergency Response
- Forensic Toxicology
 - 22 staff
 - Receive 20,000+ samples each year
 - Perform drug testing on ~10,000
 - Combination of impaired driving and Medical Examiner casework
- Maintain focus on public health

What is Forensic Toxicology?

- The use of toxicology (analytical chemistry, pharmacology and clinical chemistry) to aid medical or legal investigations
- Forensic Toxicology does not measure impairment



Testing Matrices



- Blood - majority
 - Give picture of what person is currently under influence of
 - Serum vs plasma vs blood
- Urine – history lesson
 - Can tell past use
 - Subject to dilution/adulteration
- Oral Fluid
 - Up and coming matrix for roadside
 - Several oral fluid studies across the US and Canada
- Clinical vs Forensic



Testing Workflow



- Blood Alcohol Test
- Screen by QToF
- Confirmation and quantitation
- Report results
- Interpret results
- Testify in court





It's Not Always Just Alcohol



THC	Bupropion
Methamphetamine/amphet	Quetiapine
Fentanyl	Fluoxetine
Cocaine/BE	Clonazepam
Gabapentin	Methadone
Beta-hydroxyfentanyl	Oxycodone
Diphenhydramine	Metonitazene
Alprazolam	Lamotrigine
Citalopram	Buprenorphine
Trazodone	Sertraline

Most common drug trend...



Tracking the Trends



- <https://www.npsdiscovery.org/>

The screenshot shows a web browser window with multiple tabs. The active tab is 'CFSRE - NPS Discovery' with the URL 'https://www.npsdiscovery.org/'. The website has a dark green header with 'About Us', 'Newsroom', and 'Contact Us' links. Below the header is the CFSRE logo, which includes a green geometric icon and the text 'cfsre Redefining Excellence in Forensic Science'. To the right of the logo are 'Reports' and 'Resources' dropdown menus and a search icon. A large banner image shows a person in a blue lab coat and gloves using a pipette to transfer liquid into small vials. Below the banner, there are 'Reports' and 'Resources' tabs. The main content area is titled 'NPS Discovery' and contains two paragraphs of text. The first paragraph describes the mission of the Center for Forensic Science Research and Education (CFSRE) in collaboration with law enforcement, public health, and public safety agencies to identify emerging drugs (NPS). The second paragraph acknowledges collaborative partners including NMS Labs, Temple University, the Organized Crime Drug Enforcement Task Force (OCDETF), the National Institute of Justice (NIJ), and technical partners SCIEX and Waters Corporations. At the bottom, there is a 'Reports' section with a small image of a person in a lab coat.

Mail - Amy Miles - Outlook x National Forensic Laboratory x The Center for Forensic Science x CFSRE - NPS Discovery x

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cfsre Redefining Excellence in Forensic Science

Reports Resources

Reports Resources

NPS Discovery

The Center for Forensic Science Research and Education (CFSRE) is working in collaboration with law enforcement, public health, and public safety agencies to rapidly identify emerging drugs, also known as Novel Psychoactive Substances (NPS), associated with intoxications and adverse events. The information, reports, and resources consolidated here by CFSRE allows for the rapid dissemination of information to stakeholders and effected communities.

CFSRE would like to acknowledge its collaborative NPS partners, including NMS Labs, Temple University, the Organized Crime Drug Enforcement Task Force (OCDETF) of the Department of Justice, and the National Institute of Justice (NIJ) of the Department of Justice, as well as our technical collaborative partners SCIEX and Waters Corporations.

Reports

Novel Psychoactive Substances (NPS)



NPS Challenges in Forensic Testing



- New drug “revolving door”
- Instrumentation
- Training
- Partnerships



2018 FARM BILL EFFECT

Under the 2018 Farm Bill, hemp has been removed from the Controlled Substances Act (CSA) and is now considered an agricultural product.



HEMP-DERIVED
CBD IS LEGAL



HEMP FARMERS
CAN APPLY FOR
CROP INSURANCE



MORE BANKS WILL BE
WILLING TO WORK WITH
HEMP COMPANIES



"BIG AG" WILL BEGIN
MOVING INTO THE
HEMP INDUSTRY

HEMP-DERIVED CBD PRODUCT SALES



HEMP INDUSTRY GROWTH



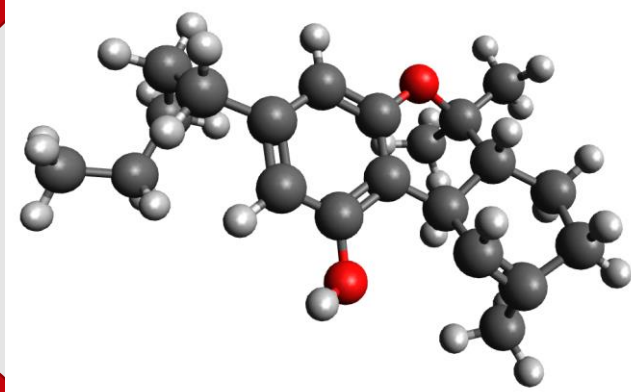
\$2.5
BILLION
BY 2022

THC Isomers

- Farm Bill Act
- Hemp, CBD

Delta - 7

Delta - 8



Delta - 10

?

CBD and Hemp are NOT THC



- Legal CBD and Hemp products are to contain less than 0.3% of THC
 - Truly legal products will not create a detectable amount of delta-9-THC in blood
- Law enforcement field test kits
 - May be able to distinguish between CBD and THC
 - Laboratory testing required
- Zero regulation/oversight of products
- Potential for adverse, drug-drug interactions

CBD Does Not Convert to Δ 9-THC



Review

Conversion of Cannabidiol (CBD) into Psychotropic Cannabinoids Including Tetrahydrocannabinol (THC): A Controversy in the Scientific Literature

Patricia Golombek [†], Marco Müller [†], Ines Barthlott, Constanze Sproll and
Dirk W. Lachenmeier ^{*} 

- End conclusion – CBD does not convert into any of the major compounds measured in forensic testing
 - Δ 9-THC, 11-OH, COOH

-
- CBD**
CANNABIDIOL
- CC1=C(C(=C(C=C1)O)C(=C2C=CC(=C2)O)C3C(C(C(C3)O)C)C

CBD and Other Product Risks



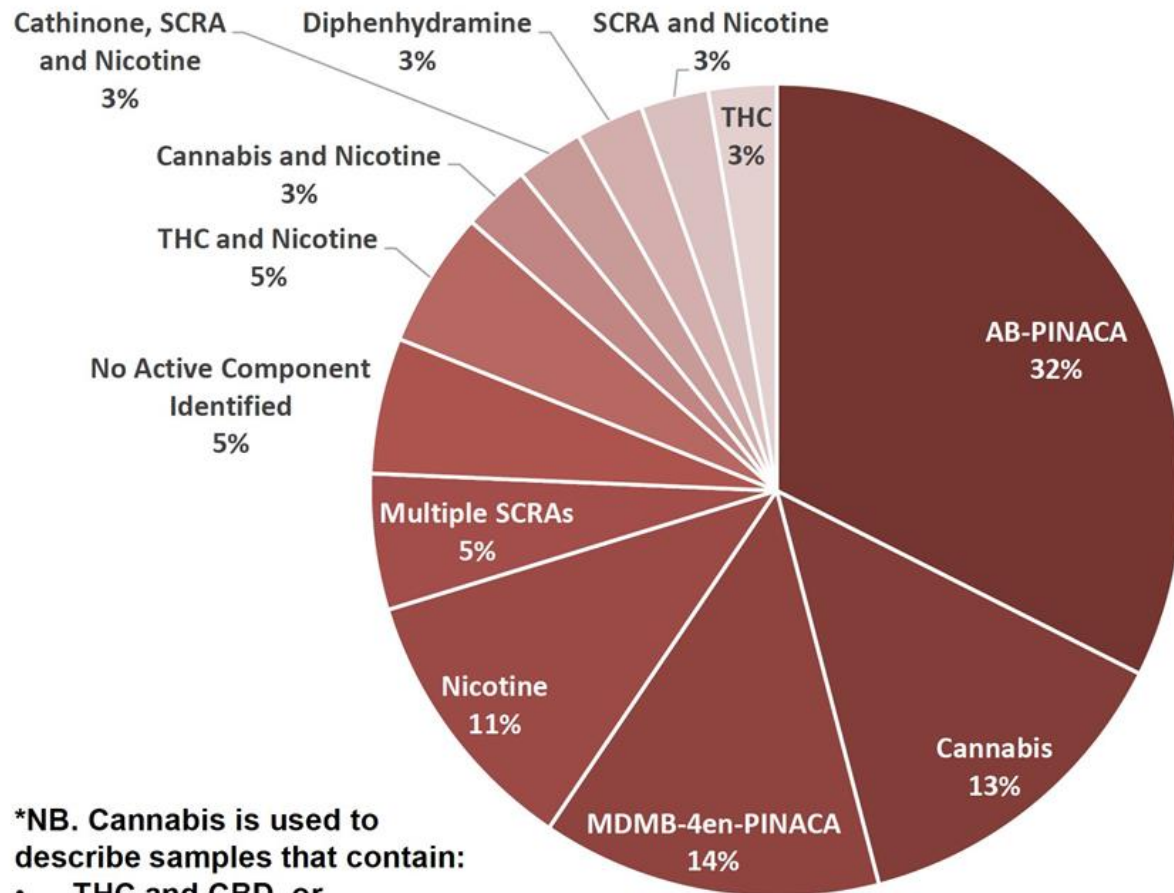
- Product risk
 - Unknown side effects with concomitant drugs
 - Claims of product QA and testing
 - Other drugs likely present in product
 - Concentration of THC varies



Zero Regulation = Unknown Products



THC E-Liquid submissions February 2021



37 samples submitted as THC E-Liquids

Age range of sample providers:
16 to 40 years

Median age of sample providers: **25yrs**

***NB. Cannabis is used to describe samples that contain:**

- THC and CBD, or
- THC and CBN, or
- THC, CBD and CBN



Mail - Amy Miles - Outlook × What You Need to Know (And ×

← → ↺ 🏠 <https://www.fda.gov/consumers/consumer-updates/what-you-need-know-and-what-were-working-find-out-about-products-containing-cannabis-or-cannabis> ... 🛡️ ☆

Getting Started 🌐 Therapak

🇺🇸 An official website of the United States government [Here's how you know](#) ▾

FDA U.S. FOOD & DRUG ADMINISTRATION 🔍 Search ☰ Menu

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What You Need to Know (And What We're Working to Find Out) About Products Containing Cannabis or Cannabis-derived Compounds, Including CBD

The FDA is working to answer questions about the science, safety, and quality of products containing cannabis and cannabis-derived compounds, particularly CBD.

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Español

- Cannabis is a plant of the Cannabaceae family and contains more than eighty biologically active chemical compounds. The most commonly known compounds are delta-9-tetrahydrocannabinol (THC) and cannabidiol (CBD). THC is the component that produces the “high” associated with marijuana use. Much interest has been seen around CBD and its potential related to health benefits.
- Marijuana is different from CBD. CBD is a single compound in the cannabis plant, and marijuana is a type of cannabis plant or plant material that contains many naturally occurring compounds, including CBD and THC.
- The FDA has approved only one CBD product, a prescription drug product to treat two rare, severe forms of epilepsy.
- It is currently illegal to market CBD by adding it to a food or labeling it as a dietary

Content current as of:
03/05/2020

Regulated Product(s)

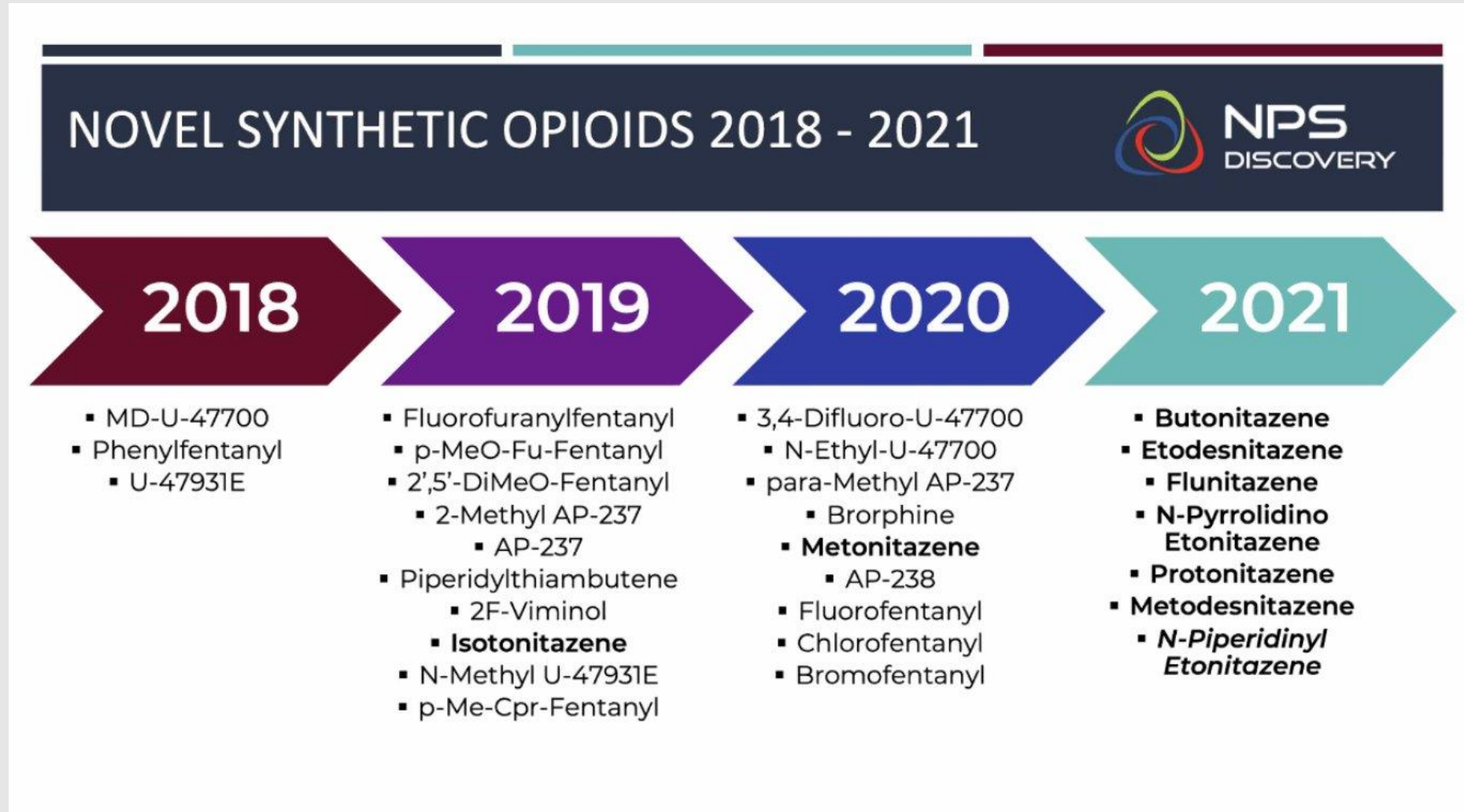
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Drugs
Food & Beverages

<https://www.fda.gov/consumers/consumer-updates>

NPS Challenges



- Novel opioids
 - Fentanyl, fentanyl analogs



Isotonitazene Milwaukee Case



- Witness finds car with 2 occupants, both appear “passed out”
- Driver was disoriented, slurred speech, droopy eyelids
- Constricted pupils, no change or reaction to light
- Shallow breathing, complained of exhaustion when only taking a few steps

Isotonitazene



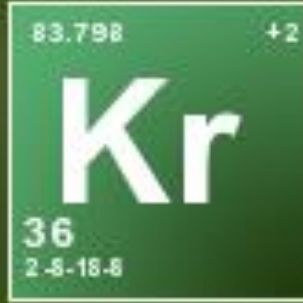
- QToF testing detected the isotonitazene
- Synthetic opioid that is similar to a controlled opioid, etonitazene
- Little scientific information on this drug but suggested greater potency than fentanyl
- Several fatal OD cases in the US
- Casework in WI: always in combination with synthetic benzos
 - Three crashes in different areas of the state

The “New” Speedball



- Methamphetamine + novel opioid





atom



Kratom



- Mitragynine and 7-hydroxymitragynine (7-OH-MG)
- Tree native to Southeast Asia
- Used as an herbal drug
 - Low doses – stimulant
 - High doses – sedative
- Commonly used to self-treat opioid addiction



Kratom Dosing



Dosage (Kratom leaves, not extracts)	Effects
2-6 grams	Mild - stimulant
7-15 grams	Stimulant, crossing over to sedative/euphoric/analgesic
16-25 grams	Sedation and euphoria ("too strong for highly sensitive people")
26-50 grams	Strong sedation and euphoria ("TOO STRONG FOR MOST PEOPLE")

Kratom



- Pharmacology
 - Opioid receptor binding
 - Antagonized by naloxone
 - Tolerance develops with 7-OH-MG (mice)
 - Cross-tolerance to Morphine
 - Respiratory depression vs. Codeine

ANNUAL DEATHS

Tobacco	435,000
Poor Diet/Exercise	365,000
Alcohol	85,000
Prescription Drugs	32,000
Motor Vehicle Crashes	26,347
Homicide	20,308
Aspirin	7,600
Peanuts	100
Kratom	0



KRATOM: Safer Than Peanuts!

Kratom



- Administration

- Chewing leaves
- Tea
- Powder/Capsules



- Side effects

- Numb tongue
- Nausea
- Abdominal pain - “...I was forced to spend the rest of the day lying in severe pain” – Erowid user





Kratom Case

- Reckless driver called in by civilian
 - Driving into oncoming traffic
 - Believed he had a passenger side flat
 - Just learning stick shift
- Poor balance when exiting vehicle
- Officer observed sleeve rolled up



Kratom Case



- Observations
 - Constricted pupils
 - Droopy eyelids
 - Slow, lethargic movements
 - Disoriented
- Admitted to taking Kratom the evening prior
 - Otherwise, just took Rx for clonazepam
 - Later stated he also has Rx for gabapentin

Kratom Case

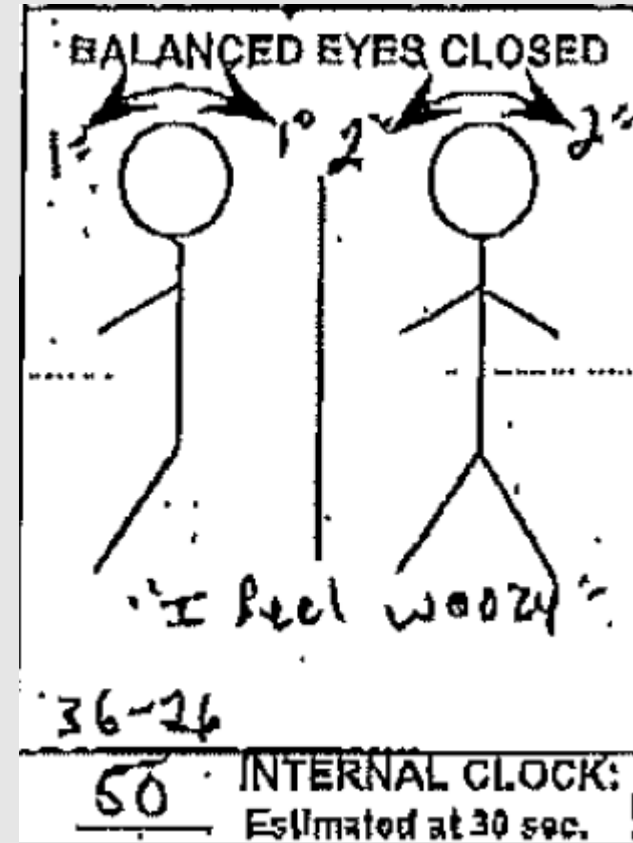


Kratom Case



- Search of vehicle
 - Multiple prescription bottles
 - Bottom of aluminum can
 - Full syringe
 - Foil with 0.5 g heroin

- Romberg balance
 - 30 seconds within 50 seconds
 - Swayed
- Walk and turn
 - Terrible balance
 - Tremors



DRE Eval



- One leg stand
 - Sway
 - Poor balance
- Finger to nose
 - Touched tip of nose 3/6 times
 - Used pad
 - “Lil bit of a challenge!”

ONE LEG STAND: 16/30

7 Sway to left 11-12
9 14/30 14 Fell

A STOP
Hold
Good
2 more
seconds

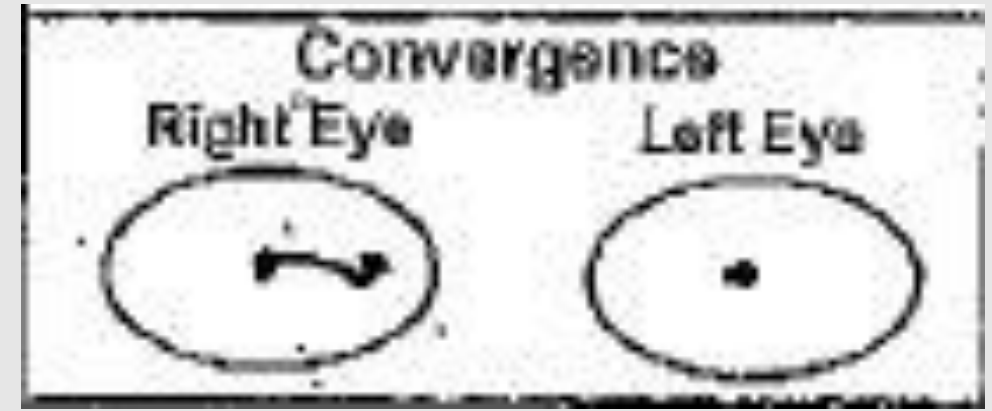
L R

L R

Leg Transfers

L		R
✓✓	Sways while balancing	✓
✓✓✓	Uses arms to balance	✓
—	Hopping	—
—	Puls foot down	✓

- HGN – none
- Lack of convergence – present
 - Left eye didn't move
- Pupils (little reaction to light)
 - Room light: 2.5 mm
 - Near total darkness: 3.0 mm
 - Direct light: 2.0 mm



DRE Eval



- Pulse – 68, 87, 82 BPM
(60 – 90)
- Blood pressure – 119/62
(120 – 140 / 70 – 90)
- Body temp: 97.3 (98.6 +/- 1)
- Muscle tone – near normal



DRE Eval



- Difficult blood draw
 - “IV drug user for 10 years”
- DRE called Narcotic Analgesics

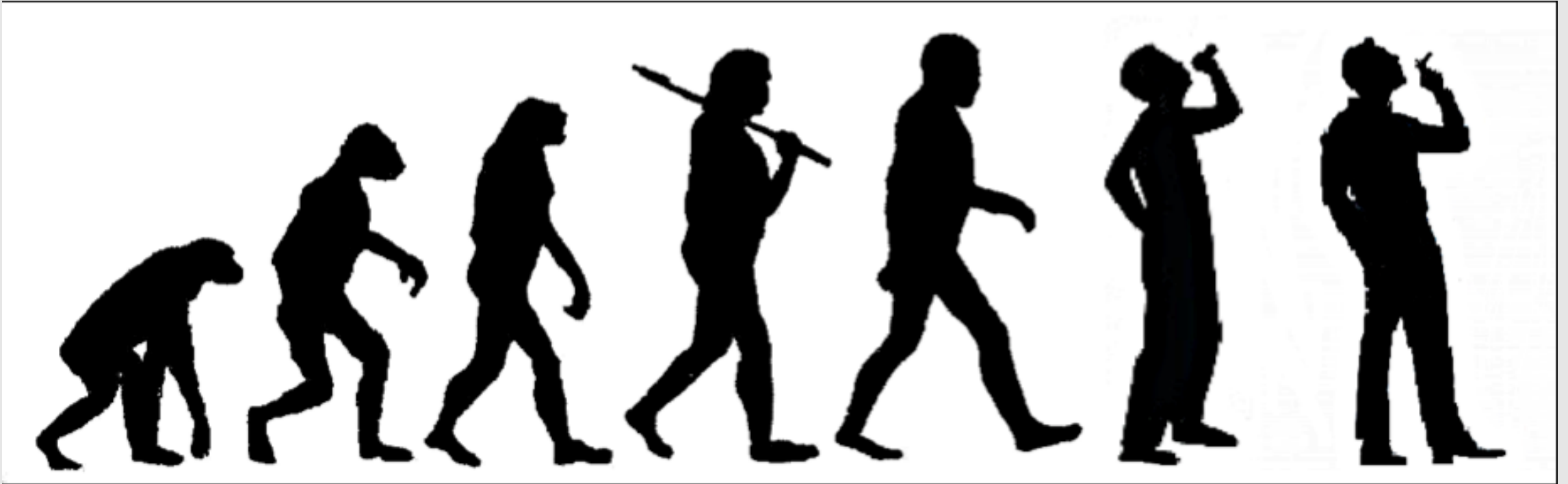


Kratom Case

- Codeine = 14 ng/mL
- Morphine = 160 ng/mL
- **Mitragynine = present**



NPS Challenges – Always Evolving



Partnerships and communication are key



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