

Q1 2018



Developing medicines based on cannabinoid science

Jim DeMesa, MD, MBA
Chief Executive Officer



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TO THE EXTENT STATEMENTS CONTAINED IN THE FOLLOWING PRESENTATION ARE NOT DESCRIPTIONS OF HISTORICAL FACTS REGARDING THE COMPANY, THEY SHOULD BE CONSIDERED “FORWARD-LOOKING STATEMENTS,” AS DESCRIBED IN THE PRIVATE SECURITIES LITIGATION REFORM ACT OF 1995, THAT REFLECT MANAGEMENT’S CURRENT BELIEFS AND EXPECTATIONS. YOU CAN IDENTIFY FORWARD-LOOKING STATEMENTS BY WORDS SUCH AS “ANTICIPATE,” “BELIEVE,” “COULD,” “ESTIMATE,” “EXPECT,” “FORECAST,” “GOAL,” “HOPE,” “HYPOTHESIS,” “INTEND,” “MAY,” “PLAN,” “POTENTIAL,” “PREDICT,” “PROJECT,” “SHOULD,” “STRATEGY,” “WILL,” “WOULD,” OR THE NEGATIVE OF THOSE TERMS, AND SIMILAR EXPRESSIONS THAT CONVEY UNCERTAINTY OF FUTURE EVENTS OR OUTCOMES. FORWARD-LOOKING STATEMENTS CONTAINED IN THESE PRESENTATIONS INCLUDE, BUT ARE NOT LIMITED TO, STATEMENTS REGARDING: (I) THE SUCCESS AND TIMING OF OUR PRODUCT DEVELOPMENT ACTIVITIES AND CLINICAL TRIALS; (II) OUR ABILITY TO DEVELOP OUR PRODUCT CANDIDATES; (III) OUR PLANS TO RESEARCH, DISCOVER, EVALUATE AND DEVELOP ADDITIONAL POTENTIAL PRODUCT, TECHNOLOGY AND BUSINESS CANDIDATES AND OPPORTUNITIES; (IV) OUR ABILITY TO DEVELOP AND MANUFACTURE OUR PRODUCT CANDIDATES AND TO IMPROVE THE MANUFACTURING PROCESS; (V) OUR ABILITY TO ATTRACT AND RETAIN KEY SCIENTIFIC OR MANAGEMENT PERSONNEL; (VI) THE ANTICIPATED TIMING OF CLINICAL DATA AVAILABILITY; (VII) OUR ABILITY TO MEET OUR MILESTONES; (VIII) OUR EXPECTATIONS REGARDING OUR ABILITY TO OBTAIN AND MAINTAIN INTELLECTUAL PROPERTY PROTECTION; AND (IX) THE IMPACT OF CAPITAL MARKET CONDITIONS ON US. FORWARD-LOOKING STATEMENTS ARE SUBJECT TO KNOWN AND UNKNOWN FACTORS, RISKS AND UNCERTAINTIES THAT MAY CAUSE ACTUAL RESULTS TO DIFFER MATERIALLY FROM THOSE EXPRESSED OR IMPLIED BY SUCH FORWARD LOOKING STATEMENTS. UNDUE RELIANCE SHOULD NOT BE PLACED ON FORWARD-LOOKING STATEMENTS. WE UNDERTAKE NO OBLIGATION TO PUBLICLY UPDATE ANY FORWARD-LOOKING STATEMENTS. THE COMPANY’S INVESTIGATIONAL DRUG PRODUCTS HAVE NOT BEEN APPROVED OR CLEARED BY THE FDA.



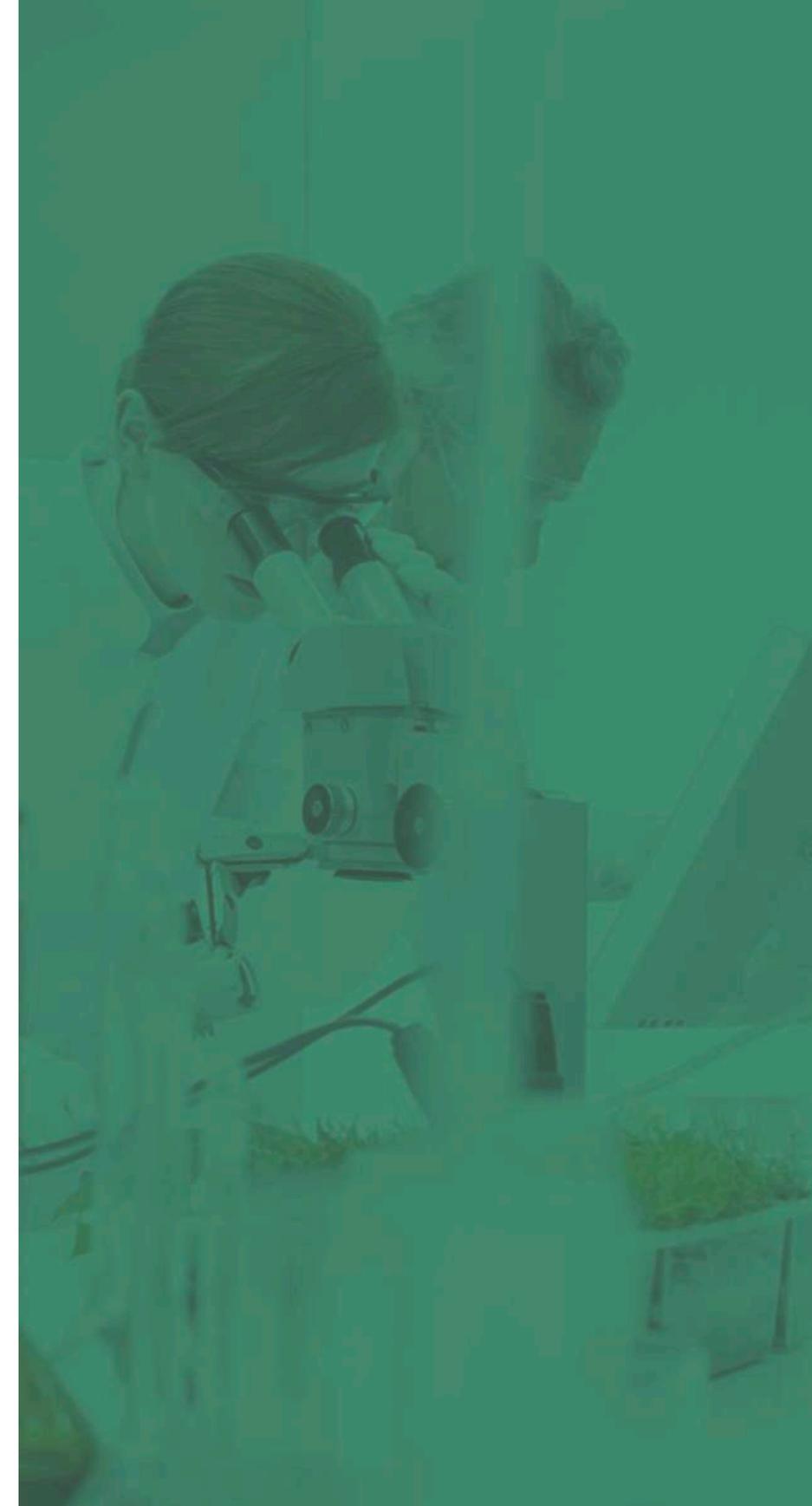
Emerald Health Pharmaceuticals

Focused on developing patented synthetic cannabinoid-derived drug candidates to treat diseases with unmet medical need

Established: 2017

Headquarters: San Diego, CA, USA

Status: Private





Key Highlights

15 years of cannabinoid science, broad patent coverage, foundation is the endocannabinoid system (ECS)

**Synthetic
cannabinoid-
derivative
pharmaceutical
drug developer**

**Multiple patented
CBD & CBG
derivatives for
treating a range of
disorders with
unmet needs**

**Phase I
human study
planned for 2018**

**Orphan Drug status
granted by
FDA and EMA for
scleroderma
and by FDA for
Huntington's
disease**

**Experienced
management in
pharma/biotech**



Why Cannabinoid-Derived Drugs?

NATURAL

The endocannabinoid system (ECS) is an internal system in our bodies that has been shown to foster overall health with two primary receptors:

CB1 and **CB2**

THERAPEUTIC

Positive effects through influence on the ECS

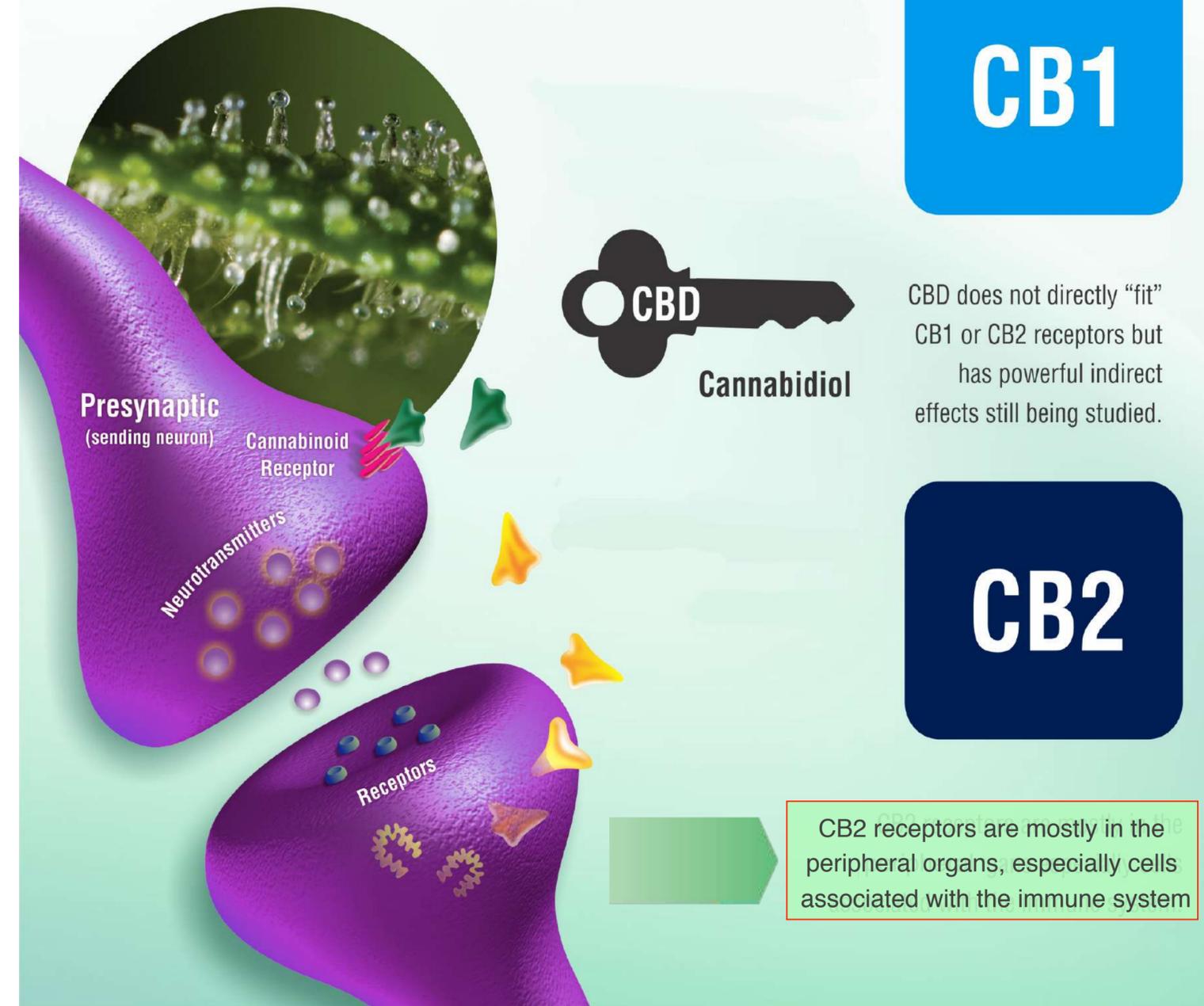
SAFE

Cannabidiol (CBD) & **cannabigerol (CBG)** are non-psychoactive, with low toxicity

Endocannabinoid System

These receptors are part of the endocannabinoid system which impact physiological processes affecting pain modulation, memory, and appetite plus anti-inflammatory effects and other immune system responses. The endocannabinoid system comprises two types of receptors, CB1 and CB2.

CB1 receptors are primarily found in the brain and central nervous system, and to a lesser extent in other tissues.



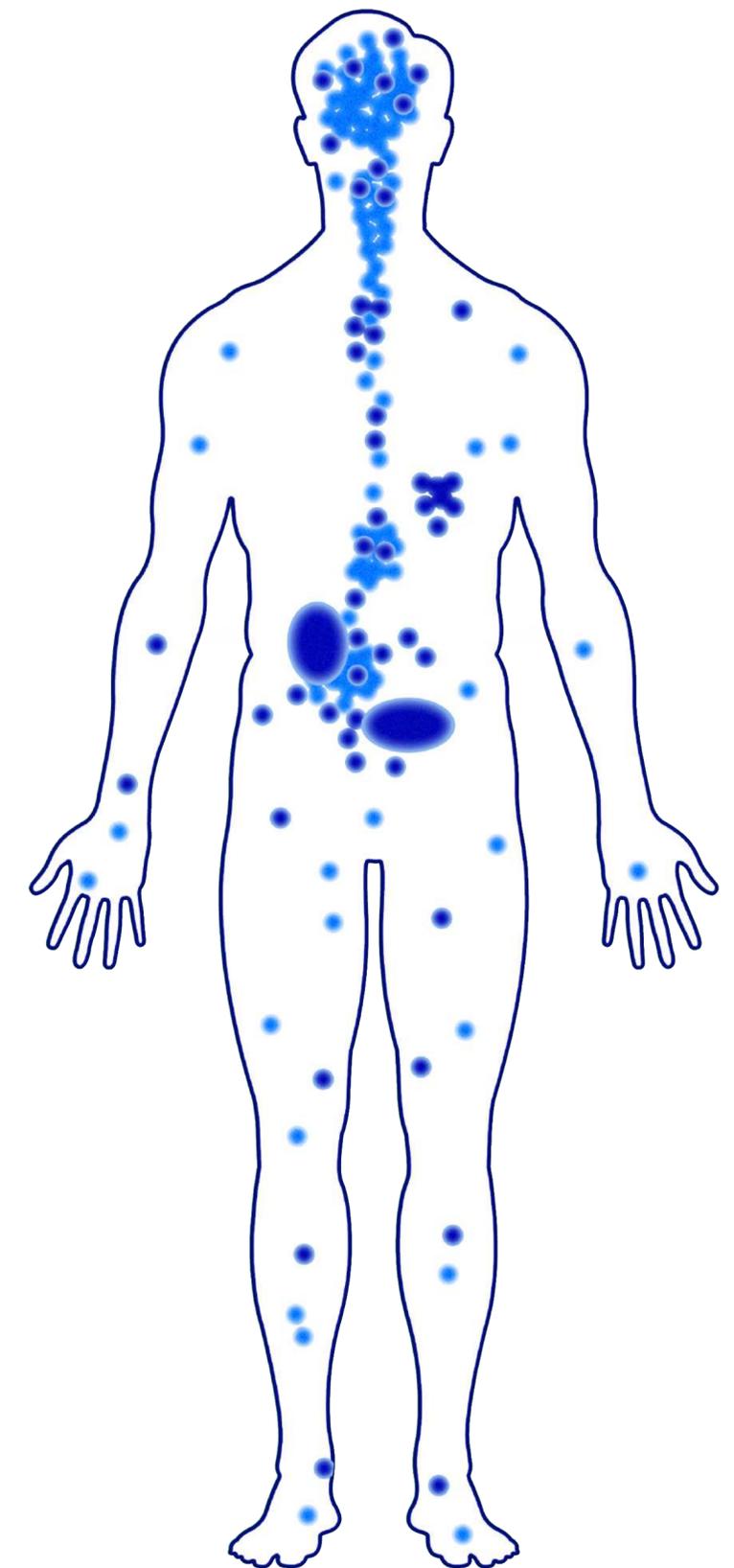
CBD does not directly "fit" CB1 or CB2 receptors but has powerful indirect effects still being studied.

CB2 receptors are mostly in the peripheral organs, especially cells associated with the immune system



Why Patented Synthetic Drugs?

- **IMPROVE CDB & CGB** receptor targeting
- **FOCUS** on receptors that can treat diseases with unmet medical need
- **DEVELOP** composition of matter patented cannabinoid new chemical entities (NCEs)
- **CREATE** a strong IP portfolio



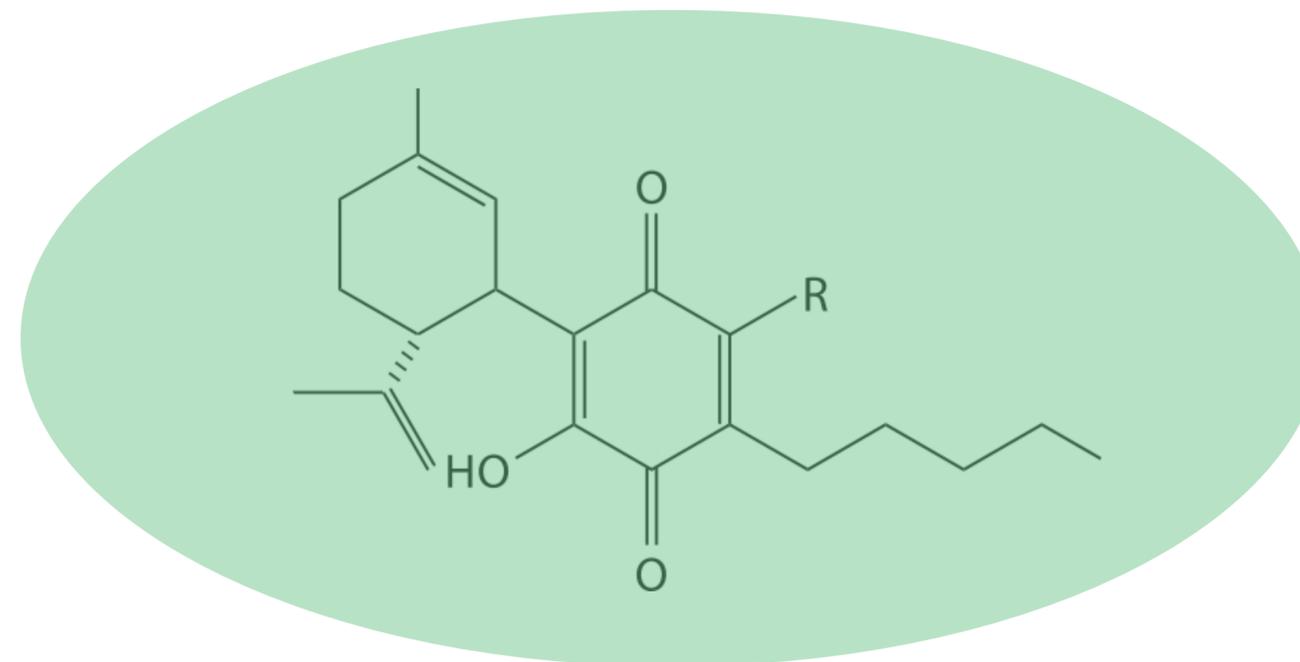


Patents: 6 Issued, 14 Pending

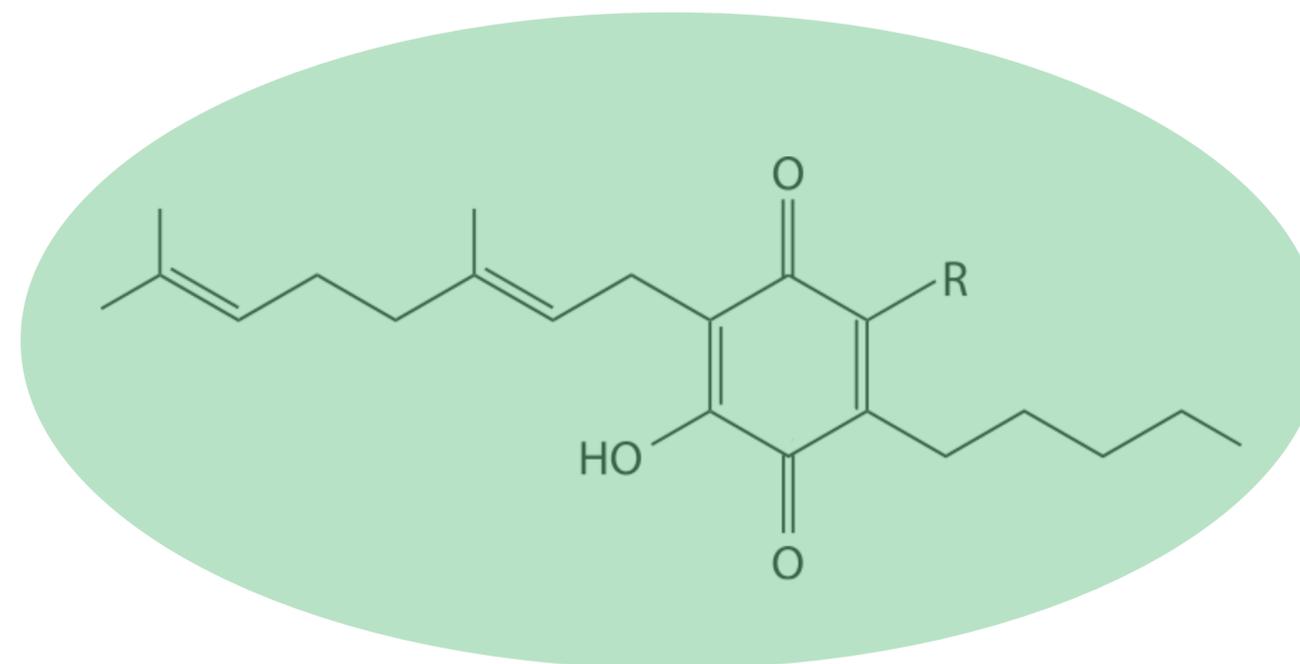
Molecules in our NCE Library

- Composition of matter patents
- Protection to 2035
- Potential for multiple products and indications

14 patented **CBD** derivatives



11 patented **CBG** derivatives





Significant Unmet Needs and Markets for 4 Initial Indications



**Data per National Multiple Sclerosis Society and Global Data*



Lead Product Candidates: Development Road Map

Proof-of-concept established for 4 initial indications



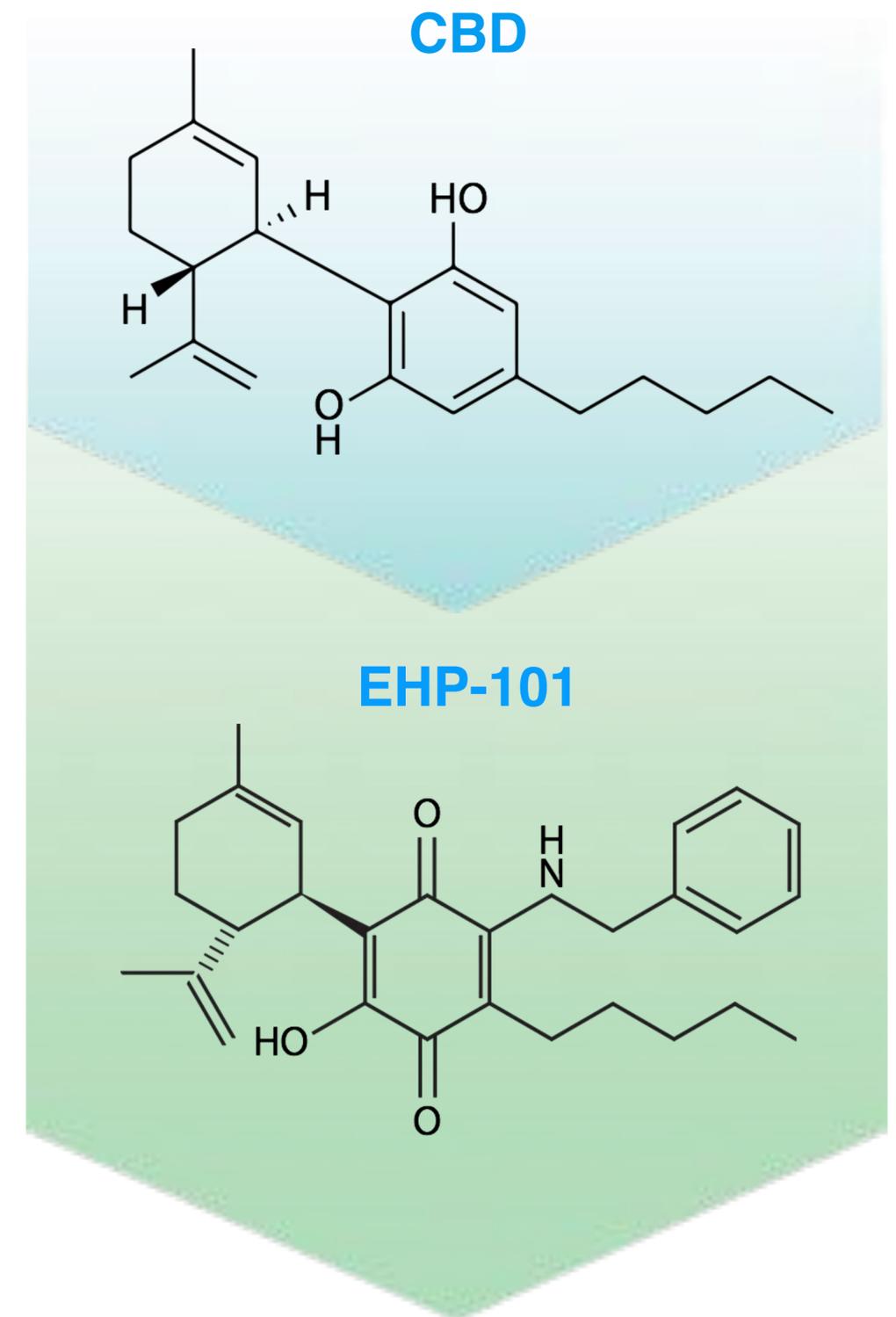


Lead Product Candidate: EHP-101

Cannabidiol (CBD) derivative

CBD:

- Does not bind to CB1
- Safe, anti-inflammatory, neuroprotective, analgesic, anti-proliferative
- Helps improve MS symptoms





Why Multiple Sclerosis?

Chronic inflammatory, degenerative, demyelinating CNS disorder

- Our molecule targets the main receptors associated with MS
- Current medications are most effective only during the inflammatory phase; less potent as the disease transitions to a neurodegenerative process
- No effective disease-modifying drugs for progressive forms
- No therapies appear to re-myelinate damaged neurons

Main symptoms of Multiple Sclerosis

Central:

- Fatigue
- Cognitive impairment
- Depression
- Anxiety
- Unstable mood

Visual:

- Nystagmus
- Optic neuritis
- Diplopia

Speech:

- Dysarthria

Throat:

- Dysphagia

Musculoskeletal:

- Weakness
- Spasms
- Ataxia

Sensation:

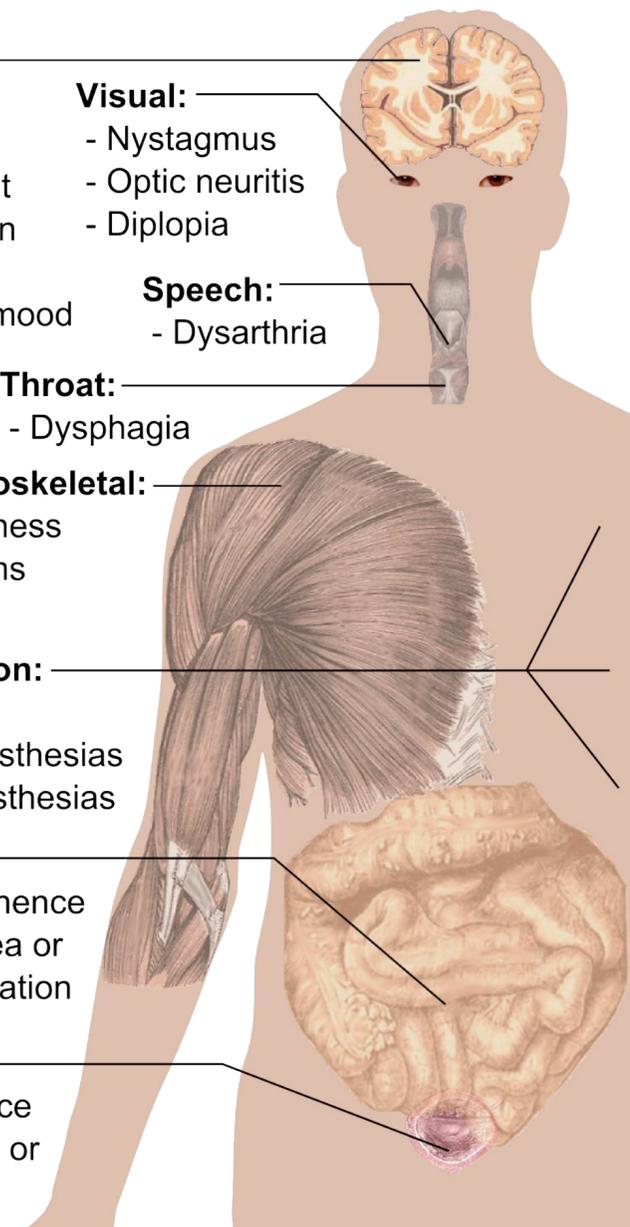
- Pain
- Hypoesthesias
- Paraesthesias

Bowel:

- Incontinence
- Diarrhea or constipation

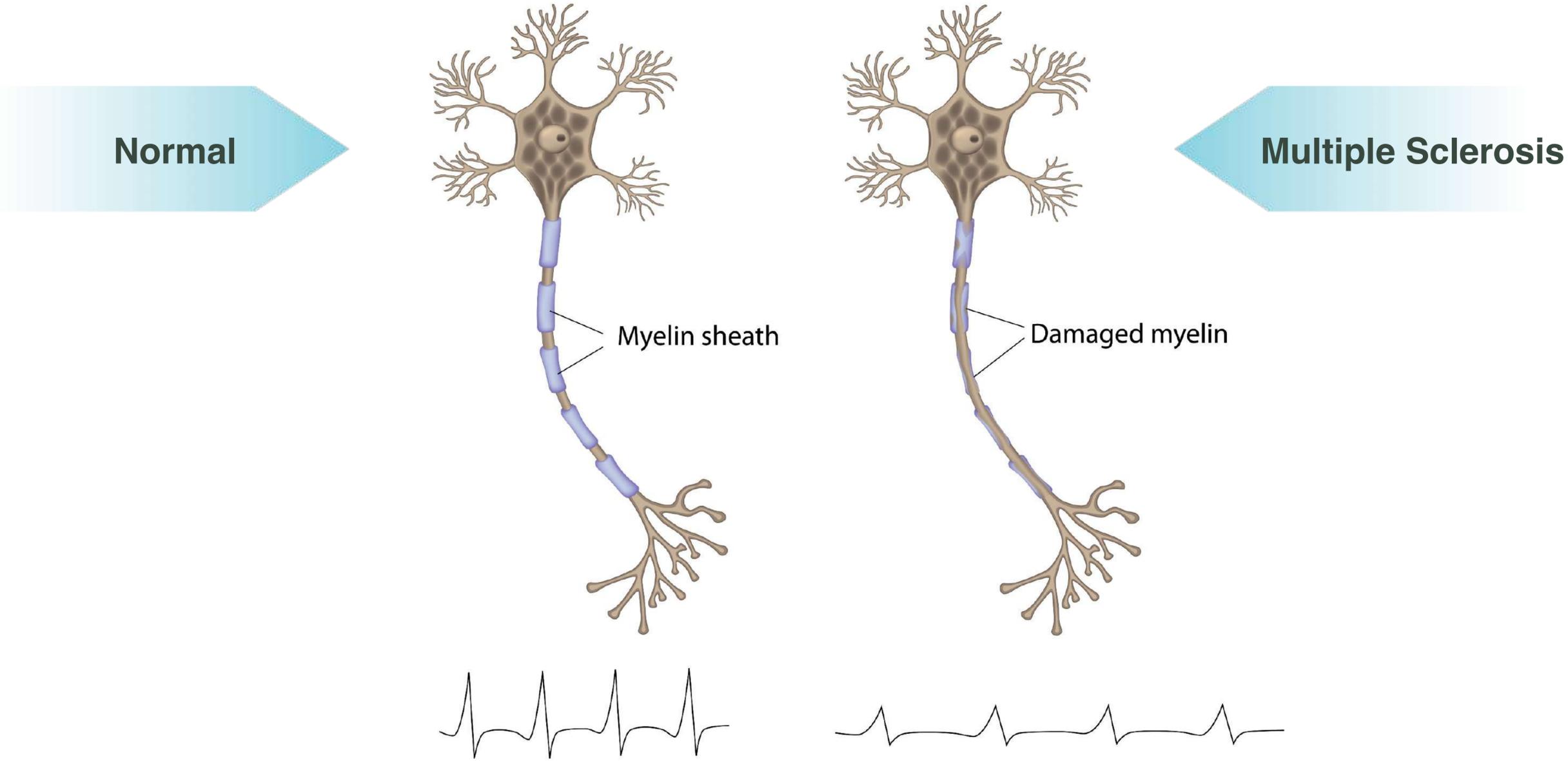
Urinary:

- Incontinence
- Frequency or retention





EHP-101 Can Potentially Re-Myelinate Nerves Damaged by MS





EHP-101: Designed for Mechanism of Action

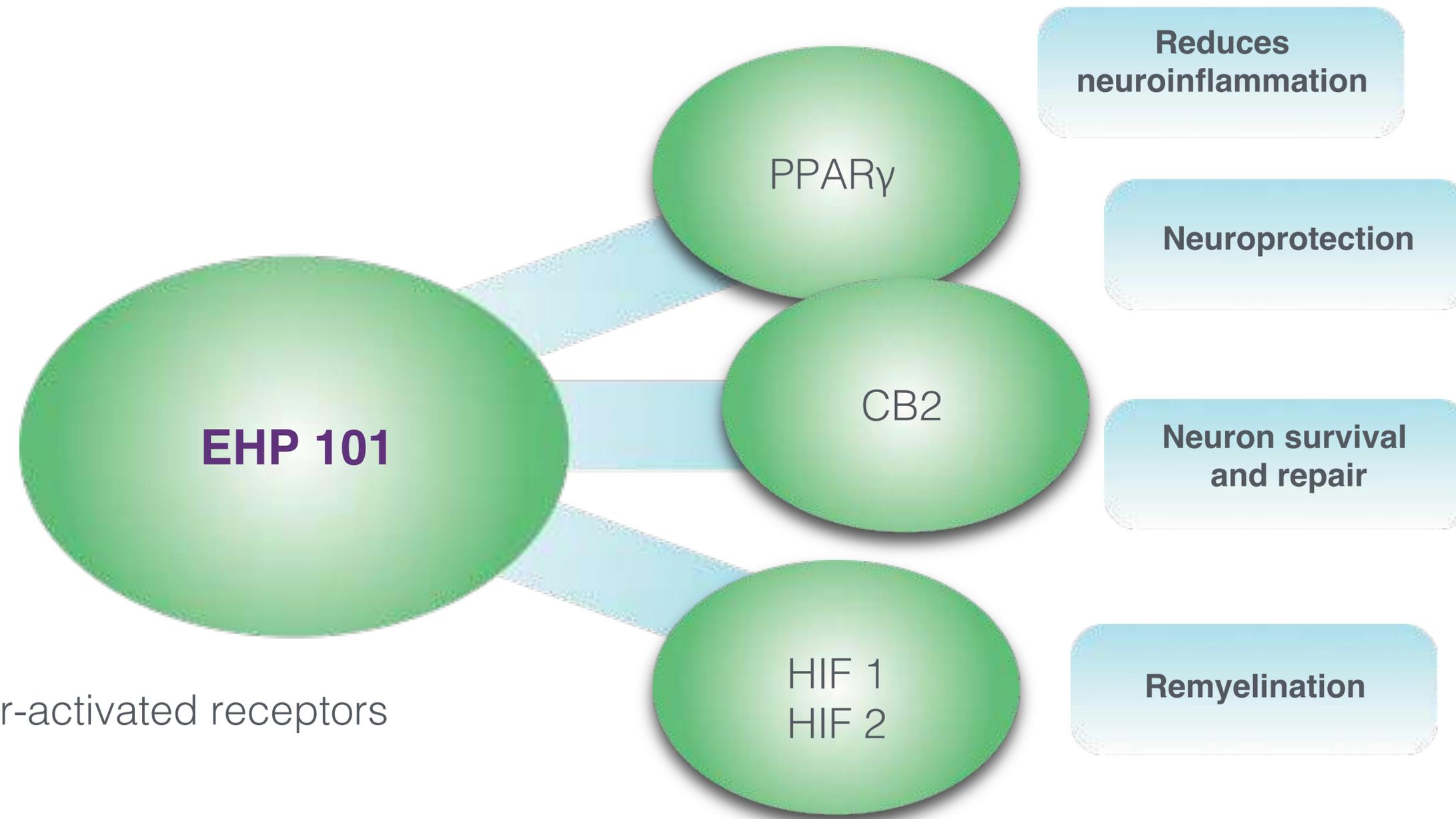
Our strategy:

To improve on CDB's known positive effects by affecting validated targets in MS:

PPAR γ , CB2 and HIF

PPAR: Peroxisome proliferator-activated receptors

HIF: Hypoxia inducible factor

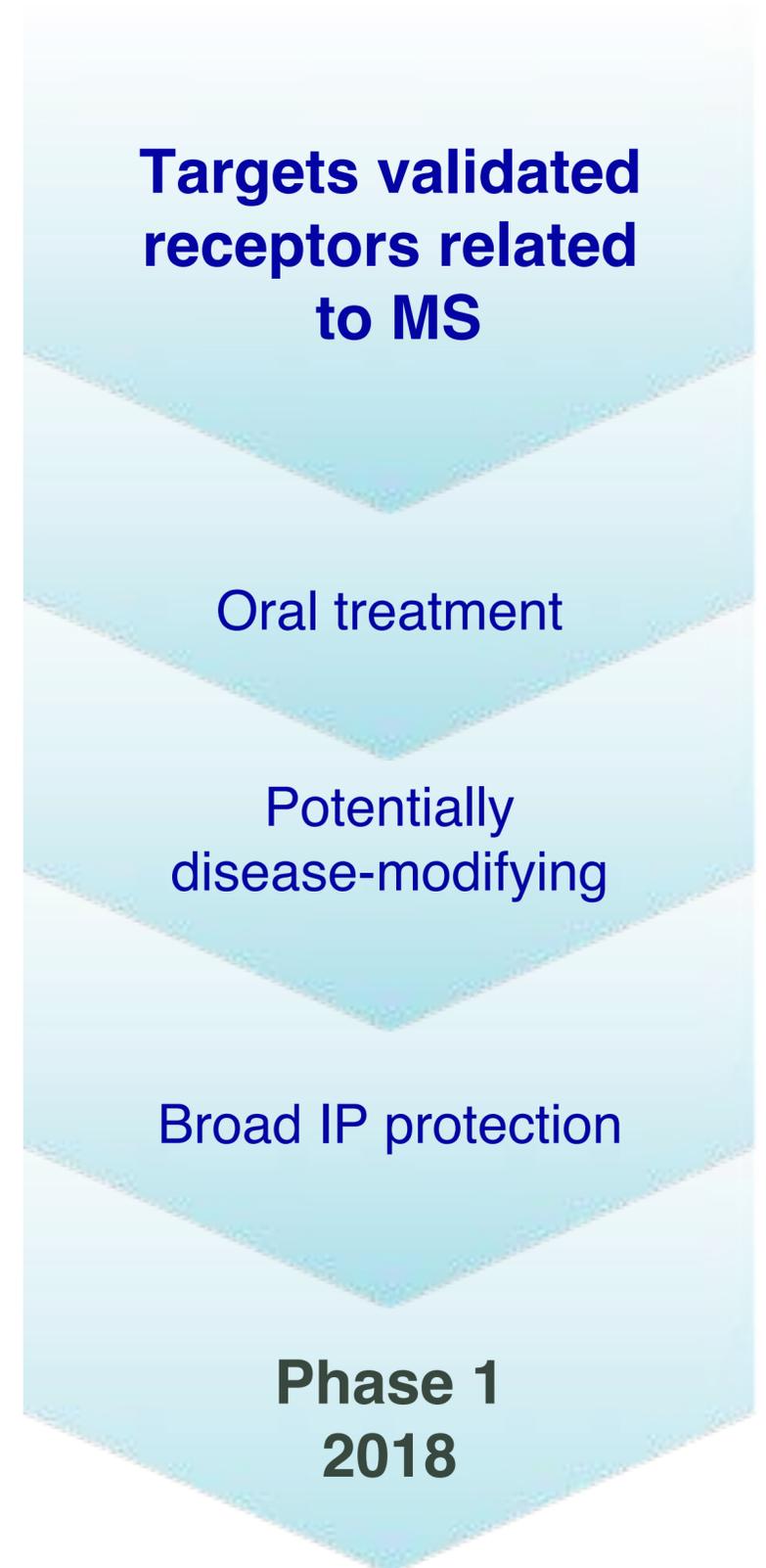




EHP-101 Multiple Sclerosis: Suggestive of Safety & Efficacy

- MoA consistent with validated MS targets
- Efficacy shown in relevant animal models of MS
- Effective at very low doses
- Low toxicity seen at much higher than therapeutic doses

Human studies planned to start this year

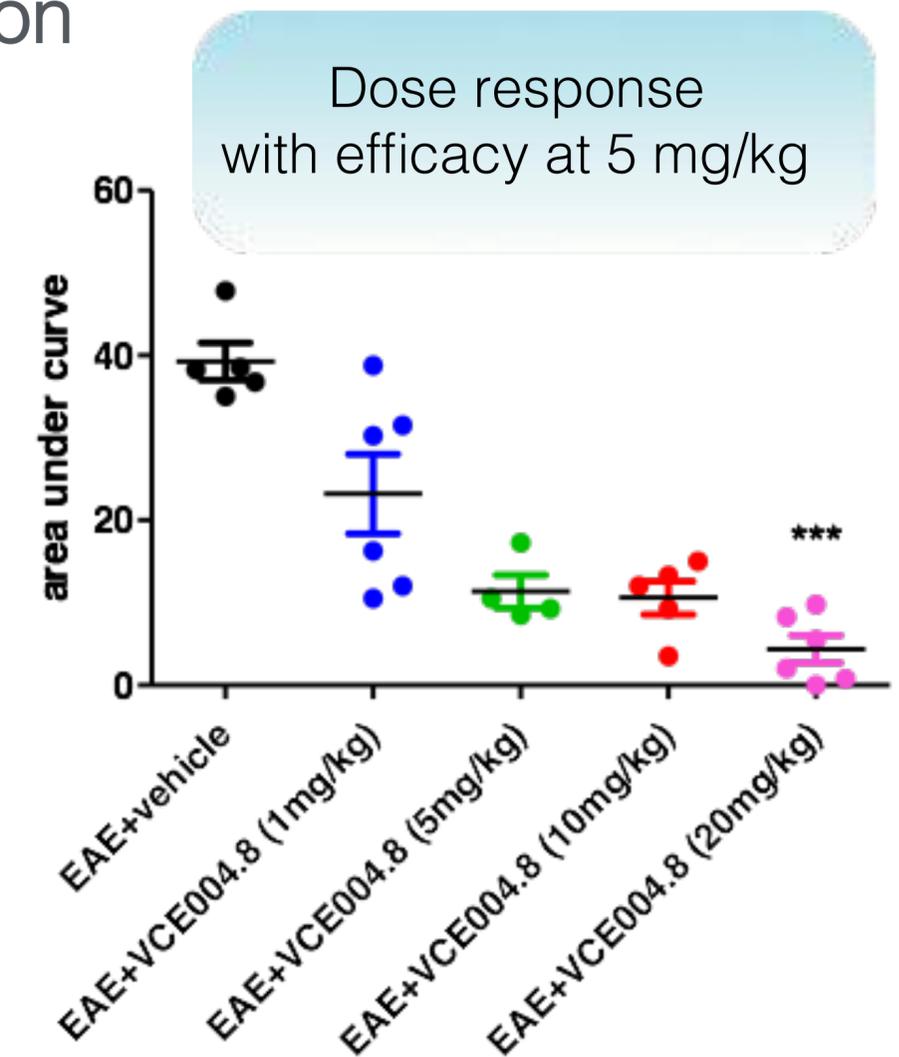
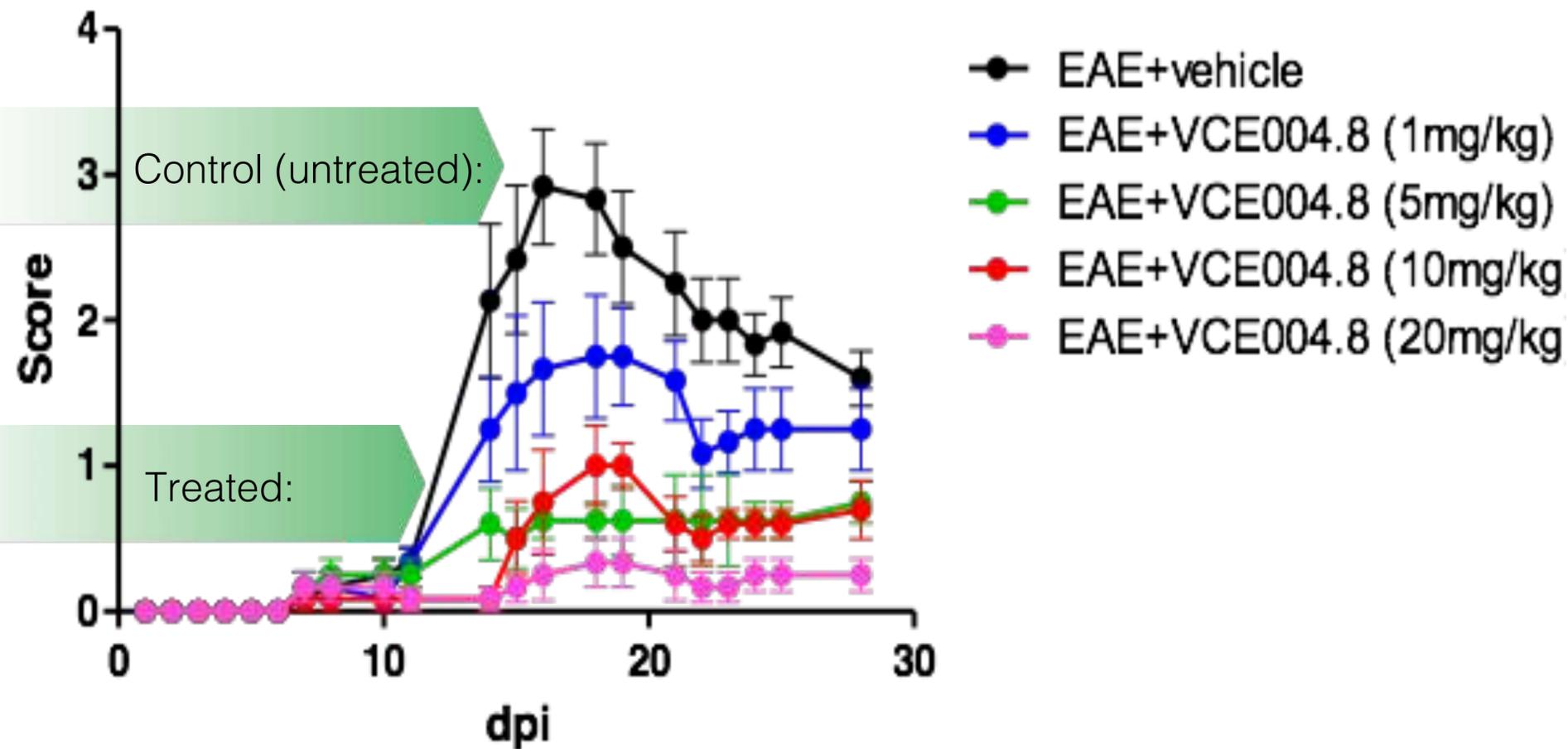




EHP-101 Multiple Sclerosis: Efficacy Demonstrated

Two widely accepted animal models of MS (EAE & TMEV)

Significant reduction in clinical signs and disease progression

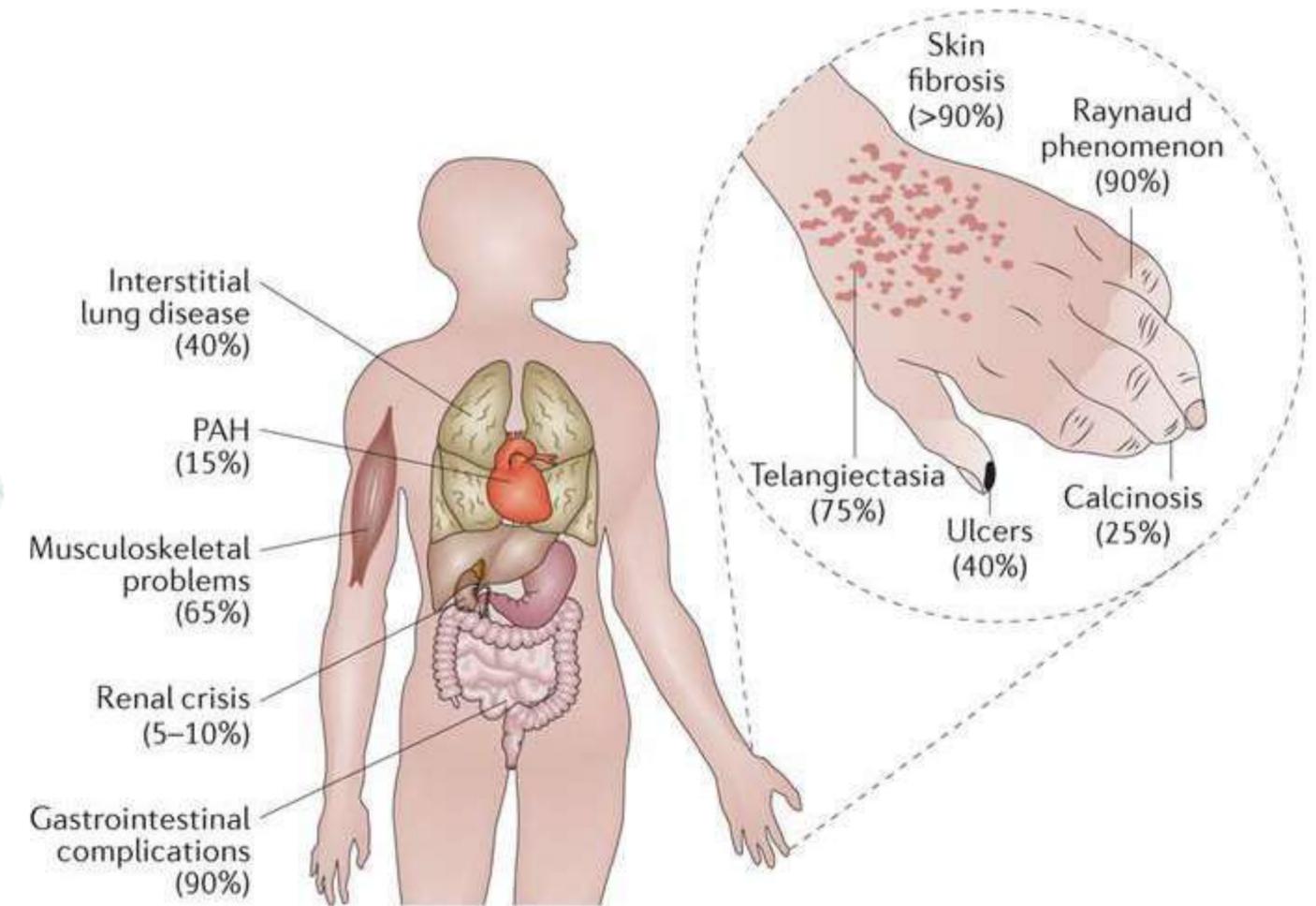


Dose response with efficacy at 5 mg/kg

EHP-101 Second Indication: Scleroderma (Systemic Sclerosis or SSc)

Chronic, systemic autoimmune disease causing fibrosis of skin and internal organs

- Rare, life-threatening disease
- No SSc-specific approved drugs
- Current therapies not effective and have significant toxicities
- Lung fibrosis is a common cause of death (~60% mortality in 10 years)

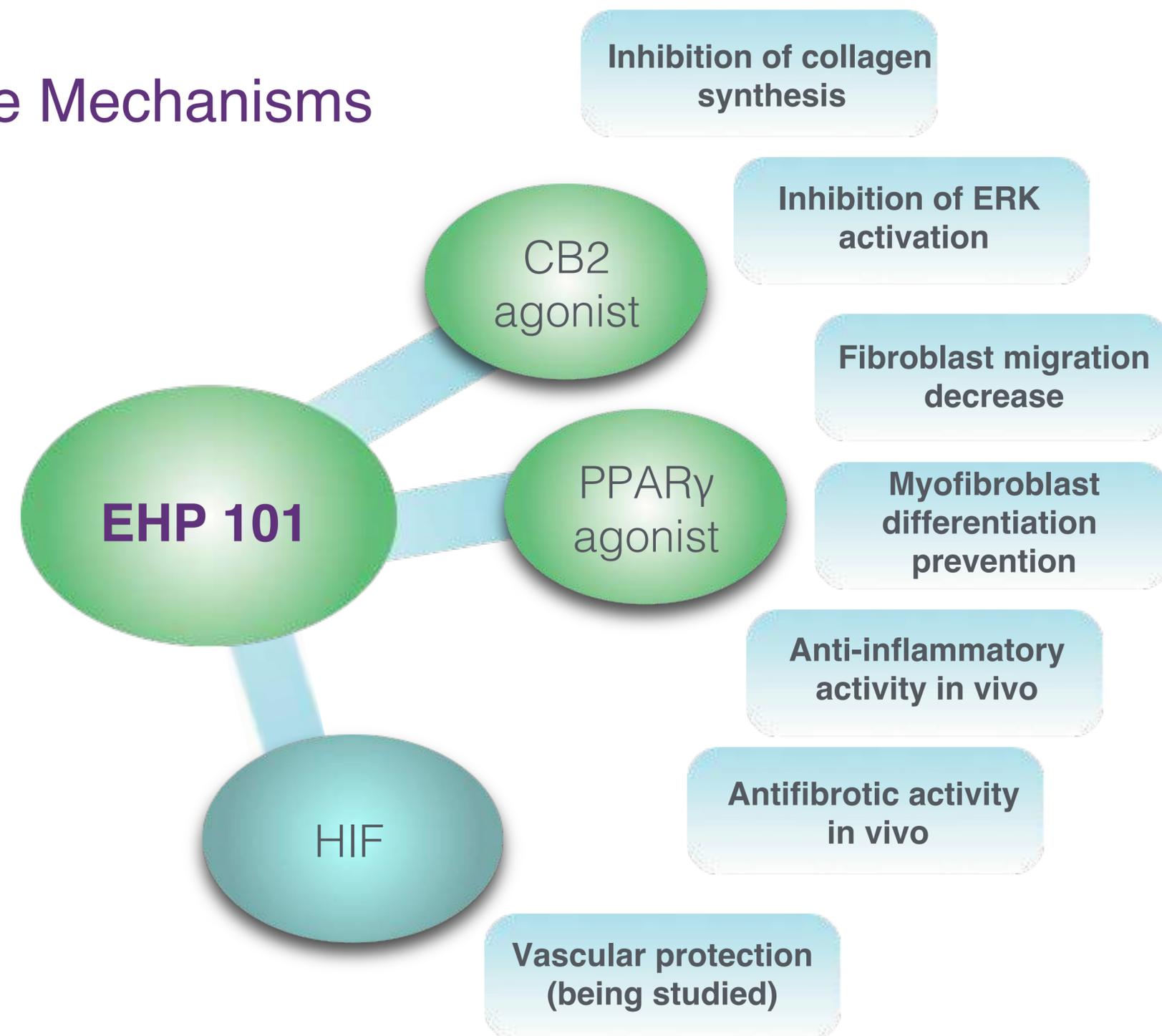


Nature Reviews | Disease Primers



EHP-101 Targets PPAR γ and CB2; Affects Scleroderma Through Multiple Mechanisms

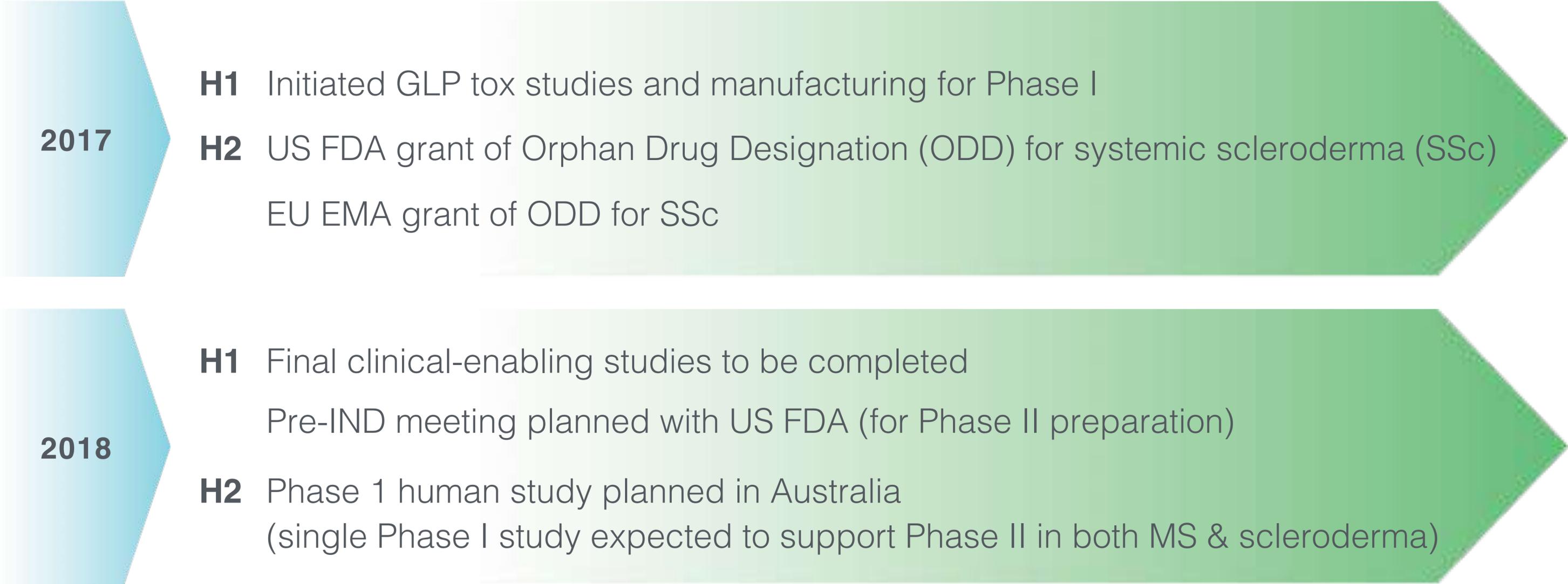
- **PPAR γ** and **CB2**: extensively studied molecular targets for the treatment of scleroderma*
- Combined effect on PPAR γ , CB2 and HIF not described for other types of marketed drugs
- Scleroderma is an orphan disease (no approved drugs; no cure)



*Minghua et al, Tavarares et al, Akhmetshina et al, Del Rio et al



EHP-101: Regulatory Plan and Timeline



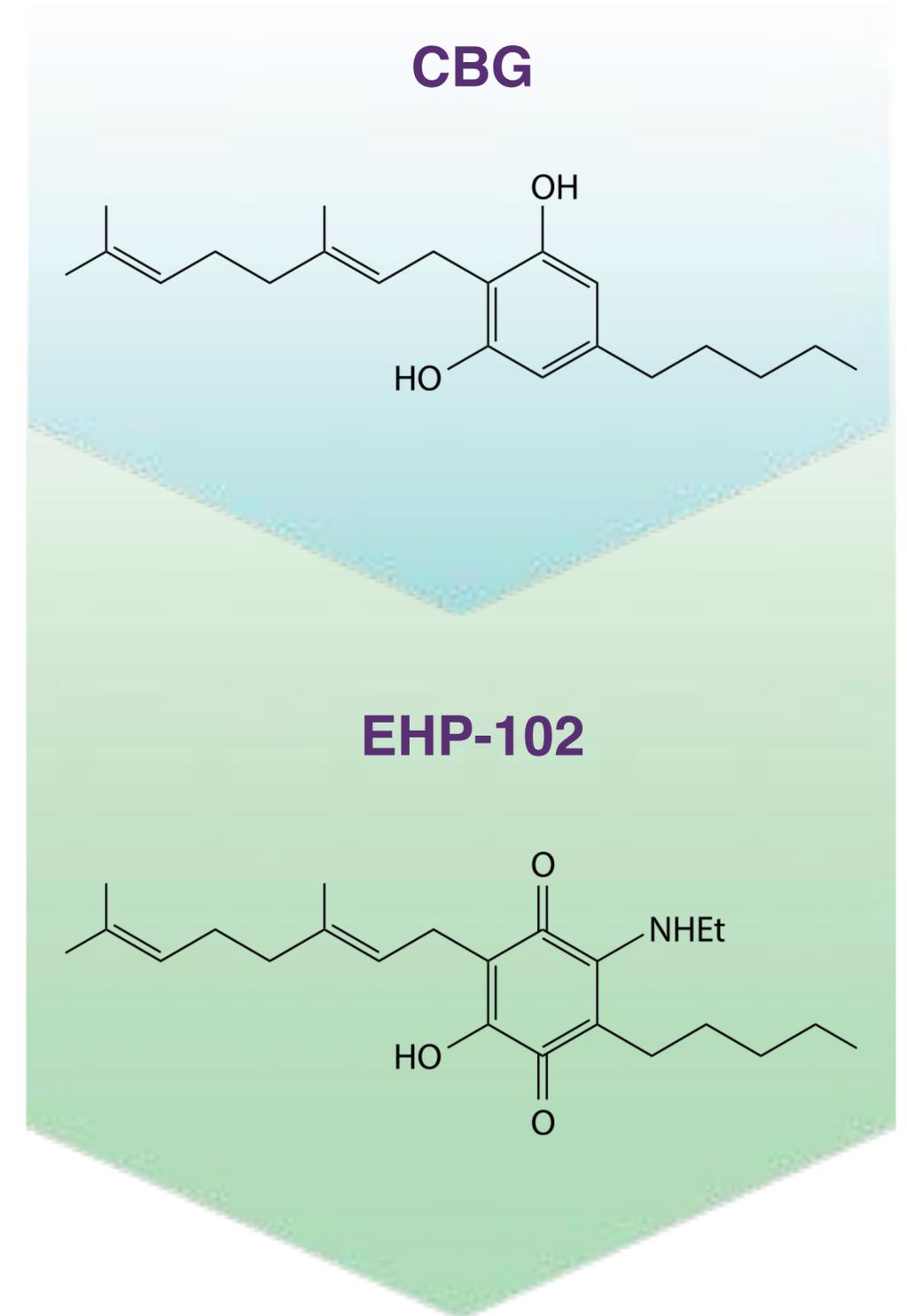


EHP-102: Second Product Candidate

Cannabigerol (CBG) derivative

CBG:

- Does not bind to CB1 (non-psychootropic)
- Provides neuroprotection in models of Huntington's disease, partially through antioxidant and anti-inflammatory activity, and PPAR γ modulation
- Suppresses norepinephrine, providing muscle relaxation and analgesic properties through effects on the CNS

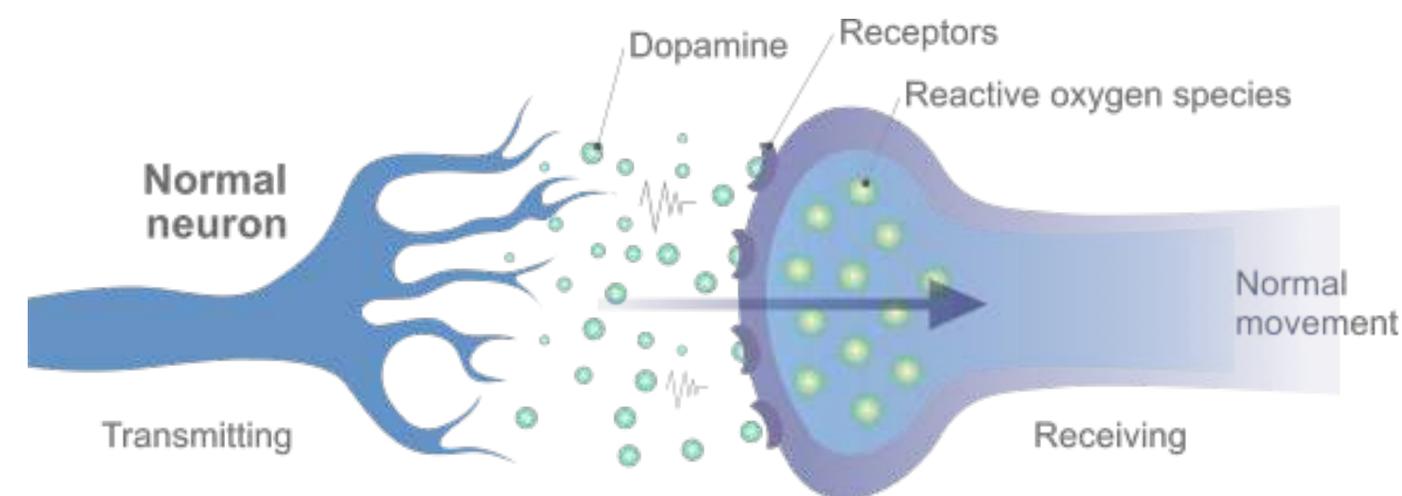




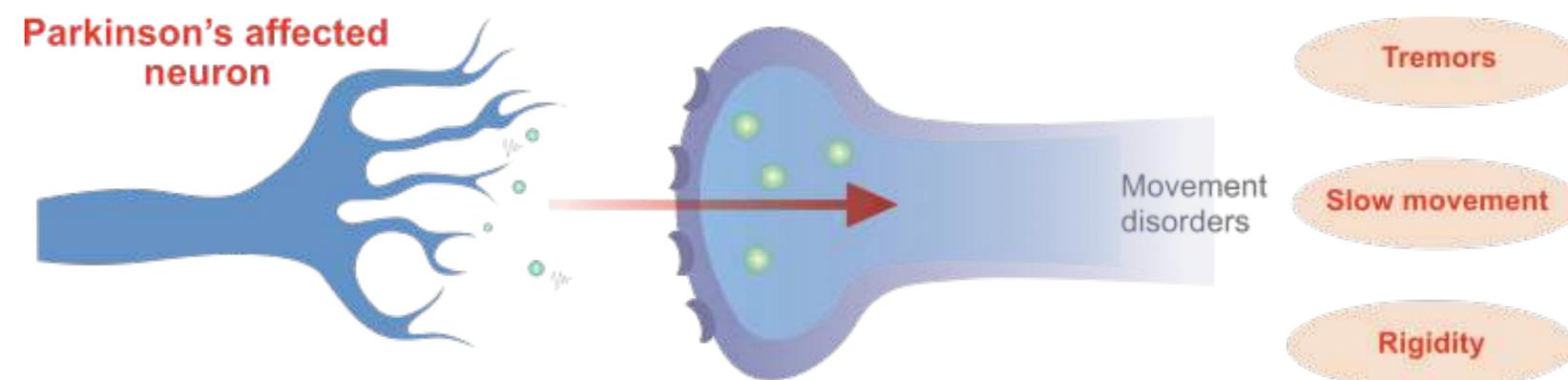
EHP-102: Parkinson's Disease

Chronic, progressive neurodegenerative disorder with no current cure

- More than 10 million people worldwide have Parkinson's disease
- A disease where damaged neurons do not produce sufficient dopamine (dopamine helps transmit impulses from the brain to the muscles)



Parkinson's Disease is a chronic, progressive neurodegenerative disorder with no current cure

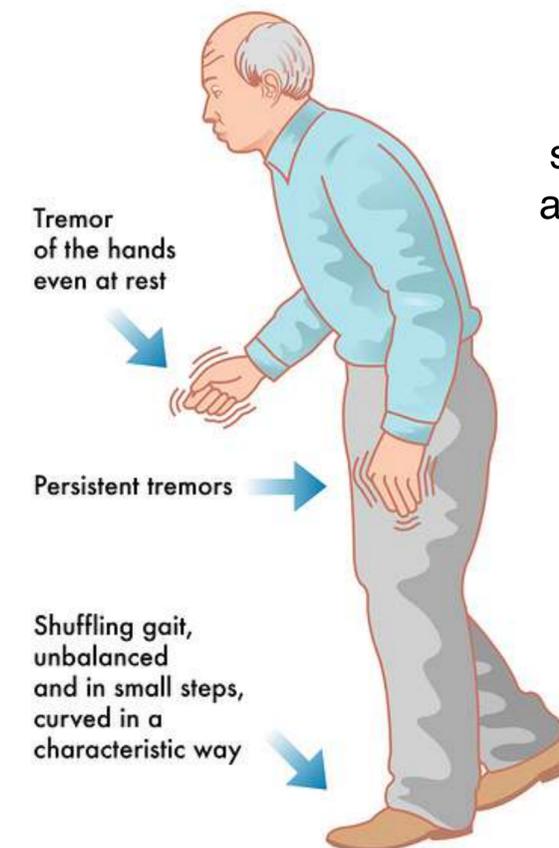
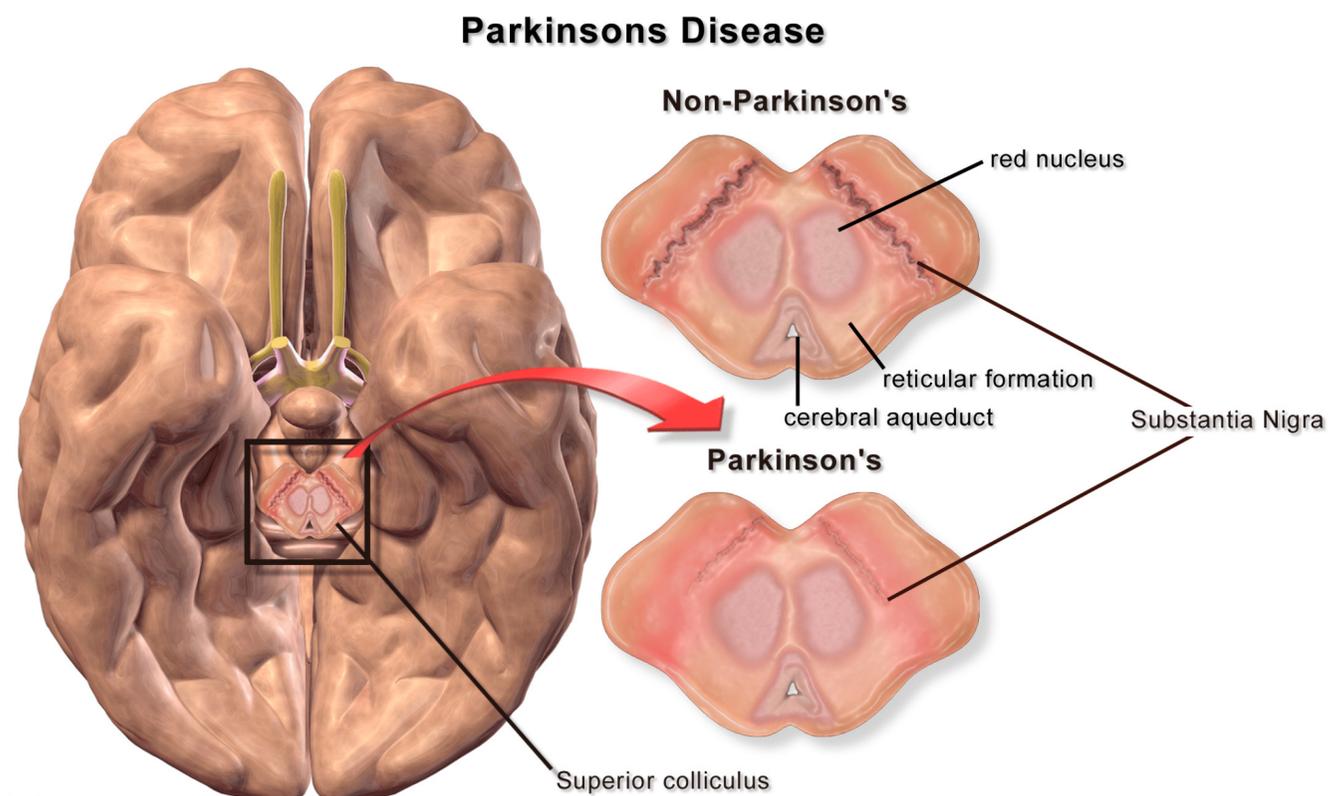




EHP-102: Parkinson's Disease

Demonstrated efficacy in mouse models

- Provides neuroprotection, partially through PPAR γ activity and reduction in proinflammatory mediators
- Improves clinical symptoms and recovers movement parameters (motor coordination and activity)
- Reduces inflammatory marker expression and prevents dopaminergic neuronal loss

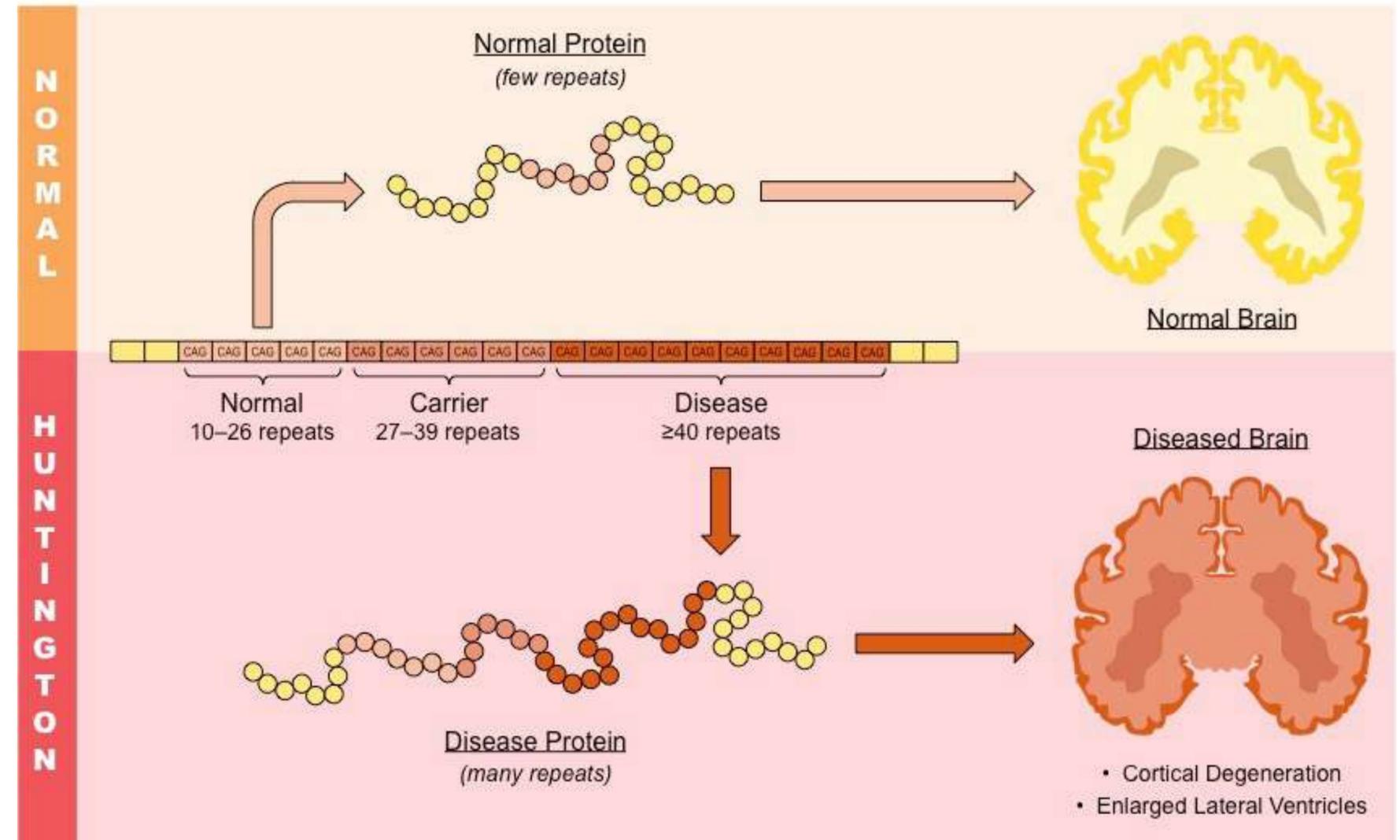


Symptoms include shaking, rigidity, slowness of movement, and difficulty with walking

EHP-102: Huntington's disease

Causes progressive breakdown of nerve cells

- An orphan disease
- EHP-102 Targets PPAR γ with improved activity
- Also targets other pathways involved in neural survival (ERK 1+2)





EHP-102: Current Status

Demonstrated preclinical efficacy





Publications

NATURE SCIENTIFIC REPORTS

OPEN

The cannabinoid alleviates bleomy scleroderma and antifibrotic effect peroxisome proliferator receptor- γ and CB₂

Received: 09 October 2015
Accepted: 29 January 2016
Published: 18 February 2016

Carmen del Río¹, Carmen Navarrete², Juan A. Gómez-Cañas^{3,4,5}, M. Ruth Pazos^{3,4,5}, Javier Fernández-Ruiz^{1,3,6}, Giovanni Appendino⁶, Marco A. Calzado¹, Irene Cantarero⁵, Belén Palomares⁵, José Aguilera^{1,2,3}, Javier Fernández-Ruiz^{1,3,6}, María Luz Bellido⁴, Federica Pollastro⁷, Giovanni Appendino⁷, Marco A. Calzado⁵, Ismael Galve-Roperh^{1,2,3} & Eduardo Muñoz⁵

Scleroderma is a group of rare diseases associated with chronic tissue injury, followed by fibrosis affecting the skin and internal organs. A hallmark of scleroderma, and disrupting the intracellular signaling to controlling fibrosis. Because of its potential role in both PPAR γ and CB₂ receptors represent attractive therapeutic targets. We have developed a non-thiophilic cannabinoid (VCE-004.8) that behaves as a dual agonist of PPAR γ and CB₂ receptors. VCE-004.8 inhibited TGF β -induced Col1A2 gene transcription and collagen synthesis. Moreover, VCE-004.8 inhibited TGF β -mediated myofibroblast differentiation and impaired wound-healing activity. The anti-fibrotic efficacy *in vivo* was investigated in a murine model of dermal fibrosis induced by bleomycin. VCE-004.8 reduced dermal thickness, blood vessels collagen accumulation and prevented mast cell degranulation and macrophage infiltration in the skin. These effects were impaired by the PPAR γ antagonist T0070907 and the CB₂ antagonist AM630. In addition, VCE-004.8 downregulated the expression of several key genes associated with fibrosis, qualifying this semi-synthetic cannabinoid as a novel compound for the management of scleroderma and, potentially, other fibrotic diseases.

www.nature.com/scientificreports

NATURE SCIENTIFIC REPORTS

OPEN

VCE-003.2, a novel cannabigerol derivative, enhances neuronal progenitor cell survival and alleviates symptomatology in murine models of Huntington's disease

Received: 29 January 2016
Accepted: 24 June 2016
Published: 19 July 2016

Javier Díaz-Alonso^{1,2,3,*}, Juan Paraiso-Luna^{1,2,3,*}, Carmen Navarrete^{4,*}, Carmen del Río⁵, Irene Cantarero⁵, Belén Palomares⁵, José Aguilera^{1,2,3}, Javier Fernández-Ruiz^{1,3,6}, María Luz Bellido⁴, Federica Pollastro⁷, Giovanni Appendino⁷, Marco A. Calzado⁵, Ismael Galve-Roperh^{1,2,3} & Eduardo Muñoz⁵

Cannabinoids have shown to exert neuroprotective actions in animal models by acting at different targets including canonical cannabinoid receptors and PPAR γ . We previously showed that VCE-003, a cannabigerol (CBG) quinone derivative, is a novel neuroprotective and anti-inflammatory cannabinoid acting through PPAR γ . We have now generated a non-thiophilic VCE-003 derivative named VCE-003.2 that preserves the ability to activate PPAR γ and analyzed its neuroprotective activity. This compound exerted a prosurvival action in progenitor cells during neuronal differentiation, which was prevented by a PPAR γ antagonist, without affecting neural progenitor cell proliferation. In addition, VCE-003.2 attenuated quinolinic acid (QA)-induced cell death and caspase-3 activation and also reduced mutant huntingtin aggregates in striatal cells. The neuroprotective profile of VCE-003.2 was analyzed using *in vivo* models of striatal neurodegeneration induced by QA and 3-nitropropionic acid (3NP) administration. VCE-003.2 prevented medium spiny DARPP32⁺ neuronal loss in these Huntington's-like disease mice models improving motor deficits, reactive astrogliosis and microglial activation. In the 3NP model VCE-003.2 inhibited the upregulation of proinflammatory markers and improved antioxidant defenses in the brain. These data lead us to consider VCE-003.2 to have high potential for the treatment of Huntington's disease (HD) and other neurodegenerative diseases with neuroinflammatory traits.

García et al. *Journal of Neuroinflammation* (2018) 15:19
DOI 10.1186/s12974-018-1060-5

Journal of Neuroinflammation

RESEARCH Open Access

Benefits of VCE-003.2, a cannabigerol quinone derivative, against inflammation-driven neuronal deterioration in experimental Parkinson's disease: possible involvement of different binding sites at the PPAR γ receptor

Concepción García^{1,2,3}, María Cristina Palomo-Garó^{1,2,3}, Sara M. Luz Bellido⁸, Moisés García and Javier Fernández-Ruiz^{1,2}

Journal of Neuroinflammation

Hypoxia mimetic activity of VCE-004.8, a cannabidiol quinone derivative: implications for multiple sclerosis therapy.

--Manuscript Draft--

Manuscript Number:	JNEU-D-18-00001R1
Full Title:	Hypoxia mimetic activity of VCE-004.8, a cannabidiol quinone derivative: implications for multiple sclerosis therapy.
Article Type:	Research

Abstract

Background: Neuroprotective compounds with antioxidant or anti-inflammatory and neuroprotective properties. Cannabigerol (CBG), which is also an agonist of PPAR γ , is a neurotherapeutic compound. VCE-003.2 is a novel neuroprotective and anti-inflammatory cannabinoid derivative. We evaluated the neuroprotective activity of VCE-003.2 in a (LPS) model of PD, as well as its effect on the PPAR γ receptor was fully activated and sustained with treatment. (Continued on next page)

Neurotherapeutics
DOI 10.1007/s13311-014-0304-z

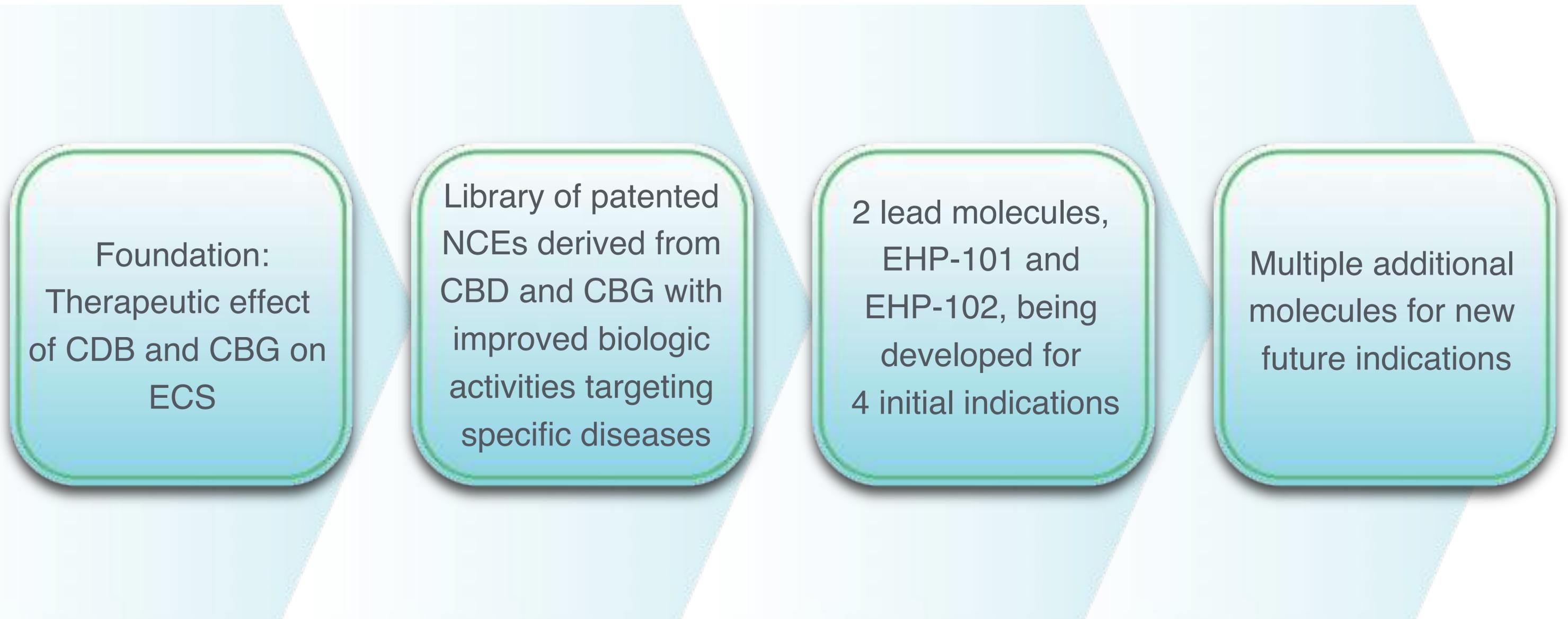
ORIGINAL ARTICLE

Neuroprotective Properties of Cannabigerol in Huntington's Disease: Studies in R6/2 Mice and 3-Nitropropionate-lesioned Mice

Sara Valdeolivas · Carmen Navarrete · Irene Cantarero · María L. Bellido · Eduardo Muñoz · Onintza Sagredo



Emerald Health Pharmaceuticals Summary





Emerald Health Pharmaceuticals Summary

Combined MoA
for EHP molecules
not described with
other drugs

EHP-101 human
study planned for
2018

Orphan status
granted for
scleroderma and
Huntington's

Management
team experienced
in developing
drugs and building
companies

Experienced Pharma / Biotech Management Team

Jim DeMesa, MD, MBA
Chief Executive Officer

29 years in pharma product development and management, including preclinical and clinical trial management, and partnering with pharma companies. 15 years as CEO of public biotech companies.

Alain Rolland, PharmD, PhD
VP, Product Development

30 years of international leadership experience in R&D, strategic product management, and business development.

Mari-Luz Bellido, PhD, MBA
VP, European Operations

Molecular biologist with **10 years** experience in preclinical development of cannabis-based compounds.

Avtar Dhillon, MD
Chairman

Chairman of 5 public life science companies, led turnaround of NASDAQ:INO from \$10m to \$550m

Jill Broadfoot
Chief Financial Officer

31 years in biotech financial management at GW Pharma (NASDAQ GWPH), CFO, Vical (NASDAQ: VICL), Ernst & Young. BS in Business Administration and CPA.

Nancy Coulson
VP, Regulatory Affairs

30 years in global pharma and biotech regulatory management with J&J, BMS, and others.

Eduardo Muñoz, MD, PhD
Chief Scientific Officer

30 years in biomedical research, Professor of Immunology, author of 200 articles, patents and book chapters with nearly 5,000 citations.

Giovanni Appendino, PhD
Scientific Advisor

One of the worlds thought leaders in cannabinoid research; Keynote speaker at the 2014 ICRS Symposium; Professor of Pharmaceutical Chemistry at the University of Eastern Piedmont; Author of 250 articles and 10 book chapters.

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