

(19)



(11)

EP 4 253 531 A3

(12)

EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
25.10.2023 Bulletin 2023/43

(51) International Patent Classification (IPC):
C12N 9/00 (2006.01)

(43) Date of publication A2:
04.10.2023 Bulletin 2023/40

(52) Cooperative Patent Classification (CPC):
C12N 9/00

(21) Application number: **23174662.9**

(22) Date of filing: **27.06.2017**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

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(30) Priority: **27.06.2016 US 201662355022 P**
13.12.2016 US 201662433431 P
23.12.2016 US 201662438540 P
23.12.2016 US 201662438601 P
23.12.2016 US 201662438702 P
23.12.2016 US 201662438588 P
23.12.2016 US 201662438695 P
09.03.2017 US 201762469006 P
02.06.2017 US 201762514104 P

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(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
17735761.3 / 3 475 417

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(54) **COMPOSITIONS AND METHODS FOR MAKING BENZYLISOQUINOLINE ALKALOIDS, MORPHINAN ALKALOIDS, THEBAINE, AND DERIVATIVES THEREOF**

(57) Disclosed herein are methods that may be used for the synthesis of benzylisoquinoline alkaloids ("BIAs") such as alkaloid morphinan. The methods disclosed can be used to produce thebaine, oripavine, codeine, morphine, oxycodone, hydrocodone, oxymorphone, hydro-

morphone, naltrexone, naloxone, hydroxycodone, neopinone, and/or buprenorphine. Compositions and organisms useful for the synthesis of BIAs, including thebaine synthesis polypeptides, purine permeases, and polynucleotides encoding the same, are provided.

EP 4 253 531 A3



EUROPEAN SEARCH REPORT

Application Number

EP 23 17 4662

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	<p>CHOE SANGGIL ET AL: "Genetic and chemical components analysis of Papaver setigerum naturalized in Korea", October 2012 (2012-10), FORENSIC SCIENCE INTERNATIONAL, VOL. 222, NR. 1-3, PAGE(S) 387-393, XP002773945, ISSN: 0379-0738 (print)</p> <p>* figure 1 *</p> <p>* page 388, left-hand column, paragraph 2 - right-hand column, paragraph 2 *</p> <p>-----</p>	1-15	INV. C12N9/00
Y	<p>FACCHINI P J ET AL: "Developmental and inducible accumulation of gene transcripts involved in alkaloid biosynthesis in opium poppy", 1 September 2003 (2003-09-01), PHYTOCHEMI, PERGAMON PRESS, GB, PAGE(S) 177 - 186, XP004448633, ISSN: 0031-9422</p> <p>* figure 1 *</p> <p>* page 177, left-hand column, paragraph 1 - page 179, left-hand column, paragraph 2 *</p> <p>* page 182, right-hand column, paragraph 3 - page 184, right-hand column, paragraph 1 *</p> <p>-----</p>	1-15	TECHNICAL FIELDS SEARCHED (IPC) C12N
A	<p>SAMANANI NAILISH ET AL: "The role of phloem sieve elements and laticifers in the biosynthesis and accumulation of alkaloids in opium poppy", August 2006 (2006-08), PLANT JOURNAL, VOL. 47, NR. 4, PAGE(S) 547-563, XP002773946, ISSN: 0960-7412</p> <p>* abstract; figure 1 *</p> <p>* page 549, right-hand column, paragraph 2 - page 553, right-hand column, paragraph 1 *</p> <p>-----</p> <p style="text-align: center;">-/--</p>	1-15	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 12 September 2023	Examiner Bonello, Steve
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

1 EPO FORM 1503 03.82 (P04C01)



EUROPEAN SEARCH REPORT

Application Number

EP 23 17 4662

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A	<p>Fisinger Ursula et al.: "Thebaine synthase: A new enzyme in the morphine pathway in <i>Papaver somniferum</i>", Natural product communications, vol. 2, no. 3</p> <p>1 January 2007 (2007-01-01), pages 249-253, XP002773948,</p> <p>Retrieved from the Internet: URL: https://www.researchgate.net/profile/Nadja_Grobe/publication/286196913_Thebaine_synthase_A_new_enzyme_in_the_morphine_pathway_in_Papaver_somniferum/links/591881f20f7e9b70f4a08c79/Thebaine-synthase-A-new-enzyme-in-the-morphine-pathway-in-Papaver-somniferum.pdf?origin=publication_detail [retrieved on 2017-09-19] * page 251, left-hand column, paragraph 2 - right-hand column, paragraph 2 *</p>	1-15	
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		12 September 2023	Bonello, Steve
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

1 EPO FORM 1503 03.82 (P04C01)