

# What Alcohol Does to Your Brain | Dr. Andrew Huberman

Because of the structure of alcohol it is what's called both water soluble and fat soluble translated into what's meaningful for you What that means is when you drink alcohol it can pass into all the cells and tissues of your body it has no trouble just passing right into those cells So unlike a lot of substances and drugs that actually attach to the surface of cells to receptors as they're called low parking spots and then trigger a bunch of downstream like domino cascades of effects Alcohol actually has its own direct effects on cells because it can really just pass into those cells So it's water and fat soluble And the fact that it can pass into so many organs and cells so easily is really what explains its damaging effects I should mention that there are three main types of alcohol There's isopropyl methyl and ethyl alcohol and only the last one ethyl alcohol or ethanol is fit for human consumption However it is still toxic Ok It produces substantial stress and damage to cells I'd love to be able to tell you otherwise But that's just a fact ethanol produces substantial damage to cells and it does that because when you ingest ethanol it has to be converted into something else because it is toxic to the body And there's a molecule inside of all of us called NAD And you may have heard of NAD because it's quite popular There's a lot of discussion about NAD in the longevity literature Right now NAD is present in all our cells from birth until death The levels of NAD tend to go down across the lifespan There are ideas that increasing levels of NAD may extend lifespan A lot of that is still controversial or at least we should say is ongoing in terms of the research But nonetheless when you ingest ethanol NAD and related biochemical pathways are involved in converting that ethanol into something called acetyl aldehyde It's broken down into acetyl aldehyde And if you thought ethanol was bad acetyl aldehyde is particularly bad acetyl aldehyde is poison it will kill cells it damages and kills cells and it is indiscriminate as to which cells it damages and kills Now that's a problem obviously and the body deals with that problem by using another component of the NAD biochemical pathway to convert acetyl aldehyde into something called acetate Acetate is actually something that your body can use as fuel And that process of going from ethanol to acetyl aldehyde to acetate does involve the production of a toxic molecule Right again acetyl aldehyde is really toxic And NAD and if we want to get technical it's the NAD to NADH ratio And that chemical step is

the rate limiting step to ethanol's metabolism What does that mean for you What that means is that if your body can't do this conversion of ethanol to acetyl aldehyde to acetate fast enough Well acetyl aldehyde will build up in your body and cause more damage So it's important that your body be able to do this conversion very quickly And the place where it does that is within the liver and cells within the liver are very good at this conversion process But they are cells and they are exposed to the seed allow to hide in the conversion process And so cells within the liver really take a beating in the alcohol metabolism events So the key thing to understand here is that when you ingest alcohol you are yes ingesting a poison And that poison is converted into an even worse poison in your body And some percentage of that worst poison is converted into a form of calories that you can use to generate energy generate a TP And the reason why alcohol is considered empty calories is because that entire process is very metabolically costly but there's no real nutritive value of the calories that it creates You can use it for immediate energy but it can't be stored in any kind of meaningful or beneficial way It doesn't provide any vitamins it doesn't provide any amino acids it doesn't provide any fatty acids It's truly empty calories I know some people talk about sugar is empty calories but sugar actually is a far better fuel source than alcohol or acetate But nonetheless when you ingest alcohol some percentage is being shuttled into a worse poison and some is being shuttled into a fuel source Now the important thing to understand is that it is the poison the acetyl aldehyde itself that leads to the effect of being inebriated or drunk I think most people don't realize that that being drunk is actually a poison induced disruption in the way that your neural circuits work And so we should ask ourselves like which neural circuits what brain areas what body areas involved in feeling drunk or inebriated in thinking about the biochemical effects of alcohol and what it's doing to the body what it's doing in all cases is it's consumed into the gut right Goes into the stomach The liver immediately starts this conversion that we talked about before of ethanol to acetyl aldehyde to acetate and some amount of acetyl aldehyde and acetate are making it into the brain it crosses the blood brain barrier Again the brain has this fence around it that we call the blood brain barrier or the BBB Many things Most things thankfully can't pass across the blood brain barrier But alcohol because it's water and fat soluble just cruises right Across this fence and into the milieu the environments of the brain which is made up of a couple different major cell types neurons nerve cells and so called glial cells which are in between the nerve cells And we'll talk

about the effects on each of those soon So what happens when alcohol gets into the brain that makes us feel tipsy or drunk And then some people makes people feel really especially energized and happy Well alcohol is indiscriminate in terms of which brain areas it goes to Again it doesn't bind to particular receptors but it does seem to have a propensity or an affinity for particular brain areas that are involved in certain kinds of thinking and behavior So one of the first things that happens is that there's a slight at least after the first drink or second drink there's a slight suppression in the activity of neurons in the prefrontal cortex This is an area of your Neocortex that's involved in thinking and planning and perhaps above all in suppression of impulsive behavior So if you go to a party and they're serving alcohol and people are consuming drinks what you'll notice is that a few minutes into that party the volume of people's voices will increase And that's because people are simply not paying attention to their voice modulation as other people start speaking more loudly other people are speaking more loudly We've all had this experience right of going to a party and then you step outside for a moment and you go oh my goodness I was shouting You come home the next day you got a sore throat might be that you picked up some sort of bug some virus or something But oftentimes it's just the fact you've been shouting all night just to be heard because as the prefrontal cortex shuts down people stop modulating their their level of speech quite as much I also noticed that people start gesticulating more people start standing up and sitting down more they'll start walking around more If there's music on people might spontaneously start dancing All of this is because these areas of the prefrontal cortex normally are providing what's called top down inhibition They are releasing a neurotransmitter called gaba on to various parts of the brain They're involved in impulsive motor behavior and thought patterns And as you shut down the prefrontal cortex that gabba ergic suppression of impulses starts to be released So people will survey things that they want to say without so much forethought about what they're saying or they might do things that they want to do without really thinking it through quite as much Or they might not even remember thinking it through at all or experience I should say thinking it through it all We haven't talked about blacking out yet in the effects of alcohol on memory But as long as we're there I'll just tell you that alcohol has a very strong effect in suppressing the neural networks that are involved in memory formation and storage This is why oftentimes we forget the events of a night out If we've been drinking one of the more important things to know about the effects of

alcohol in the brain is this disruption in top down inhibition But also that areas of the brain that are involved in flexible behavior sort of considering different options Like I could do a or I could do b I could say this to them or I could say that I could say it in that way or I could say it in this way this might be a little more tactful Those brain areas basically shut down entirely and people just tend to say what they want to say So the key thing to understand is that when people drink the prefrontal cortex and top down inhibition is diminished that is habitual behavior and impulsive behavior starts to increase Now what's interesting is this is true in the short term So after people have one or two maybe three or four drinks but it's also true that the more often that people drink there are changes in the very circuits that underlie habitual and impulsive behavior