



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : C12N 15/55, C07K 15/00, C12N 9/16 A01H 5/10, C12N 5/10, 15/82	A3	(11) International Publication Number: WO 94/10288 (43) International Publication Date: 11 May 1994 (11.05.94)
(21) International Application Number: PCT/US93/10814 (22) International Filing Date: 29 October 1993 (29.10.93) (30) Priority data: 07/968,971 30 October 1992 (30.10.92) US (60) Parent Application or Grant (63) Related by Continuation US Not Furnished (CIP) (71) Applicant (for all designated States except US): CALGENE, INC. [US/US]; 1920 Fifth Street, Davis, CA 95616 (US). (72) Inventors; and (75) Inventors/Applicants (for US only) : VOELKER, Toni, Alois [DE/US]; 1206 Covell Place, Davis, CA 95616 (US). DAVIES, Huw, Maelor [GB/US]; 307 Grande Avenue, Davis, CA 95616 (US). KNUTZON, Deborah, S. [US/US]; 2918 Pasatiempo Place, Sacramento, CA 95833 (US).	(74) Agents: LASSEN, Elizabeth et al.; Calgene, Inc., 1920 Fifth Street, Davis, CA 95616 (US). (81) Designated States: CA, JP, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> (88) Date of publication of the international search report: 5 January 1995 (05.01.95)	
(54) Title: MEDIUM-CHAIN THIOESTERASES IN PLANTS		
(57) Abstract <p>By this invention, further plant medium-chain acyl-ACP thioesterase sequences in conjunction with medium-chain thioesterase sequences. In a first embodiment, this invention relates to particular medium-chain thioesterase sequences from elm and <i>Cuphea</i>, and to DNA constructs for the expression of these thioesterases in host cells for production of C8 and C10 fatty acids. Other aspects of this invention relate to methods for using plant medium-chain thioesterases or medium-chain thioesterases from non-plant sources to provide medium-chain fatty acids in plant cells. As a further aspect, uses of long-chain thioesterase sequences for anti-sense methods in plant cells in conjunction with expression of medium-chain thioesterases in plant cells is described.</p>		

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 93/10814

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 5 C12N15/55 C07K15/00 C12N9/16 A01H5/10 C12N5/10
 C12N15/82

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 IPC 5 C12N C07K A01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO,A,91 16421 (CALGENE, INC.) 31 October 1991 cited in the application	1,3-6
Y	see page 17, line 11 - page 18, line 28; examples 9-11, 14 and 15; page 88, line 25 - page 91, line 6; page 98, line 22 - page 99, line 11; and claims. ---	2,7
X	WO,A,92 11373 (E.I. DU PONT DE NEMOURS AND COMPANY) 9 July 1992 see page 10, line 27 - page 12, line 10; page 22, line 22 - page 23, line 31; Examples 6, 7 and 10; and claims. --- -/--	1-6,12, 13,15-30

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
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- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

29 September 1994

Date of mailing of the international search report

28. 11. 94

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 93/10814

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SCIENCE vol. 257 , 1992 pages 72 - 74 T.A. VOELKER ET AL.; 'Fatty acid biosynthesis redirected to medium chains in transgenic oilseed plants'	12,13, 16-18, 21-27,30
Y	see whole document.	7,15,19, 20,28,29
X	--- US,A,5 147 792 (CALGENE, INC.) 15 September 1992	8,10, 31-33, 35,36 9,11,34
Y	see column 2, lines 52-64, column 7, lines 15-28, column 9, lines 29-39 and claims.	
Y	--- BIOL. CHEM. HOPPE-SEYLER vol. 372 , 1991 pages 528 - 529 P. DÖRMANN ET AL.; 'Acyl-ACP thioesterases(s) for the cleavage of medium- and long-chain acyl-ACPs in Cuphea lanceolata seeds' see whole document.	15,19, 20,28,29
Y	--- A. HELLYER AND A. SLABAS 'Plant Lipid Biochemistry, Structure and Utilization (P.J. Quinn, ed.), pages 157-158' 1990 , PORTLAND PRESS , LONDON see whole document.	2
Y	--- J. BIOL. CHEM. vol. 263 , 1988 pages 13393 - 13399 C.M. MIYAMOTO ET AL.; 'Organization of the lux structural genes of Vibrio harveyi' cited in the application see abstract	9,11,34
Y	--- TIBTECH vol. 7, no. 1989 pages 122 - 126 J.F. BATTEY ET AL.; 'Genetic engineering for plant oils: potential and limitations' see page 125.	9,11,34
P,X	--- WO,A,93 18158 (UNILEVER) 16 September 1993 see page 3, line 18 - page 8, line 12 and Examples 2-4.	1-6
P,X	--- WO,A,92 20236 (CALGENE, INC.) 26 November 1992 cited in the application see Examples 1, 2 and 5, Figure 12 and Claims.	12-30

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 93/ 10814

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see annex

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/210

- 1.- claims 1-7: A DNA construct comprising a structural gene encoding a plant long-chain-preferring acyl-SCP thioesterase in the antisense orientation.
- 2.- claims 8-11, 31-36: a DNA construct comprising a non-plant structural gene encoding a medium-chain-preferring acyl-ACP thioesterase under control of a plant promoter.
- 3.- claims 12-30: A DNA construct comprising a plant structural gene encoding a medium-chain-preferring acyl-ACP thioesterase.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 93/10814

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A-9116421	31-10-91	US-A- 5298421	29-03-94
		US-A- 5344771	06-09-94
		EP-A- 0480024	15-04-92
		US-A- 5304481	19-04-94
WO-A-9211373	09-07-92	AU-A- 9116191	22-07-92
		EP-A- 0563191	06-10-93
US-A-5147792	15-09-92	NONE	
WO-A-9318158	16-09-93	NONE	
WO-A-9220236	26-11-92	EP-A- 0557469	01-09-93