

Your partner for cannabinoid innovation

Discover the full therapeutic
potential of cannabinoids

dsm-firmenich 

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Advancing global patient health through innovative science

Early-stage drug development plays a critical role in expanding treatment options that will ultimately support global patient health. That's why dsm-firmenich has created an innovation platform where it can partner to explore the potential of cannabinoid-based therapies – a new and exciting field of science, with promising research across a wide variety of indications.

Looking to discover new horizons in the rapidly developing cannabinoid space? Partner with us for access to high quality ingredients, customized solutions and expert services.

Visit www.dsm.com/cbd-apis



Discover cannabinoids

Cannabinoids are a group of bioactive compounds found in the *Cannabis sativa* plant. The plant naturally produces around 80–100 cannabinoids, however, cannabidiol (CBD) and tetrahydrocannabinol (THC) are the two major cannabinoids present. While THC is known for its psychoactive properties, CBD is non-psychoactive, making it an attractive candidate for innovation across the pharmaceutical space. Rare cannabinoids – also referred to as minor cannabinoids or CBx – are found in much lower concentrations (1% of the total plant biomass).

Cannabinoids are demonstrating benefits in areas including central nervous system (CNS) diseases (like epilepsy), pain disorders, anxiety, cancer and more. Research on rare cannabinoids has been more limited to date because it can be technically and commercially challenging to extract the compounds, but increasing evidence reveals they may hold significant therapeutic potential too. Rare cannabinoids are therefore expected to be a key focus for future research and development.

The endocannabinoid system

Renewed interest in cannabinoids follows the discovery of the endocannabinoid system (ECS) in the early 1990s – a complex cell signaling network present throughout the body that helps to regulate and balance critical bodily functions, including metabolism and appetite, mood and anxiety, immunity and pain perception. Cannabinoids are understood to interact with CB1 and CB2 receptors in the ECS, via which they are thought to exert multiple effects throughout the body.

Full spectrum CBD vs CBD isolate

- **Full spectrum extracts** contain CBD as well as other cannabinoids, including <0.3% THC, and compounds, like terpenes and flavonoids. Subsequently, full spectrum extracts may have a strong natural flavor and/or odor and are difficult to isolate for effective clinical results.
- **Isolate** is CBD in its purest form and only contains the molecule cannabidiol. Some isolates are purified to contain no detectable traces of THC, effectively making it a THC-free product.



The possibilities are endless in the cannabinoid market

The cannabinoid market is bursting with innovation – with a myriad of opportunities to expand treatment options and address unmet patient needs through cannabinoid-based drug discovery and development.

\$798
million

Global sales of cannabinoid-based drugs in 2020¹

50%

Research focused on CNS disorders²

+20%

CAGR global sales 2020-2024¹

\$100
billion

CNS market by 2025³

Cannabinoid science is strongest and most established in CNS disorders

The current cannabinoid API market is focused on CNS diseases – particularly epilepsy. Characterized by recurrent seizures, epilepsy is the most common neurological disorder and affects more than 50 million people worldwide.⁴ Up to 70% of people diagnosed with the condition could live seizure-free if properly diagnosed and treated.⁵

It is projected that CBD will bring a new wave of breakthrough innovations for the treatment of CNS diseases, valuing the market at around **\$100 billion by 2025**.

There is significant research into the potential of cannabinoids, like CBD, in patients with epilepsy – especially in individuals that do not respond to conventional anti-epileptic drugs. Already, there have been positive developments in the space, including the launch of **Epidiolex**[®] for the treatment of severe, orphan, early-onset, treatment-resistant epilepsy syndromes.



Powered by robust science and a favorably evolving regulatory landscape

To date, much of the science on cannabinoids has focused on CNS diseases, however, CBD research is continuing to expand into areas including pain management, cancer, mood disorders and more.

And this is just the beginning...the market is still in its infancy and the therapeutic potential of cannabinoids is yet to be fully explored. With this comes an opportunity

to be at the forefront of new scientific developments in the space and ultimately support the expansion of treatment possibilities.

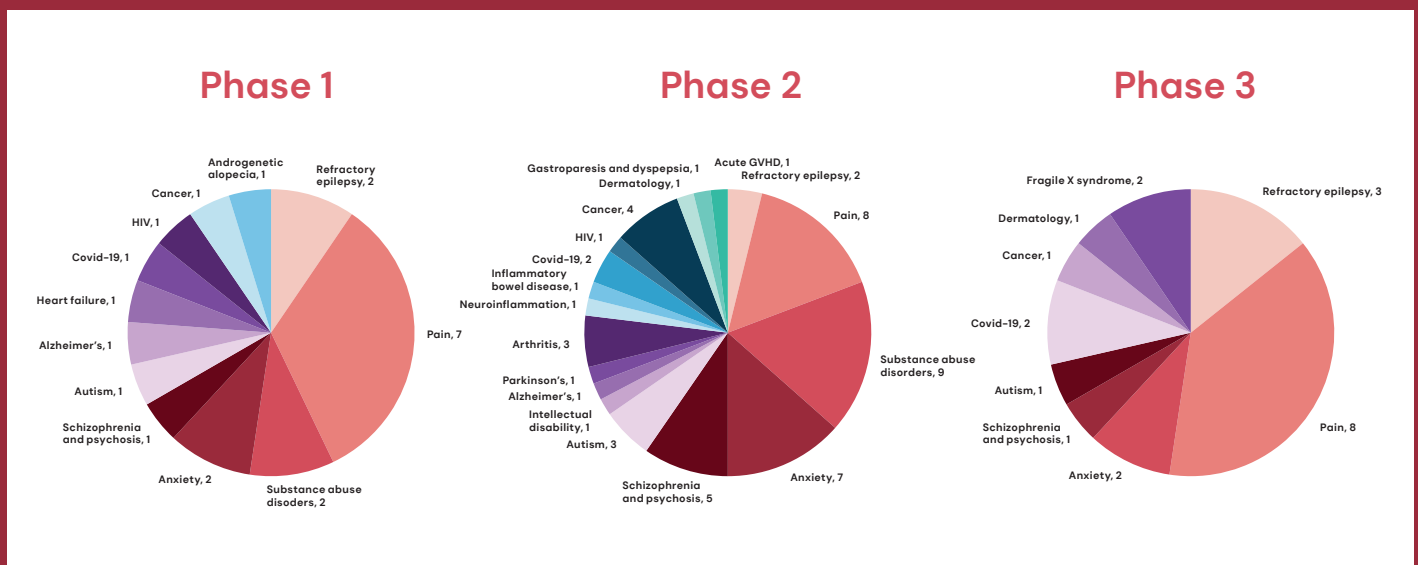


Figure 1.

Ongoing clinical trials. Completed clinical studies on CBD have investigated its role in refractory epilepsy, whereas current CBD research focuses on a variety of indications, including pain and mental illnesses.

Active monitoring of regulatory developments in major geographical markets shows a changing trend towards a favorable landscape. Regulatory bodies, like the US Food and Drug Administration (FDA) and European Medicines Agency (EMA),

are increasingly recognizing the promise of cannabinoid molecules and taking steps to improve the efficiency of regulatory pathways for the lawful marketing of appropriate cannabinoid-based drug products.⁶

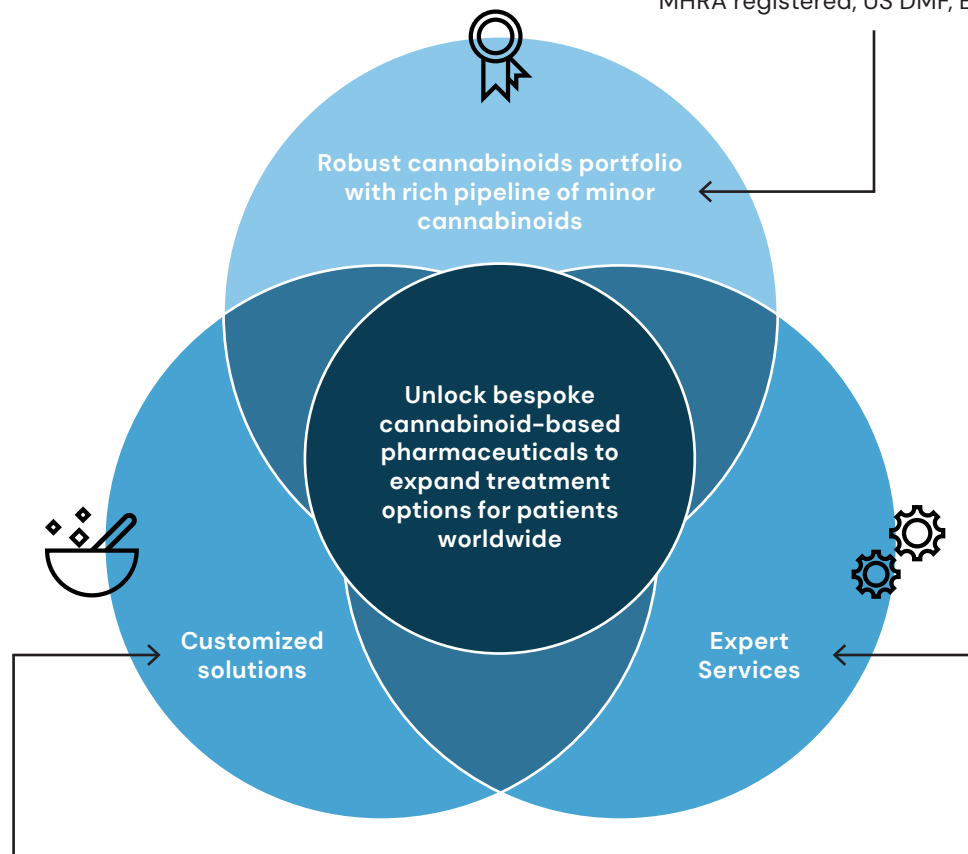
Think cannabinoid APIs. Think dsm-firmenich. Enter the cannabinoid market with confidence

It takes more than ingredients to enter the cannabinoid market with confidence. It takes a partner. As a global, science-based co-innovator, we can help you be the first to realize the full therapeutic potential of cannabinoid APIs. Together, we can translate emerging research into purposeful therapeutic solutions that support global patient health.

Break new boundaries in cannabinoid-based research and development with our innovation platform.

Robust Cannabinoid portfolio

THC-free CBA API, 100% natural hemp derived, consistent quality, science-backed, GMP-compliant, 3-year stability data, UK MHRA registered, US DMF, EU ASMF



Customized solutions

Capability to manufacture custom CBD APIs upon request, plus formulation, technical and application support

Expert services

Quality, regulatory and scientific expertise in early-stage drug development and beyond



About Brains Bioceutical

Our cannabinoid platform is enabled by Brains Bioceutical, a global pioneer in the cannabinoid space. As one of the only companies worldwide to provide a secure supply of standardized cannabinoid APIs of natural origin, Brains Bioceutical is setting the global standard for cannabinoid-based innovation.



Purification



Analytical laboratory testing



ICH stability studies



In-house research and development



Processing and manufacturing

Together, let's deliver patient driven CBD-based pharmaceuticals with purpose.
Visit www.dsm.com/cbd-apis to start the conversation.



A trusted CBD API

- ✓ THC-free, 100% natural hemp derived
- ✓ Highest purity, 100% CBD (98.0 – 102.0%)
- ✓ Contains < 0.1% impurities
- ✓ Consistent batch quality
- ✓ Ethanol / preservative / flavoring-free
- ✓ ICH-Q7 compliant
- ✓ 3 year reset date stability reported data

Together with Brains Bioceutical, we're also exploring a range of additional cannabinoid APIs:

- Delta 9 THC crystalline solid API
- Delta 8 THC crystalline solid API
- CBN crystalline solid API
- CBC
- CBL
- CBG
- CBDV
- CBGA

More than APIs

The dsm-firmenich difference

1 Regulatory & quality support

Our global regulatory expertise, strict quality policies and advanced quality management systems give you the ultimate confidence that your drug formulations are compliant in fast-changing and complex markets.* We help facilitate the successful market entry of your CBD product, supporting you throughout your life-cycle management, wherever you are in the world.

* Depending on local regulatory clearance

2 World-class scientific services

Our advanced cannabinoid innovation platform facilitates early-stage drug development and novel scientific discoveries in this new and exciting field. With access to the latest research, the ability to support customers with new data generation via pre-clinical and clinical trial development, and close relationships with a network of influential key opinion leaders, we're dedicated to developing robust science to advance cannabinoid-based solutions for the pharmaceutical space.

3 Formulation, technical and application capabilities

Our ingredient expertise and application knowledge, paired with unique technical capabilities, means our team of experts can help you overcome even the most complex formulation challenges to improve drug performance.



Solutions for enhanced stability



Solutions for enhanced solubility



Solutions for enhanced bioavailability



Solutions for targeted delivery



Solutions for enhanced technical performance

Currently, we're exploring multiple avenues and technologies for improved CBD formulations. Enhancing the oral bioavailability of CBD remains a focus for innovation. We're creating a formulation toolkit that will bring tailor-made solutions to customers – including technologies that improve bioavailability – enabling CBD to fulfill its full potential as a therapeutic agent.

Ready to unlock the full therapeutic potential of cannabinoids and deliver patient-driven pharmaceuticals with purpose?

Partner with dsm-firmenich

Visit www.dsm.com/cbd-apis to connect with an expert today.



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