



Nene-Hawaiii ↑



Hawaiian Honeycreeper ↓



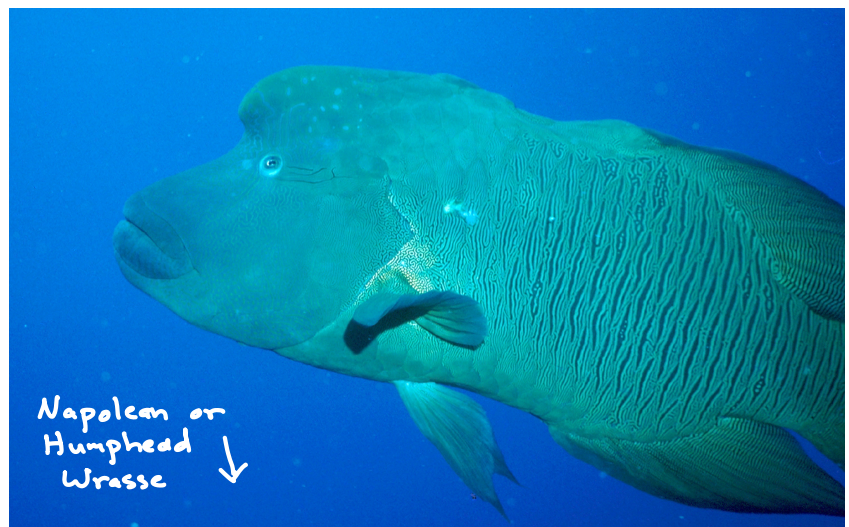
Whooping Crane ↑



Nassau Grouper ↓

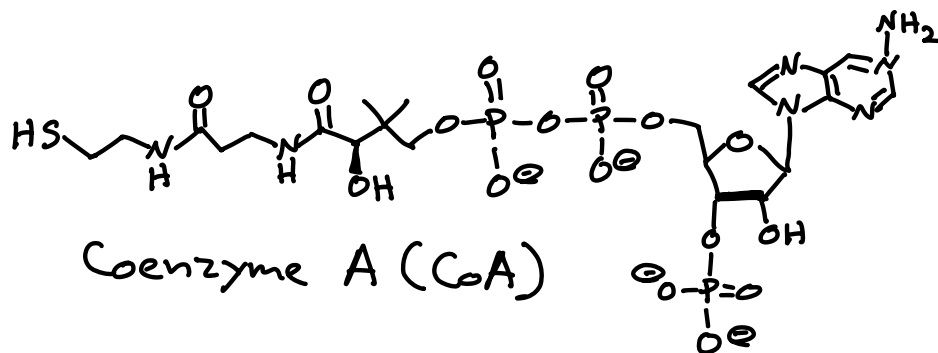


American Crocodile ↑



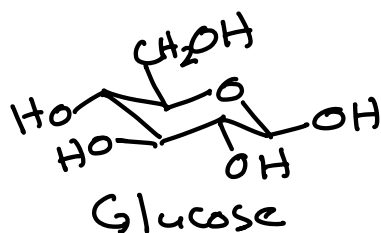
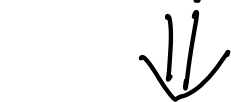
Napoleon or Humphead Wrasse ↓

How does mother nature make C-C bonds? → ENOLATES!

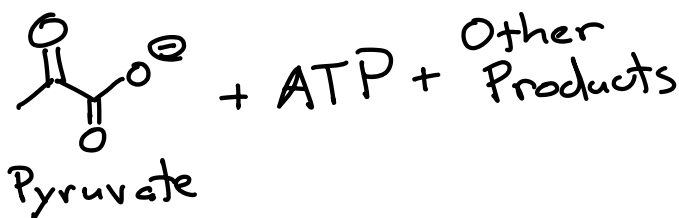


Thioesters → more reactive than esters → \ominus S-R is a better leaving group (more stable anion) than \ominus O-R.

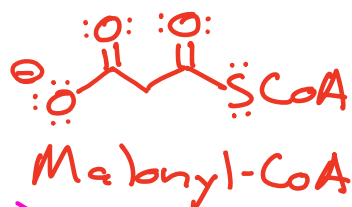
From food



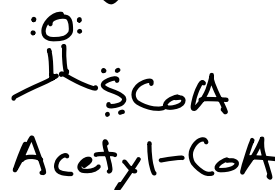
several enzyme reactions



enzymes



enzymes

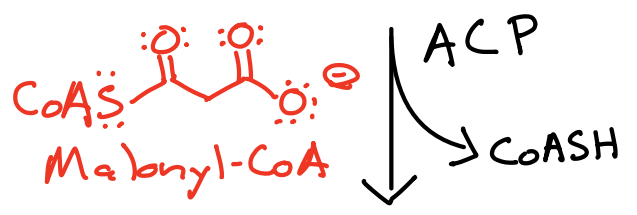
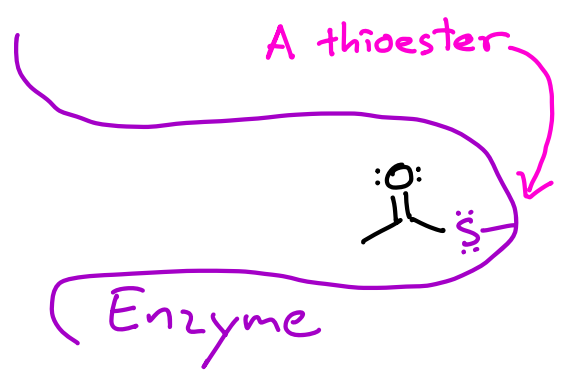


Both are thioesters

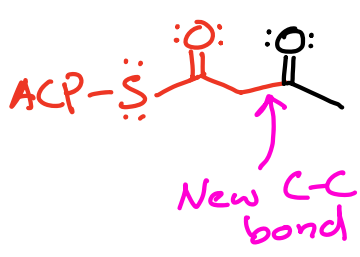
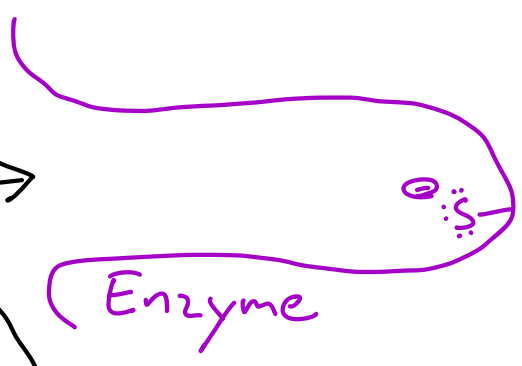
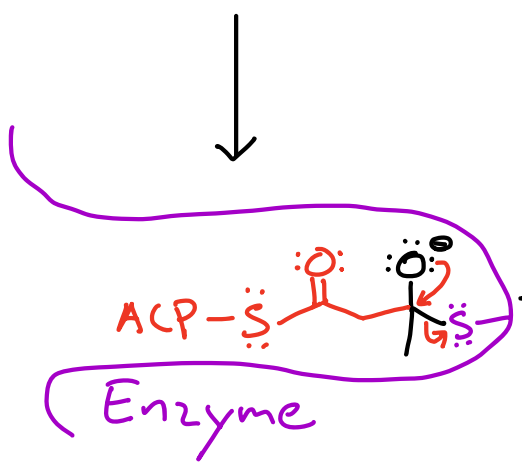
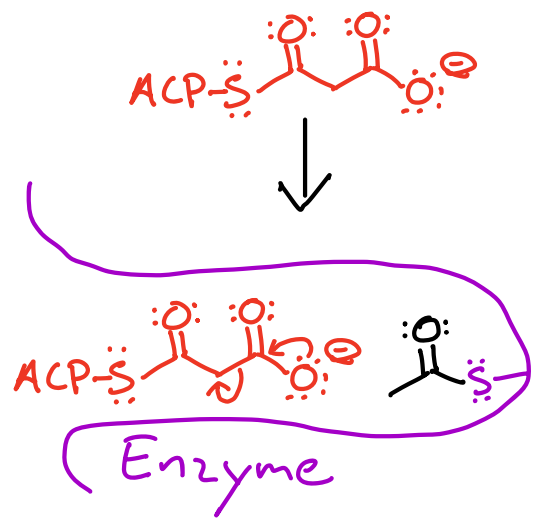
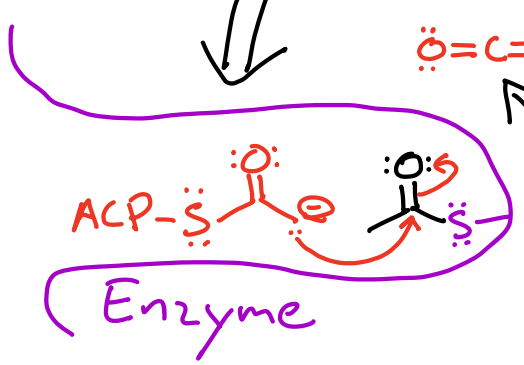
These are used to make C-C bonds in a reaction catalyzed by an enzyme that resembles a Claisen!



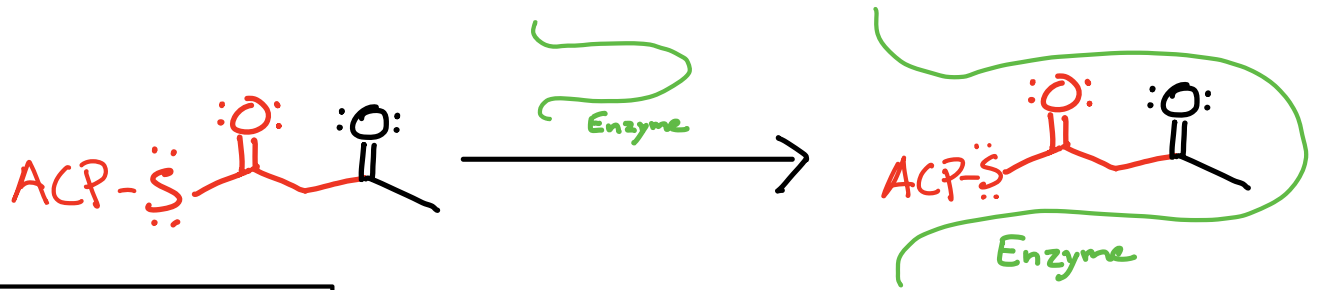
ACP = Acyl Carrier Protein



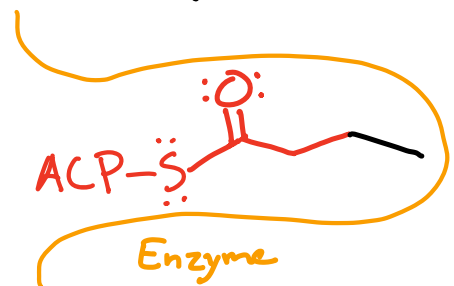
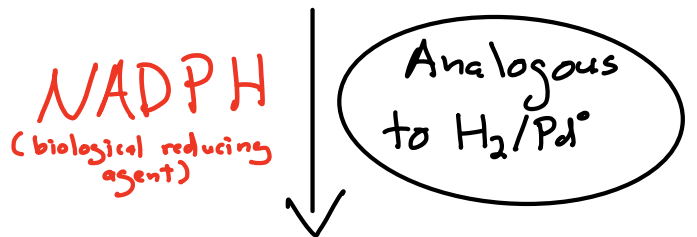
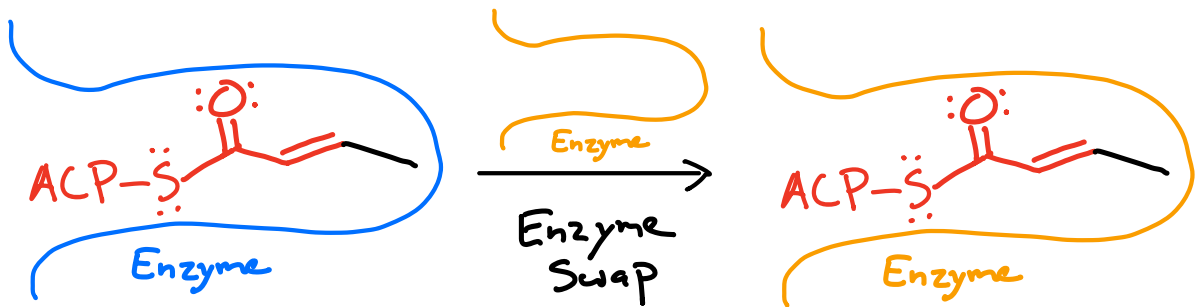
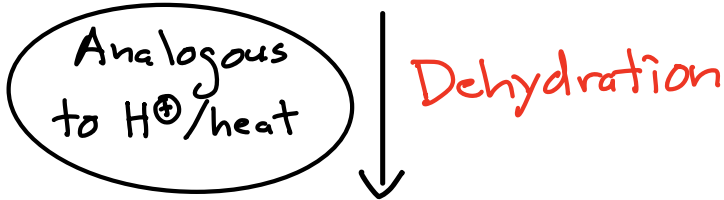
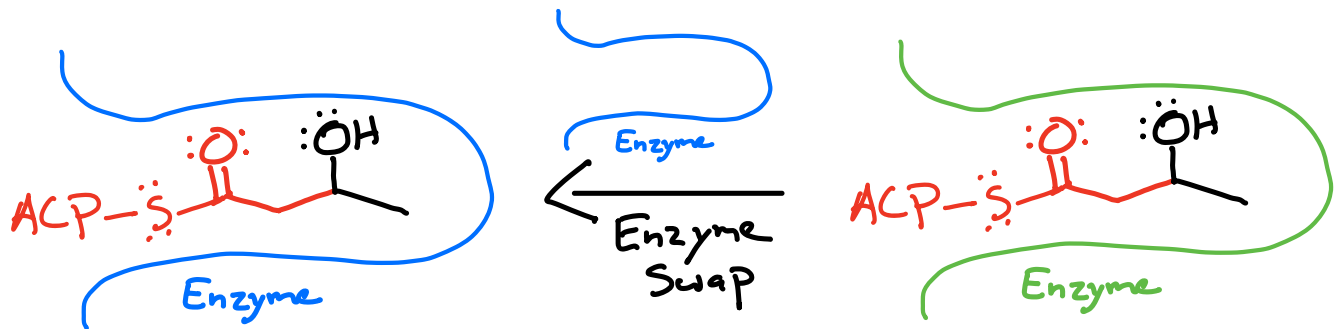
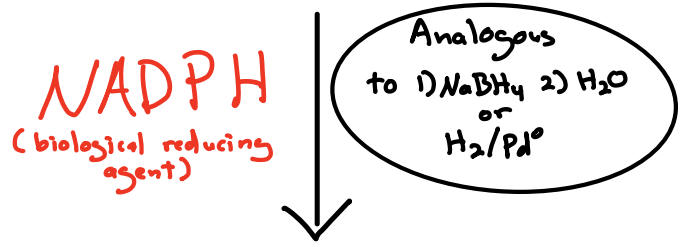
An enolate!

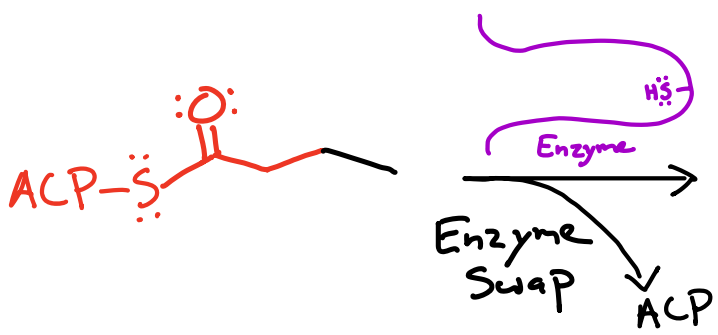


Analogous to a Claisen Condensation!

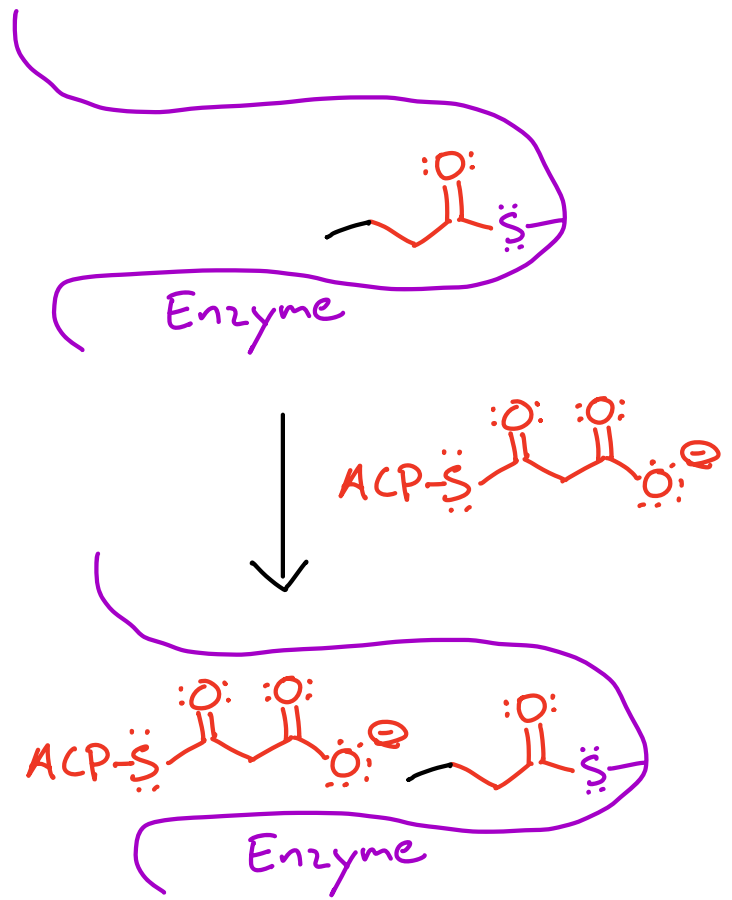


The substrate is handed off from one enzyme to another

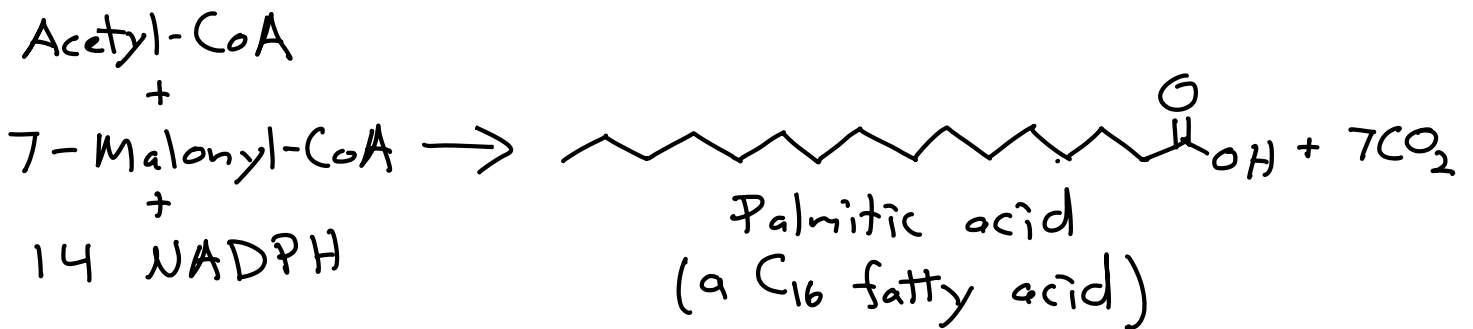




This whole cycle of a Claisen, reduction, dehydration and reduction continues 6 more times!



Overall Process:



Major Take Home Lesson

The chemistry of biological systems resembles the chemistry we have learned!

You are now well-prepared to crush biochemistry!



How do energy drinks work?



CONTAINS NO FRUIT JUICE

Nutrition Facts
1 Serving Per Container
Serving Size 12 fl. oz (355mL)

Amount Per Serving	10	%Daily Value*
Calories	10	
Total Fat 0mg		0%
Sodium 5mg		0%
Total Carbohydrate 0mg		0%
Protein 0mg		0%
Calcium 50mg		4%
Vitamin C 60mg		70%
Riboflavin 1.7mg		130%
Niacin 20mg		130%
Vitamin B6 2mg		120%
Vitamin B12 6mcg		250%
Biotin 300mcg		1000%
Pantothenic Acid 10mg		200%
Chromium 50mcg		140%

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

†The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Caffeine Content: 200mg

US BANG ENERGY BLUE RAZZ 16OZ. CAN
CONTAINS NO FRUIT JUICE

Nutrition Facts
Serving size 1 can

Amount per serving	0	% Daily Value*
Calories	0	
Total Fat 0g		0%
Sodium 40mg		2%
Total Carbohydrate 2g		1%
Total Sugars 0g		0%
Includes 0g Added Sugars		0%
Protein 0g		0%
Potassium 90mg	2%	Vitamin C 30%
Niacin 30%		Vitamin B6 30%
Vitamin B12 60%		Magnesium 2%

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

†The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

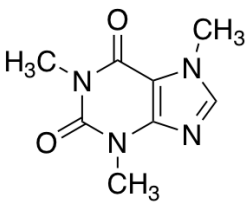
INGREDIENTS: CARBONATED WATER, CITRIC ACID, (w/ CONTROLS), NATURAL & ARTIFICIAL FLAVORS, CAFFEINE, SODIUM BENZOATE (PRESERVATIVE), POTASSIUM CITRATE, SUCRALOSE, ESSENTIAL AMINO ACIDS (L-LEUCINE, L-ISOLEUCINE, L-VALINE, L-YSINE), POTASSIUM PHOSPHATE, ASCORBIC ACID (VIT. C), ACESULFAME POTASSIUM, POTASSIUM SORBATE (PRESERVATIVE), MANGANESE CHLORIDE, CALCIUM CHLORIDE, CALCIUM DIOSODIUM EDTA, NIACINAMIDE (VIT. B3), CINZINNE D-10, PYRIDOXINE HYDROCHLORIDE (VIT. B6), METHYLBALAMIN (VIT. B12).

MANUFACTURED FOR BANG ENERGY LLC, 1700 ANSELMO DRIVE, CORONA, CA 92729 U.S.A.

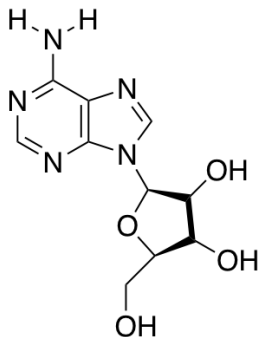
©2023 BANG ENERGY LLC

CAFFEINE IN ENERGY DRINKS
INCLUDING CALORIES & SUGAR CONTENT

3D 200mg CAFFEINE 15 CALORIES 7g CARBS 0g SUGAR	5 HOUR ENERGY SHOT 200mg CAFFEINE 4 CALORIES 1g CARBS 0g SUGAR	ALANI NU 200mg CAFFEINE 10 CALORIES 6g CARBS 0g SUGAR	BANG 300mg CAFFEINE 0 CALORIES 0g CARBS 0g SUGAR
BEYOND RAW LIT 250mg CAFFEINE 20 CALORIES 4g CARBS 0g SUGAR	C4 ENERGY 200mg CAFFEINE 0 CALORIES 0g CARBS 0g SUGAR	CELSIUS 200mg CAFFEINE 10 CALORIES 2g CARBS 0g SUGAR	GHOST 200mg CAFFEINE 5 CALORIES 1g CARBS 0g SUGAR
MTN DEW RISE 180mg CAFFEINE 25 CALORIES 5g CARBS 3g SUGAR	MONSTER 160mg CAFFEINE 230 CALORIES 58g CARBS 54g SUGAR	MONSTER ZERO SUGAR 140mg CAFFEINE 10 CALORIES 3g CARBS 0g SUGAR	NOCCO 180mg CAFFEINE 12 CALORIES 0g CARBS 0g SUGAR
NOS 160mg CAFFEINE 200 CALORIES 54g CARBS 54g SUGAR	REIGN 300mg CAFFEINE 10 CALORIES 3g CARBS 0g SUGAR	RED BULL 80mg CAFFEINE 110 CALORIES 29g CARBS 27g SUGAR	RED BULL SUGARFREE 80mg CAFFEINE 10 CALORIES 2g CARBS 0g SUGAR
ROCKSTAR 160mg CAFFEINE 250 CALORIES 63g CARBS 63g SUGAR	ROCKSTAR SUGAR-FREE 160mg CAFFEINE 25 CALORIES 1g CARBS 0g SUGAR	ZEVIA 120mg CAFFEINE 0 CALORIES 0g CARBS 0g SUGAR	ZOA 160mg CAFFEINE 15 CALORIES 3g CARBS 0g SUGAR




Caffeine



Adenosine

Coffee and tea drinks (coffee shops)	Serving size	Caffeine (mg)
Starbucks Coffee	20 oz. venti	390-490
Dutch Bros 9-1-1 Blended Freeze	large	440
Starbucks Coffee	16 oz. grande	315-390
Starbucks Iced Coffee	30 oz. trenta	320
Caribou Coffee	medium	305
Dunkin' Frozen Coffee	medium	295
Starbucks Coffee	12 oz. tall	235-290
Dunkin' Coffee	20 oz. large	270
Starbucks Caffè Americano	16 oz. grande	225
Dunkin' Coffee	14 oz. medium	210
Starbucks Cold Brew	16 oz. grande	205
Starbucks Flat White	16 oz. grande or 20 oz. venti	195


Antagonist
 Caffeine → Turns off your
 "drowsiness" switch because it
 binds where adenosine binds
 to signal low ATP and
 therefore drowsiness.

Vitamins B₆ and B₁₂ → stimulate
 production of ATP in your body
 so you have energy available

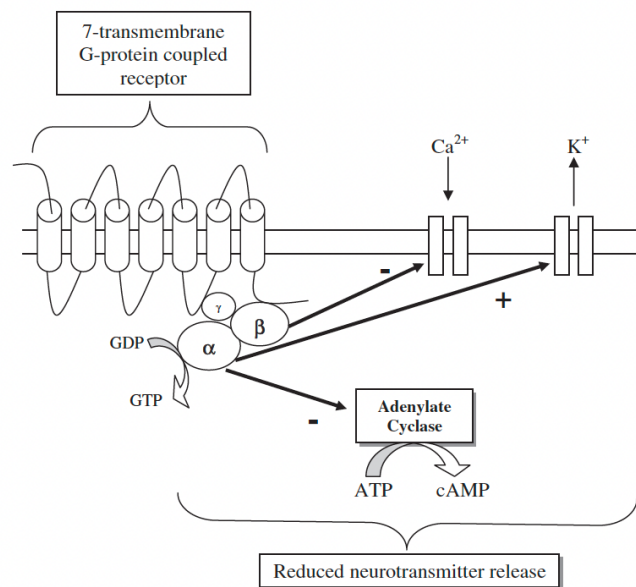
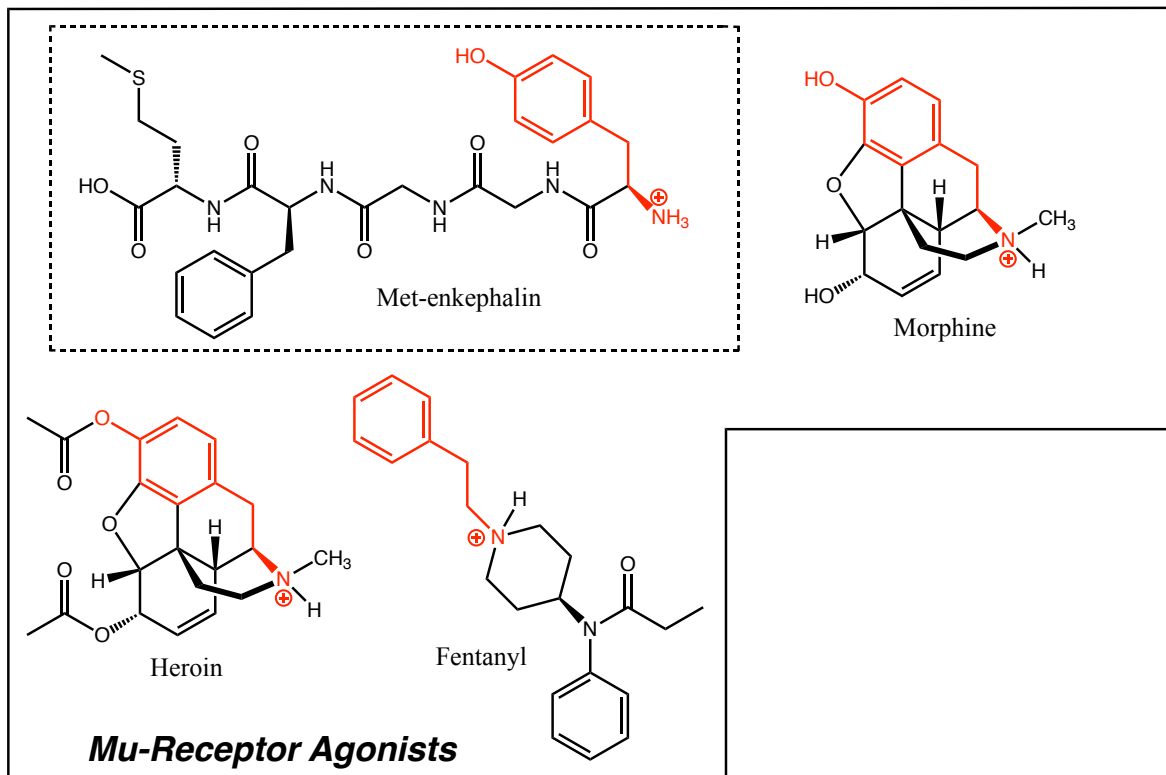


Fig. 1 Seven transmembrane structure of opioid G-protein-coupled receptor. Receptor activation by opioid receptor ligands leads to initiation of intracellular transduction pathways that include stimulation of potassium efflux, inhibition of VSCCs and inhibition of adenylyl cyclase. In this diagram the G-protein is denoted α , β , γ but the α -subunit interacts with K^+/Ca^{2+} channel and adenylyl cyclase.

Fentanyl activates μ -opioid receptors (Gi/o-coupled) on GABAergic interneurons in the VTA, decreasing their cAMP levels and suppressing GABA release.

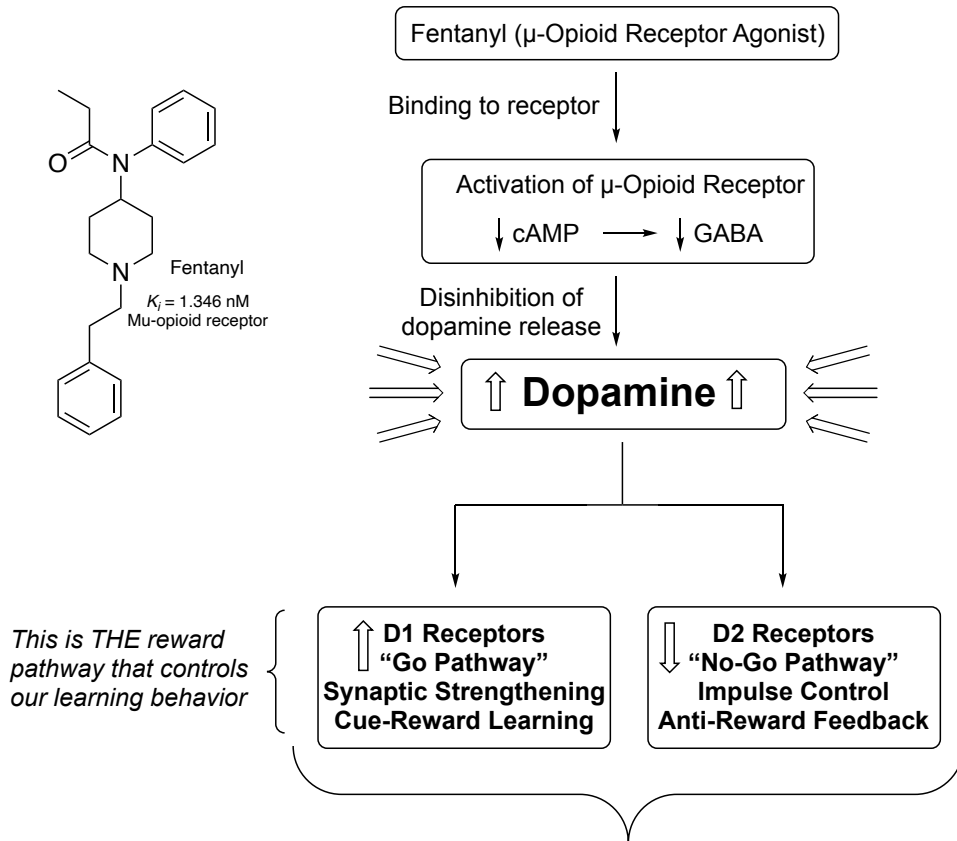
This disinhibits dopamine neurons and drives a surge of dopamine release into the nucleus accumbens.

Dopamine then acts on **D1 receptors** (Gs-coupled) to increase cAMP/PKA/CREB signaling, producing synaptic potentiation and strong reinforcement of fentanyl-associated cues.

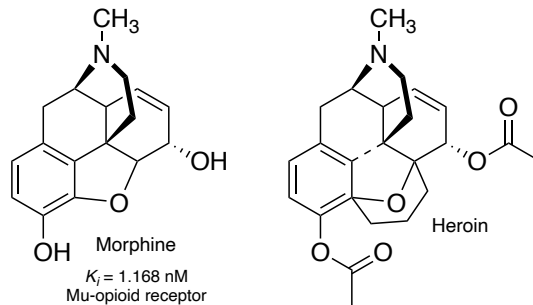
In parallel, chronic fentanyl use **downregulates D2 receptor** (Gi/o) signaling, which normally provides inhibitory control and reduces compulsive reward seeking.

The combined effect—**D1 sensitization plus D2 suppression**—shifts basal ganglia signaling toward reward acquisition, producing the neurochemical basis of fentanyl addiction and relapse vulnerability.

Fentanyl triggers addiction by disrupting the brain's normal reward and control systems. It activates opioid receptors in a part of the brain that normally keeps dopamine release in check, effectively **removing the brakes** and causing a strong surge of dopamine—the chemical that signals pleasure and reward. This dopamine then acts on two types of receptors. **D1 receptors** amplify the brain's "go" signals, strengthening the memory and motivation to use the drug again. **D2 receptors**, which normally help with self-control and resisting impulses, become less active with repeated fentanyl use. As D1 activity becomes stronger and D2 activity becomes weaker, the brain becomes increasingly wired to seek fentanyl while losing the ability to hold back, creating the powerful cycle of addiction.



An individual is driven to pursue the drug and cannot anticipate negative consequences of drug use



HEALTH

Why fentanyl is deadlier than heroin, in a single photo

By Allison Bond Sept. 29, 2016

[Reprints](#)



Menu

ONE PILL CAN KILL

DEA Fentanyl Seizures in 2024

In 2023, DEA seized more than 79.5 million fentanyl-laced fake pills and nearly 12,000 pounds of fentanyl powder. The 2023 seizures are equivalent to more than 376.7 million lethal doses of fentanyl.

The 2024 fentanyl seizures represent over 93.7 million deadly doses. *

17,900,000+

1,813+ lbs.

Millions of Fentanyl
Pills Seized

Pounds of Fentanyl
Powder Seized

* 2 mg of fentanyl equates to a potentially deadly dose





PRESS RELEASE

13 Arrested in Connection with an LSD, Fentanyl and Methamphetamine Trafficking and Money Laundering Scheme Occurring in the West Campus Area of the University of Texas at Austin

Friday, December 4, 2020

Share >

For Immediate Release

U.S. Attorney's Office, Western District of Texas



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Authentic Xanax® Front and Back



[Click to download the full image](#)

Counterfeit Xanax® Front and Back



PRESS RELEASE

13 Arrested in Connection with an LSD, Fentanyl and Methamphetamine Trafficking and Money Laundering Scheme Occurring in the West Campus Area of the University of Texas at Austin

Friday, December 4, 2020

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For Immediate Release

U.S. Attorney's Office, Western District of Texas

Jake Ehlinger's family releases statement saying Texas player died of accidental overdose



Brian Davis

Hookem

Published 4:56 p.m. CT Oct. 21, 2021 | Updated 3:54 p.m. CT Oct. 22, 2021



Remembering Texas linebacker Jake Ehlinger

Jake Ehlinger, younger brother of former Longhorns quarterback Sam Ehlinger, was found dead on May 6, Austin police said. *Austin American-Statesman*

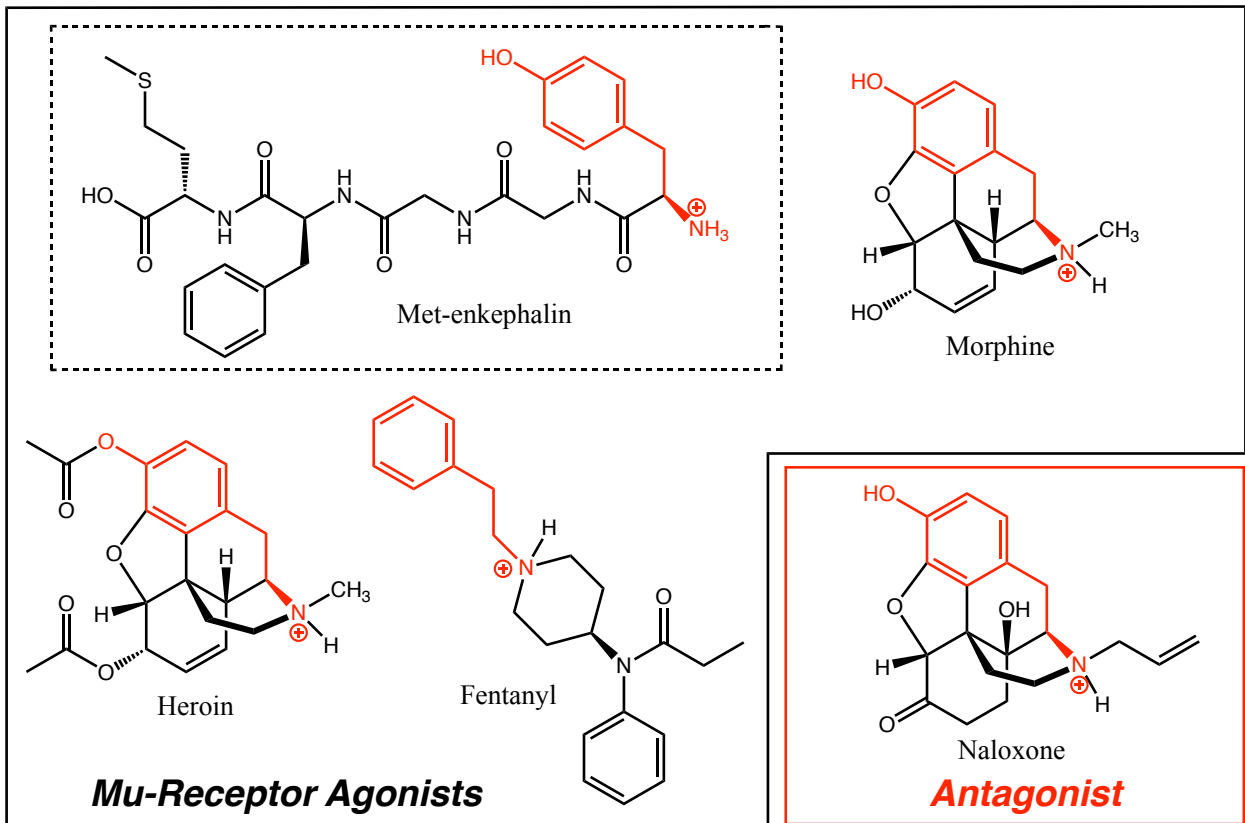


SHIFT is ready for a different conversation.



For decades substance use and college campuses have been talked about as an inevitable rite of passage for college students, creating a norm that can far out shadow the dynamic pursuits of college students that revolve around academics and future opportunities.

SHIFT engages the community in dialogue that changes the culture of campus substance use from one of misuse to one of well-being.



NARCAN[®] NASAL SPRAY – ANYONE CAN SAVE A LIFE

Be ready – at home or on the go. NARCAN[®] Nasal Spray is a treatment designed to rapidly reverse the effects of a life-threatening opioid emergency. Available as an over-the-counter medicine.



Original Prescription Strength
Easy to Use
Can Save a Life

NARCAN[®]

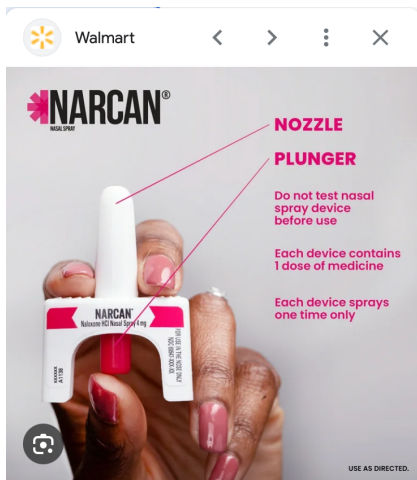
Naloxone HCl Nasal Spray 4 mg

Emergency Treatment of Opioid Overdose

Designed to Rapidly Reverse the Effects of a Life-Threatening Opioid Emergency

2 Single-Dose Nasal Spray Devices
0.003 fl oz (0.1 mL) each

For use in nose only



NARCAN Nasal Spray 4 mg, Emergency Treatment of...

[Visit >](#)

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Should I carry naloxone?

Sometimes it can be difficult to imagine how one person can have an impact on the culture of substance use – but you can! By carrying naloxone and learning the right way to administer it to someone having an opioid overdose, you have the potential to save a life. Even if you don't personally know anyone using opioids, you may find yourself in a situation where having naloxone on hand could make a huge difference. By showing that you care and taking the time to learn, you're helping to raise awareness about how important it is for each of us to play a part in shifting the culture of substance use.

How do I use naloxone?

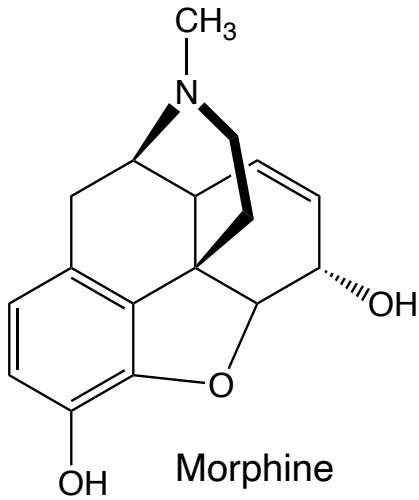
Okay, so now you know what naloxone is, and why it's so important – but how do you actually use it on someone experiencing an opioid overdose? Great question – luckily, Operation Naloxone at UT provides free trainings for students, staff, and faculty. Email shift@utexas.edu for more information. [Request an Operation Naloxone training.](#)

How do you administer the nasal spray version of naloxone (Narcan)?

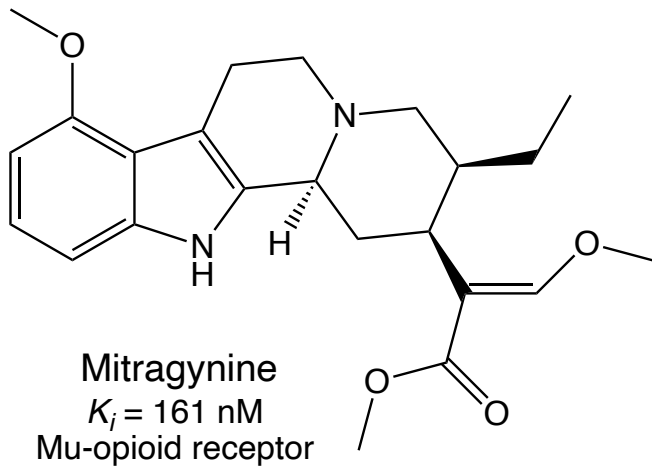
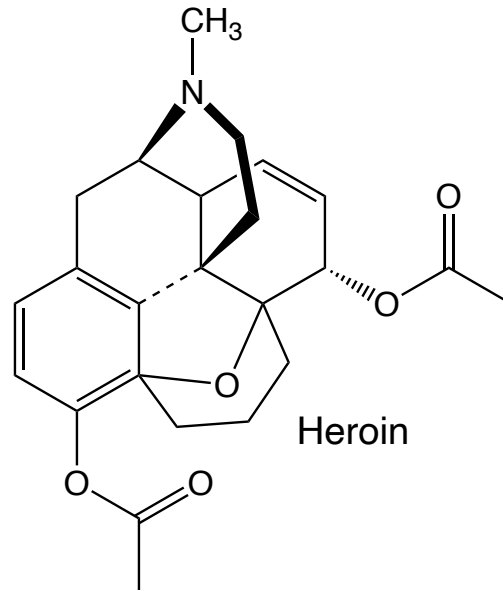
- Open the Narcan package, place the nozzle in the person's nostril and press the plunger.
- [View the CDC video](#) on how to administer Narcan.

Where can I find naloxone?

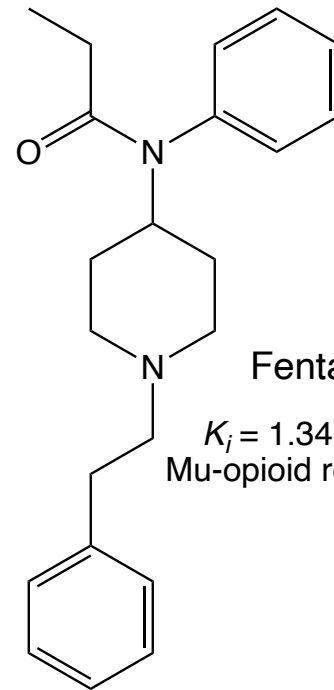
- Naloxone is available for distribution to all students, faculty, and staff at the Perry-Casteneda Library security front desk, the Longhorn Wellness Center (SSB 1.106), and the Center for Students in Recovery (Belmont 222).
- Naloxone is available for emergency access at all residence hall front desks, Sid Richardson Library, the Life Sciences Library, the Perry-Casteneda Library, and through UTPD.
- Many pharmacies dispense naloxone without a prescription, but there may be a copay depending on the insurer. You can call your insurance provider in advance to learn more about the potential copay cost.
- In Texas, you can request free naloxone via mail at MoreNarcanPlease.com.
- [Map of free naloxone access sites in Austin.](#)



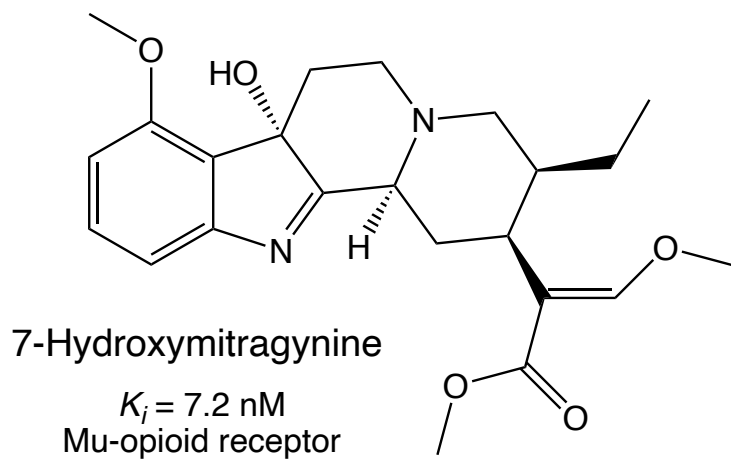
$K_i = 1.168 \text{ nM}$
Mu-opioid receptor



$K_i = 161 \text{ nM}$
Mu-opioid receptor



$K_i = 1.346 \text{ nM}$
Mu-opioid receptor



$K_i = 7.2 \text{ nM}$
Mu-opioid receptor

Regulatory Toxicology and
Pharmacology
Volume 59, Issue 3, April 2011,
Pages 385-390

ACS Chem. Neurosci. 2023, 14,
195-197



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PRESS



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GET \$80 OFF the first two
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"The head is affected pleasantly; you feel friendly, not beer sentimental; you cannot hate with kava in you. Kava quiets the mind; the world gains no new color or rose tint; it fits in its place and in one easily understandable whole."

- Tom Harrison, author

QUALITY CONTROLLED



Raw material, in-process, finished product, and product stability testing performed by trained quality control scientists.



CERTIFIED LAB TESTED

Each batch's ingredients and final product pass multiple tests for active ingredient consistency and contaminant safety.



MADE IN THE USA

Quality ingredients sourced from around the world, manufactured in an FDA-regulated facility in Tulsa, Oklahoma.



What is Kava?

Kava, a member of the pepper family, is a traditional drink made from the roots of the kava plant. It has been enjoyed for centuries by the indigenous people of the South Pacific as a social and ceremonial beverage. Kava is known for its relaxing and calming effect on the mind and body.

Kava-Forward Tonics and Supplements

Thoughtfully crafted to help you feel good.

SHOP NOW →

enjoy *feel free*® products when you want:



A CLEAN ENERGY BOOST WITHOUT THE JITTERS



A SOCIAL LIFT WITHOUT THE BOOZE (OR HANGOVER)



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CLASSIC tonic

SHOP NOW



CLASSIC capsules

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NATURALLY CAFFEINATED

feel free® tonic

Our newest feel-good wellness tonic is a kava drink made with kava, kola nut, lion's mane and rhodiola. These ingredients are known to enhance relaxation, cognitive function, and productivity.* *feel free* is naturally caffeinated with 100mgs of caffeine per serving to boost and sustain your energy without the crash.

12-Pack Case (24 Servings) | 2oz (59ml) Bottles

<input checked="" type="radio"/>	Subscribe & Save	\$105	SAVE 29%
<input checked="" type="checkbox"/>	Instant 29% savings (\$147 \$105)		
<input checked="" type="checkbox"/>	Delivery every 30 days		
<input checked="" type="checkbox"/>	Cancel / pause your monthly delivery anytime		
<input type="radio"/>	One-Time Purchase	\$147	

Subscribe & Save | \$105

- 🚚 Ships within 5 business days
- 📦 Free shipping for every U.S. order
- 🔄 Money back guarantee

GET \$40 OFF ✕

Free shipping on all feel free orders →



THE MINIMUM AGE REQUIRED TO PURCHASE AND CONSUME THIS PRODUCT MAY BE 18 OR 21 DEPENDING ON THE JURISDICTION. SHAKE WELL. REFRIGERATE AFTER OPENING.

Supplement Facts	Amount Per Serving	%DV
Serving Size: 1 oz (29.5 mL) Servings Per Container: 2		
Iron	0.4 mg	4%*
Kava root (extract)		
Total Kavalactones	260 mg	*
Kratom leaf (ground)		
Total Alkaloids	34 mg	*
Mitragynine	20 mg	*
7-hydroxymitragynine	<0.05 mg	*

*Daily Value (DV) based on a 2000 calorie diet
*Daily Value (DV) not established

Other ingredients: water, pineapple juice, natural flavors, stevia leaf, citric acid.

RECOMMENDED USE: TAKE 1 OZ BY MOUTH. DO NOT EXCEED 2 OZ IN A 24-HOUR PERIOD.
Note: Anything that makes you feel good can become habit-forming including alcohol, caffeine, sugar, and kratom. Only use *feel free* CLASSIC in the recommended quantity and dosage. If consumed responsibly, *feel free* CLASSIC has not been shown to cause any serious physical or social harm. Caution: This product is not for use by or for sale to persons under the age of 18, or in some jurisdictions, 21. Consult a healthcare professional before taking any dietary supplement. Do not consume more than one serving at a time and no more than two servings per day. This product is not recommended for pregnant or nursing women or persons who are sensitive to the active ingredients like kava. Do not consume with excessive alcohol.

These statements have not been evaluated by the FDA. This product is not intended to diagnose, treat, mitigate, cure, or prevent any disease or illness.

BOTANIC TONICS, LLC
13105 E. 61ST STREET, SUITE B • BROKEN ARROW, OK 74012

CAFFEINE FREE

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Our original feel-good wellness tonic is a kava drink made with kava and other ancient plants known to help with relaxation, productivity and focus.* These plants hail from the South Pacific and Southeast Asia, where they've been used socially and in wellness for centuries.

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Federal authorities seize over \$3 million worth of kratom products

by Alexandria Tafoya, KTUL Staff | Tue, May 2nd 2023, 7:21 PM CDT



The Oklahoma state is seen at the Capitol in Oklahoma City on Feb. 3, 2020. (KTUL photo)



TULSA, Okla. (KTUL) — Northern District of Oklahoma reported on Tuesday that United States Marshals and investigators from the U.S. Food and Drug Administration seized over \$3 million worth of products containing Kratom.

According to the report, more than 250,000 units of dietary supplements and bulk dietary ingredients seized were or contained kratom, including more than 1,000 kilograms of bulk kratom.

The seized kratom products were manufactured by Botanic Tonics, LLC of Broken Arrow, and are marketed under the brand name "Feel Free Plant Based Herbal Supplement."

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Judge awards \$11 million to family in death of Boynton Beach woman from kratom

Krystal Talavera, a mother of four who lived in Boynton Beach, died in 2021



LET'S HEAR IT!

WASHINGTON STATE

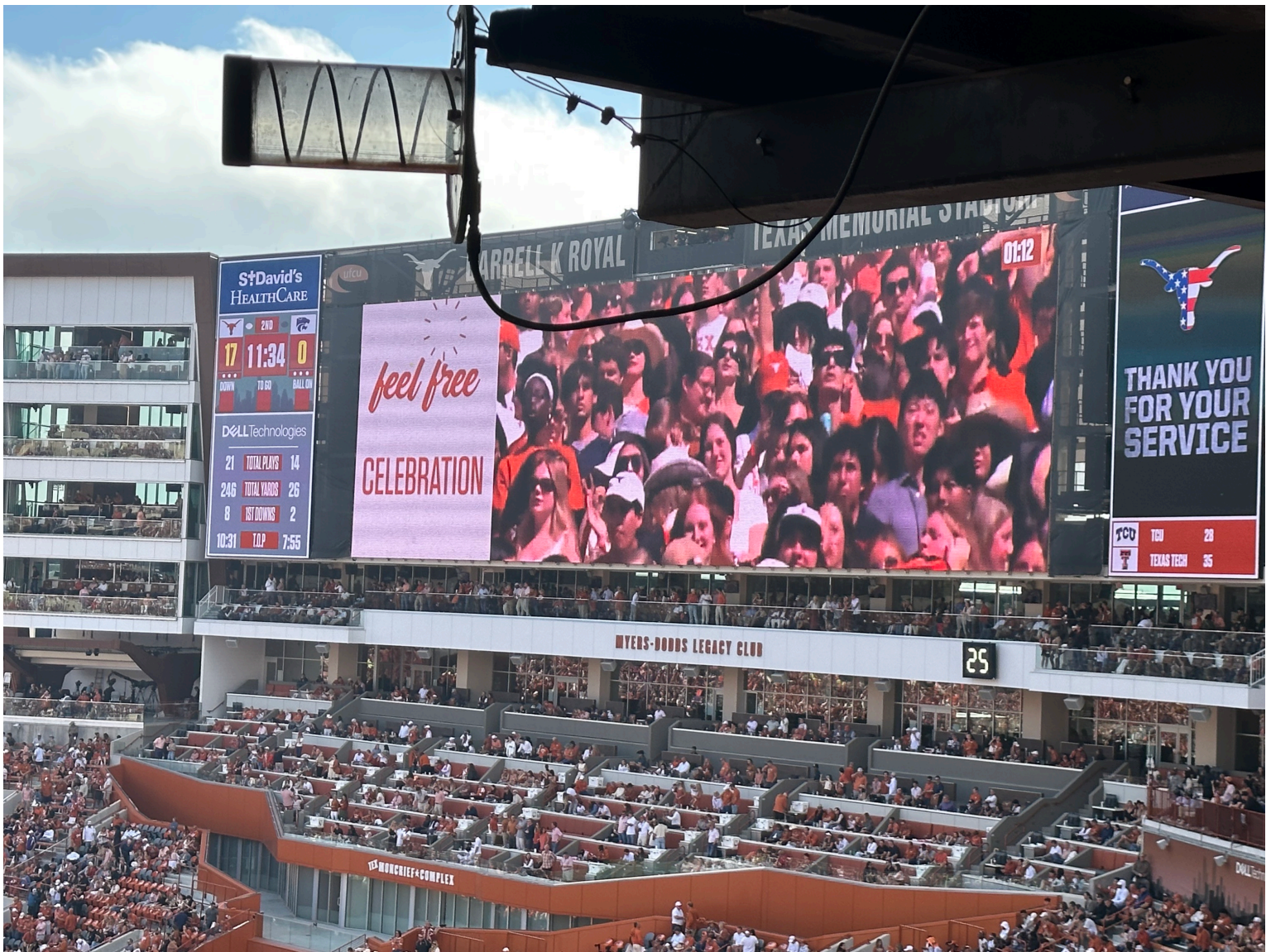
Dad found dead in living room after using kratom, lawsuit says. Jury awards family \$2.5M

BY JULIA MARNIN

UPDATED JULY 24, 2023 1:05 PM







S+David's
HEALTHCARE

17 11:34 0
DOWN TO GO BALL ON

Dell Technologies
21 TOTAL PLAYS 14
246 TOTAL YARDS 26
8 1ST DOWNS 2
10:31 TOP 7:55

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Hi Dr. Iverson,

I graduated with a BSA in Neuroscience in May 2023, and you were my organic chemistry professor during COVID! During your class, you shared about Operation Naloxone at UT Austin which turned out to be instrumental in my life when I was in need of Narcan a few years later for my loved one battling addiction. I am currently reflecting about this experience in my personal statement, and I thought I'd send you this paragraph from my rough draft:

Day 1 was the day I found out he was using drugs recreationally since the age of 13. Year 6 was the year I accepted his substance abuse as a progressive illness. The darkness that lured him in changed my life forever when he disappeared one night and under the influence called our mom to let her know he was lost, the call disconnecting shortly after. I was afraid to know the substances he used, but one day with my heart ringing in my ears, I asked. This is how I knew I needed to request Narcan from the free distribution services that you had told us about in OChem class. I tracked his last location on our shared family app and without knowing where or to what I was headed my mom and I drove to him. With shaking hands I read the Narcan instructions and prepared for the worst. In the distance, I could see my brother's car and I could see his face and head resting back onto the driver's seat. The rest of the events that night are oddly blurry yet so clearly ingrained in my memory. I remember having to put his car in park, trying to wake him up unsuccessfully, shouting out to my mom to call 911, using the Narcan, his eyes suddenly opening wide and him taking a deep breath in. Today, my brother is recovering after years of battling anxiety, depression, and substance abuse. His experiences from childhood to adulthood have been a driving force in my research endeavors and education in neuroscience.

I am grateful for the impact you have had on my academic journey and wanted to share this part of my story with you. Thank you for your inspiration and guidance!

Background on the HIV virus → AIDS

- 1) HIV is a retrovirus → single strand of RNA inside a protein coat → codes for 19 proteins
- 2) HIV infects cells of the immune system → HIV binds to specific receptors on these cells
- 3) Once inside the cell the RNA is reverse transcribed to DNA by a viral enzyme.
"Reverse transcriptase"
- 4) The DNA is integrated into the the host genome by another viral enzyme.
"Integrase"
→ The viral DNA remains inactive for some time within the DNA genome.

5) After an unknown signal, the viral DNA becomes active and produces a single long mRNA, that produces a very long HIV single protein. → called a polyprotein

6) The HIV polyprotein is cleaved into individual proteins by another viral enzyme called the AIDS protease → cleaves amide bonds at the correct sequences. → has two carboxylic acids (Asp) at the correct location to cleave the amide bond. → called an aspartyl protease because of the two key carboxylic acid groups on aspartic acid amino acids (Asp).