



(43) International Publication Date  
12 September 2013 (12.09.2013)

(51) International Patent Classification:

C07D 209/30 (2006.01) C08G 67/00 (2006.01)  
C07D 209/10 (2006.01) A61K 31/404 (2006.01)  
C07D 277/68 (2006.01) A61K 31/428 (2006.01)  
C07D 293/10 (2006.01) A61P 35/00 (2006.01)  
C07D 403/06 (2006.01) A61P 31/00 (2006.01)  
C07D 417/06 (2006.01) A61P 33/00 (2006.01)  
C09B 23/02 (2006.01) A61P 43/00 (2006.01)  
C08G 61/12 (2006.01)

(21) International Application Number:

PCT/US2013/028776

(22) International Filing Date:

2 March 2013 (02.03.2013)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

13/411,539 3 March 2012 (03.03.2012) US

(71) Applicant: NANOQUANTUM SCIENCES, INC.  
[US/US]; 800 Bellevue Way, Suite 400, Bellevue, WA  
98059 (US).

(72) Inventors: JONES, Gary, W.; 15550 SE 79th Place,  
Newcastle, WA 98059-9227 (US). TATARETS,  
Anatoliy, L.; Geroyiv Pratsi Str., Build. 48d, Apt. 24,

Kharkiv, 61135 (UA). PATSENKER, Leonid, D.; 23-  
Serpnia Str., Build. 43, Apt. 24, Kharkiv, 61103 (UA).

(74) Agent: HULTQUIST, Steven, J.; Hultquist IP, PO Box  
14329, Research Triangle Park, NC 27709 (US).

(81) Designated States (unless otherwise indicated, for every  
kind of national protection available): AE, AG, AL, AM,  
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,  
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,  
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,  
HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP,  
KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD,  
ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI,  
NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU,  
RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ,  
TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA,  
ZM, ZW.

(84) Designated States (unless otherwise indicated, for every  
kind of regional protection available): ARIPO (BW, GH,  
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,  
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,  
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,  
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,  
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,  
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,  
ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: HALOGENATED COMPOUNDS FOR PHOTODYNAMIC THERAPY

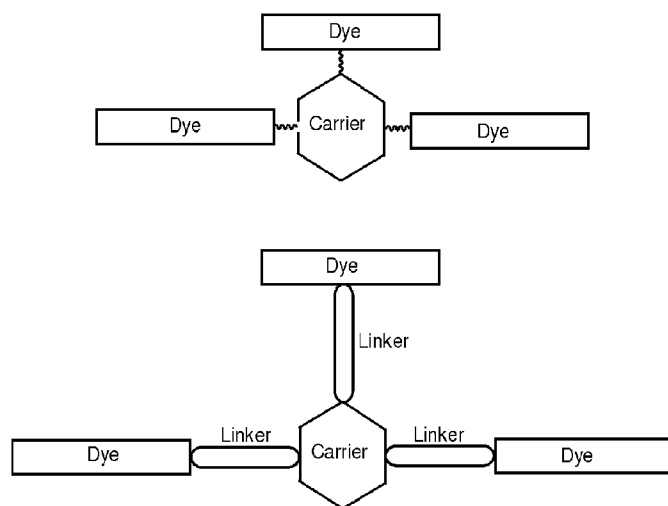


FIG. 1

(57) Abstract: Halo-organic heterocyclic compounds are described, in which at least two halogen atoms are bound to a nitrogen-containing heterocyclic terminal moiety of the compound, with at least one of such halogen atoms being iodine or bromine. Also described are polymethine dyes based on these heterocyclic compounds, and dendrimeric compounds and conjugates of such polymethine dyes. The polymethine dyes are characterized by enhanced properties, e.g., brightness, photostability, sensitivity and/or selective affinity that make them useful to target cancer cells, pathogenic microorganisms, and/or other biological materials, in applications such as photodynamic therapy, photodynamic antimicrobial chemotherapy (PACT), cancer treatment, selective removal or attachment of biological materials, antimicrobial coating materials, and other diagnostic, therapeutic, spectrum shifting, deposition/growth, and analytic applications.





---

**Published:**

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

**(88) Date of publication of the international search report:**

24 October 2013

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2013/028776

A. CLASSIFICATION OF SUBJECT MATTER (see extra sheet)		
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)		
C07D 209/30, 209/10, 277/68, 293/10, 403/06, 417/06, C09B 23/02, C08G 61/12, 67/00, A61K 31/404, 31/428, A61P 35/00, 31/00, 33/00, 43/00		
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 practicable, search terms used)		
PatSearch (RUPTO internal), Esp@cenet, STN on the Web		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2010/0323389 A1 (LI-COR, INC.) 23.12.2010, abstract, paragraph [0002]	1-64
A	RU 2088228 C1 (INSTITUT BIOKHMICHESKOY FIZIKI RAN et al.) 27.08.1997, abstract	1-64
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents:		
"A"	document defining the general state of the art which is not considered to be of particular relevance	"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
"E"	earlier document but published on or after the international filing date	"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
"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)	"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
"O"	document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed	
Date of the actual completion of the international search 31 May 2013 (31.05.2013)		Date of mailing of the international search report 08 August 2013 (08.08.2013)
Name and mailing address of the ISA/ FIPS Russia, 123995, Moscow, G-59, GSP-5, Berezhkovskaya nab., 30-1		Authorized officer N. Shibanova
Facsimile No. +7 (499) 243-33-37		Telephone No. (495)531-64-81

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2013/028776

**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.: 1-11, 13-29, 31-64 (partially)  
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:  
Independent claims 1, 15 refer to an extreme large number of possible compounds. Support and disclosure within the sense of Articles 5 and 6 is to be found for only a very small proportion of the compounds claimed. Therefore the search over the whole breadth of claims is impossible and was restricted to compounds given in examples and defined in dependent claims 12, 30.
  
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:

The present international application lacks unity within the meaning of Rule 13 PCT. Claims of the invention comprise 2 groups of inventions, which are not so linked as to form a single general inventive concept. With respect to a group of inventions, unity exists only when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features, the latter expression designating those features that define a contribution which each of the inventions, considered as a whole, makes over the prior art.

The first group of inventions comprises independent claims 1, 13, 14, 15, 35 and 53. The special technical feature for this group of inventions is a heterocyclic compound defined in claim 1.

The second group of inventions comprises independent claim 65. The special technical feature for this group of inventions is transmitting light that is frequency modulated in a range of from 100 kHz to 100 THz.

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.:

**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.

**INTERNATIONAL SEARCH REPORT**  
Classification of subject matter

International application No.

PCT/US 2013/028776

*C07D 209/30 (2006.01)*  
*C07D 209/10 (2006.01)*  
*C07D 277/68 (2006.01)*  
*C07D 293/10 (2006.01)*  
*C07D 403/06 (2006.01)*  
*C07D 417/06 (2006.01)*  
*C09B 23/02 (2006.01)*  
*C08G 61/12 (2006.01)*  
*C08G 67/00 (2006.01)*  
*A61K 31/404 (2006.01)*  
*A61K 31/428 (2006.01)*  
*A61P 35/00 (2006.01)*  
*A61P 31/00 (2006.01)*  
*A61P 33/00 (2006.01)*  
*A61P 43/00 (2006.01)*