**Title:** GENES ENCODING SULFATE ASSIMILATION PROTEINS

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**Abstract**

This invention relates to an isolated nucleic acid fragment encoding a sulfate assimilation protein. The invention also relates to the construction of a chimeric gene encoding all or a portion of the sulfate assimilation protein, in sense or antisense orientation, wherein expression of the chimeric gene results in production of altered levels of the sulfate assimilation protein in a transformed host cell.
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## INTERNATIONAL SEARCH REPORT

**INTERNATIONAL APPLICATION NO.**  
PCT/US 99/15810

### A. CLASSIFICATION OF SUBJECT MATTER

| IPC 7 | C12N15/29 | C12N15/82 | C12N5/10 | C12Q1/68 | C07K14/415 |

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

### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbol)

| IPC 7 | C12N | C12Q | C07K |

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

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<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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| X         | SMITH F. ET AL.: "Regulation of expression of a cDNA from barley roots encoding a high affinity sulphate transporter"  
PLANT JOURNAL,  
vol. 12, no. 4, 1997, pages 875-884,  
XP002129909.  
the whole document  
---  
|          | SOHLBERG L. AND SUSSEX I.: "AC D89631"  
EMBL DATABASE, 1997, XP002129910.  
Heidelberg  
the whole document  
---  
| X         |          | 6,10,11 |

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
  
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* "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another application or other special reason (as specified)
  
* "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
  
* "Z" document member of the same patent family

**Date of the actual completion of the international search:** 7 February 2000  
**Date of mailing of the international search report:** 23.02.00

Name and mailing address of the ISA  
European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel: (+31-70) 340-2040, Tx: 31 651 epos nl,  
Fax: (+31-70) 340-3016  
Authorized officer  
Kania, T

Form PCT/ISA/210 (second sheet) (July 1992)
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<td>TAKAHASHI H ET AL: &quot;Regulation of sulfur assimilation in higher plants: a sulfate transporter induced in sulfate-starved roots plays a central role in Arabidopsis thaliana.&quot; PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA, (1997 SEP 30) 94 (20) 11102-7., XP002121792 the whole document</td>
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INTERNATIONAL SEARCH REPORT

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 additional sheet

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.

Form PCT/ISA/210 (continuation of first sheet (1)) (July 1998)
This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-11 partially

   An isolated nucleic acid fragment encoding a corn sulfate permease comprising a member selected from the group of: a fragment encoding an amino acid sequence that is at least 85% identical to the sequence set forth in SEQ ID NO:2,4,6, or a fragment complementary thereto. Said fragment optionally being RNA, preferably selected from SEQ ID NO:1,3,5. Chimeric genes, transformed host cells, proteins derived therefrom. Use of said sequences for altering the level of expression of a sulfate assimilation protein in a host cell, and for diagnostic purposes. Products derived from said diagnostic screening studies.

2. Claims: 1-11 partially

   idem for SEQ ID NO:7,8 (artichoke)

3. Claims: 1-11 partially

   idem for SEQ ID NO:9-14 (rice)

4. Claims: 1-11 partially

   idem for SEQ ID NO:15-18 (soybean)

5. Claims: 1-11 partially

   idem for SEQ ID NO:19-22 (wheat)