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(71) Applicant: **PRESIDENT AND FELLOWS OF HARVARD COLLEGE** [US/US]; 17 Quincy Street, Cambridge, Massachusetts 02138 (US).

(72) Inventors; and

(71) Applicants: **KISHI, Jocelyn Yoshiko** [US/US]; 170 Brookline Ave, #810, Boston, Massachusetts 02215 (US).
SAKA, Sinem K. [US/US]; 60 Royal Street, Apt. 2, Allston, Massachusetts 02134 (US).

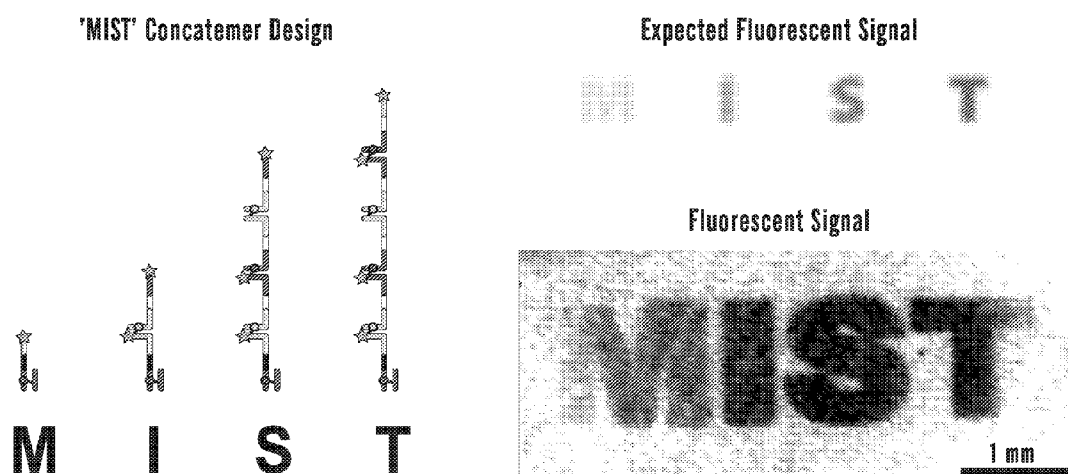
(72) Inventors: **LIU, Ninning**; 191 Park Drive, Boston, Massachusetts 02215 (US). **YIN, Peng**; 51 Winthrop Road, Brookline, Massachusetts 02445 (US).

(74) Agent: **BRAICH, Ravinderjit** et al.; Nixon Peabody LLP, Exchange Place, 53 State Street, Boston, Massachusetts 02109 (US).

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(54) Title: NUCLEIC ACID-BASED BARCODING

**FIG. 11**

(57) Abstract: Provided herein are methods and compositions related to nucleic acid barcoding. In some aspects, provided herein are methods and compositions for writing, storing, reading, and resetting data, for example, using photocrosslinking and/or a substrate or compressible hydrogel.

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,
KM, ML, MR, NE, SN, TD, TG).

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))*

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:

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(15) Information about Correction:

see Notice of 13 August 2020 (13.08.2020)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 19/59484

A. CLASSIFICATION OF SUBJECT MATTER

IPC - C12Q 1/68; C40B 20/04; C40B 70/00; C40B 40/06 (2020.01)

CPC - C12Q 1/6834; G01N 21/77; B01J 2300/021; B01J 2219/0547; B01J 2219/00608; B01J 2219/00711; C40B 20/04; C40B 70/00; C40B 40/06; G11C 7/00

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)

See Search History document

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

See Search History document

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

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2016/0312272 A1 (President and Fellows of Harvard College) 27 October 2016 (27.10.2016). Especially para [0004], [0005], [0092], sheet 6 fig 4B.	1-6, 41-43, 59-63
Y	US 2017/0267997 A1 (THE BROAD INSTITUTE, INC.) 21 September 2017 (21.09.2017). Especially para [0006], [0090], [0094], [0095]	1-6, 41-43, 59-63
Y	Bystrykh. Generalized DNA barcode design based on Hamming codes. PLoS One. 17 May 2012, Vol 7, No 5, Pages e36852 1-8. Especially pg 2 col 1 para 3, pg 3 col 1 para 2, pg 4 table 2.	1-6, 41-43, 63

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

"D" document cited by the applicant in the international application

"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

29 August 2020

Date of mailing of the international search report

18 SEP 2020

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Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-8300

Authorized officer

Lee Young

Telephone No. PCT Helpdesk: 571-272-4300

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 19/59484

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.: 7-17, 22, 24-36, 44-57, 64-81
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:

-----Go to Extra Sheet for continuation-----

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.:
1-6, 41-43, 59-63

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

International application No.

PCT/US 19/59484

Continuation of Box III: Observations where Unity of Invention is lacking

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 searched, the appropriate additional search fees must be paid.

Group I: Claims 1-6, 41-43, 59-63, drawn to a method or composition comprising two nucleic acids that comprise hybridizable domains that can be photo-crosslinked.

Group II: Claims 18-21, 23, 37-40, 58 drawn to a method or composition comprising writing data on or within a substrate with nucleic acids that encode data

The inventions listed as Groups I and 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:

Special Technical Features:

Groups I has the special technical feature of two nucleic acids that comprise hybridizable domains that can be photo-crosslinked, not required by Group II.

Group II has the special technical feature writing data on or within a substrate with nucleic acids that encode data and reading the encoded data., not required by Group I.

Common Technical Feature:

1. attaching a nucleic acid to a substrate

However, said common technical feature does not represent a contribution over the prior art and is disclosed by US 2017/0337324 A1 to President and Fellows of Harvard College (hereinafter "Harvard").

As to the common technical feature, Harvard discloses attaching a nucleic acid to a substrate (para [0071]; "one or more oligonucleotide sequences described herein are immobilized on a support (e.g., a solid and/or semi-solid support). In certain aspects, an oligonucleotide sequence can be attached to a support using one or more of the phosphoramidite linkers described herein"; para [0006]; "According to one aspect, the oligomer, such as an oligonucleotide includes a data block sequence. According to one aspect, the oligomer, such as an oligonucleotide includes an address sequence (such as a barcode sequence) specifying the location of the data block in the bit stream.)").

As the common technical feature was known in the art at the time of the invention, this cannot be considered a common special technical feature that would otherwise unify the groups. The inventions lack unity with one another.

Therefore, Groups I and II lack unity of invention under PCT Rule 13 because they do not share a same or corresponding special technical feature.

Item 4 (cont.) Claims 7-17, 22, 24-36, 44-57, 64-81 are held unsearchable because they are not drafted according to the second and third sentences of PCT Rule 6.4(a).