

Question 1: How do the effects of Delta-8 THC differ from those of Delta-9 THC (and other THC isomers)? Does it matter if the compound is produced in plants or chemically?

**Nephi
Stella:**

So, to start this to give everybody the current understanding on Delta 8, Delta 10, which I will be comparing to Delta 9, what I'll be saying is based on peer reviewed scientific papers that have been published in the field. The field research has started in the in the sixties, so we have 50 years of really a small number of high quality papers, at least for the time that they were doing these experiments.

So as a pharmacologist, I think about small molecules. So what you're seeing on the deck here is the small molecule. So how does Delta 9 differ from Delta 8? You can see that the it's a very small chemical difference, which has been highlighted here in red by the circle. There's a very small difference in terms of the chemistry. So I think about the molecule and then, I think about how it travels in our body and then how it affects the brain or our body. And most of the time we think in terms of how does affect the body, how does affect the immune system. So we need to understand how the molecule will affect our body. We need to understand how much dose, how much is taken, what kind of what we call formulation is it in the form of a pill? Or is it a liquid and is it through the stomach orally, or through the lungs. That might actually produce differences in the biological effect. Those are the kind of questions that the field is asking to try to understand the differences between all these molecules.

And once we understand how it works, and at the body level, we can even understand how these molecules work at the very small level, at the molecular level. So, this very small molecule will actually interact with a protein, which is called the receptor. And when this molecule interacts with this receptor, just like a key lock, it will open up some biological response, either in the brain or in the body. So those are the kinds of things that are the scientific field. This is what research is trying to understand the differences between all these compounds.

I just wanted to go over the source of these molecules, so cannabinoids or phytocannabinoids produced by the plant and then we can extract it. So that's one way that we can actually get the molecule, or the exact molecule can be synthesized in the laboratory.

Or one could actually invented a new molecule. That's what we actually could be talking about, an artificial molecule.

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

So, in terms of the Pharmacologist, when we try to understand the response, what does this molecule do in our body. In our eyes, whether it's produced by the plant, or with this whether it's produced chemically in the laboratory, if the molecule is 100% pure either from the plant or the lab in most in our perspective, this molecule will produce the same biological effect.

The main cannabinoid compound that has been studied over those 50 years was Delta 9 THC. This is the molecule that is has been legalized and produces some effects on our body that can be differentiated on the brain or on the entire body. Probably 10 or 15 years ago, the field has started to study cannabidiol, or even mixtures of Delta 9 and cannabidiols together and tried to understand what kind of biological response these molecules will produce. Delta 9 THC and cannabidiol produce very different biological responses because they work through very different mechanisms. That's where the field is when we think Delta 9 THC and cannabidiol. We not only think about what effect this molecule will have on the brain, how they will be relaxing or changing your sensation or affecting your ability to move or be alert, but we also think about the side effects of Delta 9, and particularly in the context of the vulnerable population, for example, the adolescents where their body really might actually have some detrimental effects from taking Delta 9 THC. Cannabidiol has a very different profile and have much more medicinal properties that are interesting and still need to be and I think discovered.

What do Delta 8 and Delta 10? The scientific community has not paid much attention to these two molecules. As I said, peer reviewed papers, what is currently available are in the literature are a handful of papers. The main result that they found in the eighties is that the biological activity of Delta 8 is very similar to the biological activity of Delta 9, maybe more mild Delta 9, but maybe a portion of the effect and maybe a different duration. The field has not paid too much attention to Delta 8, because it does almost the same thing as Delta 9 in our initial view of the molecule. When cannabidiol arrived, it produced a completely different biological response. And the scientific field was very interested in trying to understand. The current understanding of the pharmacology between Delta 8 and Delta 10 truly quite open. I had a hard time finding publication, peer reviewed papers on Delta 10.

The field has very limited information that is several decades old on what is the biological activity of Delta 8. I think today we have we have today tools that are in much more precise and we could actually engage into some research to understand a little bit better how it works.

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

Jessica Tonani	It is my understanding a lot of those earlier papers were on medical pediatric patients that may want a less psychotropic event than Delta 9, is that is that kind of a fair assessment?
Nephi Stella	The one paper that I know of was actually differentiating the psychotropic effects. It's actually a really interesting paper from the eighties, because they provide some definition of what psychotropic means, how does it affect your brain? And therefore, they have some definitions, for example, changing your sensory awareness, liking music, relaxation, or even some medical properties like for sleep. They were truly trying to compare the psychotropic effect on the brain of, at least of the one that I know that has been peer reviewed.
David Gang	<p>The second part of the question here is does it matter if it is produced in plants are chemically and I think Nephi did a really good job of describing that if it the same molecule, it really doesn't matter where it comes from. It's the same molecule. But what's interesting is that the plant produces this enzymatically, they have special little proteins. They are like little machines that make certain things, and they only make a certain type of these molecules, kind of like we'd say, the right handed version.</p> <p>There's also another version that's the left handed version that the plant doesn't make. But if you are a chemist, making these in a lab, a lot of times being able to make the left or right handed version is very difficult. And a lot of times you'll get a mixture of both. And this is something we'll talk about in more detail in response to the other questions, but it goes along with this one. If you don't have the ability to control that very well, and you don't have the ability to separate those two versions, you're going to have a mixture of two compounds, one of them will be active. And the other one may have a completely different activity. So, that's important consideration here, is that how it's produced chemically or synthetically in a lab can have a really big impact on what you actually end up with.</p>
Brad Douglass	I wanted to elaborate a bit on what David just said and a bit on what Nephi went into in terms of biological effects. On the hand, we have physiological effects and perhaps psychotropic effects. Another aspect of biological effects is what the body does to a molecule. So those of you that are familiar with pharmacokinetics and pharmacogenomics know that we have metabolism and excretion.

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>And we do have some data on how the body metabolizes Delta 8 THC relative to Delta 9 THC and it's very similar. So you still have the pathway where you have 11 hydroxy compounds to 11 carboxy and it's excreted.</p> <p>And that's a key point when it comes to understanding safety. So that's an important point, considering the relative differences and safety of Delta 8 versus Delta 9</p>
Nick Poolman	<p>I think we've kind of talked about this, but I just want to make sure of what are talking about. For Delta 9 and Delta 8, they each have 4 enantiomers. And we are very specifically talking about one that the plant makes. I mean, correct me if I'm wrong, but I believe we're getting at the three other enantiomers we really know nothing about. Is that a fair statement? (David Gang, Brad Douglass, and Nephi Stella agreed).</p> <p>There are for both Delta 9 and Delta 8 there are two stereo centers, meaning there are two areas in the molecule where, I think David said, there can be right handedness or left handedness. So you can have right-right, right-left, left-right, and left-left. I believe we're talking about left-left, I had to venture a guess there, but anyway the different handedness to the different molecules. That's what I mean, by enantiomers.</p> <p>The plant with the enzymes only makes one set of hands. The other three sets of hands we know nothing about, they do get created chemically if you were trying to make these molecules.</p> <p>But, as far as we know, and as far as the plant is concerned, there is nothing there for us to talk about, meaning that those are the 3 sets the 3 enantiomers and aren't available in the plant.</p>
Amber Wise	<p>I think for the non-chemist here, what the significance there is, it creates different three dimensional shapes for the molecule in the end. So when we draw them on paper, like we see here on the slide, it looks really, really similar, but in three dimensional space, they take up different shapes. That means they bind to our receptors differently and have different activity, which gets back to the biological aspect of it.</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

Jessica Tonani	I think of it like a lock and key kind of mechanism, and you might have a stickier lock or a stickier key. That is the way is the way I think of it.
Brad Douglass	A good example that attendees might be familiar with is the terpene carvone. D-carvone smells like caraway, which is like your right hand, and L-carvone smells like mint. So, it's just a very tangible understanding of how different handedness can affect properties that we sense or that affect us.
David Gang	Another way to think of it is like a hand in glove, if you have a right handed glove and a left handed glove. Like some latex gloves, you can put them on and it doesn't matter, but some work gloves are really designed to go only on one hand. That's kind of like the binding that Nephi said of this receptor, the receptors is kind of like the glove. It's got a certain shape and then the molecules, like the hand that has to fit in there, you can't put a left hand into a right handed glove very well. It doesn't work. And so you don't get the same response. So, all of these are just different ways to think about it.
Question 2: When producing Delta-8 THC, what do and don't we know about byproducts? How are these detected?	
Amber Wise	<p>So, I have a couple different points to make here. These are obviously pretty large questions, but first of all, there are different steps along the pathway to making Delta 8 or Delta 10 or anything. We'll clarify potentially the difference between an artificial molecule, which is completely synthesized from something else versus something that's been extracted from a natural product. And then something that's potentially been extracted and then transformed. So, if I'm going to give what I think is probably the most economical, highly used transformation at the moment, which is converting CBD into Delta 8.</p> <p>The different steps along that pathway are many, and there are many different ways to do every step. So, 1st of all, you have to get the CBD out of the plant material. You could use crude CBD to do the conversion, you could isolate the CBD further, you can have distillate, you can have really pure, pure isolate as you're starting material as the CBD.</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

Then, there's a conversion stuff from CBD to Delta 8. There's a whole bunch of ways you can do that ranging from relatively safe and clean chemistry to things that I don't even want to mention here that I've seen on forums on the Internet in terms of the chemicals that can be utilized to make this transformation. And then, after you make that transformation, you need to generally do some sort of cleanup on the finished product. And there are a number of steps there as well, and so there are any many different ways to accomplish this chemistry. In terms of byproducts, I think of there being two categories, one of them being side reactions and chemistry that didn't go exactly as you think it does. For non-chemists, if you're converting a pot like a whole batch of molecules from one molecule to another, it's not 100% really ever. Sometimes you don't get any conversion. Sometimes you get 50/50 conversion and so the types of chemistry you are doing and how you're doing it creates side reactions and different chemistry from the starting material.

That one kind of byproduct is potentially cannabinoids, but all kinds of other organic molecules that aren't necessarily cannabinoids that come out of these reactions, depending upon the reaction conditions. And then the other type of contaminant or byproduct that I think of are the leftovers from the chemistry steps - the residual solvents, the catalysts, God knows what people are using in the process. Have all of those been removed from the final product? And so to answer, that's sort of the second part is, how are these detected? Well, first of all, the commercial labs in Washington state do not have the ability to identify or separate many of these just cannabinoid compounds, right? If we just talk about the side reaction, chemistries, many of these molecules have the same molecular weight and we're seeing images that they're really similar. So separating these it's very difficult. Its possible scientists can do it. It's very expensive. It's very time consuming, and there aren't a lot of standardized methods or guidance for us to go on.

So, the other thing in that regard is commercial Labs in Washington state can, if they're doing the chemistry correctly, separate and identify Delta 8, Delta 9, and Delta 10. The standard for Delta 10 only just became a commercially available in the last few months so our lab does not currently have a test for Delta 10. It takes weeks to months to develop that kind of thing, but there are labs in Washington that I understand, can detect Delta 10 and separate them.

And we're not even talking about all the other minor cannabinoids and other side reactions that could be seen as some of these molecules, and so without diving too much into it, if you're not doing your separation very well, you can get these molecules together.

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>And so, one piece that looks like Delta 8 might actually be a combination of Delta 9 or some other side reaction products. So there's a lot of complicated chemistry involved with the detection part.</p> <p>There's just a number of different ways to go from the starting plant material to a final product, and many people are potentially doing this in a clean and safe and correct way using trained chemists and many people. I'm sure particularly the unregulated market is doing this in garages and using Internet forums as instructions, and we're getting God knows what out as a product on the other side. So, it's a spectrum, I think of potential outcomes that we're seeing. Well, I think I'll leave it there.</p>
Jessica Tonani	<p>Somebody told me an analogy on a panel I was on a while back about cooking eggs, scrambled eggs. Some people are really good at scrambling eggs, but other people can take the same eggs and make something horrible. And so from a chemistry perspective, I like to think of it as people having different quality in their production. Everybody doesn't make the same product if they're given the same eggs s. If that makes sense.</p>
Amber Wise	<p>Absolutely, and even the way that you extract say, we're talking about extracting CBD from the plant material first and then using that product as you're starting material. When you extract using CO2 or ethanol or butane, you get different groups of dominant molecules and so then you're starting material is different. Then somebody who might take that crude and then isolate the CBD into something really pure to start the product or the reaction from. And so, if you start with a crude mixture using one extraction method, or if you start with a more pure mixture, you're going to end up with very different end products. And then there's other clean up steps from there. Every time you do a step, there are multiple pathways that you can take. And I saw a reference, have not had a chance to look it up, but somebody put a paper out recently from, I believe as a government lab, that had ways that you could, like a forensics lab, could detect the byproducts that are in a particular product and figure out the chemistry they used to make that product. So if you're using battery acid, instead of trichloroacetic acid, you would get different dominant end products or different contaminants in the end to mixture. And so there are ways that people can investigate this stuff, but it's very time consuming. It's very high end, chemistry, it's very expensive. So,</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>your average lab that is designed to test flower or concentrate for a specific set of molecules in a very prescribed way, because we have accreditation to do it a specific way, can't just all of a sudden change up our chemistry to see these molecules that we have yet to even necessarily identify very well.</p>
David Gang	<p>I think I'd like to add something to that. I know we're talking about the science, we're not talking about policy, but one of the things that I think everybody is on the same page with, and that as safety's important. And we're going to have to deal with how we make policies around safety, but from the scientific perspective, what is a safe mixture? What is the safe product? How do you know that you have something that's actually safe? That's one of the things that's actually quite difficult to understand and figure out in a lot of times. Maybe another analogy, we're doing lots of analogies today. So I'll throw out another one. And this goes along with whatever you said, and that is, how do you detect and how do you measure what we have, and she mentioned that the fact that we have certain standard methods for measuring cannabinoids in the state lab, the state accredited labs. And it is kind of like the technology there, it's good, solid, robust technology. It works, but it's also very limited in what it can tell you. A good comparison would be kind of like a TV set from the seventies, which gives you an image, it's like a 20 inch screen and gives you a resolution of about 200 by 100, something like that. It's great for watching shows like I Love Lucy or CHIPS or whatever else. These TV shows were designed for that. But now imagine you're trying to go if you go into Costco today, and you see these 8K ultra HD televisions, and you can stand there and watch somebody doing one of these base jump flights through the fjords in Norway and you can see the details of the flowers as they fly by them.</p> <p>The TV is so amazing in detail and how much they can see. And how much you could image with those. But now take that same base jump flight and put it on that old TV. What are you going to see? Well, you'll see that. There's mountains there and you'll see that. Somebody's kind of flying along right now. So, you know, what's going on, you know, it's there, but all of those details, you just can't see them.</p> <p>And that's kind of like the technology that we're dealing with too, is that if you want to find out what those problem compounds might be, what the safety issues might be, because you've got interesting, from a chemist perspective, interesting chemistry going on that doesn't give you the product you want and gives you side reactions if you don't have the ability to see those. You're not going to know they're there and from a user's perspective, somebody out in the community, somebody may say I've got this certificate analysis that says, here's my, you know, we looked at twelve cannabinoids, here's the levels of these. We</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>looked at a bunch of terpenoids, here's a level of these. Therefore, you know, that what you're looking at or taking is safe. But that's like, looking at it through that seventies TV set, right? There may be other things in there that you just cannot see with that type of analysis that may or may not have a safety impact on the person that's going to be using whatever that product is.</p> <p>And that's an important thing to think about here. Right? It doesn't mean that that technology's bad. It's not it's good. It's very useful, but there are other technologies that was mentioned earlier. It's very expensive and very time consuming to get that 8 K resolution. So that's one of the reasons why we don't do that, typically. And for a lot of reasons, you don't need it, but if you're really looking at trying to understand in detail what's really going on, especially when somebody's doing these interesting chemical transformations that are never talked about. If you don't know what went in, how are you going to know what came out? Only if you have the forensic technology she talked about, they have those fancy instruments to do that, but it's not something they can do in a CSI episode. It doesn't take 30 minutes. It takes days.</p>
Jessica Tonani	<p>Well, I think the other thing David is you end up with a lot of known unknowns like you'll see things, you won't know them when you use that technology, more details on that.</p> <p>There are standards that we have. If we're told that we have to find a red car, we have what a red car looks like, but we might not know what a blue car looks like if we don't have a standard for what the color blue. The standards are important and I think the more detailed the chemistry gets harder for us to actually have standards to tell us. We know something's there. They just not know what it is.</p>
Amber Wise	<p>Oh, I was going to clarify. It was one of the points. I actually sort of skipped over my first points. But when we're talking about, what is safe or what is not safe. What do we test for? We're talking a lot about cannabinoid tests. Which is one, there are metals tests, which is a completely separate prep and analysis and instrument. There are residual solvents, which is a completely different set of tests and prep, there are other types of molecules that we don't often talk about in the cannabis realm, phytochemicals, side reactions. What assay do we use? What molecules do we look for? That's almost endless. So it starts to get complicated quickly and I don't want it to overwhelm people, but I do want people to understand that</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>it's not like CSI. You can't just put something in a machine and get a safe answer out the other end. It's not that simple.</p>
Brad Douglass	<p>I think it's worth raising the concept of an ingredient standard. So, ingredient standard is different than an analytical standard. The analytical standard is your pure compound you use that to develop your methods and test for something in an unknown. An ingredient standard is something that has been used by food regulators for some time to set specifications on what an ingredient can have in it, its purity, and what it can't have it. A good example. Would be vanilla and.</p> <p>Their standards for vanillin and whatever you use it in, say, a cream soda or a candy, but the vanillin you use, wherever you get it from, has to be of a certain purity. They can't can only have a certain level of residual solvents.</p> <p>And there might be some byproducts of vanilla production that can't be included in there. And that's been used as a pragmatic way to address this issue.</p> <p>We can't always know what all the unknowns are, but if we can have reasonable, certainly about the things that we don't want to include or that present a potential safety issue or, you know, present a purity problem.</p> <p>Those standards can be developed and have been developed for, for decades in the food industry.</p>
Jessica Tonani	<p>I think you're right. That's right. I was going to say, kind of gets back the scrambled egg situation. If the scrambled eggs are good enough, there may be a metric that which you say a product needs a certain standard.</p>
Brad Douglass	<p>Right. Think of an over easy egg, an over easy egg has to be runny enough, but if it's too runny, it doesn't meet the criteria for an over easy egg.</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

Nephi Stella	<p>I wanted to add a little bit more discussion about the, I don't want to be the voice of the concern, but just to think about the potential toxicity let's revisit how the history has dealt with that. In the past decades ago, individuals were mainly using cannabis based products, which were pretty moderately high in the amount of THC and toxicity. We always have to think about what is the dose, how much is taken so it is true that today, because of the Delta 9 THC compounds that have increased in their concentration, there's new questions about the safety profile of this higher concentration, and that's for Delta 9. For CBD turns out because of the widespread use of all these products, it looks like just by public experiments, it looks like the CBD product is actually quite safe. I haven't really heard too many horror stories. However, I remember even now, but 10, 15 years ago, when synthetic cannabinoids, or I would say, probably artificial cannabinoid molecules that are very potent, very strong, were synthesized in the laboratory and give rise to products like Spice or K2. And that's a completely new molecule quite different actually than Delta 9. But an artificial, completely new molecule and then when these individuals were starting to use high doses of these molecules, we discovered new toxicity profiles, people that would go to the emergency room with some renal failures, individuals that would undergo seizures. And that was the toxicity profile that was linked to a completely new molecule that was starting to be used by individuals.</p> <p>So, in this case, when we start thinking about Delta 8, and now we understand that there's 4 different types, maybe, and we've studied maybe only 1, we are actually encountering again this new situation where we don't know what the toxicity profile is of these other Delta 8 or Delta 10 molecules. I hope they'll be safe, but until we actually do the testing, we will not know. So I just wanted to emphasize this view of not only we need to be able to quantify the amount of molecules, but we need to monitor how individuals are responding to this new molecule that really has never been tested before. I just wanted to add that point to the discussion.</p>
Question 3: What amount of commercially-available (produced and sold) Delta-8 THC is produced from cannabidiol (CBD) relative to the amount that is simply extracted from the cannabis plant?	
Brad Douglass	<p>Let's start by recognizing that it's impossible to know all the details of where the Delta 8 THC that's bought and sold is coming from in today's market. And I have some insight on how some people are producing Delta 8 or extracting Delta 8, giving you my opinion. I wanted to share a bit of an economic argument here or some economic information. So, between the two, so Delta 8 THC that's produced from cannabidiol or</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>CBD, or Delta 8 THC that's extracted from the cannabis plant whether marijuana or hemp, it makes no difference here. If you produce Delta 8 THC from CBD, you're starting with a starting material that costs less than 500 dollars a kilo. But with reagents, you're producing Delta 8 THC for a cost less than a 1000 dollars a kilo.</p> <p>When it comes to Delta 8's natural abundance in cannabis and hemp plants, usually you're looking at when it's detected at a weight percent less than 0.1%. There have been some reports that it can be found on cannabis up to 1%, but even if you're trying to extract and purify an ingredient like Delta 8 THC from cannabis at 1%, the cost of production is significantly more than if producing it from CBD.</p> <p>So, to me, that indicates, and this is what some of my insight about the industry tells me is that most, if not all of the Delta 8 thc, at least from these two avenues, most is coming from hemp or hemp CBD, and we'll leave other potential routes from Delta 9 or from yeast production out of it for these purpose. For this question, that's how I understand the market.</p>
Jessica Tonani	And Brad, just one point around it is that in general hemp is much lower price to produce higher amounts of CBN just because it's a little less, or substantially less, regulated. And so the costs are lower and the production field sizes are larger. Is that fair?
Brad Douglass	That's fair. And I think that's another important point. There's a reason that Delta 8 THC has really mushroomed recently and that's partly because hemp has become less expensive. CBD from hemp has become less expensive and more prevalent, more of it is sitting around. So the two are related, partly because of this.
David Gang	The Delta 8 THC produced from cannabidiol, is that going to be, to use the language you heard earlier, is that going to be the left THC version? The left right version? Right right version, the left right? You know what I'm saying? Is it a pure form? Or is it a mixture?

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

Brad Douglass	<p>That's a great question here. Well, we look at the chemistry, so the chemistry of producing Delta 8 THC from CBD involves at least a ring closure step. So being something that doesn't have stereo chemistry at those stereogenic centers, and you're creating it.</p> <p>So I don't have analytical data on the stereo selectivity of THC, Delta 8 THC produced from CBD. But what I know about that chemistry is that you're likely to be producing a mixture of different isomers.</p> <p>So, it's very unlikely, and I'm not aware of any processes that allow you to be stereo selective in producing the right handed molecule exclusively.</p>
David Gang	<p>Yeah, that was my understanding too. I wanted to make sure I was clear on that. I, I've looked at the paper, the technology that I have. I think is being used to produce it from CBD is relatively inexpensive, compared to other technologies that could be used. And of course, that makes sense. Right? Economics is going to drive this. So, it's basically a dilute acid solution and it's something pretty cheap to get access to. But it's also, like you said, it's not selective at all. So you end up with something that from my perspective should have been a mixture. I just wanted to make sure that I was clear on that.</p>
Brad Douglass	<p>Another point about the chemistry there that's probably important to share is that even if you've seen Delta 8 THC from CBD through Delta 9 THC, the isomerization process also can scramble stereochemistry, so to speak. That's another part there in terms of the stereochemistry.</p>
Jessica Tonani	<p>Brad, you also brought up the weight volume in a plant and I think there is a conception out there that it's maybe possible to genetically modify the plants or selectively breed plants in some way to create plants that produce large amounts of Delta 8, but I don't know a way. My understanding is most of it is not necessarily dictated by the genes of the plant, but it's actually conversion of Delta 9, post production of Delta 9. Is that a fair assumption that it really is not the plants are producing Delta 8, the plants producing Delta 9 that then isomerized into Delta 8.</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

Brad Douglass	You know, more about this than I did do Jessica, but what we do know is that Delta 8 has been reported to be found on cannabis samples right? It's unclear whether the plant, particularly THC-A synthase, makes Delta 8 THC acid. What we do know is that it has been found on some plants, how it got there, maybe it is produced by the plant, you know that better than I do or maybe it was just a process of isomerization occurring on the plant or through drying or processing.
Jessica Tonani	I think the fact that we haven't been able to really identify plants that produce high levels of it leans towards the post Delta 9 synthesis, but I might be proven wrong on that long term.
David Gang	One thing I can say to that, too is we've been analyzing a number of hemp samples over the last couple of years. And we have standards for Delta 8 on our technology on the HVLC technology that we use, we use both that technology as well as LCMS so a little bit higher resolution. We never have detected Delta 8 in any of the hemp samples that we've looked at. You see, Delta 9, you know, there are always below the regulatory limit with the samples we've been handed, so THC levels are low in general. The delta 9 levels are low. So, if Delta 8 is produced by that enzyme at a very, very small fraction, it may just be way below a level that's detectable. Or it could be what you said, Jessica, is very possible that if it is detected in the plant material, that it is due to some kind of processing after the fact.
Nick Poolman	<p>So, this question assumes that Delta 8 has some production within the cannabis plant. Let's say, let's make the assumption that Delta 8 can get there. Probably not isomatically, but get there to some degree right?</p> <p>I think part of the question is asking, do you in any of your experiences, do you think anybody is just separating, isolating Delta 8 out of a cannabis, have marijuana plants instead of doing a further chemical rearrangement?</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

Jessica Tonani	I think the economics from what we've seen and the plant, and somebody just made a comment, and that the plant really doesn't only make the acids, which is correct. I think we're looking at the Delta 8. We've never seen it in high enough levels, we have a plant diversity library. I think Brad, I don't know how many tens of thousands of samples that you guys have run and. You said 1% level from a processing perspective, that getting out 1% is very, very pricey. I don't know Brad. You how many samples do you guys have seen it?
Brad Douglass	To reiterate when you do see it if you see it, it's much lower than 1% down to less than point 0.1% in cases. And even at 1%, you're absolutely correct Jessica, the economics of trying to extract that and purify that from other compounds that are similar to it is it's certainly not competitive with producing it from CBD economically.
David Gang	Brad when you measure it at that close to 1% level, what's the relative level of the Delta 9? In those same samples, do you have any recollection of that?
Brad Douglass	Yeah, relative and I won't put percentages on it, but usually much more orders of magnitude.
David Gang	So these are going to be in high THC strains that are going to be a bit that you're looking at, in order to see it at that level right?

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

Brad Douglass	Right and if you look at those, there's only a few instances where Delta 8 has been reported in the literature as being found in cannabis plant samples and in those the same holds true that it's found alongside of Delta 9 and in much smaller quantities.
Jessica Tonani	And I've heard urban legends, I don't know if these are true, but that some of those samples with higher levels may have had fire retardant or potentially different things potentially put on them. I don't know if that's urban legend or not, you never know. Total rumor mill that I've heard is some of them were maybe some of the Humboldt fires and different things like that. And I don't know.
Question 4: From a chemist's perspective, what does "synthetic" mean? How does this differ from "artificial"?	
David Gang	<p>This has already been actually addressed a little bit in some of the previous comments. So I think maybe I can kind of summarize that. I think I'll start with what artificial means. And that is something that's completely new. So we heard that from Nephi talking about Spice and other compounds that they, they bind to the cannabinoid receptor, but they're not related at all structurally to the phytocannabinoids, they are different types of molecules. So they have a similar effect, but it came from a different place. And they are usually, I mean, if it's artificial, it means it comes from starting building blocks that are completely different from what's found in nature. Synthetic can mean something that is made in the lab. Okay, so you can have, for example, that vanilla example, we had earlier vanillin is of the flavor of vanilla it's produced by the vanilla orchid. And you can extract it using alcohol from the vanilla bean. Or you can put your vanilla bean when you're making your crème brûlée or whatever, and you get this nice vanilla and added to your food you are interested in eating and that's the natural form of it. You can also produce vanillin by taking lignin that you extract out of trees.</p> <p>And go through some chemical processes and you end up with exactly the same molecule. It's still vanillin, but that's now a synthetic version because it didn't come from the what? We would consider the natural source. It didn't come from the vanilla bean.</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>Okay, it came from somewhere else. It came from some other molecule, but it's still the same exact molecule. An example of an artificial molecule would be something that would taste kind of like vanilla, but be a completely different compound.</p> <p>Another way to think about this would be sweeteners. People are pretty familiar with sweeteners. Right? We're all familiar with sugar.</p> <p>You know, sucrose, that's the sugar, the table sugar that we, all use. There are artificial. There are some natural sources for that. You can get sugar from sugarcane. There are artificial sources where you could actually take petroleum and you could use petroleum to synthesize sucrose if you really wanted to.</p> <p>I don't know why you would, because be pretty expensive compared to how cheap it is to get it naturally, but you could do that. And then there's this stuff called Splenda, which is a completely different molecule, but it's also sweet. So, it has some of the properties that we think are important for being a sweetener. But it's not natural. It's an artificial molecule. It's never found in nature. It's completely new.</p> <p>It just happens to have some of the same kind of functions. Red food colorings are the same there, there natural red food colorings that come from beets, some of them come from beetles from the Andes and some of them are made in the lab that are not natural that are completely artificial that are different structures, but they give you the red.</p> <p>And I think with the cannabinoids is the same kind of thing is, do you have something that is the same molecule that's found in the plant that you make it a lab, that would be synthetic, or is it something that binds to the receptor? It has a similar kind of function in the body, but it's a completely different molecule and was made up in the labs from scratch, that would be something that would be artificial. I hope that's a good explanation for the differences.</p>
Nephi Stella	Maybe I can, I can add to that. So if we come back to the analogy of the hands. Do I understand that there's only 1 Delta 8 THC that is produced by the plant and then the other Delta 8 THC that have other

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>confirmations actually, are they produced by the plant? Or are they only produced in the lab sympathetically, and therefore they would be artificial. Be good to know.</p>
David Gang	<p>Right, That's a really good question. I think the answer to that question is, we don't know. Nobody has really looked in great detail to try to find those other molecules to be honest with you. So they might exist in the plant. They might not. Based on what we know biochemically of how those cannabinoids, how they are produced in the plant, how the enzyme functions and how specific it is. And how it only makes 1 version 1 handed version of everything, it's very unlikely that that process leads to the opposite handed version. Very, very unlikely. Is it possible that there's another set of enzymes that we just don't know about yet that are present at really low levels?</p> <p>Maybe, they have not been identified yet and based on our knowledge of the sequence, the genome sequence, you know what? We have an idea of what the genes that are in there and what could be the enzymes it could be there. There's nothing that looks like one of those. So, maybe there's a completely different system to make those at very low levels. We've never detected or maybe they just don't exist. But until somebody really looks in detail and characterizes everything in the plant, we probably won't know but I think the assumption is, at this point, it's very unlikely that the other ones are made naturally.</p>
Brad Douglass	<p>And I think that's a great answer. David. I might have a question for you in the industry and, I mean, the larger food industry, often hear phrases like nature, identical or lab grown, referring to ingredients that are synthetically produced, but are not artificial. How do you as a plant biologist think about phrases like that?</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

David Gang	<p>Oh, that's a good point. I mean, actually a really good example of that is citric acid. So, citric acid is a tart compound that comes from citrus originally. That's where it got his name. It's also present in regular metabolism in all organisms. It's in everything.</p> <p>And it's, but it's present high level in citrus fruit, and that's why we identified it from there. But citric acid is added to lots of different foods for lots of different purposes. It's added for a tartening agent. It's also has some anti-microbial properties at some level. So, it's also added as a kind of a natural food preservative for certain types of foods when it's appropriate, but we don't get it from citrus fruits anymore. It's all made in vats by yeast in a lab, that's where it all comes from now because it's a lot cheaper and easier to make it that way than it is to try to extract it out of citrus fruits at this point. So it's the same exact molecule. And I don't know if I really answer your question with that example I hope I hope it helps a little bit, but it's, you know, you end up with the same thing, but you can get it from a different source.</p>
Brad Douglass	<p>I think it's a great answer.</p>
David Gang	<p>I'll add one more thing to meet to be clear on this, the phytocannabinoids that we're talking about, tetrahydrocannabinols et cetera, cannabiniol. They are restricted to a very limited set of plants, and to our knowledge, that's like, one plant that's the cannabis sativa species right now as far as we know other plants do not make these molecules.</p> <p>Very limited production, very limited distribution on this planet to that 1 species as far as we know. Maybe that other plants make them at low levels. We haven't found it. Yet. People have actually looked they've never found it yet. To our knowledge, this is a kind of a unique set of compounds.</p>
Nick Poolman	<p>David brought up the term phytocannabinoids, which hasn't been used recently in this panel but I think is a great term.</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>I'll ask him a two-part question. Is it fair to assume that both Delta 9 THCA and Delta 9 THC are considered phytocannabinoids and would you consider Delta 8 a phytocannabinoid?</p>
David Gang	<p>If you're asking me, I say the answer is yes, cannabidiol is also a phytocannabinoid. There's a whole set, there's over 100 of these compounds we know about that all fit in the same general class.</p> <p>They have similar structure, they're not identical, but they're similar. They're put together from the same general building blocks and they're very similar in how they're produced. And they belong in the same class. They and some of them not all of them. Some of them bind to that cannabinoid receptors Nephi mentioned earlier. There's also a group of compounds called endocannabinoids which are produced in human brain, and also in other parts of our body, completely different structural class of compounds, but those also bind to those receptors in the body. And that's one of the reasons why the phytocannabinoids are active. Right? Those are natural. The endocannabinoids are something and maybe Nephi can go into a little more detail here if needed. But they're are a group of compounds that are that the human body and animal bodies used to help regulate certain processes, like sensing pain and other things like that. And the phytocannabinoids are molecules that this one plant produces that can bind to that same receptor. That's why they have the same general name of phytocannabinoid, but they're different classes of compounds. That's why I like to use the word phytocannabinoid because it is the specific class of compounds.</p>
Nephi Stella	<p>I like the word phytocannabinoid a lot too, and I think about it, just like what was said is produced by this plant.</p> <p>And if there's maybe used to be 60 that we had 10 years ago, it sounds like now we've moved on to 100 phytocannabinoids as we develop new technology we discover new ones. But it's not because we have 100 phytocannabinoids that they all produce biological effects. Actually, from the current understanding, the main ones are Delta 9 THC and cannabidiol and the, there's some evidence that cannabidiol cannot be (inaudible) might also have some biological activity, but the field thinks about phytocannabinoids In in terms of their biological activity, there's maybe a handful of cannabinoids that are actually doing something and other ones would not produce strong biological effect if again, if you use that very high dose, maybe there might be some effects, but not that we know of right now.</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

<p>Jessica Tonani</p>	<p>Nephi, you brought up a good point that's worth noting is that different compounds can have different biological effects, certain things you could take a dot of them and die and other ones, you could consume your body weight in and be fine. And that gets kind in to the toxicology of the different compounds. And also the efficacy of whatever effect we're looking for from a compound. The amount of person needs to take may be very different, which I think it's an important point.</p>
<p>Nephi Stella</p>	<p>Very true. Pretty much everything taken at very high dose becomes toxic. It's all about moderation. The analogy for the is endogenous cannabinoids that I use often is it it's similar to the opioid system where you have the opioids that we take as medications as painkillers, but our body also produces endorphins. And the role of endorphins is to control our pain level. For example, running is painful and therefore our body produces endorphins so that we can manage the pain while we run and we get a little bit addicted to running because we like the endogenous endorphins working. So our body produces, and what morphine does, for example, is hijacks the system.</p> <p>So, in the field of research, when we wanted to understand what is the biological role of the endocannabinoids, those molecules that we produce in our body, we think about well, what does the molecule do? Delta 9 THC for example? Well, it enhances sensory awareness. Maybe one of them (inaudible), or it reduces pain so, maybe one of the functions of these endocannabinoids that we produce in our body, actually, it's not maybe, the function of these endocannabinoids that we produce in our body is to control pain and those phytocannabinoids, what they do is they hijack this system, they add more painkilling properties, so that's a parallel for somebody who wants to understand a little bit, endocannabinoids that are produced by our body. Their function is quite similar to what the cannabinoids are doing.</p>
<p>Brad Douglass</p>	<p>So, I might add, if we're not running out of time, there is a good question that came in from the audience and maybe I can help speed along the next question when we get to it but it's relevant here. Gregory Foster asked, Is the synthetic cannabinoid laws that we have on the books in different states and federally, is that more rapidly described as artificial cannabinoids rather than synthetic cannabinoids? And the general answer to that is yes, largely things like Spice and K2 are artificial, they're not found in nature, not</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>produced by a cannabis plant. So these laws are better probably referred to as artificial cannabinoid laws, but there's history there why they are called synthetic but I think you're absolutely right.</p>
<p>Question 5: Are temperature changes and solvent-use unique to extraction and processing of cannabis or are they used for other extracting and processing other plants?</p>	
<p>Brad Douglass</p>	<p>I'll try to be concise. I think the short answer is no, that temperature changes and solvent use are not unique to extraction or processing cannabis. In fact, these processes are used ubiquitously throughout the plant and food processing world. Temperature changes can be something as simple as pasteurization. Solvent use, generally all the flavors, at least the natural flavors we have in commerce have been extracted by some solvent, whether that solvent is something you think of, like a hydrocarbon or even something like super critical CO2. It's still a solvent and I think that that's key. There's certain aspects certain manufacturing functions that are apply to cannabis that are found all over the place and some of these can actually impart chemical changes. So we're familiar with cannabis that increasing temperature or adding heat can take your cannabinoid acids and decarboxylate those to your neutral cannabinoids.</p> <p>Similar things happen. If you look at oregano, it's a good example. Just by drying oregano it decarboxylates. If you've ever noticed the difference in smell between fresh oregano and dried oregano that's what's happening there. There's other good examples where you're having chemical changes occur based on some of these temperature solvent changes, kind of approaches and processing. Other chemical alterations that occur with both processing methods. Current through fermentation that is chemistry that's going on there so I'll stop there but I think the point is to underline that temperature changes, PH changes is another, solvent use. These are found everywhere in the food botanical processing world.</p>
<p>David Gang</p>	<p>I don't have anything to add. I thought Brad did a great job answering that one.</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

Participant Question and Answer Session	
Participant Question 1	
Michael Goodman	What does MALC stand for?
Kathy Hoffman	I think what he's asking is behind my name in the opening slide masters and public administration, and a master of arts and leadership and change, I think that's what he is looking at.
Participant Question 2	
Brendan Jeffrey	Are you saying stereo chemistry of these molecules is unlikely to affect the user experience or safety questions, or are you saying lab synthesized THC molecules are not (unintelligible). do you have concerns over cannabinoids stereo chemistry?
Brad Douglass	I think what we're saying Brendan is that we don't know, we don't have much knowledge as a scientific or toxicological enterprise about what some of these other enantiomers or stereoisomers do. There's some indications that they may proceed through similar metabolic routes. But we're unsure at this stage, and I think what I was trying to describe with the chemistry is that you are likely producing a mixture of isomers. So, it's unclear whether it's a (unintelligible) mixture where you're getting 50 - 50 mixes. But since we have multiple stereoisomers in here, it's not just enantiomers, it's likely you're seeing some of those, but again, we don't have good data on that.
David Gang	I guess the other thing I would add is even though we don't have data on that, based on what we know about molecules like this that are, it's not a very complex molecule, but it's also not a very simple molecule. So it's kind of relatively complex. When these are produced by plants or other organisms, and then taken up by some other organism, like a human, the right and the left handed versions tend to have

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>different properties. The example we heard earlier about smell of different compounds, carvone, right? Plus and minus version or different smells, it would be very unusual for the molecules that have very different shapes, I mean, a left and right hand, they look similar, but they're not the same. They're very different, actually. They don't do the same things. And so it would be very unusual for them to not have some kind of different activity in the body. Now, what does that mean for safety at this point? We don't know. We don't know of that. One of them may be just not active at all. One may be active, the other one's inactive. That's one possible example of what could happen, there's some examples of that from nature that we know about as well where the body just kind of ignores it or secretes it and it doesn't really impact you at all if you eat it. But there are, it could be that there could be a possible negative effect. The answer, like Brad said, we just don't know at this point. But both of those options are on the table right now with what we do now.</p>
<p>Nephi Stella</p>	<p>And maybe just to add to what David just said, because I agree completely what he was saying, it's always also a question of the dose how much compound is taken, maybe small doses will not have much toxicity, but high doses might so it depends on the product also.</p> <p>A touch of optimism - we have the scientific tools now to actually try to start studying these questions. And we should probably start studying them quickly if they are making Delta 8 THC that are making their way into people's hands and, and they're consuming them. We do have some scientific means to study in advance if there are some toxicity associated with these compounds.</p>
<p>Participant Question 3</p>	
<p>Ryan Takahasi</p>	<p>What is the LCB agency going to do to protect the cannabis industry, more specifically the producers who produce biomass, specific for making Delta 9 RSO or distillate. The nonspecific distillate has been a staple for this industry.</p>
<p>Kathy Hoffman</p>	<p>I guess I would agree that is a policy question, and we are here today to ask questions to our panelists about cannabis plant chemistry. We are happy to take the question at another time, but at this point, if you</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	do have a question about cannabis plant chemistry for our panelists, now's the time to ask it. So we'll, we'll circle back to that question, perhaps during the rule development process.
Participant Question 4	
Jeff Wilhoit	Question for Amber Wise: What would you consider to be safe methods people are using to make Delta 8? What chemicals are used? Are there any methods that use LCB approved solvents?
Amber Wise	I'm certainly not going to say what I think is safe or not and I honestly don't know all of the varieties of chemistry people are using out there, but the LCB approved solvents are potentially possible. I think it's a little unclear to me. And maybe this is already clearly laid out on the rules, but is of Liquid wash considered a solvent, because there's a lot of different chemicals that can get introduced in the cleanup processes or separation processes that aren't necessarily considered extraction solvents, but could linger in the final product. And it's not necessarily, I mean, certainly this is a worker safety issue potentially, if the chemicals and processes involved are not being done safely and correctly. But also the cleanup steps ultimately are more important to me than the synthetic route to get there. And how are you separating out those final products? Help here? Are they, and what's left behind? I think I'll just leave it there.
Participant Question 5	
Rusty Sutterlin	Is decarboxylation considered a synthesis?
Brad Douglass	I think in discussions that we had as panelists before we came on for this deliberative dialogue, we had discussed this point, which is, is there a dividing line between chemically altered, and something that's the product of synthesis and I think as a collective recognizing here from Rusty that there are full processes that are used in food production, that chemically alter products, so you are doing chemistry, but is that a product of synthesis? Probably not.

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	I think the key is trying to define that dividing line and is something a product of synthesis and when is something a product of processing. Like, for example, decarboxylation, that's chemically altering a cannabinoid acid, but is that synthesis? Probably not and that's, I think one of the challenges in regulating not only Delta 8 THC, but other cannabinoids is understanding where that dividing line exists.
Jessica Tonani	Right, I think you're completely right in the sense that it makes it from a regulatory, science isn't black and white. There's a lot of (unintelligible) that makes it a little bit interesting for the regulatory perspective and, and we're not here about regulatory, but the science isn't crystal clear if that makes sense.
Brad Douglass	That's a good point. Jessica, I'm a synthetic chemist right? So, if you ask me what the synthesis entail, sure, this is your decarboxalate and that's a synthetic step. I mean, it's a decomposition step, but it's a, it's a chemical step. It's part of my synthesis. In other cases if I'm just adding heat, then that's not intentional synthesis. There's no bright line answer here, just a lot of challenges in defining it. Even from a scientific standpoint, as you mentioned, yes.
Participant Question 6	
Claire Stenersen	Could you clarify for the more common cannabinoids, THC and CBD as an example, are there only one-handed naturally occurring molecules? So other-handed CBD would be considered artificial, possibly?
Nephi Stella	I think this is along the lines of the question that I had to David. Maybe you can summarize what you said again, David?
David Gang	I think the answer there is that, so follow that analogy of hands and gloves if you're talking right handed gloves. If all you find in nature is a right handed glove and you look all over the world and all you pick up

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>are right handed of gloves. And then somebody shows up and said, Here's a left handed one. Where did that one come from? Well, it could be that you just didn't look hard enough and it does exist in nature. We just don't know yet that it exists in nature or it could be that they made an artificial glove, an artificial left hand in glove and it's different. Right? So, until it's been identified in a natural source, if it's never been identified in the natural source, then it would be considered artificial. But once it's found in a natural source is no longer really considered artificial. It would be, I mean, maybe it was synthesized earlier, but if it is the same exact molecule, and it's in a natural source, then it is a natural molecule. It's no longer will no longer be considered artificial.</p>
<p>Brad Douglass</p>	<p>I can maybe add a bit to that as well. I think also the question I was asking, Are there different stereochemistry concerns, depending on the cannabinoid, and the answer is yes, so CBD, THC, they all have two stereogenic centers at the 6,7,8 positions. There's other cannabinoids like CBN that don't have stereochemistry or stereo centers in those positions, they have other concerns like systrans isomerisms. But I guess my point is that there are different stereo chemical concerns for different cannabinoids.</p>
<p>Participant Question 7</p>	
<p>Greg Foster</p>	<p>This explanation of artificial versus synthetic is very useful and seems to indicate that the law on synthetic cannabinoids, examples Spice or K2, was actually about artificial cannabinoids.</p>
<p>Jessica Tonani</p>	<p>I think Brad did a good job of explaining this. I don't know if anyone else has any other comments.</p>
<p>David Gang</p>	<p>I thought I had after I saw that question, pop up, is that it is possible to make a synthetic Delta 9 THC if you don't extract it from the plant, but you make it in a lab. And my understanding, like we said, we're not talking policy here but my understanding from the law is a lot of cases, the way it's worded is that the cannabinoids are defined as being extracted from the cannabis sativa plant, right, so if you don't, there's a possibility, if the law is only defining cannabinoids that are regulated in that way that they're extracted from the plant, then somebody could make them artificially in the lab or synthetically in the lab and end up with</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>the same molecule, which case is no longer an artificial molecules is the synthetic version, but they could potentially skirt the law by doing that. And the law was written in a way so they can't do that. That's why synthetic is used in the lot from my understanding. And so Delta 9 THC is Delta 9 THC, whether you get it from a plant or you make it from other molecules in the lab, at least from the regulatory perspective. My understanding that, like I said, whether we're not really talking about how those decisions were made, but that's just my understanding. I don't know if anybody could correct me on that, f that makes sense.</p>
Nephi Stella	<p>I just want to add having had a schedule 1 license, federal schedule 1 license for 20 years at the University of Washington and receiving cannabinoid compounds from NIH to do our research, the definition of cannabinoids is two fold and that, I think is where the challenge is. The first definition is because it's produced by the cannabis plant and therefore those hundred phytocannabinoids are regulated as the schedule 1 compounds. But there's additional cannabinoids that are added to that definition. And those are for example the cannabinoids that are in Spice, JWH 0118 is the synthetic compound and those are on schedule 1, federal license, because, not because they're produced from the plant, but because they produce psychotropic effects. They have the activity of cannabinoids. So, at least at the federal level on the schedule 1 license list of we have these phytocannabinoids as an ensemble. Maybe 10% of them that are bioactive, then these other cannabinoids that are synthetic, and they are artificial, and they produce very strong cannabinoid mimetic effects. So, I think this is where the ambiguity, is that whether there needs to be some thought of how to define these compounds, not only by either chemical structure, but probably a more challenging definition by their biological activity.</p>
Jessica Tonani	<p>I think you're right Nephi. To just add a little bit more complication to the issue of synthetic THC, dronabinol, I think is scheduled 3 as a prescription. So, you know, when you look at, when you look at this, we have prescriptions, we have plants, we have others. From the regulatory perspective, there's very different tracks that have kind of all collided making it really complicated. And the science doesn't always follow the policy, or the policy follow the science, I'm not really sure which way. But it complicates it.</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

Participant Question 8	
Brooke Davies	You had mentioned that our current lab technology is limited and made a comparison to an old TV, preventing the lab from seeing the full details or purity of these types of products. Do the same issues you reference exist for I-502 products derived or extracted from the cannabis plant exist currently on the adult use market? And she clarified that when she said cannabis plant, she means plants grown within I-502 with more than point 0.3% THC. So she's referencing not hemp plants by that definition.
Amber Wise	So you're asking if the, the issues we see or not being able to detect the difference between Delta 8 and Delta 10 occur also in the current I-502 market? Is that what your question is?
Brook Davies	I think, just broadly more to the comparison made to the sort of the outdated technology and not being able to see the full detail of whether it's by products or whatever it is, did those things exist just for products that are currently on the market as well, or does our lab technology need to be updated broadly to make sure that all of the products are safe, or is it just specific to this kind of new sector of products?
Amber Wise	I hesitate to use the term outdated technology. This is perfectly fine technology for quantifying the molecules that we are supposed to quantify. I think the question you're asking is, can we, I get I get asked numerous times a year by clients calling up and saying "I bought brought this product. Can you tell me if it's safe or not?". I absolutely cannot tell you if it's safe or not. That is not a test we run, unfortunately. And so I can give you a list of compounds that we are able to detect and at what level we are able to detect them at and beyond that, I can't really help, unfortunately, I wish I had endless time and resources, and we do have instruments in our lab that can do much more advanced chemistry. We just use them in different ways for our business and I would also love it if people were able to pay us what it cost to do some of these more complicated tests. I would develop them if someone was willing to cover our costs, but it's tens of thousands of dollars to see, a new molecule I have the instruments I have very complicated, expensive instruments, but to develop the chemistry to see some of these, it's time consuming and expensive. They exist in many other labs and academic research facilities. It's not that chemists can't do it. It's that the ability for regular people to access that. Chemistry is very difficult. So to answer your direct question is,

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>yes, this absolutely exists currently in the market. There are potentially things that are not safe for us to consume that exist in products that are on the market that we're not looking for. I mean, I think if it was dangerously dangerous, we would see public health problems coming up. So, I don't want to scare people and say, yes, there's all kinds of terrible things in the product on the market. But, yes, there is the potential for things to be slipping through the cracks that we are not looking for. A really good example is metals that we're not quantify, like nickel or copper that we're only supposed to look for four, but not even in Washington state and all products. So that's a very simple example. There are thousands of others.</p>
Jessica Tonani	<p>Amber, we also see, you know, in our research, kind of selectively breeding weird plants, that certain cannabinoids pop up, that don't have standards or things that are also, there's a panel that we look for in a panel that's new, it's available. It's just not routinely tested for it because it's not normally seen at high levels.</p>
Brad Douglass	<p>I may elaborate a bit and Amber, you did a great job and that's a difficult question, but just to underline something that you said that, even with the cannabis plant sample or cannabis product, that's not the product of synthesis. They're always going to be unknowns. You're not going to know everything that's in that sample and it doesn't matter how much money you spend to upgrade lab technology. There's always going to be unknowns. So from a scientific standpoint, perhaps an economic standpoint, there's always that balance. Right? How much do you want to pay to know a larger fraction or percentage of those unknowns? And it's going to go to infinite cost to find 100% of those? Whether it's just a cannabis plant or something that's derived from synthesis.</p>
David Gang	<p>I really don't have anything to add. I think Amber did a great job answering you. The only thing I would say is, yes, I hope people didn't get the idea that I said that the technology was antiquated and totally useless. That's not what I was trying to say, right? You can still use different technologies for different things. They have different places and different purposes. But I just wanted to make sure that people were aware that the standard test that they submit a sample to is not going to tell them everything that's in that sample. Which Brad, I think clarified very well. And there's a reason for that, it just, it costs a lot. The more you want to look at it the more it's going to cost.</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

Participant Question 9	
Rusty Sutterlin	In the vanilla example, is it considered natural as long as the starting material is from nature and examples? Are given would wood pulp, clover, rice bran, et cetera again?
David Gang	That's going to be actually a regulatory question how it's defined. It's not an actual scientific question. The USDA has policies on that for specific compounds. The FDA does too, depending on who's purview it is. Brad, anything else to add to that?
Brad Douglass	No, you're absolutely right. Data. That is a regulatory question. And what I will add is that it's it depends on where on the globe you reside. So our colleagues in health Canada, they have different regulations for what constitutes natural, or what something could be labeled natural for. Same goes for the EU as the U. S., so there's not one uniform standard around the globe for what constitutes a natural compound.
Participant Question 10	
Rusty Sutterlin	There is a lot of Delta 8 on the market now, has anyone heard of negative effects related to the stereochemistry of Delta 8? I definitely understand the part about the chemistry and concerns there, and it probably is anecdotal also. There's not a lot of research out there, but there's a huge amount of Delta 8 out on the market now that is being made from CBD and I personally haven't heard of a lot of problems or concerns about the stereochemistry so I'm just wondering if anybody else had heard differently.
Jessica Tonani	I'm not sure people are really testing stereo chemistry. I've heard increases in poison control and things like that, but that may be, I haven't seen anything peer reviewed or anything. I don't know if anybody else on the panel has or has anything to add.

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

<p>Brad Douglass</p>	<p>No, I'd say it's too recent and I think one of the challenges is teasing apart what reported effects or adverse events are related to chemistry and what are related to mixtures of compounds being called Delta 8 THC. I think that's sort of the crux of this issue. Stereochemistry, it's just hard to tease out based on the data we have currently.</p>
<p>Nephi Stella</p>	<p>Maybe I'll add, unfortunately, most of the time when we find out about toxicity it is by following the emergency room, and finding out the people intoxicated like, what just happened with the, with the artificial cannabinoids that are sprayed on Spice and K2. So because it's a new product, I guess we're hoping that there's no toxicity, but the field is not really to my knowledge, the field is really not studying too much the biology of Delta 8 again, because it's not that exciting for scientists, because it's just too similar to Delta 9. We get really excited when there's a completely new molecule CBD that does a completely different biological activity. So, to my understanding, the cannabinoid field is not studying too much Delta 8 at this point. And if there's going to be some toxicity, we're probably going to learn from it through the emergency rooms and hospitals and those kind of studies.</p>
<p>Jessica Tonani</p>	<p>And to Brad's point, I think one of the issues is teasing out, if there an issue pops up. I mean, it's similar to the vape cartridge issue where it took quite a while to kind of get the samples and figure out what was the causative agent kind of situation and I think with this, there's kind of two situations and different people in the panel can speak to this. But the first is other things outside of Delta 8 that are in the product, and then the second is the stereochemistry of the Delta 8 itself and so I don't know personally how much the concern should be weighted for one or the other but there are kind of two variables to tease out and this, if anything is being seen out there, I don't know if Brad or amber David have anything to add to that.</p>
<p>Brad Douglass</p>	<p>I might add going back to the idea of an ingredient standard that I raised early on in the panel. And I think that some of these questions could be addressed proactively with ingredient standards that define, say, if you were to permit Delta 8 THC you would only permit one enantiomer and only permit one stereo isomer, or you wouldn't, you would prohibit certain levels of potential by products. I think there's a path to addressing it that way from wearing my scientific toxicological hat that doesn't rely on us waiting and</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	seeing what happens and trying to tease apart different stories we hear in the news or different apocryphal stories that we hear about people having adverse events.
Nephi Stella	I agree with that, I want to second that, I think we have the tools to be proactive and because the industry, and the individuals are starting to use these compounds and the scientific world now use those tools and catch up and make sure that those products are safe.
Jessica Tonani	And I think you're right, Brad, you know, there's very different quality and products out there and, and it may be a path to the setting, a quality standard by which products have to meet.
Participant Question 11	
Blade Bolden	Is there a clear distinction between a solvent being used for post processing or purification versus a solvent that is used for extraction specifically?
Brad Douglass	I think I understand the question. Well, Blade's perhaps typing elaboration, and I believe it's a regulatory question in terms of how the rules in Washington treat solvent usage at different points in the extraction and manufacturing process which I won't answer. In terms of a science or safety standpoint what I will say is that in, from that perspective, it doesn't matter where along the process a solvent perhaps is being used as long as, and if it presents a danger to the consumer, as long as it's not in the end product or there in levels low enough so it's not a concern and that should be the only issue. It doesn't matter where in that process of making that product that you're using that solvent, in my opinion.
Participant Question 12	
Dan Oliver	In general, perhaps this dialogue is only supposed to be on the subject of Delta 8 and Delta 10 THC, but the question is, isn't it also true that you can chemically and synthetically convert CBD to Delta 9 THC? Is

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>there any reason why that should be as concerning, if not more concerning, than the synthetic creation or conversion to Delta 8 or Delta 10 from a health and safety as well as market standpoint?</p>
<p>Amber Wise</p>	<p>I can answer part of it at least, is that yes, it is possible that conversion exists. I think all of the same concerns we've raised are also valid in terms of the different ways you can do that chemistry the types of chemicals and processes that may be used in that process. I think if we had a very highly functioning traceability system in the state, it would be possible to utilize CBD from plants that were tagged in I-502 to convert that to Delta 9. It seems silly to me to do that within the legal I-502 system given how easy it is to grow high THC plants by themselves but I think what the question is getting out potentially, is CBD coming from outside of Washington state I-502 grown hemp from wherever, and then converting that into Delta 9 and then potentially in introducing that in to sale in Washington, which my understanding is not legal under the current system and theoretically would not be within traceability compliance. I don't know how concerned, I have no concept of how prevalent that process might be at this point.</p>
<p>Brad Douglass</p>	<p>I can add to that a little bit. Well, let me start by saying I'm a synthetic chemist, so you give me oxygen, hydrogen, carbon then I could make you pretty much anything you want give enough time and resources. But what I do want to say about that, is that, t's the best way to answer that.</p>
<p>Nephi Stella</p>	<p>I was going to add a different answer, the biological answer, which is that 3 or 4 years ago, there was a paper that was published, and I can tell you right away it was retracted and confirmed that it was wrong. And the paper was stating that individuals that were taking cannabidiol orally, it would actually transform into Delta 9 THC into the gut, that there was an enzymatic reaction. And, of course, this was very concerning for many people who were trying to use cannabidiol as a medicine and really wanted to avoid Delta 9 THC learning that would be transformed in the gut would be very concerning, but to reassure the audience actually, this paper has been thoroughly retracted. So currently, at least in our body, there is no known way where cannabidiol can be transformed into Delta 9, but Brad can do it with his oxygen and his hydrogens.</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

<p>Brad Douglass</p>	<p>And I will say, I guess the point I want to make is that, although it can be done, it's more difficult to convert CBD to Delta 9 THC than Delta 8 THC, a little bit more expensive and specialized reagents. And the chemistry to do so is less selective so it's easier thermodynamically to produce Delta 8 THC than Delta 9 THC. So, if you're producing Delta 9 THC from CBD, you have a problem where you're often producing Delta 8 THC they are trying to avoid. So, is it possible? Yes. Is it economically viable, particularly if you had a standard of purity that you're working towards? Unknown, but unlikely, depending on the competition.</p>
<p>Participant Question 13</p>	
<p>Lukas Hunter</p>	<p>How would the panel define the difference between extraction and refinement further? Is this distinction really important or should the whole process of creating cannabis concentrates features defined as an extraction? I'm more so just curious about the panel, at what point, if there is a point where there's a distinction between extraction and refinement that really matters. There's clearly a tie to regulation around this because of what the implication of extraction means. What the panel scientist, it's hard not to not ask the question of is there is it always extraction or is extraction the initial point of taking biomass and converting it into an oil that needs further refinements to create into other products, and just looking to get opinion on that? Just my own curiosity.</p>
<p>David Gang</p>	<p>I think that it's definitely fits with this definitely could fit within the realm of policy. What the state decides to define as the extraction, put it in quotes, whatever you want to call it, process from the, from a natural products chemist perspective. The extraction process is pulling a molecule out of the plant material. So it's that initial step of pulling the molecule out of the biomass. That's the scientifically, that's the extraction. Anything after that we are then going to purify it. That's then a purification step. You can call it refinement whatever terms you want to use. But it's really only the initial step that from, from my scientific perspective is really the extraction now. The state could decide to roll all of that process, the initial extraction and then refinement of purification and call that whole thing as an extraction from a regulatory perspective, they could decide to do that.</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>I think that's definitely going to be a regulatory issue that needs to be discussed and decided I've got that's definitely a policy thing. There may be reasons why from a policy perspective it's important to treat it a different way than how, if you were generally just looking at in the lab you would.</p>
<p>Lukas Hunter</p>	<p>Yeah, of course, I don't mean to direct it. There is some policy, but really just looking to get the perspective. No saying that what you say is policy.</p>
<p>Participant Question 14</p>	
<p>Jim MacRae</p>	<p>What do the panelists think of the equation of THC with potency in current law?</p>
<p>Amber Wise</p>	<p>I will start really quickly. This is a thing I bring up over and over again. First of all, that the word potency is never used correctly in the cannabis space. So just using that word at all in relation to the percent cannabinoids in a mixture should be reduced if possible. I know it's partly in policy regulation language, whatever, but I do like to clarify that potency means a specific thing in pharmaceuticals that is the amount of an active molecule that your body actually uptakes and processes, and what we call potency in the cannabis space is actually a percent by weight generally of cannabinoids. So, to answer the other question, I'm going to use another clarifying term that we discussed a little bit previously in this panel.</p> <p>So potency being expanded to the amount of THC in a product, again, this psychoactivity, psychotropic nature of other molecules is yet to be fully determined scientifically So, obviously there are lots of molecules that are psychoactive in the, in the cannabis plant, psychoactive can just mean it's acting on your brain. Caffeine is psychoactive. CBD is psychoactive. Anything that changes, or interacts with your brain technically, is psychoactive. Psychotropic is when it alters your perception of reality, or some physical or mental state. I don't have the definitions in front of me these are off the top of my head.</p> <p>So, I think there are potentially well, there are, many molecules in the cannabis plant that are psychoactive. Some of them might also be psychotropic, like Delta 8, Delta 9, and so if we're only going to equate potency with amounts of THC I think that is probably missing potential psychotropic nature of some</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>of these products and also, 5 years from now, we'll be moved on to talking about another molecule. It won't be dealt to 8 and Delta 10, it will be God knows what at that point, so I think I'll just leave it there with some scientific clarifications and no opinion.</p>
<p>Participant Question 15</p>	
<p>Jeremy Moberg</p>	<p>Given the lack of understanding of the science and purity, should the state allow synthetic production as it currently does or ban it immediately as eleven other states have concluded?</p>
<p>Brad Douglass</p>	<p>I'd like to take the opportunity to reiterate from the science side and again, my opinion, I won't veer into the policy side, but I, I do see a path. It is true that there are some concerns or potential issues with products that are produced sympathetically. But I do see a path with ingredients standards and the proper regulations to test and regulation products that they can be safely used. So that's purely opinion. And based on my understanding the science and toxicology. But I think it's possible, whether that's right for policy is not for me to answer.</p>
<p>Jessica Tonani</p>	<p>I agree with you, Brad and I think, you know, the one thing I'll say is, it's not going to be an easy path, you know, there's a lot of there's a lot of questions around science impact to other stakeholders, different things. I mean, it's a complicated, I personally don't think it's a yes or no answer, but that's just me, but I do see a path to get to it.</p>
<p>Jeremy Moberg</p>	<p>My question is really to the panelists. I mean, is it, is it comfortable to be talking about the science with so many unknowns, at the same time that this product is already available, and from a scientific point of view, wouldn't you rather be doing this work before we were letting this out into consumers and for essentially them to be left without very little information to work on?</p>
<p>Jessica Tonani</p>	<p>I think it'd be brutally honest, and I might get into trouble with this. So I have to pretend, please don't get upset but I know I've been a medical marijuana patient for just twenty years now, and something that</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>we've kind (unintelligible) and then the science behind and I think that this time we're trying to kind of invert that, but I hear what you're saying, but I also know this is an industry that, to some degree is has a history of doing. And I, I probably shouldn't have said that, so I'll stop there.</p>
<p>Amber Wise</p>	<p>I think I've been trying to find the right place to bring this up and I think this might be as good a places any but what we're really seeing here, the crux of some of this is the separation of state regulated high THC I-502 in Washington versus federally quasi-legal CBD hemp. Also, there's hemp programs within Washington state, and they all are regulated by different bodies. They all have different rules and now we're seeing them converge.</p> <p>Because we have overlapping molecules that are involved. I don't have a good answer for that, but it definitely points to if we had one central say federal rule making set for this, it's not going to solve our issues today of having Delta 8 on the market already in the science barely catching up, but we would have avoided many of these situations had we had much more centralized and organized rules from day one or it was never, you know, illegal in the first place to, to have in hand and study it.</p>
<p>Brad Douglass</p>	<p>The enterprise of science, I think, is fraught with unknowns. There's so many unknowns. And I think largely those that aren't doing science think about science is being exact and specific and I'll give one counter example here that if we waited to know perfectly the safety or understanding of a substance, we wouldn't have any cannabis regulated systems at all.</p> <p>I'll veer a little bit more into the personal opinion here, in my opinion and this is me as a parent, not necessarily a scientist, if my child was going to go purchase a Delta 8 product, for example, I'd rather have them understand and buy it from a testing and regulated system than some other system again. Personally, and I'll stop.</p>
<p>Nephi Stella</p>	<p>Let's take the example of THC products and CBD products. We had some understanding of what THC, Delta 9 THC does to the human body and a pretty under good understanding that CBD is relatively safe and can be used, and therefore those products were developed and therefore, at this point, they're doing pretty well. Now, we have a completely new molecule that we haven't really studied, Delta 8 THC. The</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>pharmacologist would like to take baby steps, small doses would be, because we don't have the data. If we have the data that it's a safe molecule then of course we can generate products that have a lot of Delta 8, but if we don't have the data, then probably the approach is to be cautious and provide products that have low doses so that we, if there is any toxicity, at least, we can manage it and avoid it. Because we don't know what it does, so, maybe starting slow would be the way to go.</p>
<p>Participant Question 16</p>	
<p>Bonnie Jo Peterson</p>	<p>How can the cannabis industries collaborate to have this needed research conducted right so, possibly this gap that's being spoken to about more information that would help in these conversations?</p>
<p>Jessica Tonani</p>	<p>I think one of the biggest things I'll start with is research funding, there's two sources or there's several sources, but they generally fall into you get money from some sort of government agency, or you get money from some private source and the money from government agencies has been seriously lacking and seriously restricted in this area. And if you look at some of the larger cannabis research projects out there, you know, University of Sydney, for example, the Lambert Institute that's privately funded, and it's not a small amount of money that privately funded that. So, you know, I would strongly advocate that, one of the things that can help lead the research the fastest is funding for research, the second thing that we have hurdles around regulation of this plant that get extremely difficult and some arbitrary regulation around THC content that makes research difficult but the reality is, we have hurdles and regulation and we have hurdles and funding, and I think the easiest thing that we as a community can do is figure out that funding component and run as fast as we can and push the regulation as far as we can. And, you know, there's potential mechanisms for when we look at all of this one of the things that Amber brought up was heavy metals for example. You know, heavy metal research can be done on hemp which has less than 0.3 percent THC or plants that have greater than 0.3 percent THC, and that research can transcend across both the high THC and low THC plant market, so hemp and high THC, and so there's, there's mechanisms by which some of this research, we can get creative on the plant types and how we do it and how it transcends across products with THC and not with THC. But that requires funding, so, you know, talk to your representatives, try to get more at this point hemp funding, if you're lucky high, THC cannabis funding, but also look at private, like, try to figure out how you give money to WSU or UW, or different</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	<p>groups to enable the funding, you know, contact David or Nephi and say, hey, I got I got some money. Let's figure out how you can use it in your research project. So let's figure out the best way to use it.</p>
<p>Nephi Stella</p>	<p>I'll jump in and applaud what you just said, Jessica. I agree. I think we need much more funding, but maybe we can be a little bit, go a little bit deeper. I think there's two types of funding. The federal funding has very specific type of questions, the federal government that they're interested in and, and, uh, I think at the state level, each state will have their specific type of questions, so I think it would be really exciting if we could implement, at the state level, some cannabis related questions that are relevant to the Washingtonians and, for example, having access, studying, researching the products that are currently available in Washington state would be very exciting and very important to do and would be a very different type of question than the federal government is trying to ask through the NIH. So, I think there's opportunities. I'm hoping there's an opportunity to actually create a parallel scientific research system where we would be asking Washington state specific questions that might be very different than what the federal government is interested in.</p>
<p>Amber Wise</p>	<p>I could add, I like Bonnie Jo's use of the word collaborate here because this research is expensive and it's very rare that one entity has the resources to just do it right. Also, research is not something that one person generally does in a room by themselves. So, I think, to Nephi's point of having state specific, and also federal specific programs parallel to each other is interesting and potentially useful and I know there's, I have not followed this partly due to my business, but I know there's been some conversation about starting a Washington state cannabis and or hemp have research consortium of some variety, either, is it at an industry funded research facility? Is it just a pot of money that people can apply to? Many, many industries, agricultural industries have structures like this, where there is fundamental research that gets done on Apple diseases, for instance, on different varieties of blueberries You know, there's different professional organizations that coordinate this and so that could be a route as well, and maybe, hopefully, ideally, it could transcend I-502 and hemp and be sort of one larger group that we're talking about more or less the same plant here. It is the same plant scientifically. And to have these two separate boxes barely ever talk to each other, it makes it even more complicated.</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

Jessica Tonani	<p>Amber, you know, the two boxes, it's only THC that's differentiating those boxes so if we look at the entire plant, 99.9% of the things that are interesting for a research perspective are exactly the same and, you know, we all know THC, it's been researched and continues to need to be researched, but that's really like the differentiating component right now, for us from a regulatory research perspective.</p>
David Gang	<p>One thing I'd like to add. I agree with everything everybody said. One of the things though that we have to be aware of, is that the current federal regulatory system is such that universities like Washington State University, University of Washington have to be careful in certain types of research that we can do. For example, we can't grow high THC plants.</p> <p>We're just not allowed to because doing so would be breaking federal law. And so we can't do that and we can't take in plant material that somebody else grew because then we are accepting an illicit substance and therefore we are breaking federal law. So, even though the state of Washington says that these pay to work with, and it's legal within the state, the federal government says currently that we can't. And because those universities rely on very large, to a large extent on federal funding for a lot of what they do, they have to be careful about what they do, so they don't jeopardize all of the funding for everything at the university, because they allow that type of activity. so we've been restricted on being able to do research projects that fit within these certain little boxes that the FDA and DEA defined are allowable with regards to high THC plants, and Nephi can go into this, if he wants a little bit more too, but that's, I mean, at Washington State University. That's definitely been the case. Things are different now with hemp. We can it's a completely different situation. There's a lot we can do with that plant. There's a lot of research that a lot of people would like to do inside the state of Washington related to higher THC plants, especially with regards through what exists in them, what safety issues, there's all kinds of things we could do, but we just are still restricted. And I guess the question, come back to Bonnie Jo's question. But how can we collaborate on this? One of the things that I think important is, you know, we have got to be careful what I say here about promoting policy. Right? We don't want to promote policy or specific policy directions here. I think that's where this conversation, my thought is going to go and I think you can lead to that. There are things that we can do to maybe think about how do we how do we define how these plants are viewed and do we need to think about it from the research perspective and maybe a slightly different way from a consumer perspective maybe regulation that is associated with</p>

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

	research should be different than how it's associated with a consumer application, and I know we're not really supposed to do a policy. That's not really policy. It's my personal opinion.
Participant Question 17	
Justin Nordhorn	When we're talking about the extraction, the synthesis, and creation of a new molecule, kind of a three bucket area of these, we were also referring to the phytocannabinoid, and then later in the conversation that that term came up again, and we had some discussion around that. My question here is simply, can a synthetic cannabinoid that is the same as the extracted one, it's the same molecule, can that be considered a phytocannabinoid, or is that just classified more as a synthetic by itself?
David Gang	Well, I would say from the scientific perspective, if it is the same exact molecule and it is like Delta 9 THC, which is derived from cannabis sativa, it's a natural occurring compound, and it is one of the phytocannabinoids that define that class of compounds, if you make that from scratch in a lab, it's still the same class of compound.
Justin Nordhorn	Okay, and that helps. So, basically, the creation of the newest, of a new molecule, so completely artificial as was termed earlier, that would not be a phytocannabinoid. However, a synthesized and an extracted natural from a plant would still both be considered a phytocannabinoid.
David Gang	Well, yes, and no, because it depends on the artificial molecule. If you make it so that it has the general structure. So, from a chemist perspective, compounds are defined based on the class of compounds they are, so it's like the structure, what is the basic structure of it? What are the major building blocks? So, if you make an artificial molecule that has the basic structure, but then has some other pieces that are a little bit different, and those pieces make it so that it's not found in nature. So, it's therefore an artificial molecule, but it still has the basic structure. You could still call it as the class of a phytocannabinoid from a chemist perspective.

Deliberative Dialogue - THC Compounds Other than Delta-9 June 3, 2021

Brad Douglass	I think the key David that if it's found produced by cannabis or some other plant, it's a phytocannabinoid irrespective of the source, whether it's produced synthetically, or some other way still a phytocannabinoid.
Jessica Tonani	And Justin, the other thing is yet you can't differentiate that by an analytical method, if somebody brought you the two samples and said which one was produced by the cannabis plant, you couldn't, if they were pure, tell the difference.
Justin Nordhorn	And then, I don't know if Brad would have an elevator speech version, or I can follow up with you afterwards on this, but you had mentioned around the Delta 8 to Delta 9 conversions out of CBD that they were considerably different. And in looking at the first slide that we put up with the molecule showing that there's such very close similarities between Delta 8 and Delta 9 on the compound structure of the molecule, why is so much more complicated to create a Delta 9 from a CBD value versus a Delta 8 from that CBD molecule?
Brad Douglass	I think to keep it simple, Justin, is that the Delta 8 THC molecule is more stable thermodynamically so it would rather be Delta 8 than Delta 9 energetically. And that's why it's easier to produce Delta 8, than it is Delta 9.