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Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

— *of inventorship (Rule 4.17(iv))*

[Continued on next page]

(54) Title: METHODS OF PREDICTING OF CHEMICAL PROPERTIES FROM SPECTROSCOPIC DATA

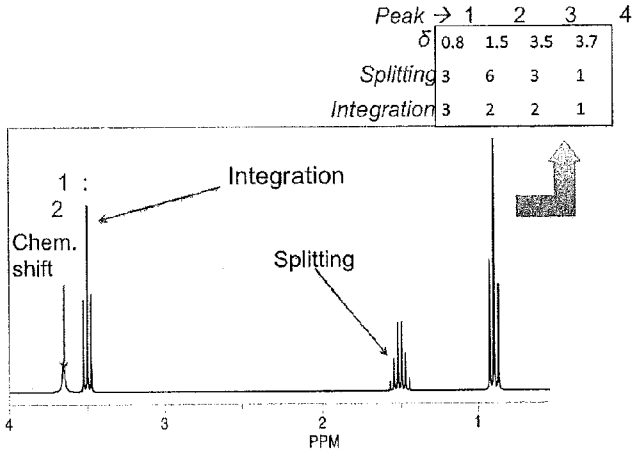


FIG. 1

(57) Abstract: A method of predicting of chemical properties from spectroscopic data is described. The chemical property can be, for example, octanol-water partition coefficient (logP), skin permeability (log K_p), or other biologically or ecologically relevant property, such as oral bioavailability, skin sensitization, acute aquatic toxicity, chronic aquatic toxicity, aquatic bioaccumulation, or mutagenicity. The spectroscopic data can be experimental or predicted NMR data, e.g., experimental or predicted ^{1}H-NMR or ^{13}C-NMR data.

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Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(88) Date of publication of the international search report:
12 March 2015

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/042784

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G01N 33/48 (2014.01)
CPC - G06F 19/18 (2014.11)
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(8) - G01N 33/48, 33/50, 31/00 (2014.01)
USPC - 702/19, 22, 30, 38; 703/11; 435/7.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - G06F 19/18, 19/24, 19/16 (2014.11) (keyword delimited)

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

Orbit, Google Patents, ProQuest
Search terms used: nmr, chemical property, resonances, measuring, calculating, predicting, chemical shifts, octanol, water partition, coefficient

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/0162219 A1 (SEM et al) 28 August 2003 (28.08.2003) entire document	1-3,15-16
Y		4-12,17
X	US 2004/0220749 A1 (MILLER et al) 04 November 2004 (04.11.2004) entire document	18
Y	US 6,341,256 B1 (DEEM et al) 22 January 2002 (22.01.2002) entire document	4-8, 12-14,17
Y	US 2010/0108567 A1 (MEDOFF) 06 May 2010 (06.05.2010) entire document	5, 7-8
Y	US 2002/0123848 A1 (SCHNEIDERMAN et al) 05 September 2002 (05.09.2002) entire document	9-10
Y	US 2011/0004453 A1 (ENGELSEN et al) 06 January 2011 (06.01.2011) entire document	11-14
Y	US 2002/0169561 A1 (BENIGHT et al) 14 November 2002 (14.11.2002) entire document	14
A	US 7,925,484 B2 (DAWSON et al) 12 April 2011 (12.04.2011) entire document	1-14, 18
A	US 2010/0268474 A1 (LEOHR) 21 October 2010 (21.10.2010) entire document	1-14, 18

☐ Further documents are listed in the continuation of Box C. ☐

* 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 application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation 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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 December 2014	16 JAN 2015
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/042784

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 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 No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

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

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 additional fees, this Authority did not invite payment of additional fees.

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.:
1-18

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-18, drawn to a method of predicting a chemical property for a compound.
Group II, claims 19-20, drawn to a system for predicting a chemical property for a compound comprising an NMR spectrometer including a magnet and probe.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: comparing the predicted values of the chemical property to experimentally determined values of the chemical property, and determining a correlation coefficient between the predicted values of the chemical property to experimentally determined values of the chemical property as claimed therein is not present in the invention of Group II. The special technical feature of the Group II invention: a magnet for generating a static homogeneous magnetic field; and a probe including RF coils disposed within said homogeneous magnetic field as claimed therein is not present in the invention of Groups I.

Groups I and II lack unity of invention because even though the inventions of these groups require the technical feature of measuring and/or predicting a plurality of NMR resonances of the compound; defining at least one molecular descriptor of the compound based on the measured and/or predicted resonances; and calculating a predicted value of the chemical property based on the at least one molecular descriptor, this technical feature is not a special technical feature as it does not make a contribution over the prior art. Specifically, US 2003/0162219 A1 (SEM et al) teaches a method of predicting a chemical property of a compound (predicting specificity toward individual binding compound based on conformation, para. 0193), comprising: measuring and/or predicting plurality of NMR resonances of the compound (a change in magnetic moment or spin state of an electron that correlates with a change in a bound conformation can be measured with nuclear magnetic resonance (NMR) spectroscopy, para. 0096); defining at least one molecular descriptor of the compound based on the measured and/or predicted resonances (when based on NMR data, a conformation-dependent property can be identified as an NMR signal including, for example chemical shift, para. 0097; thus chemical shift is considered "one molecular descriptor" herein); and calculating a predicted value of the chemical property based on the at least one molecular descriptor (such a correlation can be determined by measuring a conformation-dependent property for various conformations of a ligand and determining the extent of change in the signal with change in the conformation, para 0101. A structural model can also be derived from a theoretical calculation including comparison to a known structure, para. 0049).

Since none of the special technical features of the Group I or II inventions are found in more than one of the inventions, unity of invention is lacking.