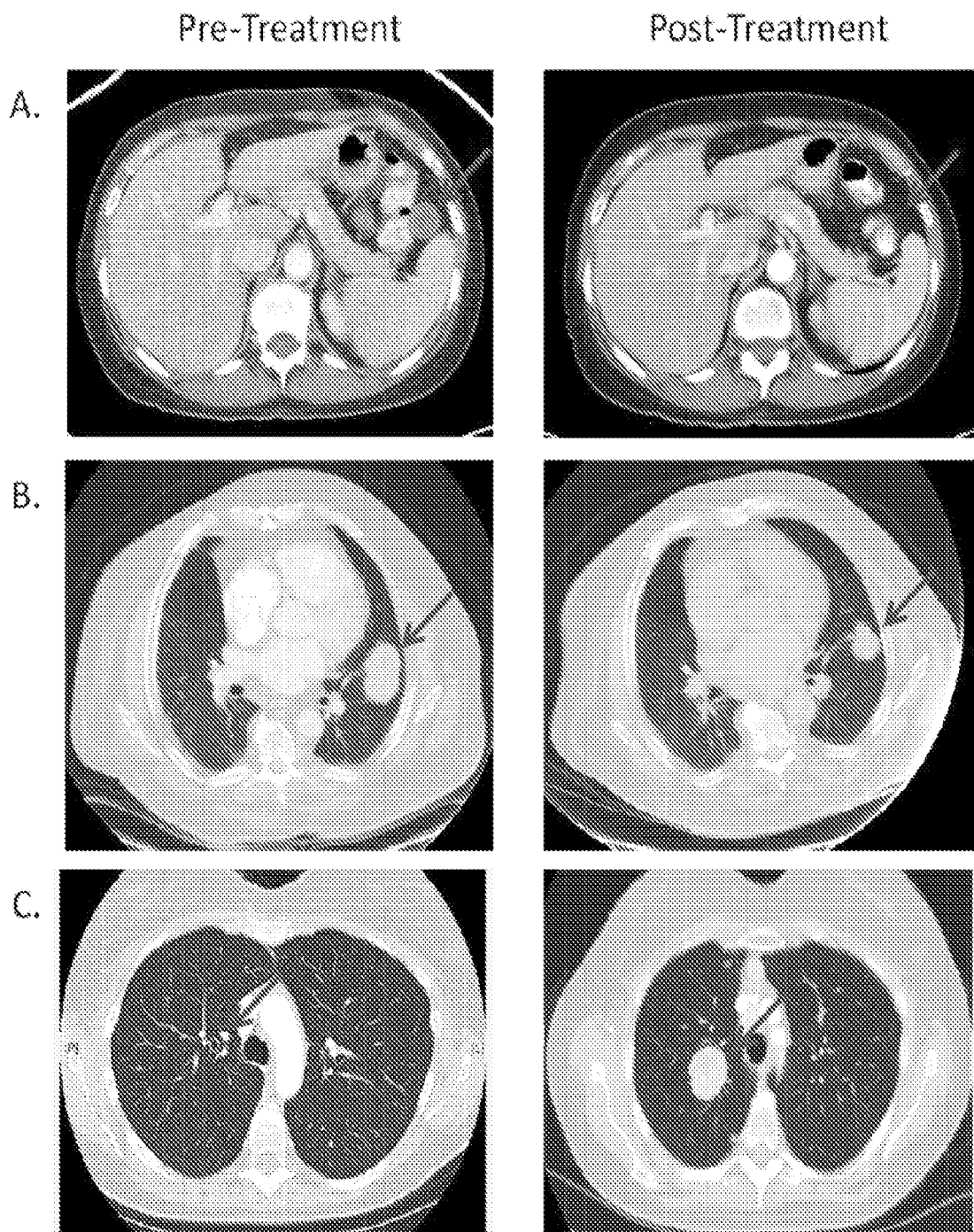


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**FIG. 1**

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| Sample            | Mutations |
|-------------------|-----------|
| Long-Term Benefit |           |
| SD2056            | 115       |
| CR3665            | 120       |
| CR0095            | 198       |
| CR6336            | 256       |
| CR1509            | 344       |
| CR4880            | 527       |
| SD0346            | 540       |
| SD1494            | 858       |
| CR9699            | 1188      |
| CR9306            | 1304      |

| Sample                | Mutations |
|-----------------------|-----------|
| Minimal or No Benefit |           |
| NR8727                | 1         |
| NR3156                | 2         |
| NR5784                | 3         |
| NR9341                | 19        |
| NR1867                | 28        |
| NR5118                | 39        |
| SD2051                | 39        |
| CR7623                | 99        |
| SD5934                | 112       |
| SD5038                | 245       |
| NR4810                | 307       |
| NR3549                | 364       |
| NR4949                | 484       |
| SD6494                | 529       |
| SD7357                | 1028      |

***FIG. 2A***

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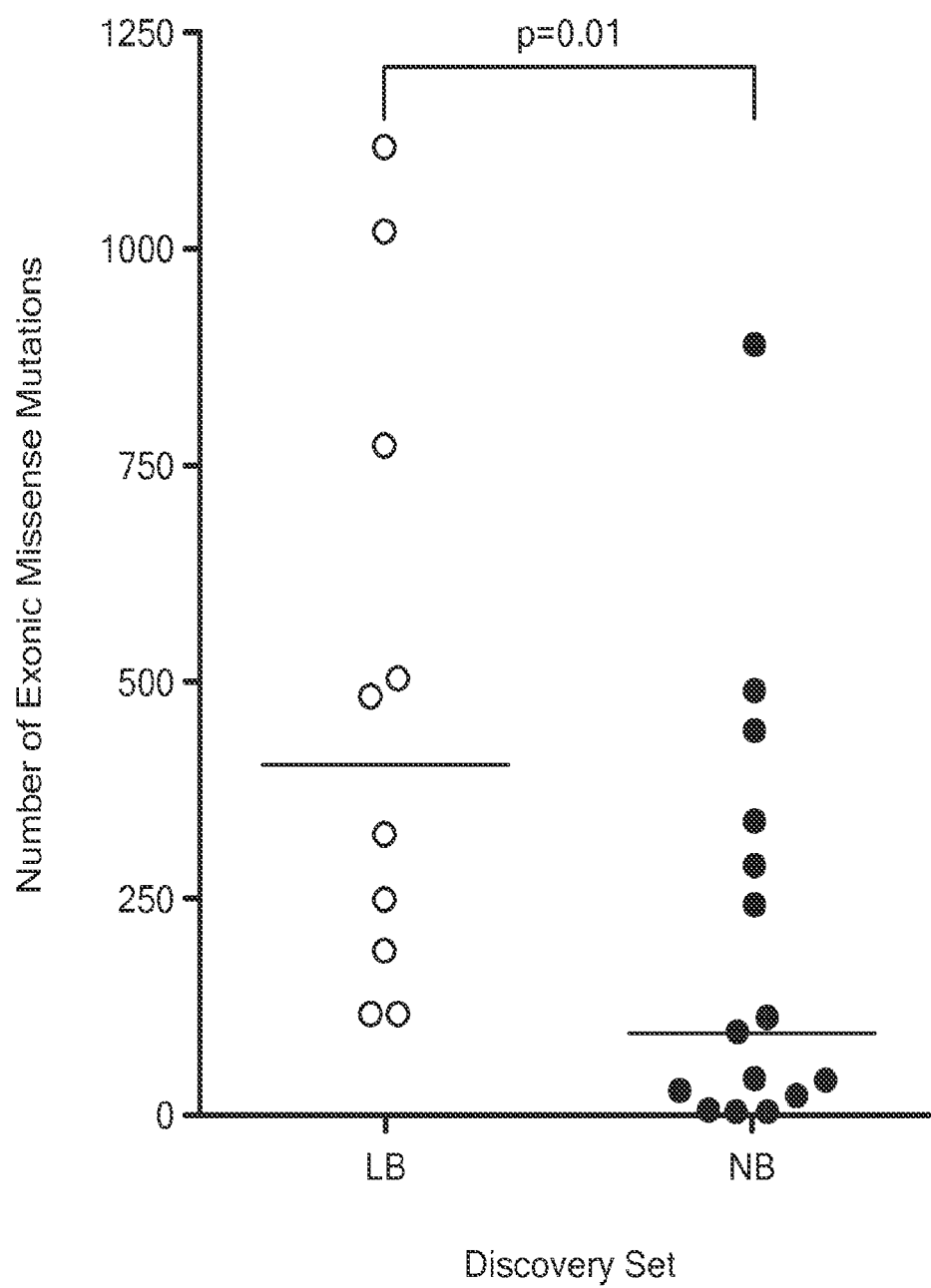


**FIG. 2B**

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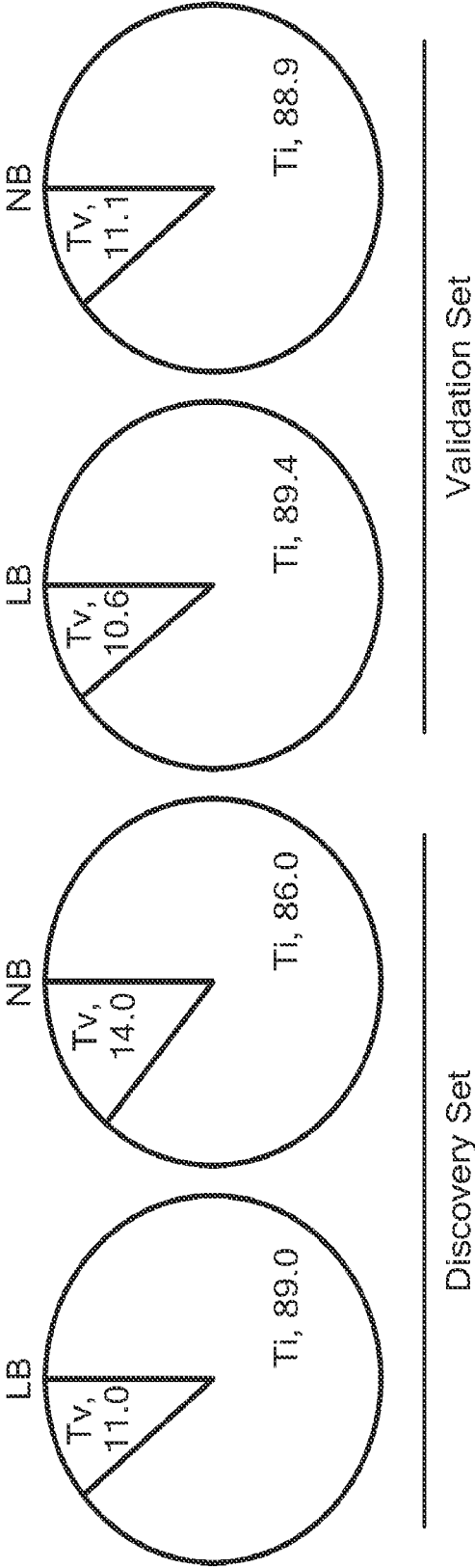


FIG. 2C

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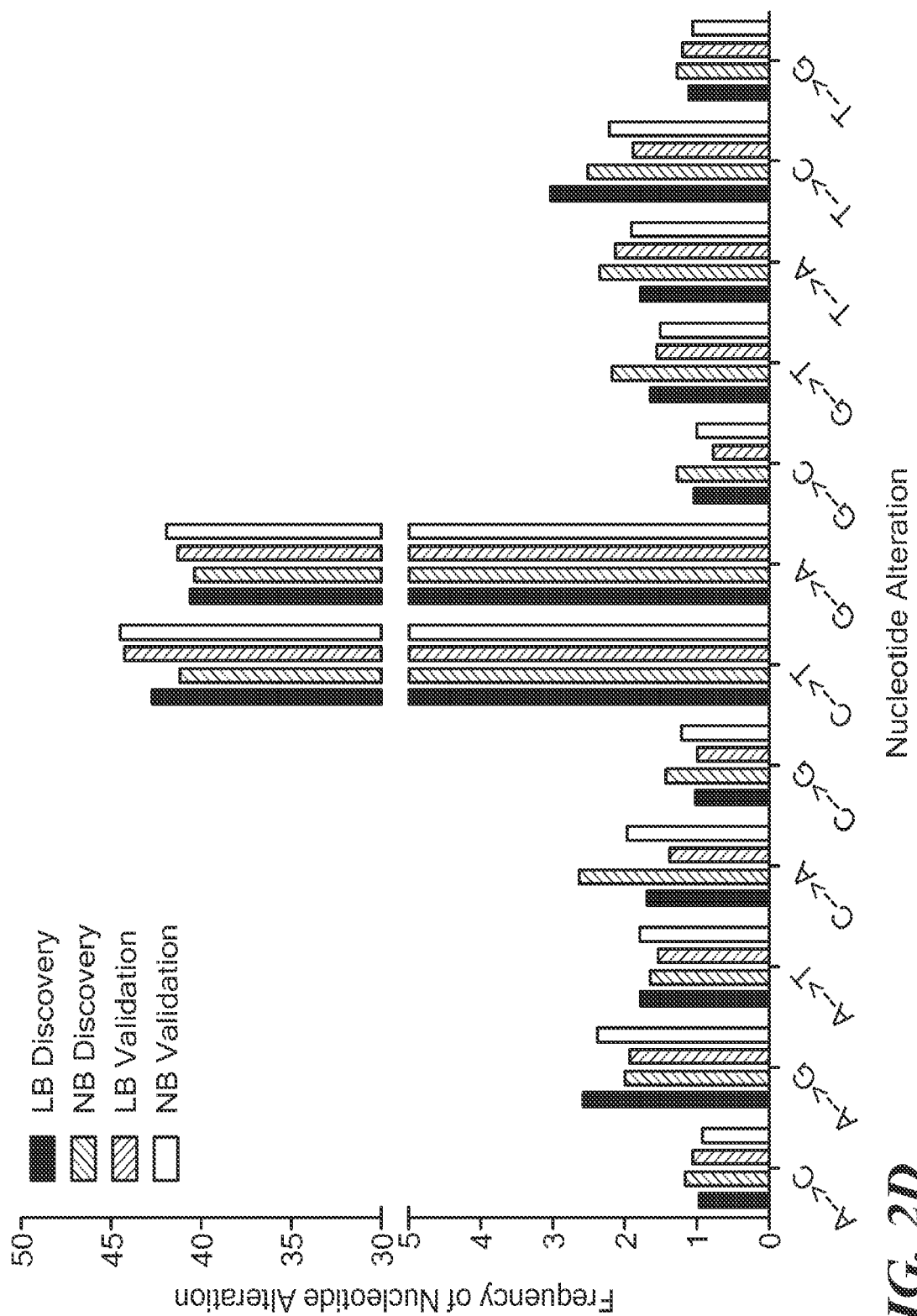


FIG. 2D

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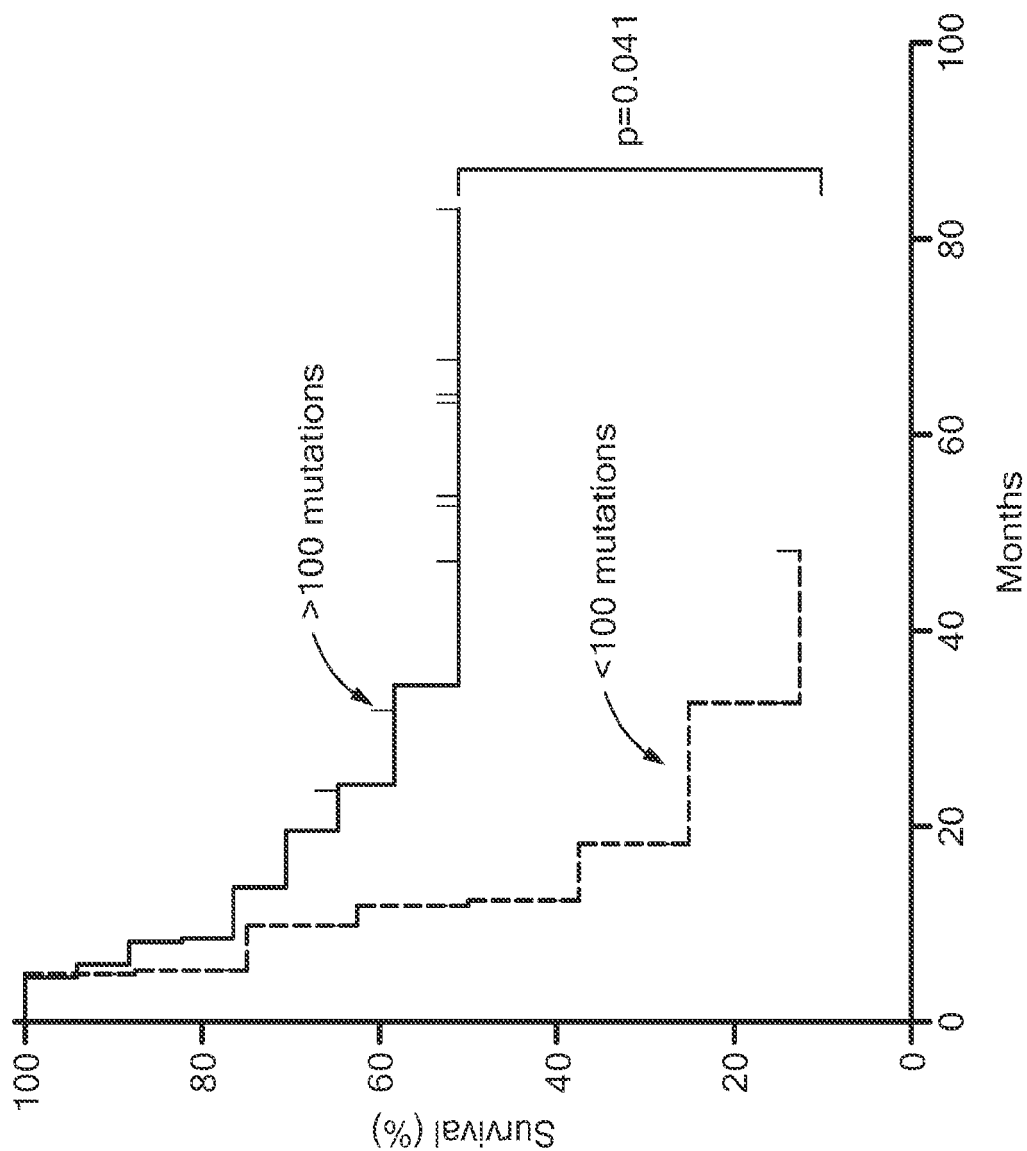
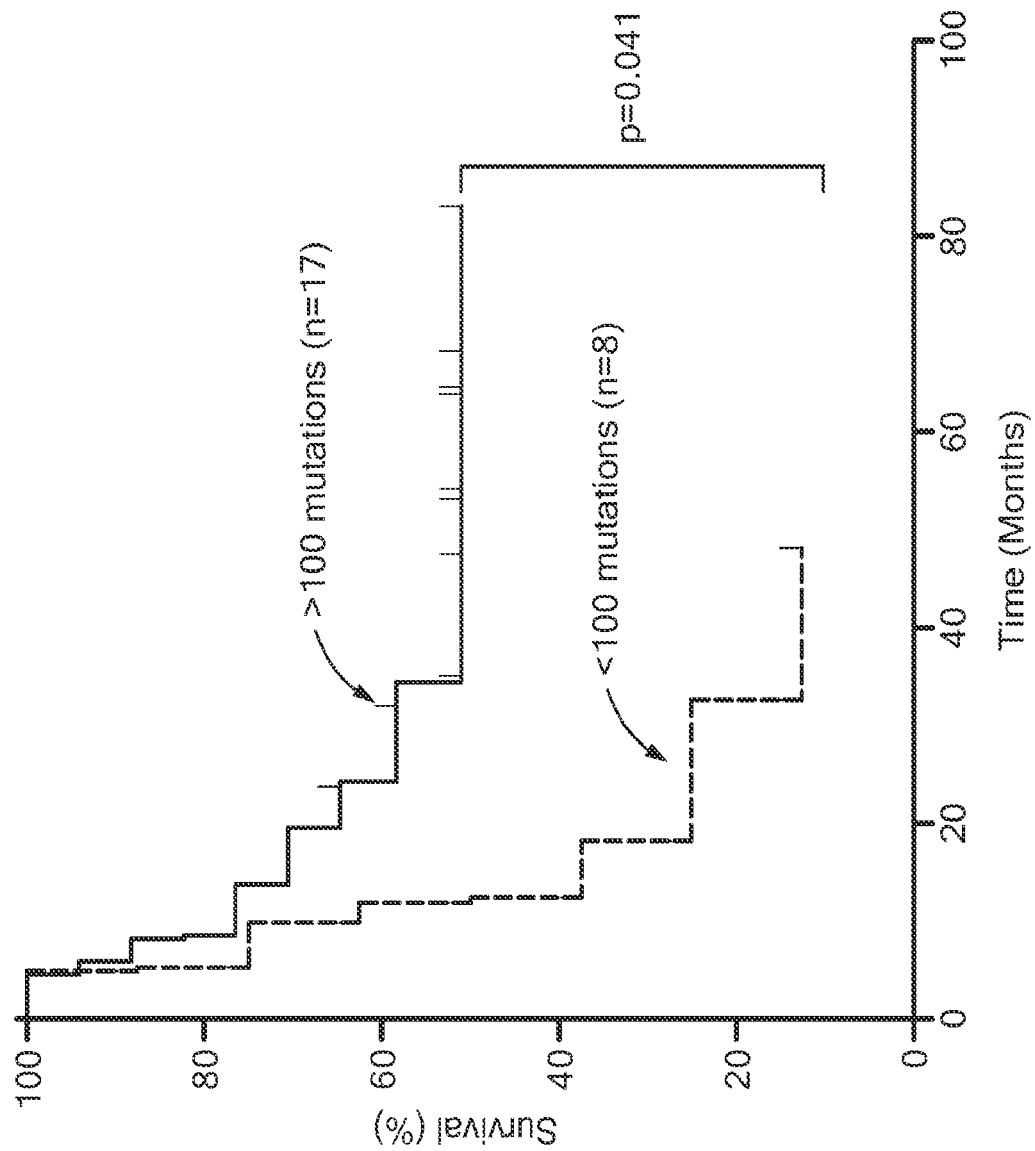


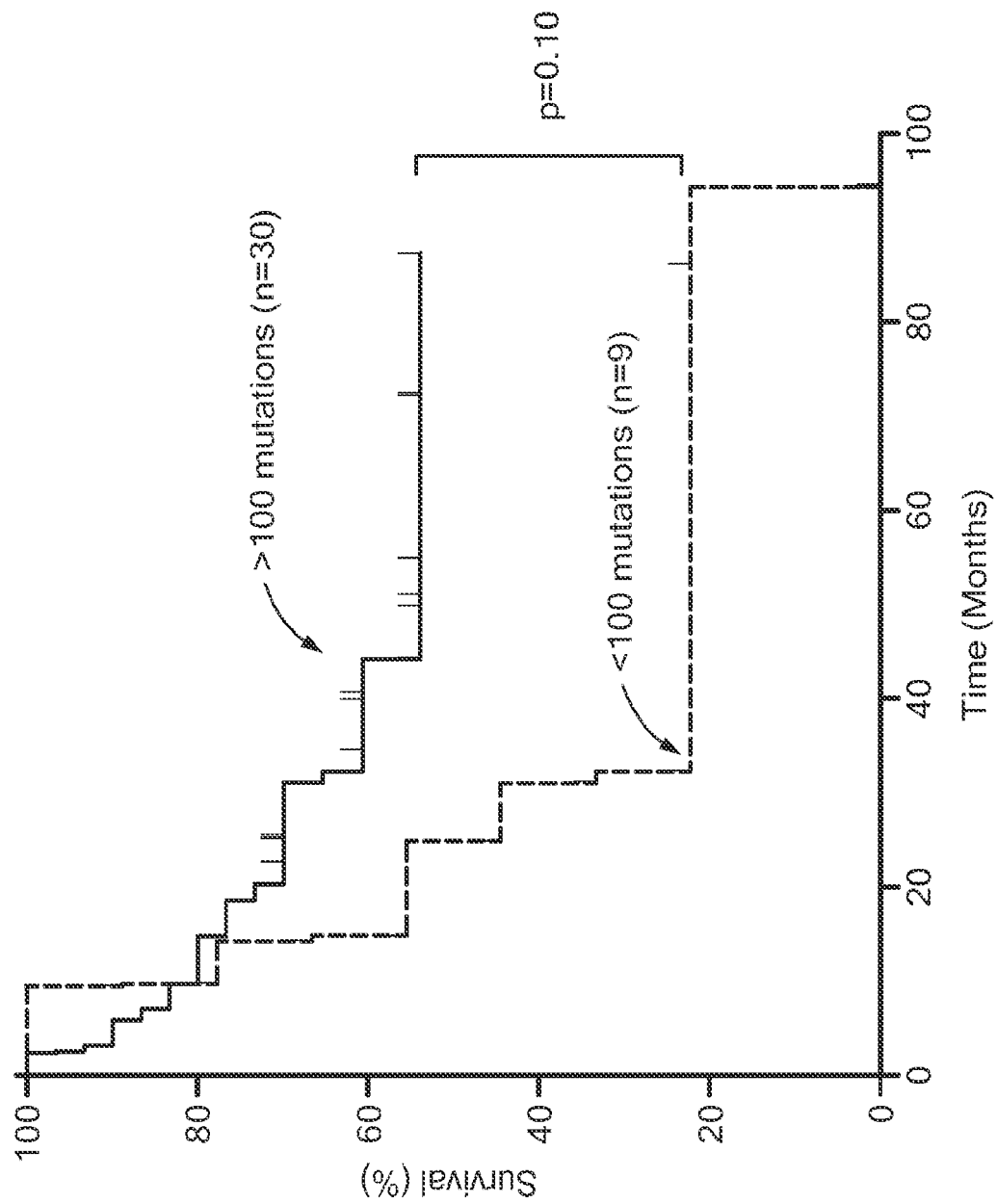
**FIG. 2E**



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**FIG. 2G**

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**FIG. 2H**

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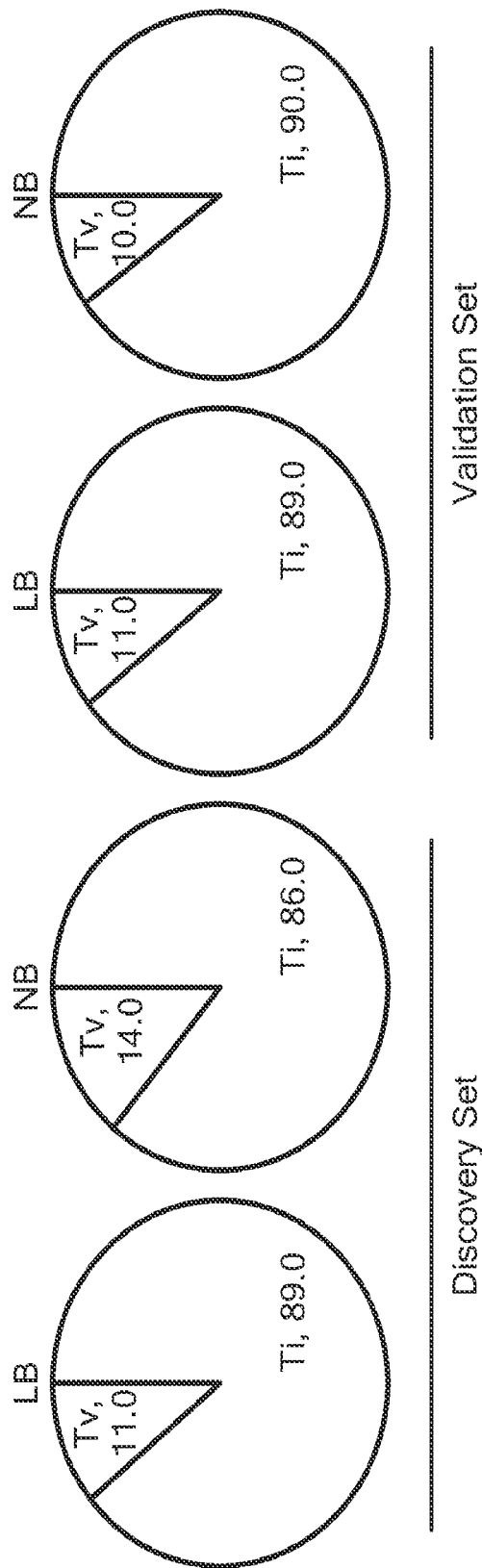
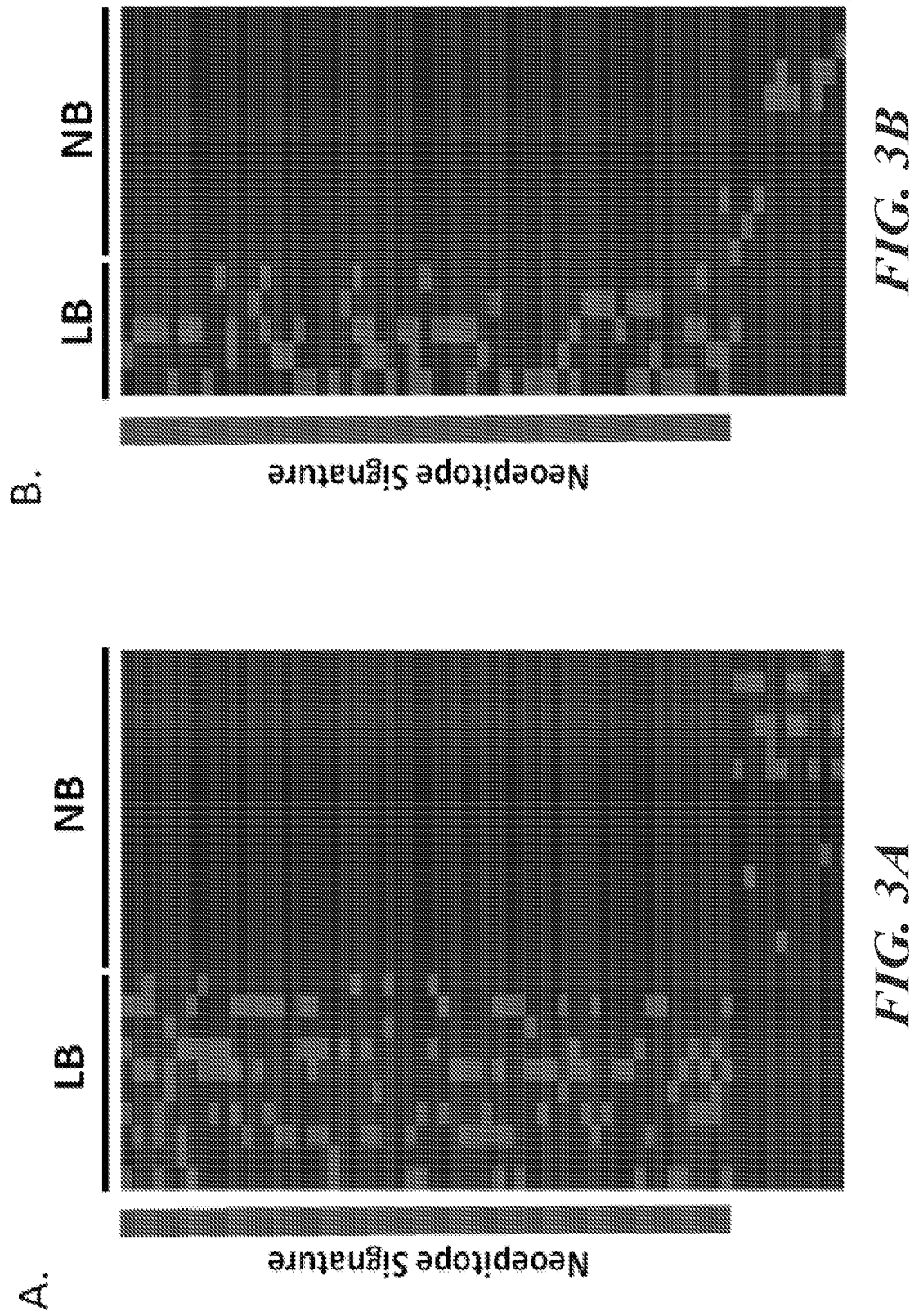
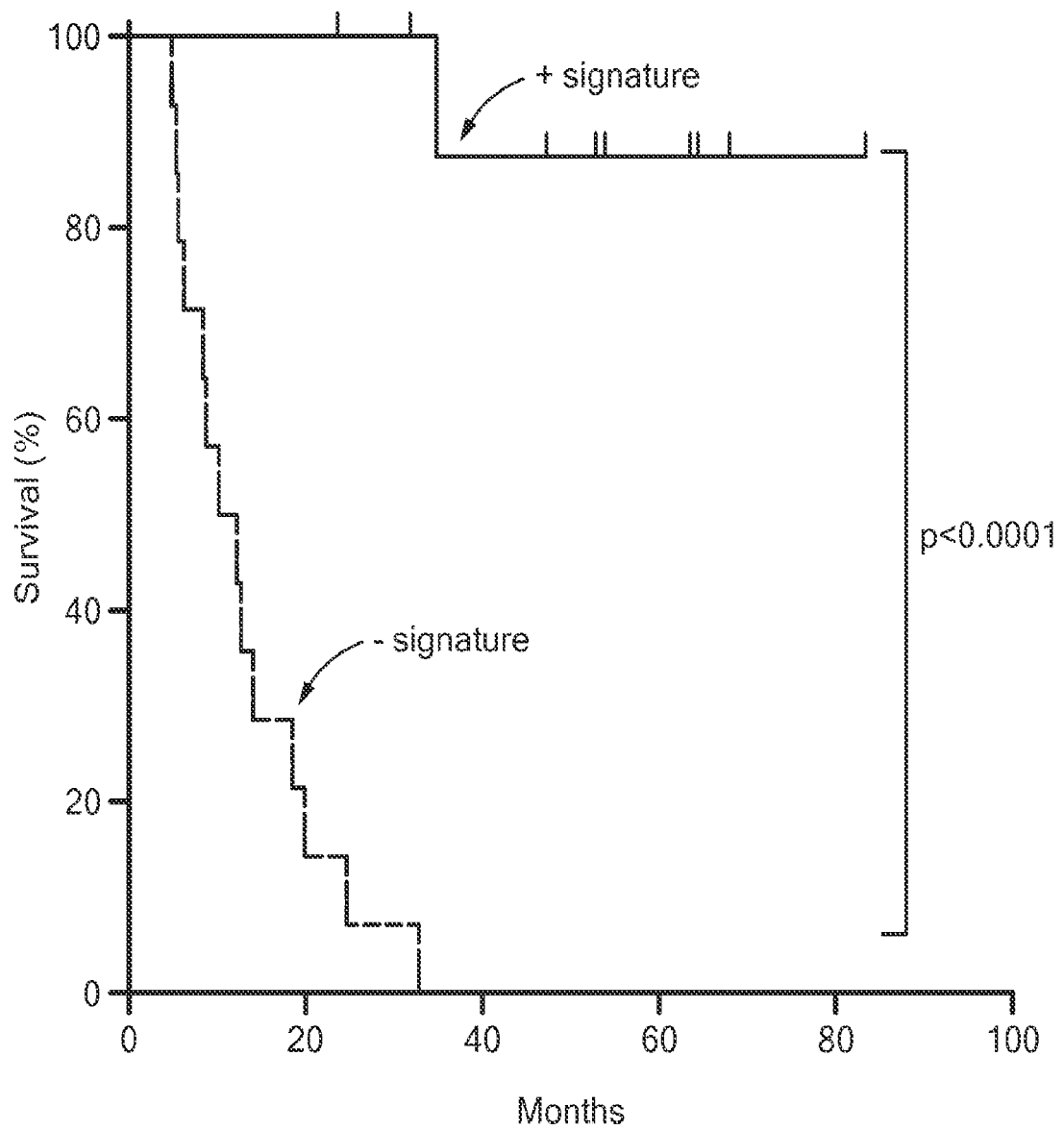


**FIG. 2I**

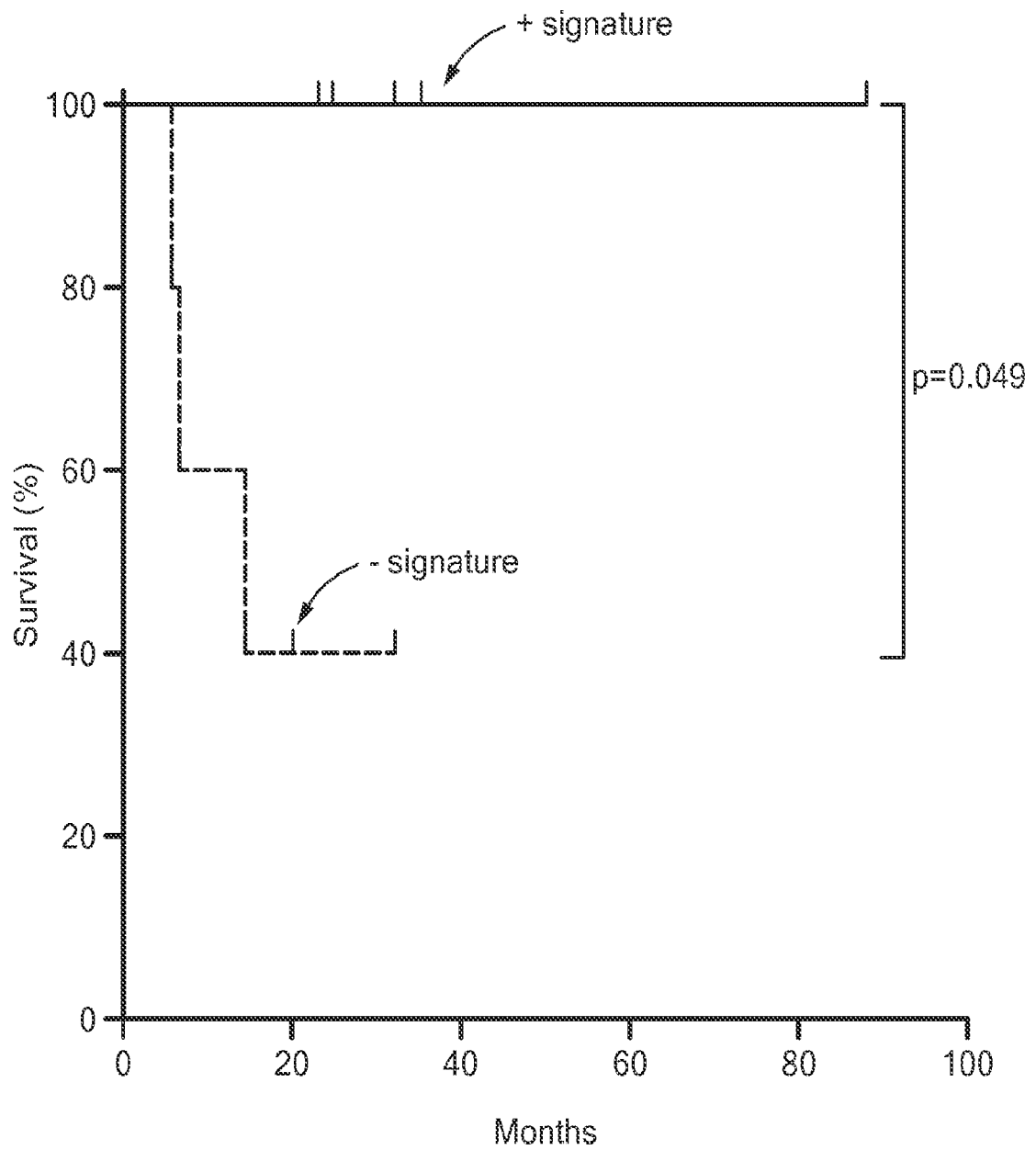
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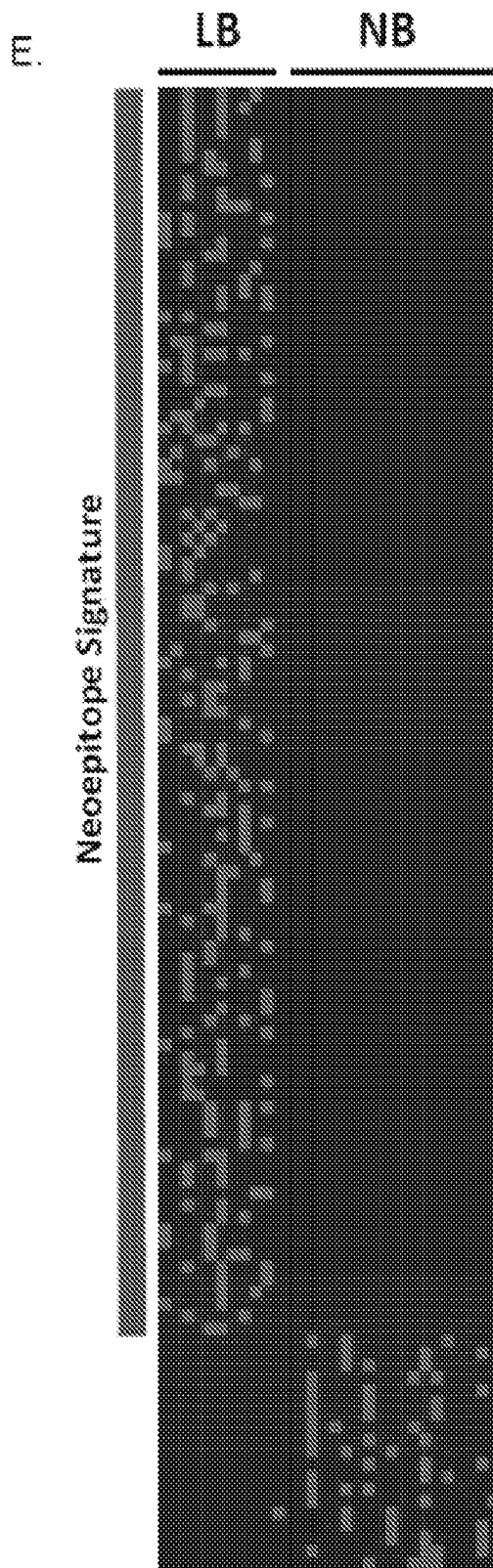
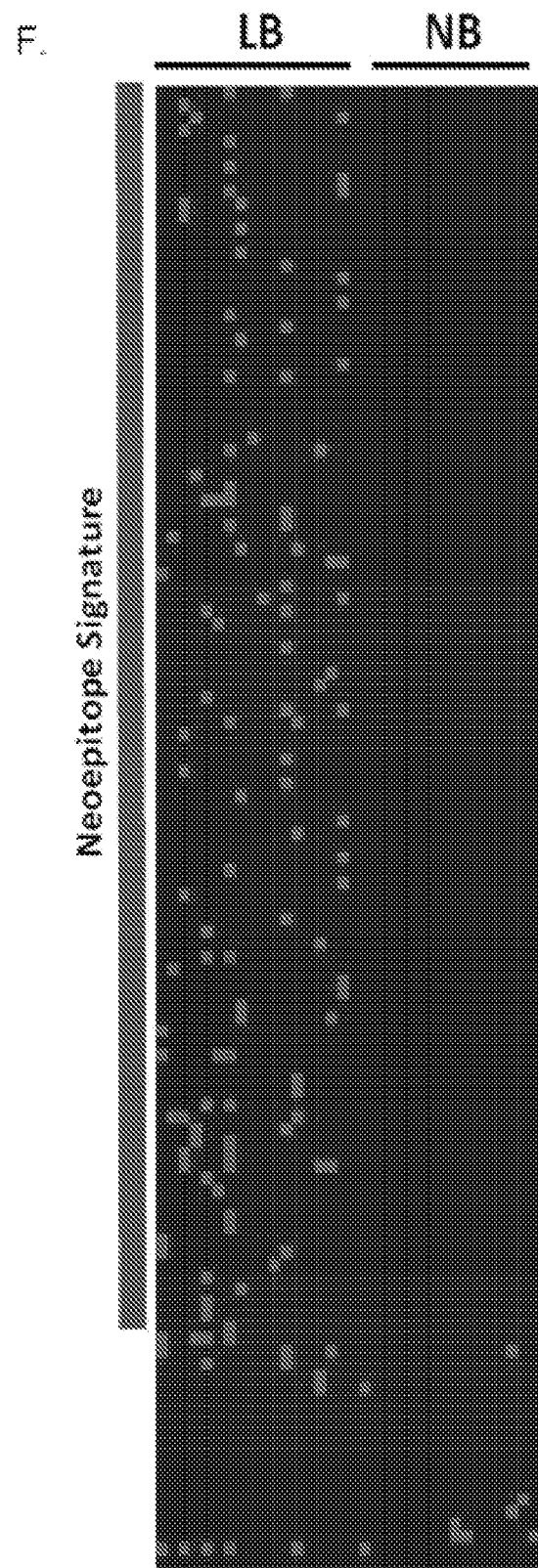
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**FIG. 3C**

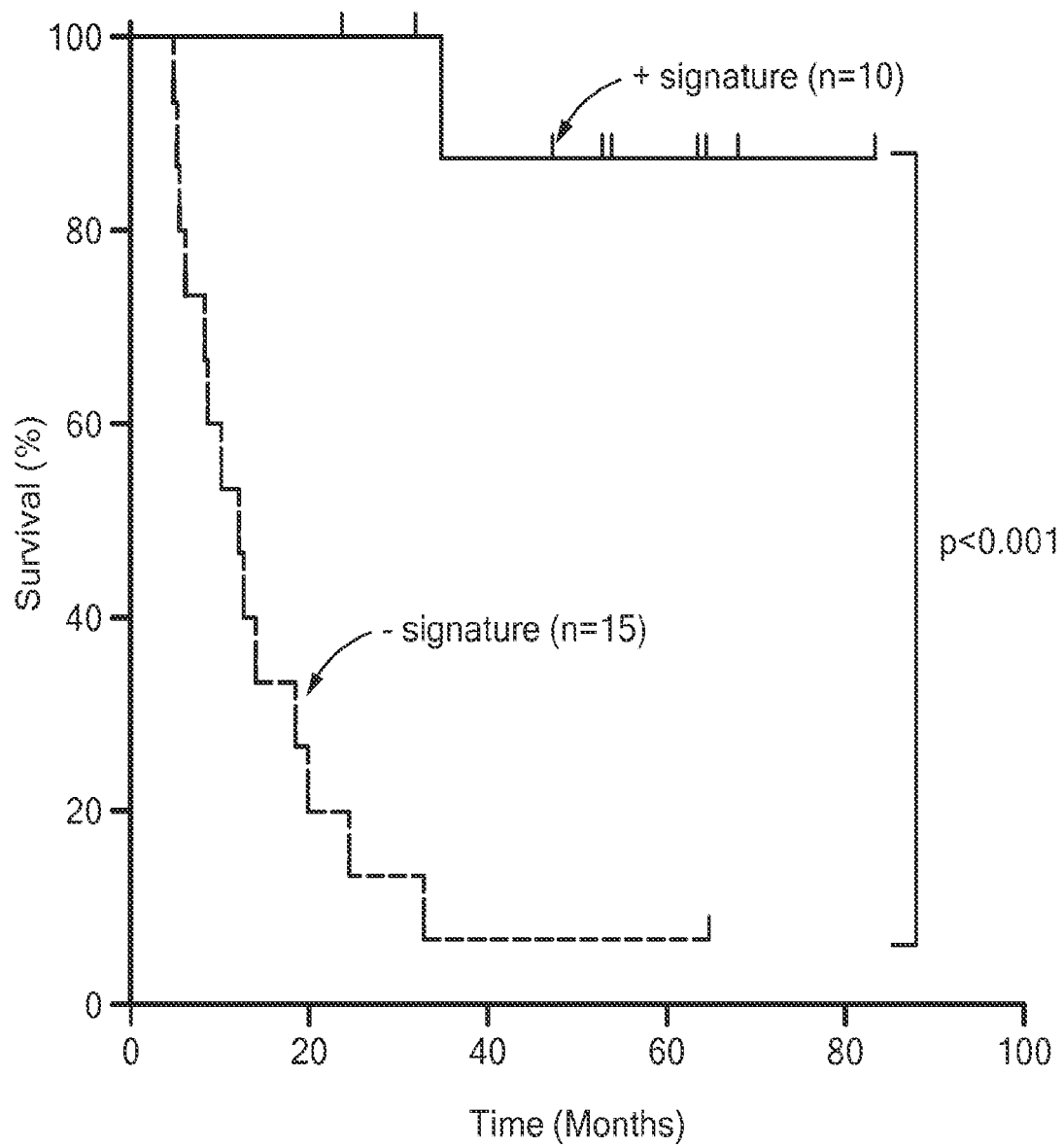
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**FIG. 3D**

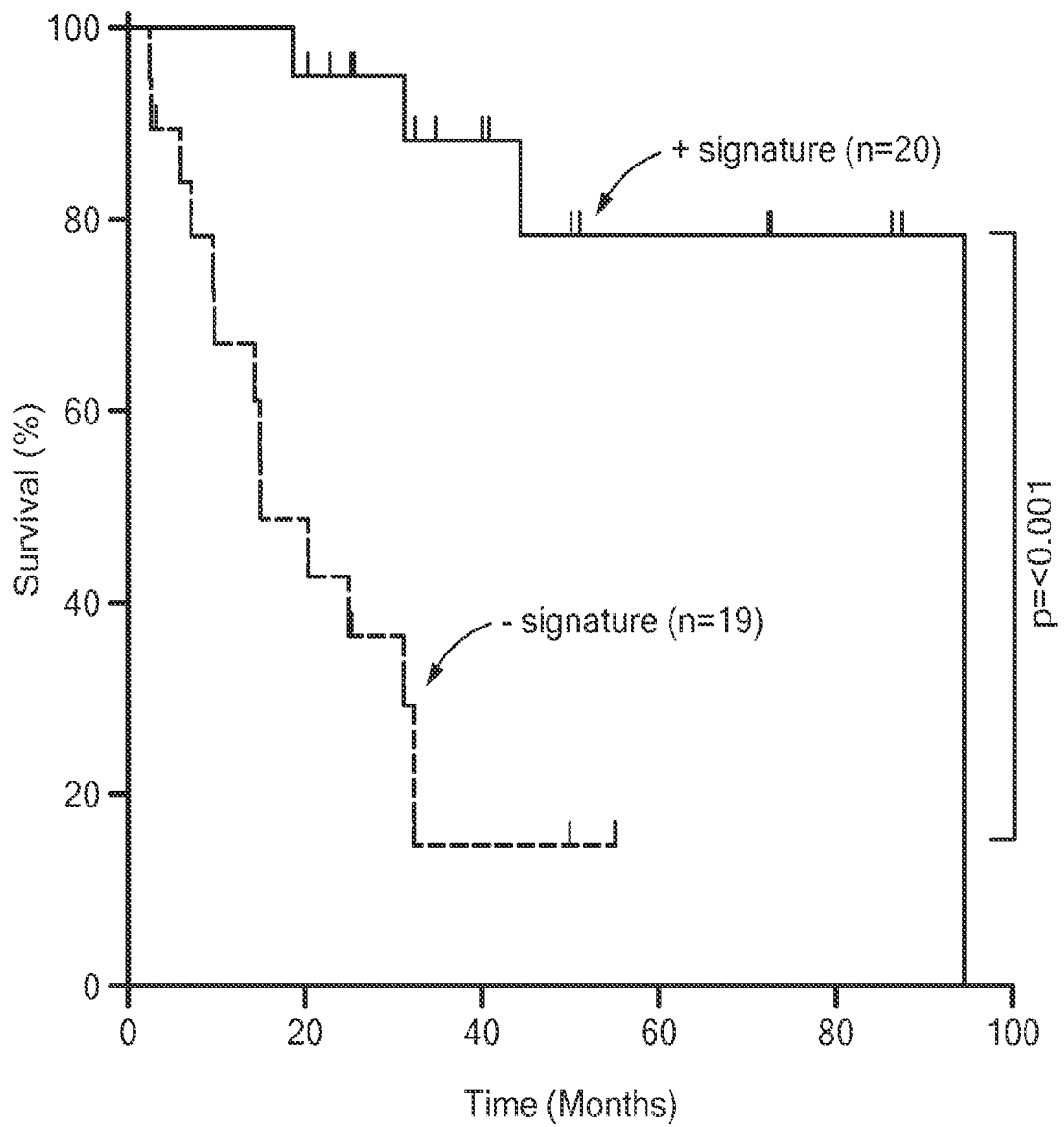
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*FIG. 3E**FIG. 3F*

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**FIG. 3G**

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**FIG. 3H**

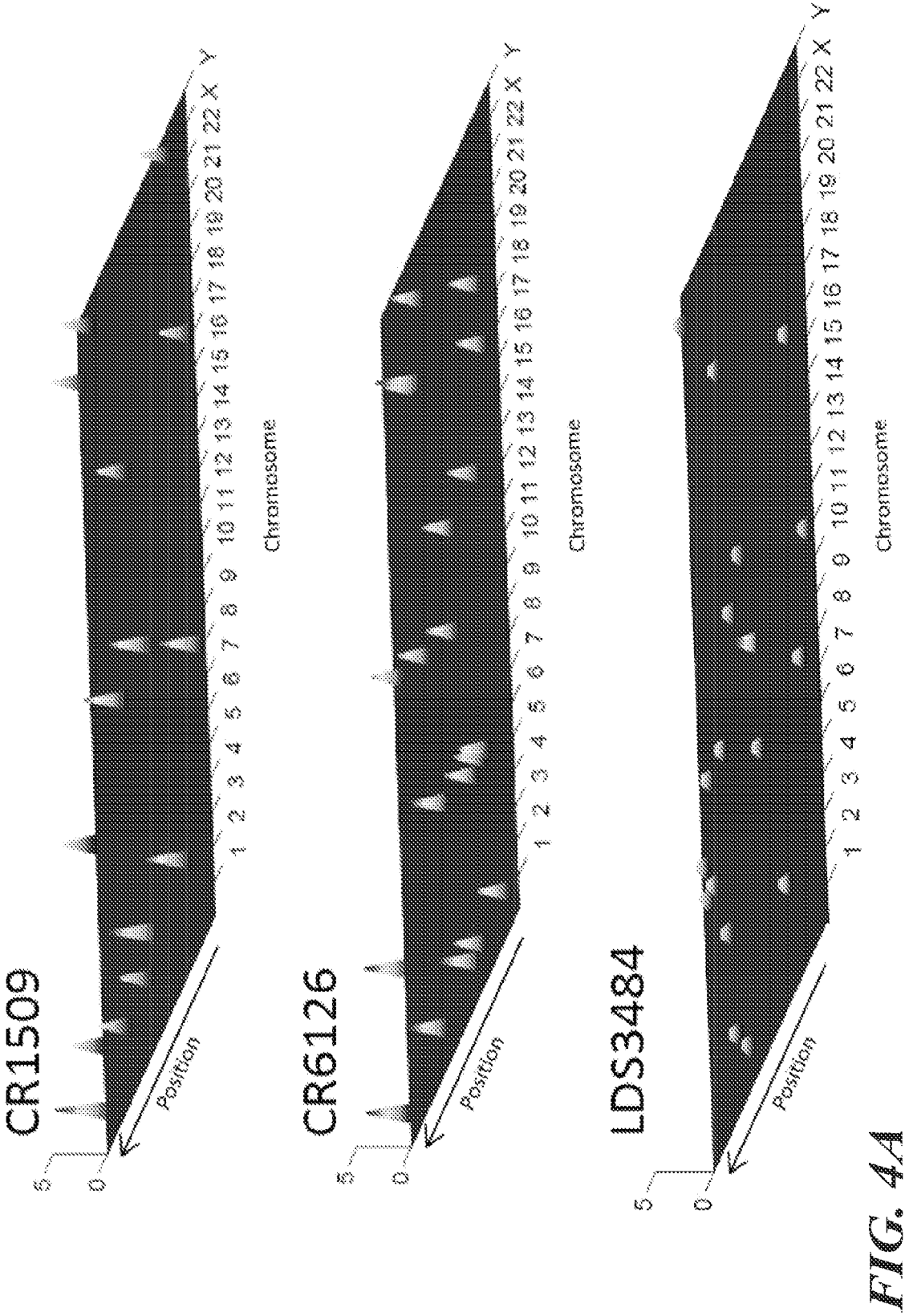
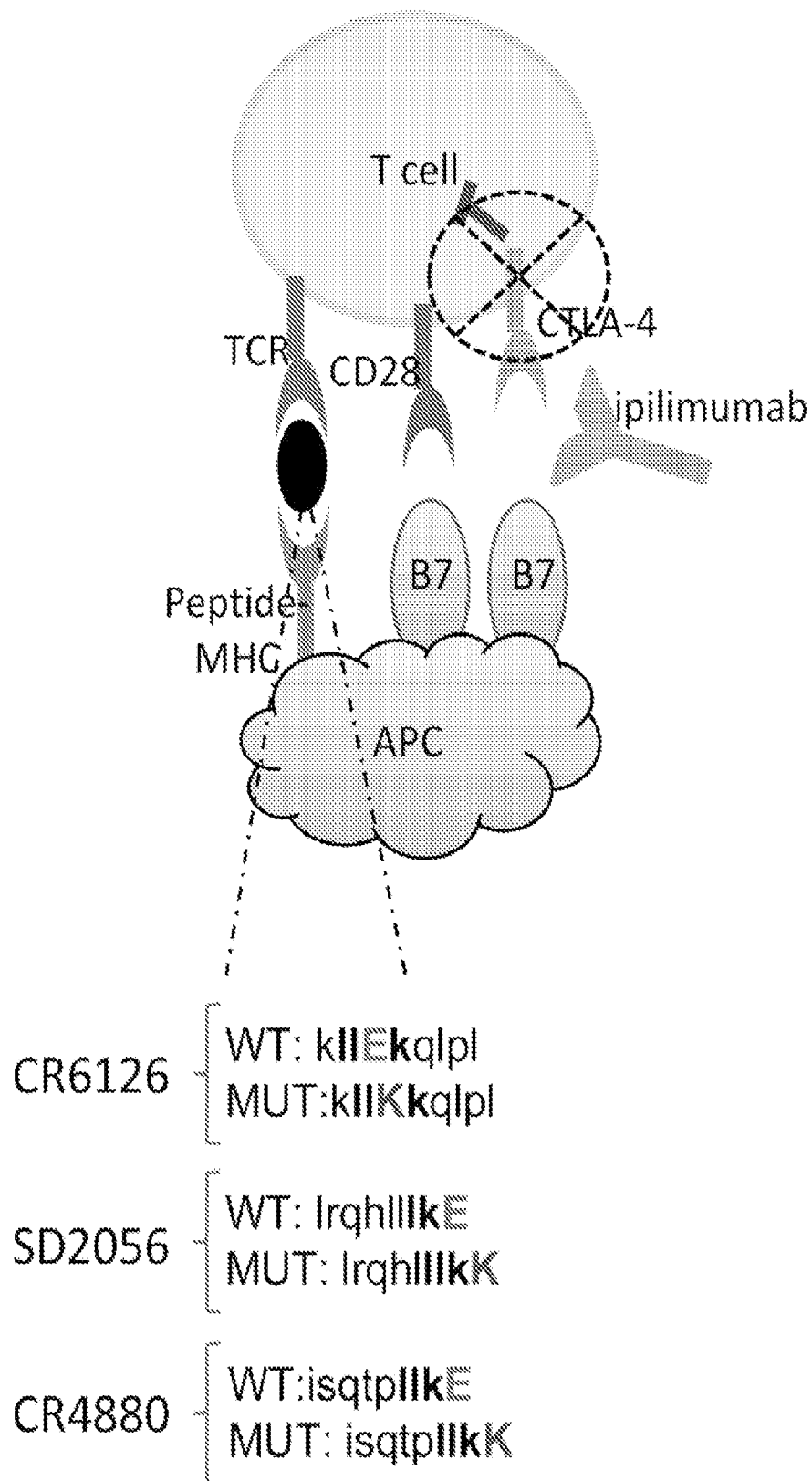
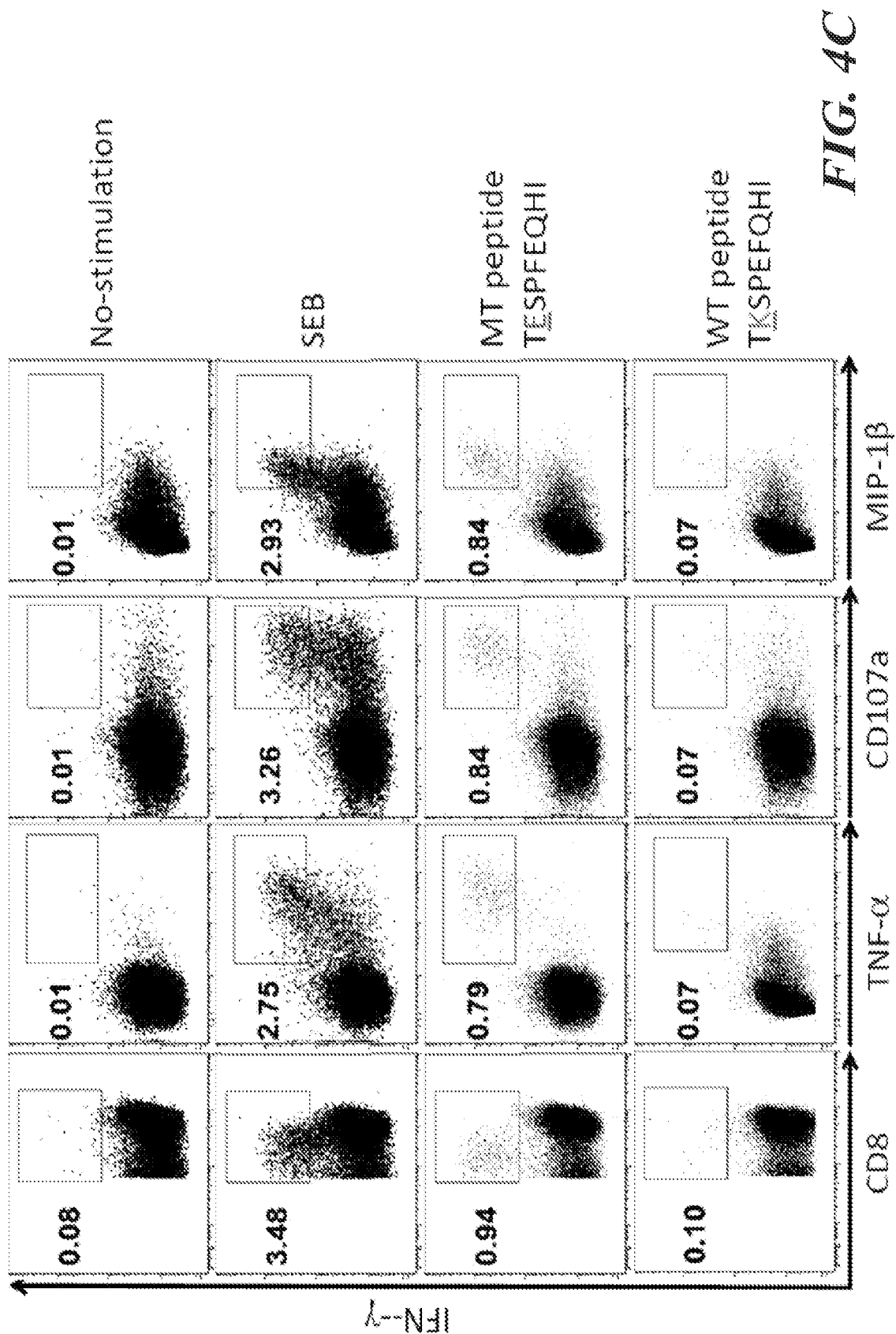


FIG. 4A

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**FIG. 4B**



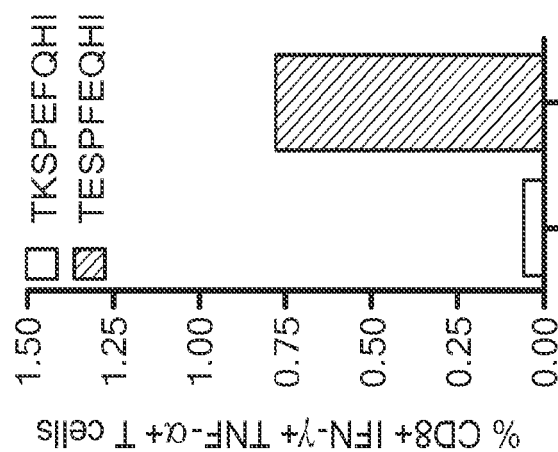
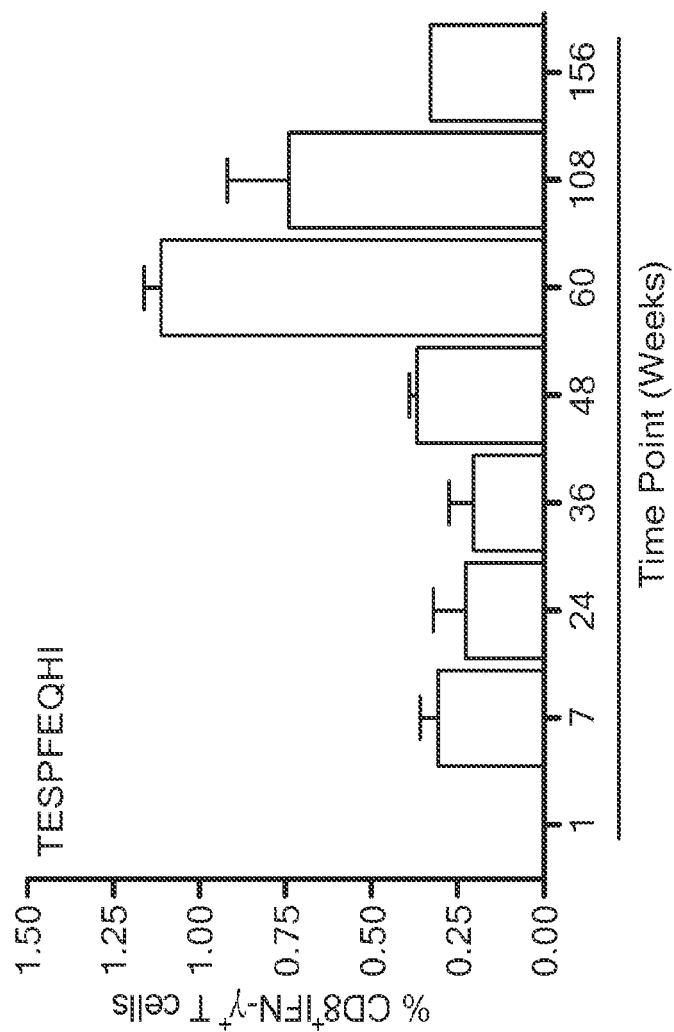


FIG. 4D

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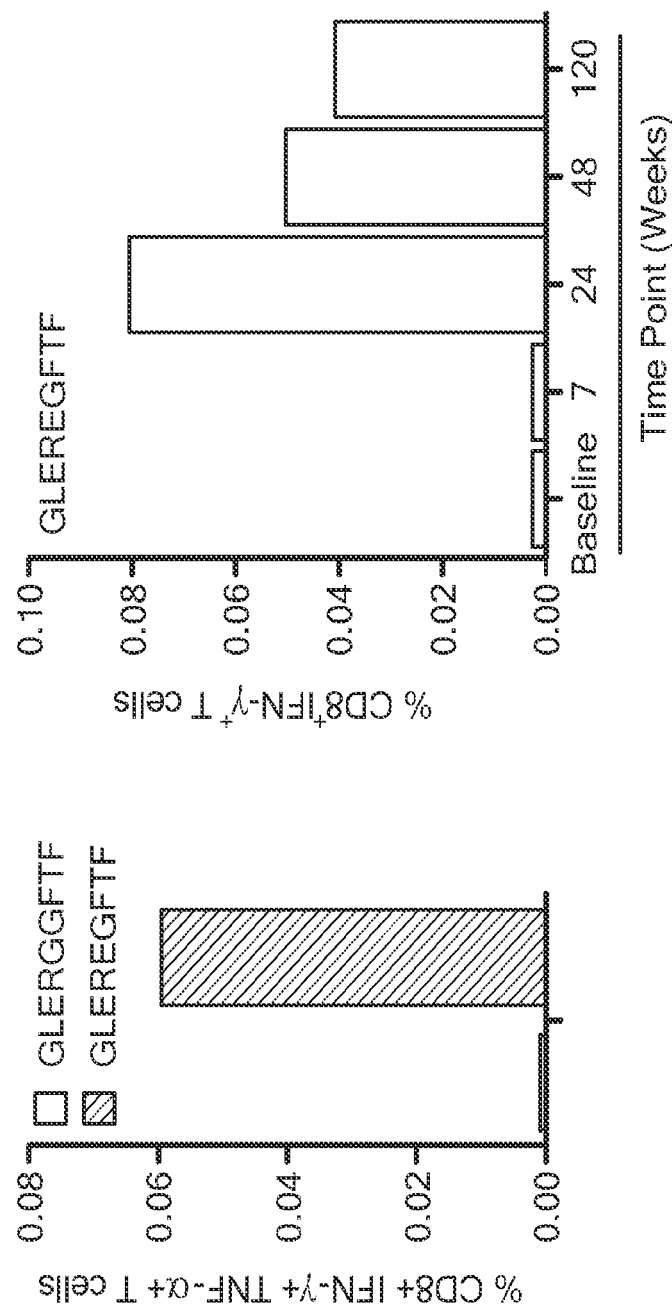
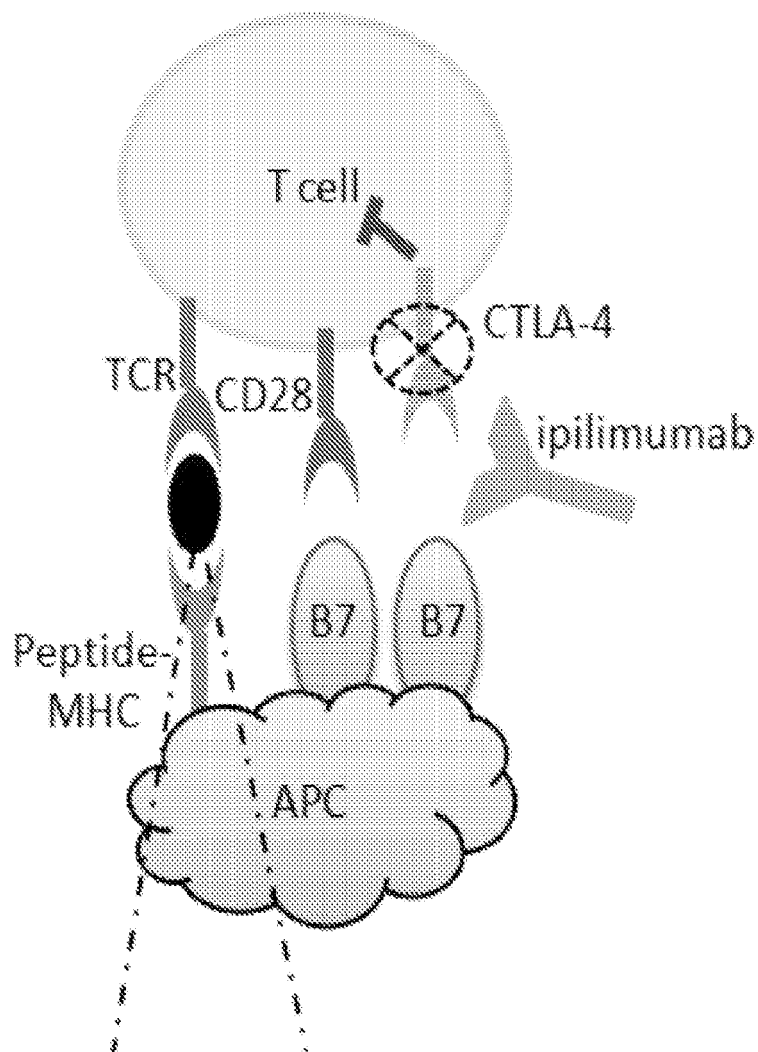


FIG. 4E

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|        | Wild Type  | Mutant     |
|--------|------------|------------|
| SD1494 | yII Gssalt | yII Essalt |
| CR9306 | vGssadily  | vEssadily  |
| PR4092 | yFpeessal  | ySpeessal  |

**FIG. 4F**

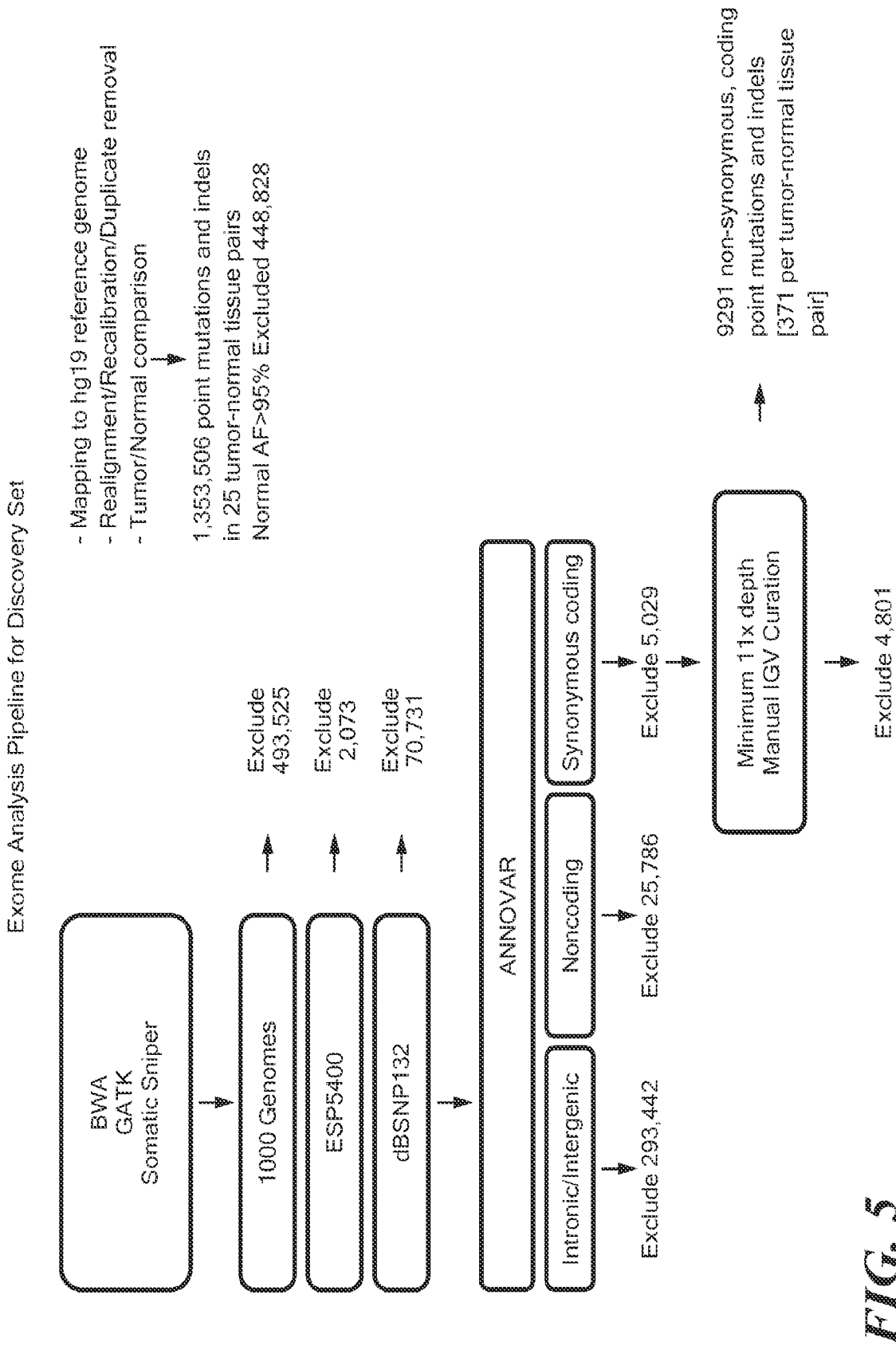


FIG. 5

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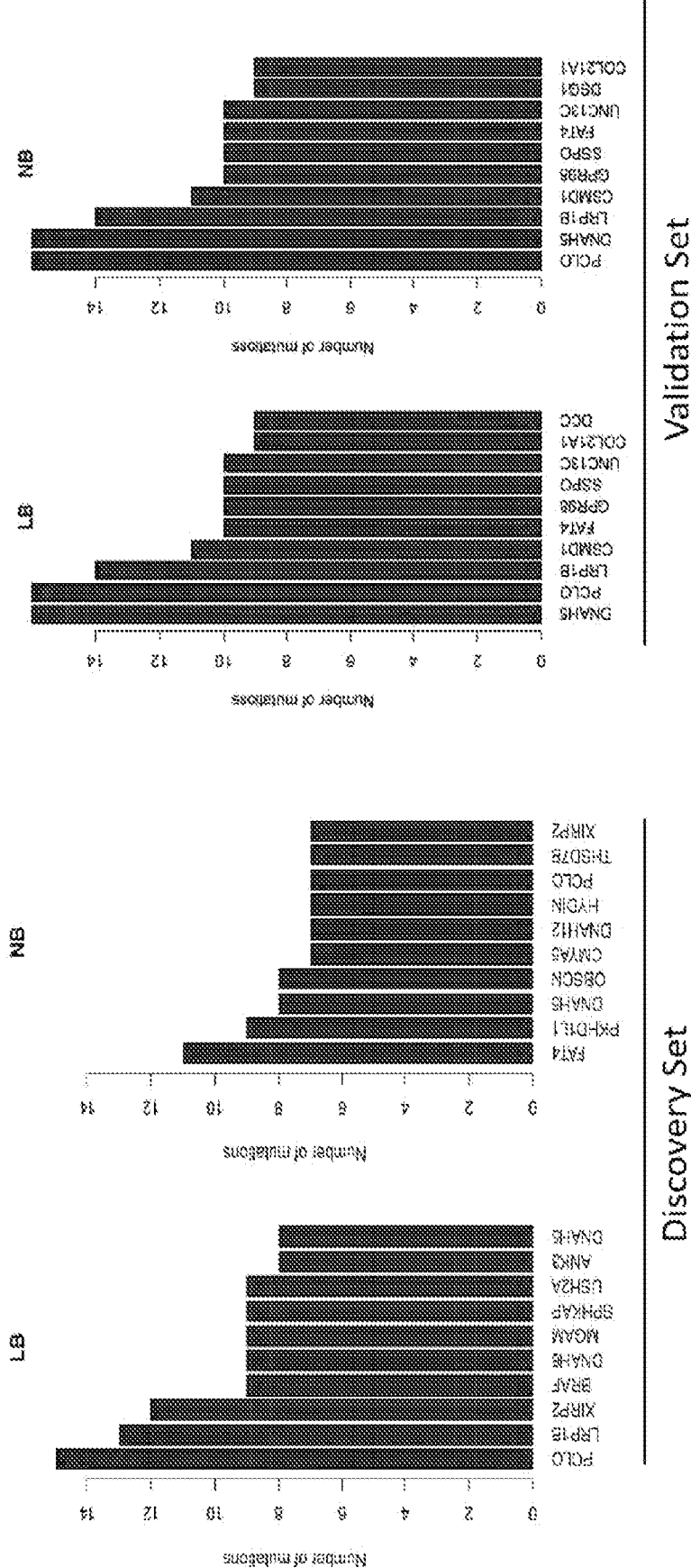


FIG. 6A

Validation Set

Number of Mutations

Mutation Type

- Missense
- Nonsense
- Indel
- Splicing
- Response Type

| Validation Set | Missense | Nonsense | Indel | Splicing | Response Type |
|----------------|----------|----------|-------|----------|---------------|
| NR4531         | 1050     | 50       | 0     | 0        | 0             |
| LSO4744        | 1000     | 50       | 0     | 0        | 0             |
| NR9520         | 950      | 50       | 0     | 0        | 0             |
| LSO3464        | 850      | 50       | 0     | 0        | 0             |
| LSO4691        | 800      | 50       | 0     | 0        | 0             |
| CR6128         | 750      | 50       | 0     | 0        | 0             |
| NR4635         | 700      | 50       | 0     | 0        | 0             |
| NR9449         | 650      | 50       | 0     | 0        | 0             |
| CRBR0244       | 600      | 50       | 0     | 0        | 0             |
| LSOBR1120      | 550      | 50       | 0     | 0        | 0             |
| LSO0167        | 500      | 50       | 0     | 0        | 0             |
| CRBR4472       | 450      | 50       | 0     | 0        | 0             |
| BR9705         | 400      | 50       | 0     | 0        | 0             |
| LSOBR1059      | 350      | 50       | 0     | 0        | 0             |
| CRBR4461       | 300      | 50       | 0     | 0        | 0             |

Stacked bar chart showing the number of mutations for various Discovery Sets, categorized by Mutation Type (Missense, Nonsense, Indel, Splicing) and Response Type (LB, NB). The Y-axis represents the Number of Mutations (0 to 1400). The X-axis represents the Discovery Set.

**Legend:**

- Mutation Type:**
  - Missense (Dark Grey)
  - Nonsense (Medium Grey)
  - Indel (Light Grey)
  - Splicing (White)
- Response Type:**
  - LB (Dark Grey)
  - NB (Medium Grey)

**Discovery Set Data (Approximate Values):**

| Discovery Set | Missense | Nonsense | Indel | Splicing | LB | NB |
|---------------|----------|----------|-------|----------|----|----|
| CR9306        | 1350     | 100      | 50    | 0        | 0  | 0  |
| CR9699        | 1300     | 100      | 50    | 0        | 0  | 0  |
| SD7327        | 1250     | 100      | 50    | 0        | 0  | 0  |
| SD1494        | 1150     | 100      | 50    | 0        | 0  | 0  |
| CR4680        | 1100     | 100      | 50    | 0        | 0  | 0  |
| SD0346        | 1050     | 100      | 50    | 0        | 0  | 0  |
| SD5484        | 1000     | 100      | 50    | 0        | 0  | 0  |
| NR4949        | 950      | 100      | 50    | 0        | 0  | 0  |
| NR3548        | 900      | 100      | 50    | 0        | 0  | 0  |
| CR1509        | 850      | 100      | 50    | 0        | 0  | 0  |
| NR4810        | 800      | 100      | 50    | 0        | 0  | 0  |
| SD6326        | 750      | 100      | 50    | 0        | 0  | 0  |
| SD5938        | 700      | 100      | 50    | 0        | 0  | 0  |
| CR0095        | 650      | 100      | 50    | 0        | 0  | 0  |
| CR3666        | 600      | 100      | 50    | 0        | 0  | 0  |
| SD3056        | 550      | 100      | 50    | 0        | 0  | 0  |
| SD5934        | 500      | 100      | 50    | 0        | 0  | 0  |
| CR7620        | 450      | 100      | 50    | 0        | 0  | 0  |
| SD2034        | 400      | 100      | 50    | 0        | 0  | 0  |
| SC6118        | 350      | 100      | 50    | 0        | 0  | 0  |
| NR1816        | 300      | 100      | 50    | 0        | 0  | 0  |
| NR0344        | 250      | 100      | 50    | 0        | 0  | 0  |
| NR764         | 200      | 100      | 50    | 0        | 0  | 0  |
| NR1016        | 150      | 100      | 50    | 0        | 0  | 0  |
| NR1368        | 100      | 100      | 50    | 0        | 0  | 0  |
| 272688        | 50       | 100      | 50    | 0        | 0  | 0  |

**FIG. 6B**

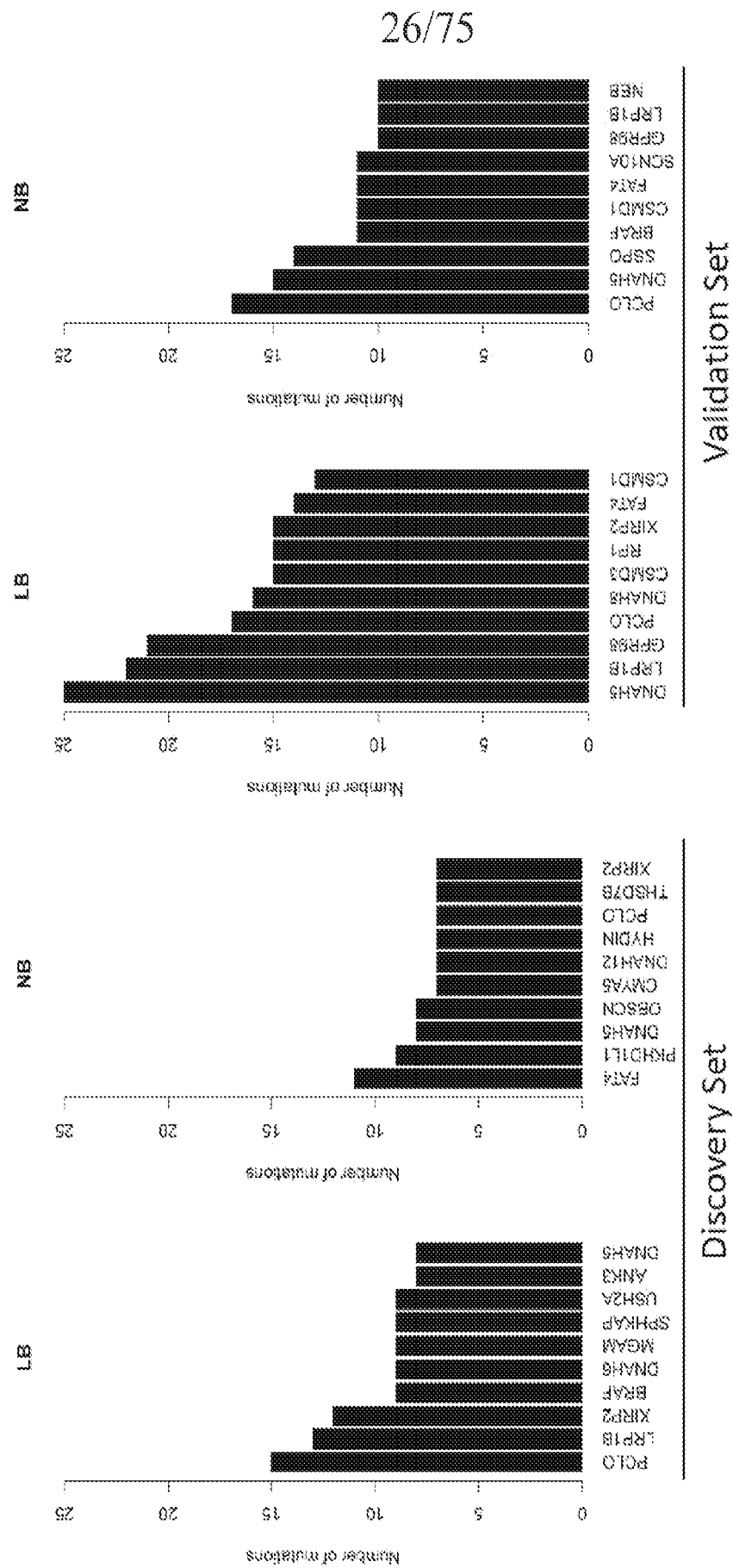


FIG. 6C

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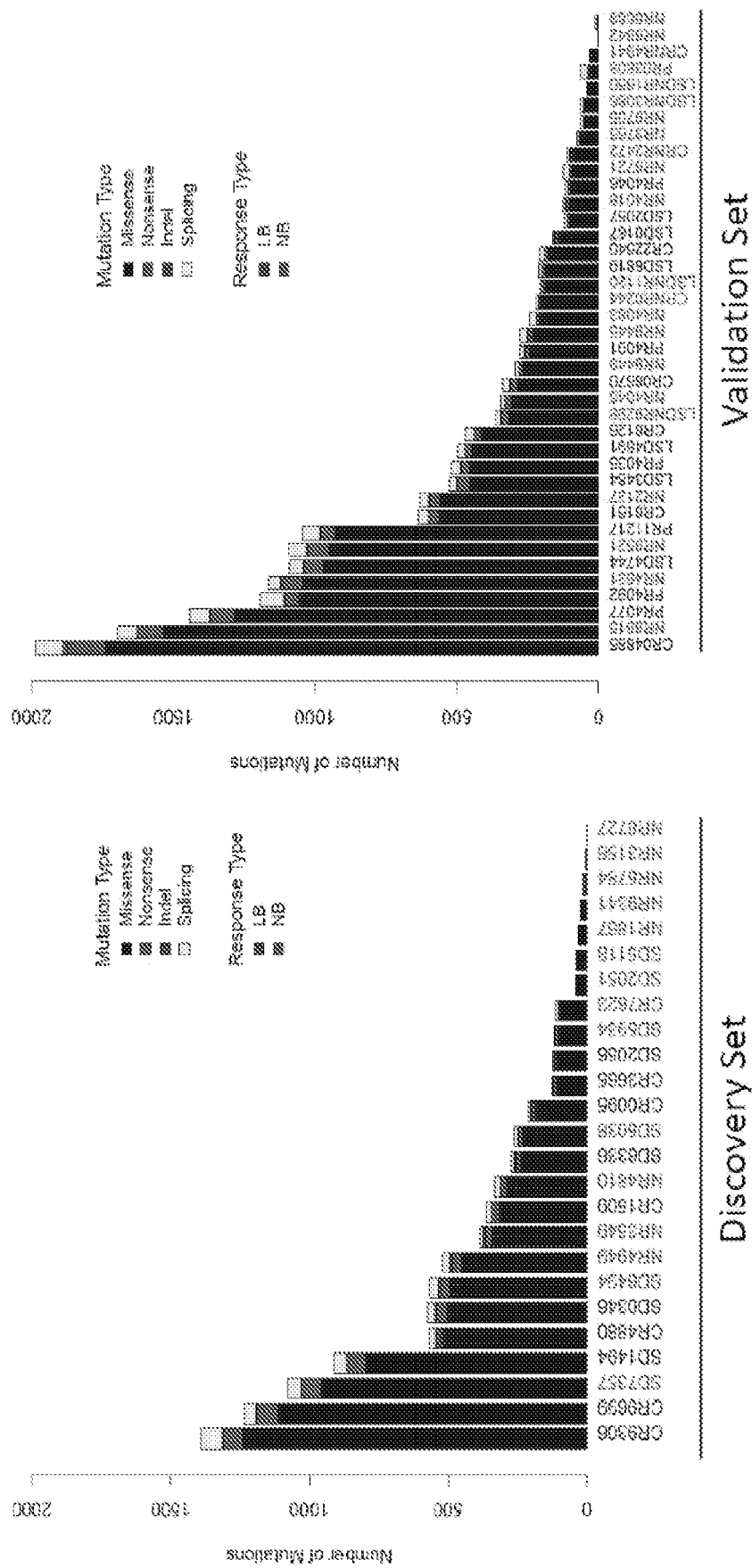


FIG. 6D

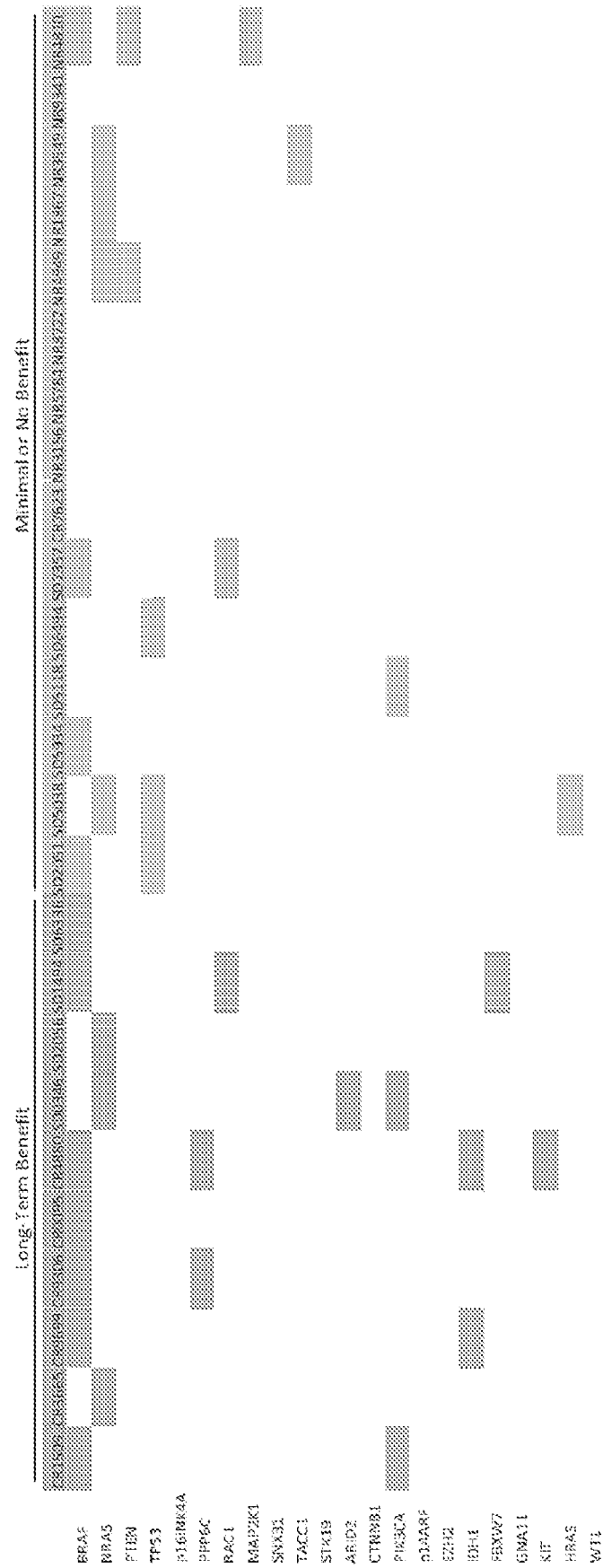


**FIG. 7A**

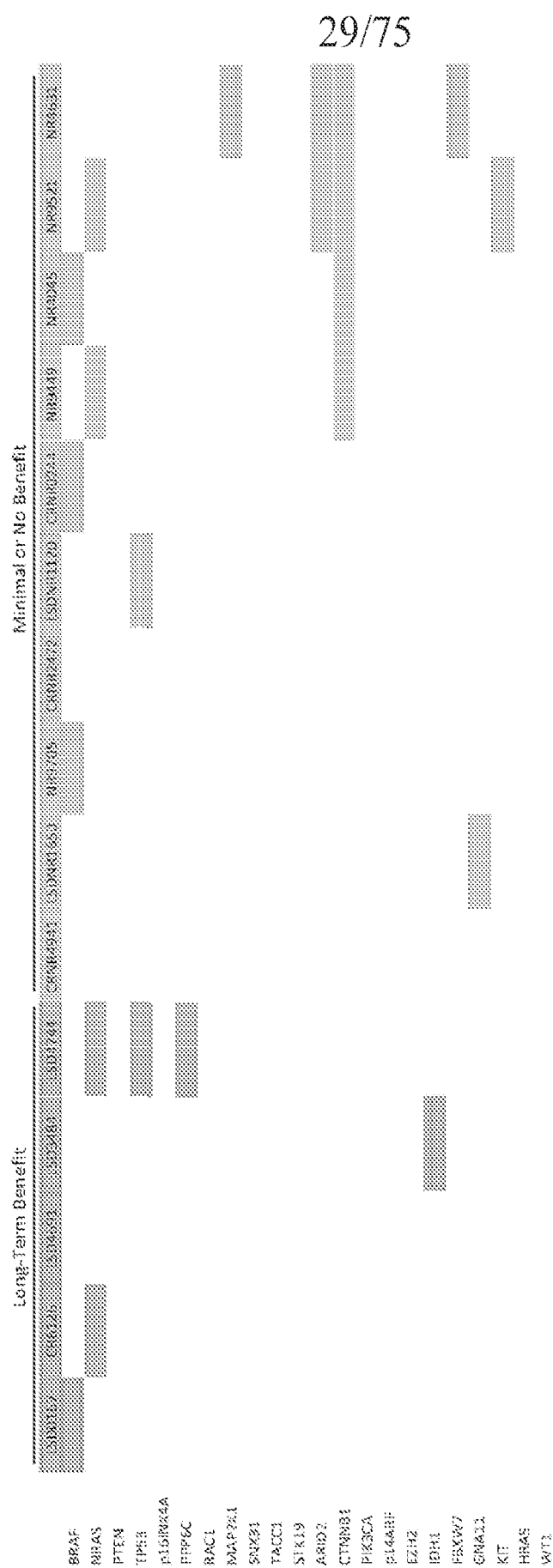


**FIG. 7B**

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**Sample                      Mutations****Long-term Benefit**

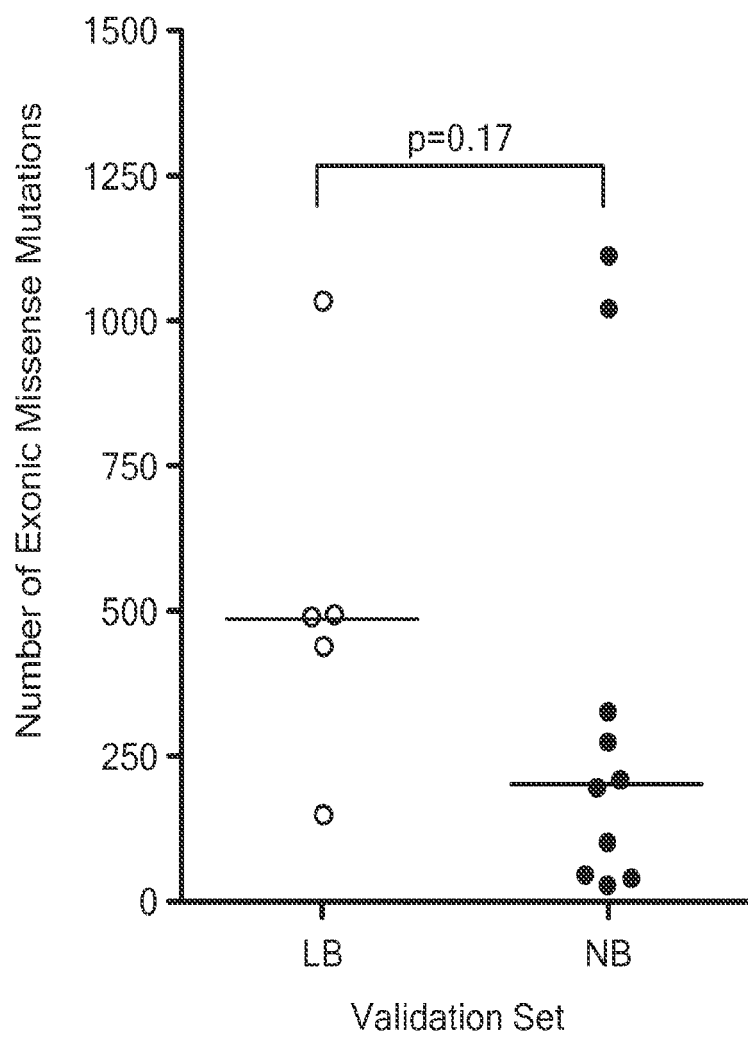
|         |      |
|---------|------|
| LSD0167 | 152  |
| CR6126  | 442  |
| LSD4691 | 491  |
| LSD3484 | 495  |
| LSD4744 | 1037 |

**Minimal or No Benefit**

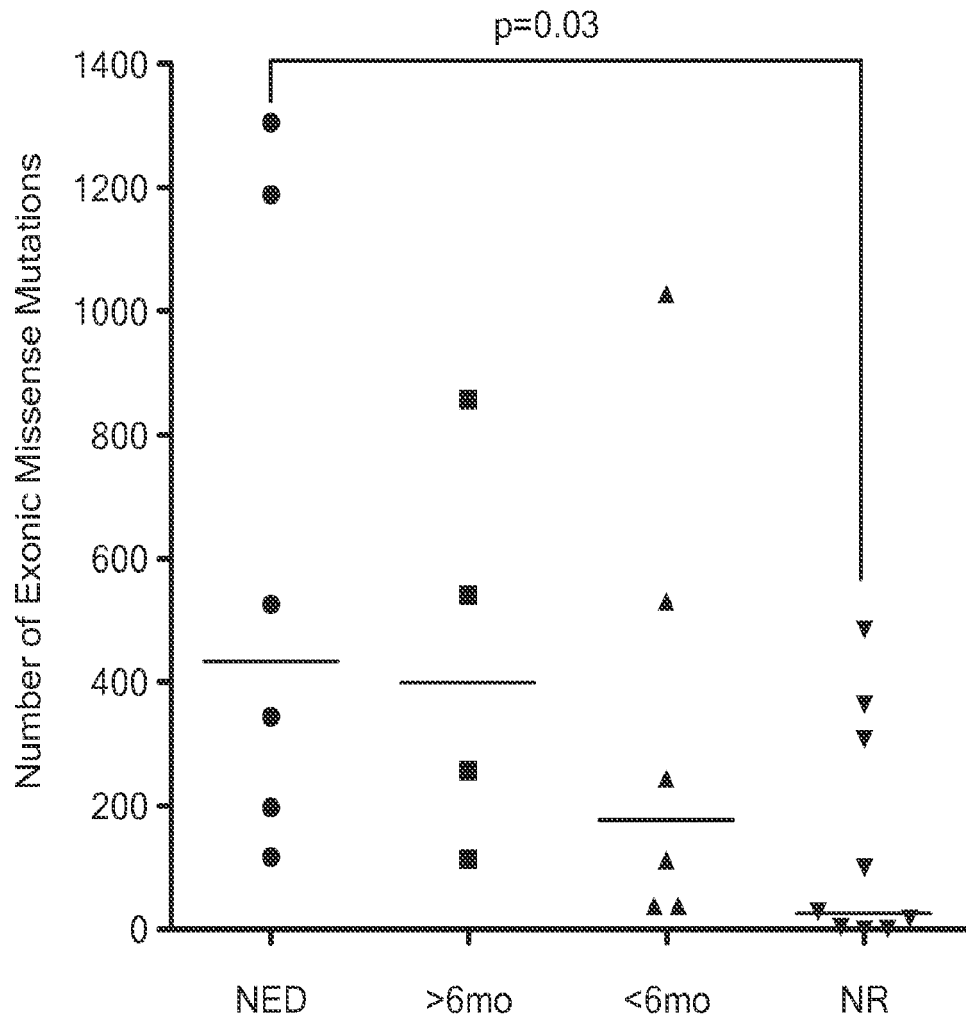
|           |      |
|-----------|------|
| CRNR4941  | 29   |
| LSDNR1650 | 42   |
| NR9705    | 49   |
| CRNR2472  | 102  |
| LSDNR1120 | 198  |
| CRNR0244  | 211  |
| NR9449    | 278  |
| NR4045    | 330  |
| NR9521    | 1026 |
| NR4631    | 1116 |

***FIG. 7C***

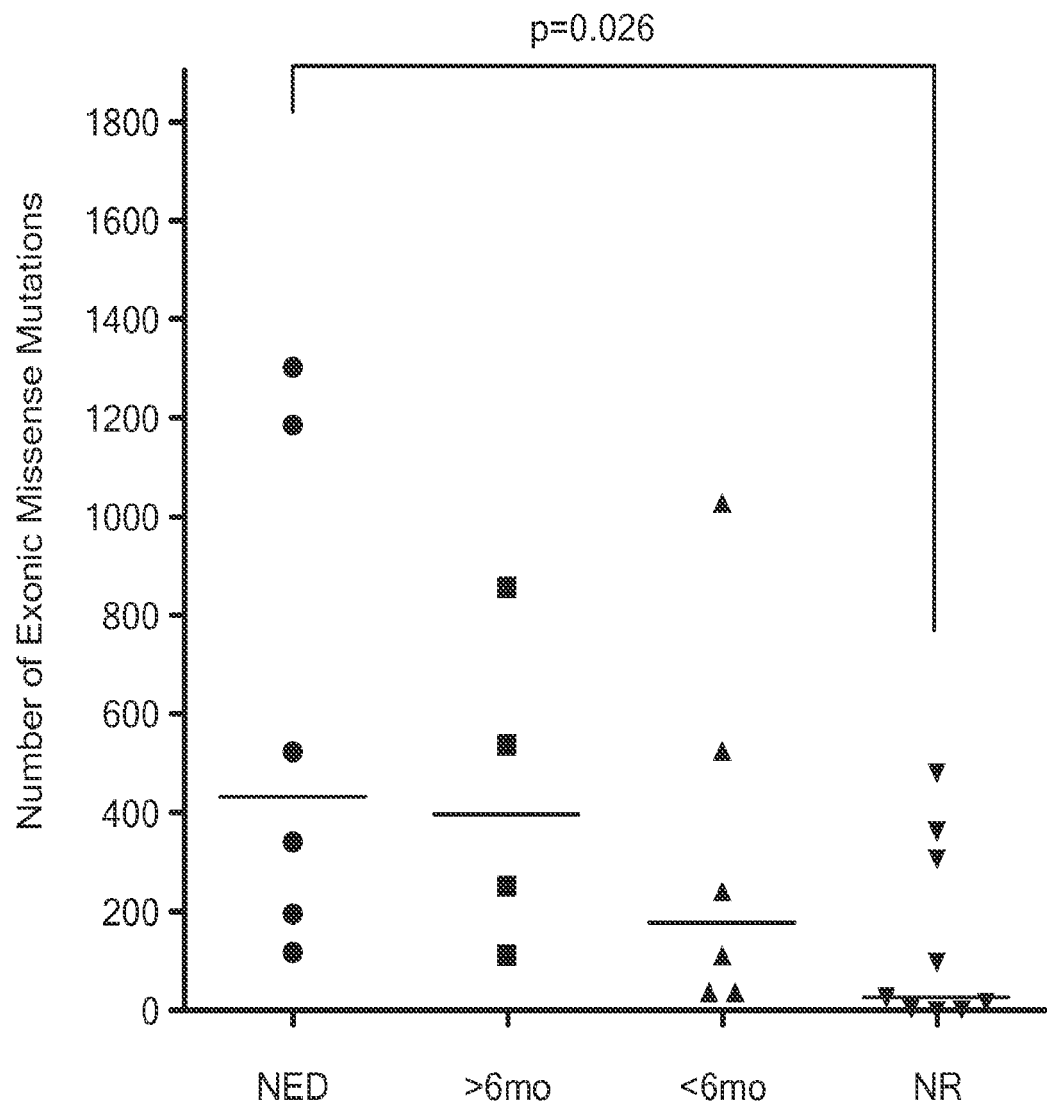
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**FIG. 7D**

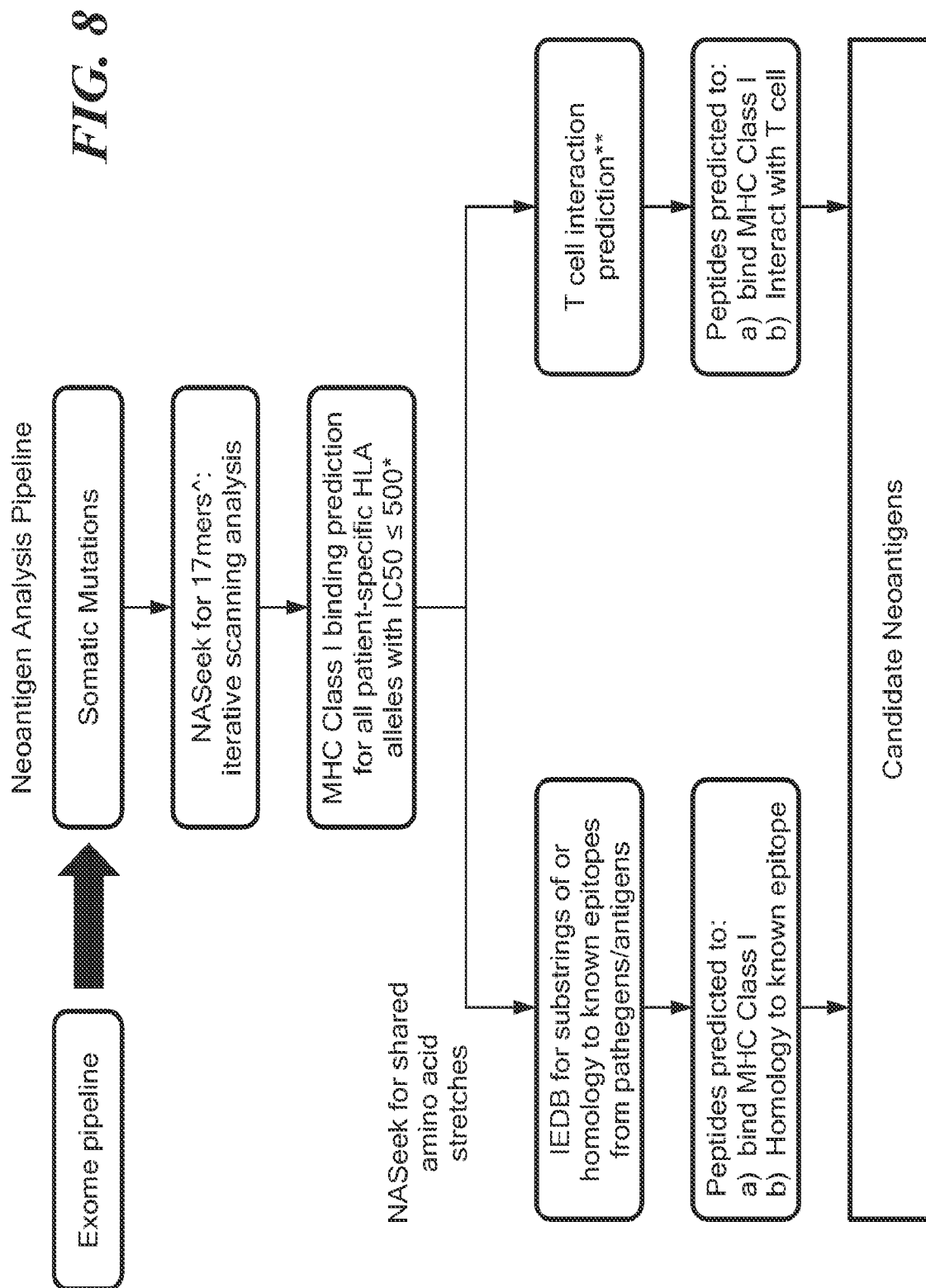
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**FIG. 7E**

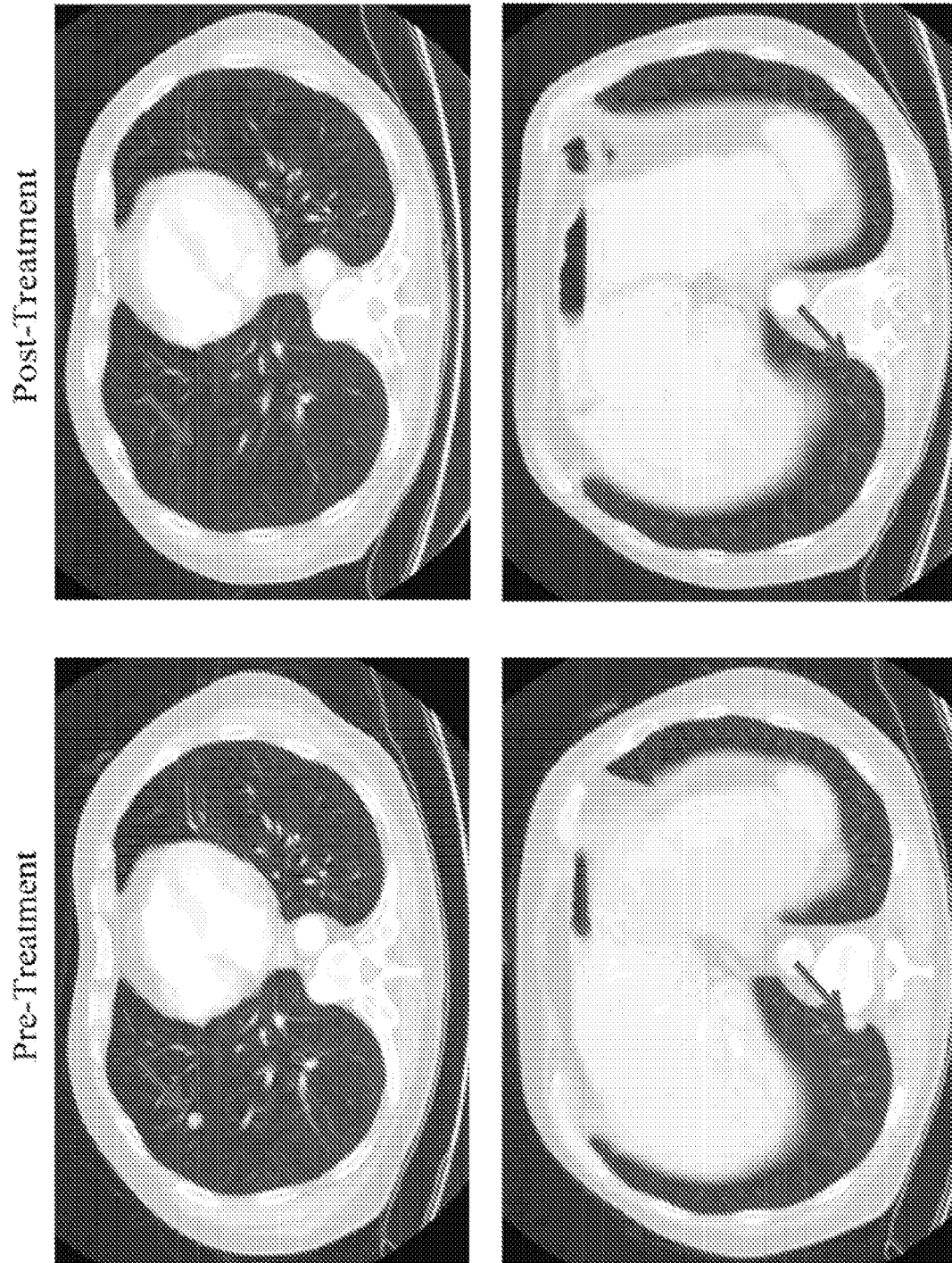
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**FIG. 7F**

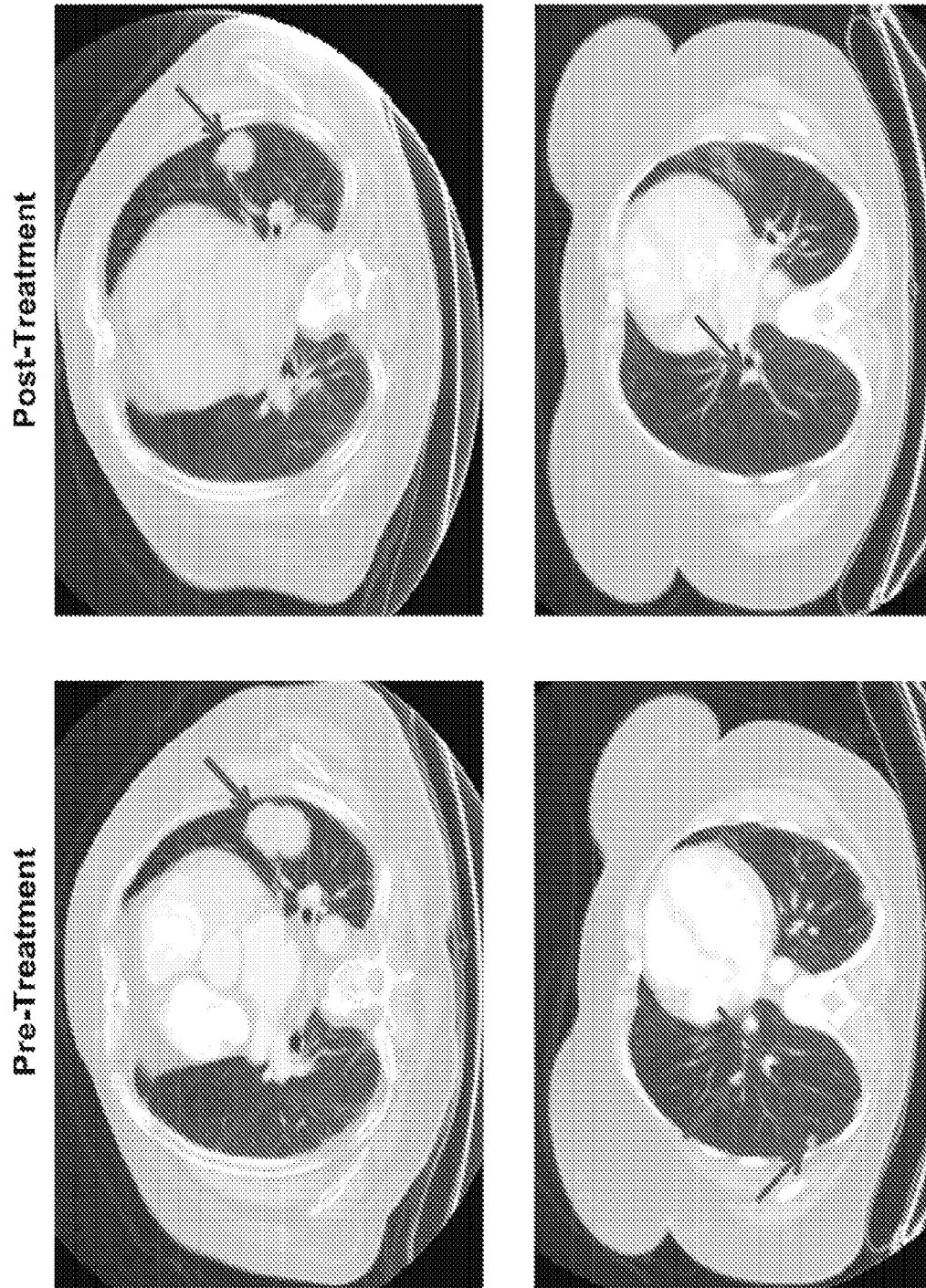
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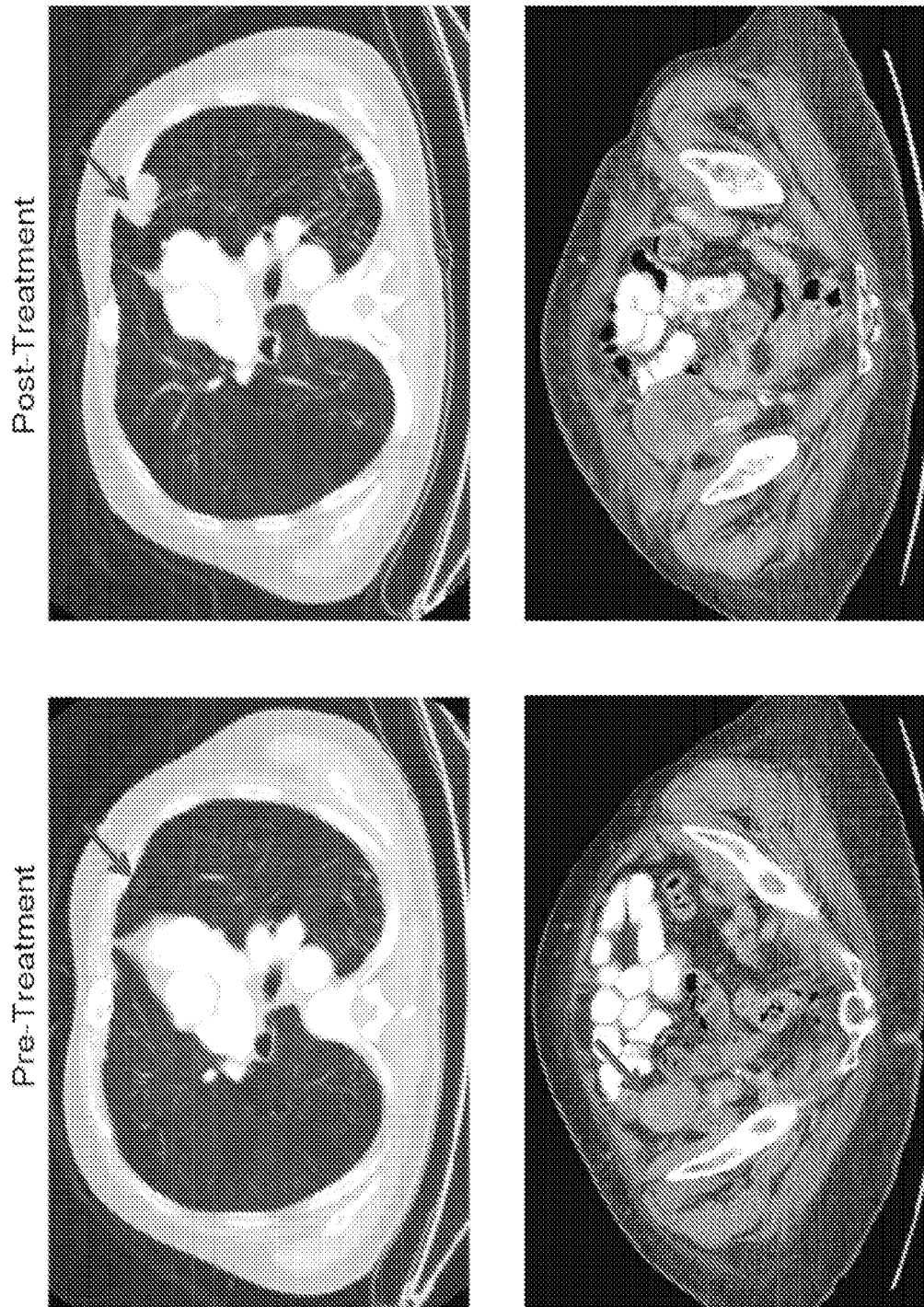
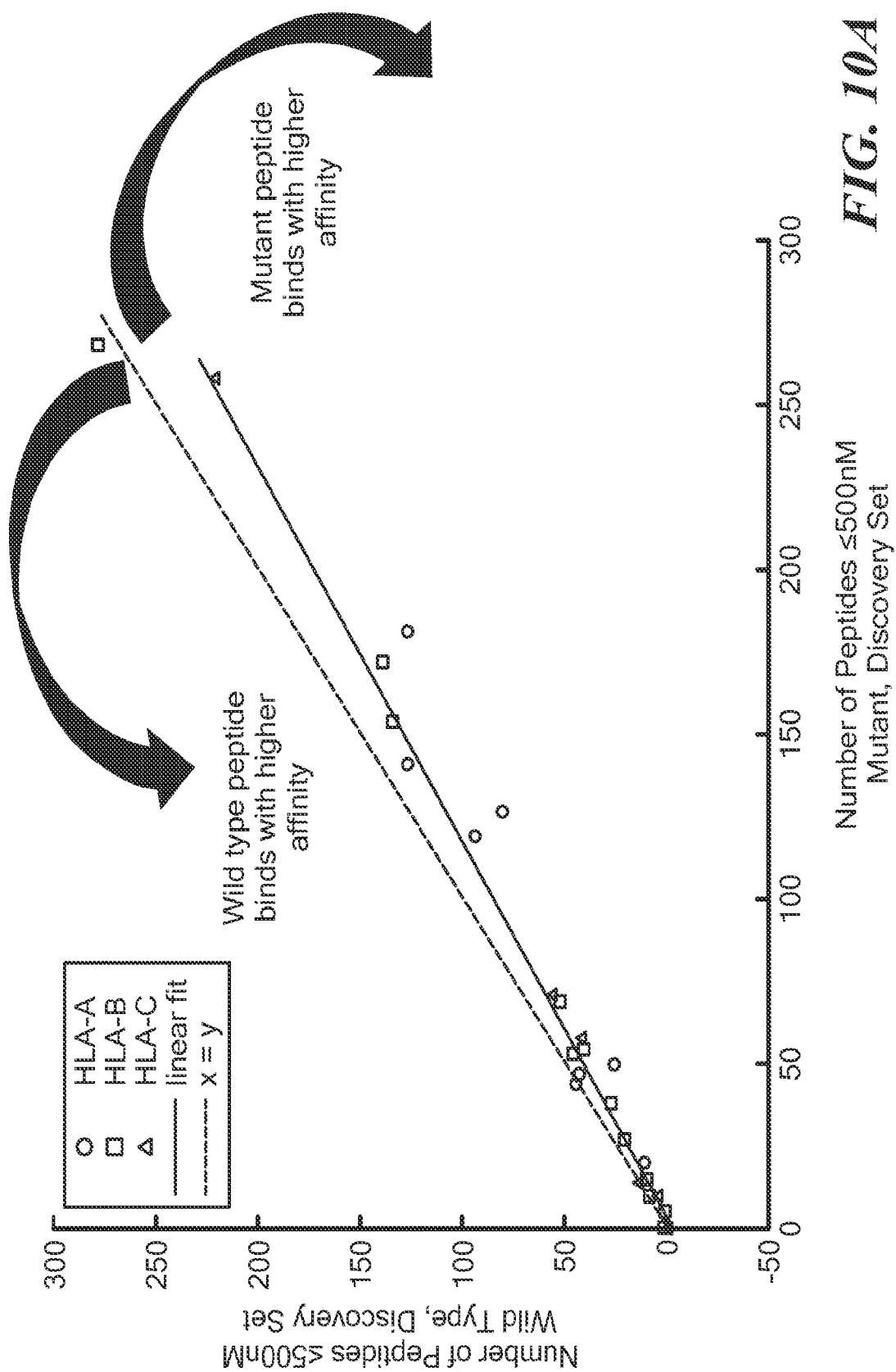
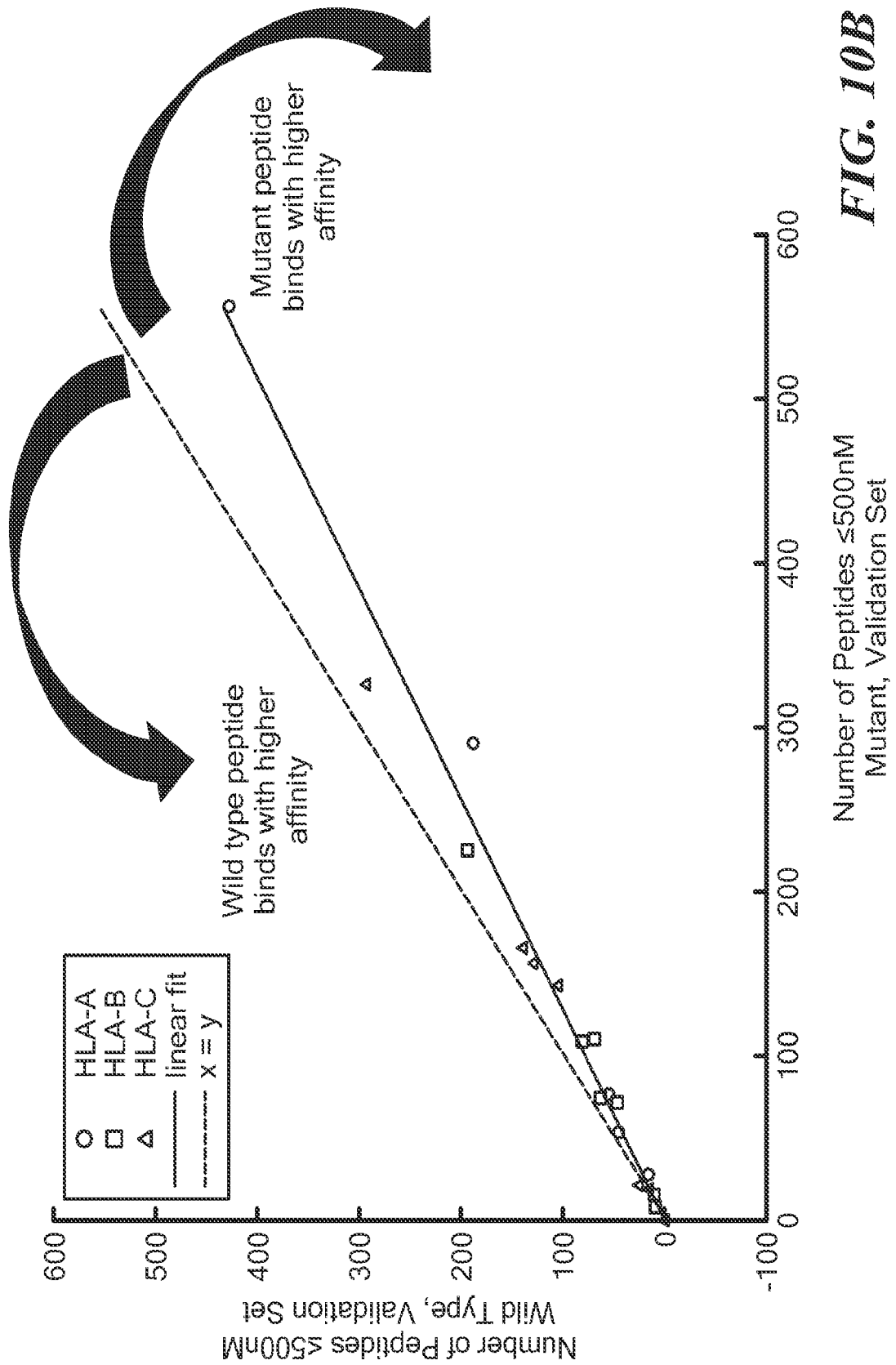


**FIG. 9C**

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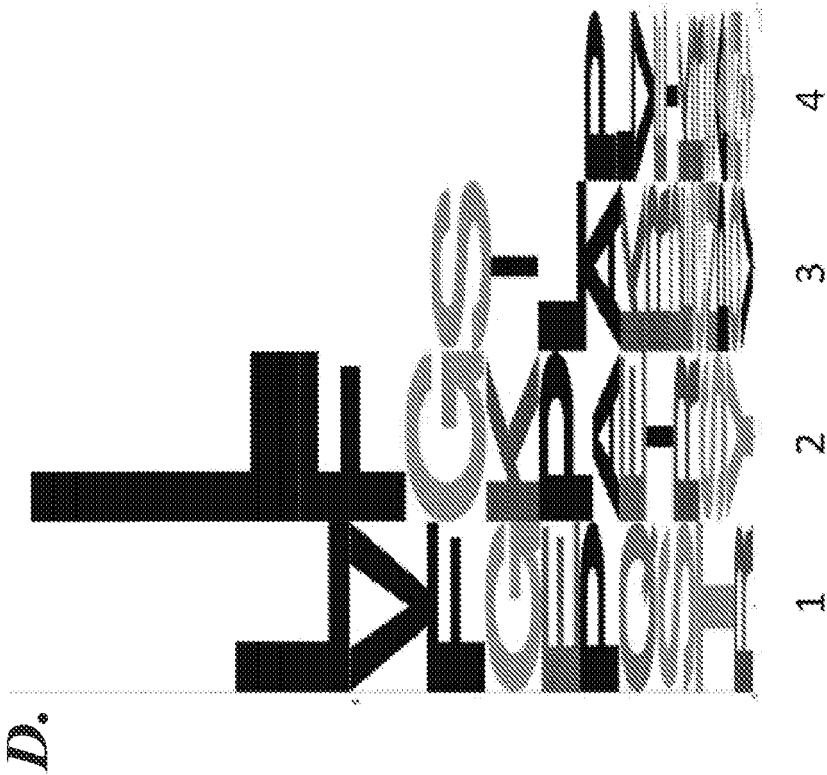


*FIG. 10D*

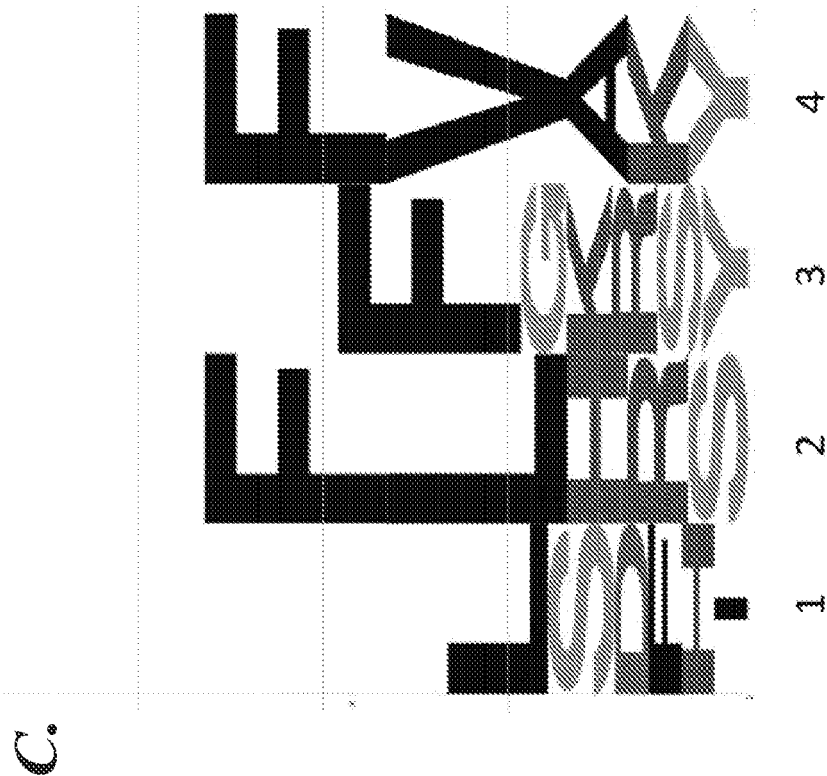
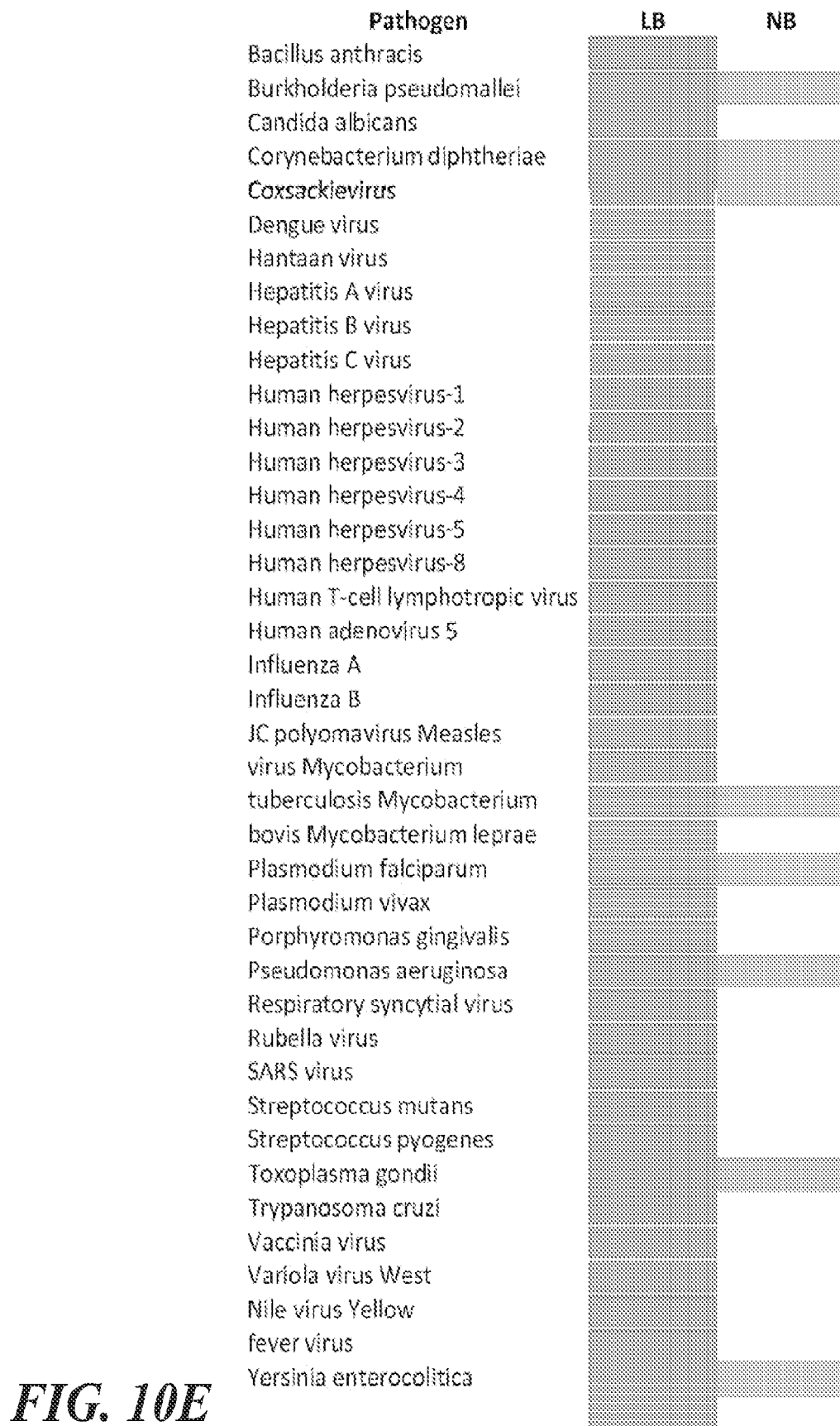


*FIG. 10C*

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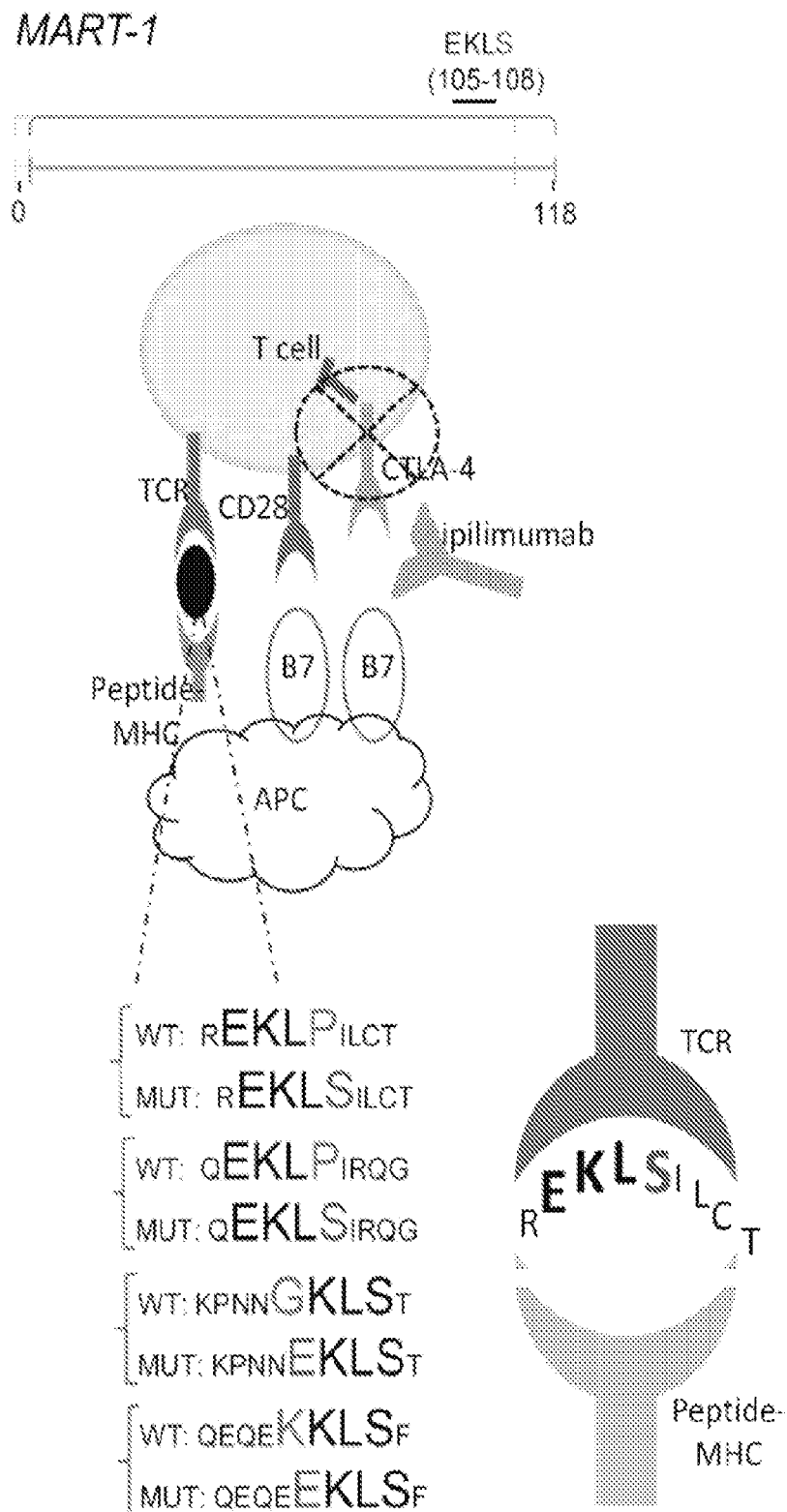
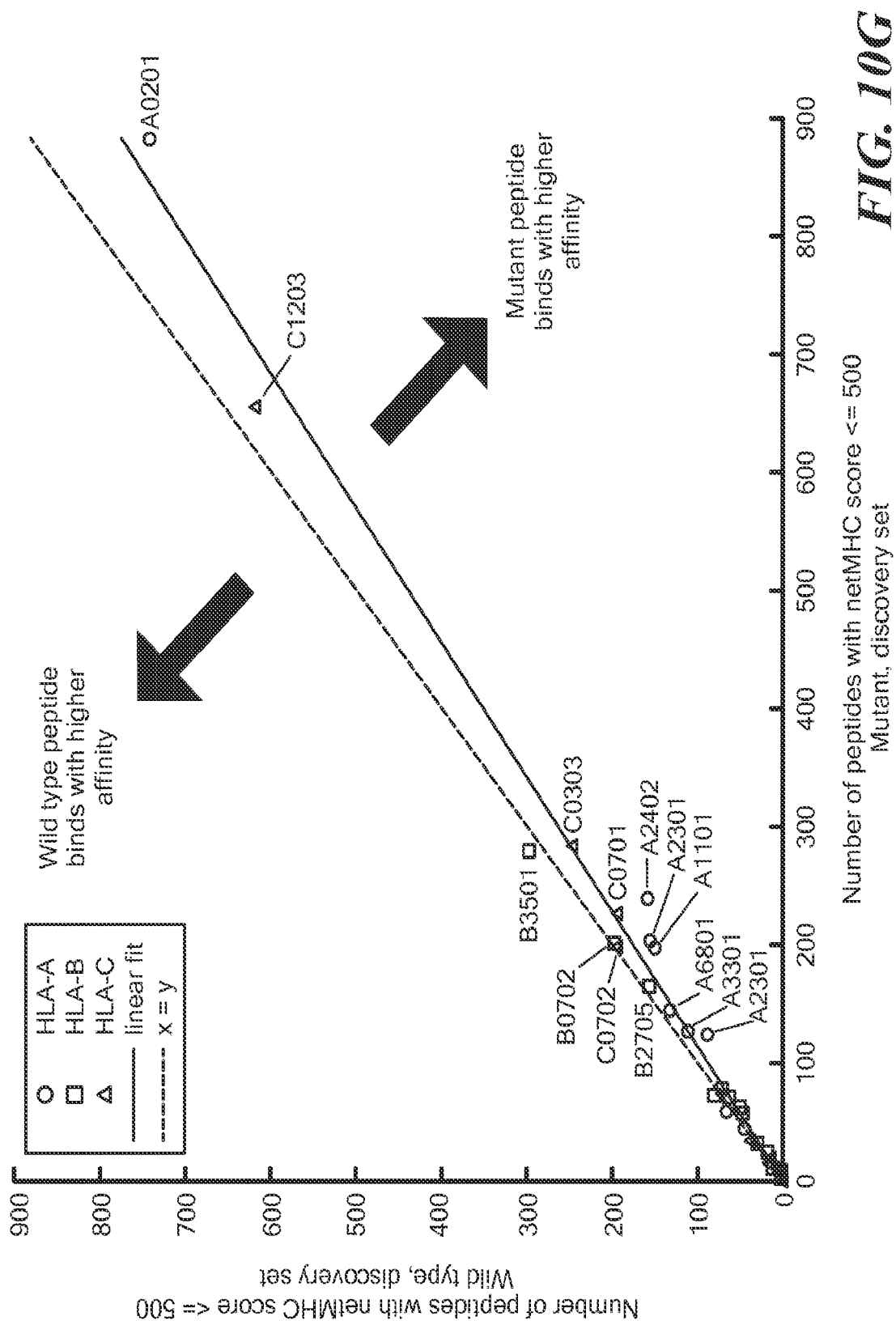
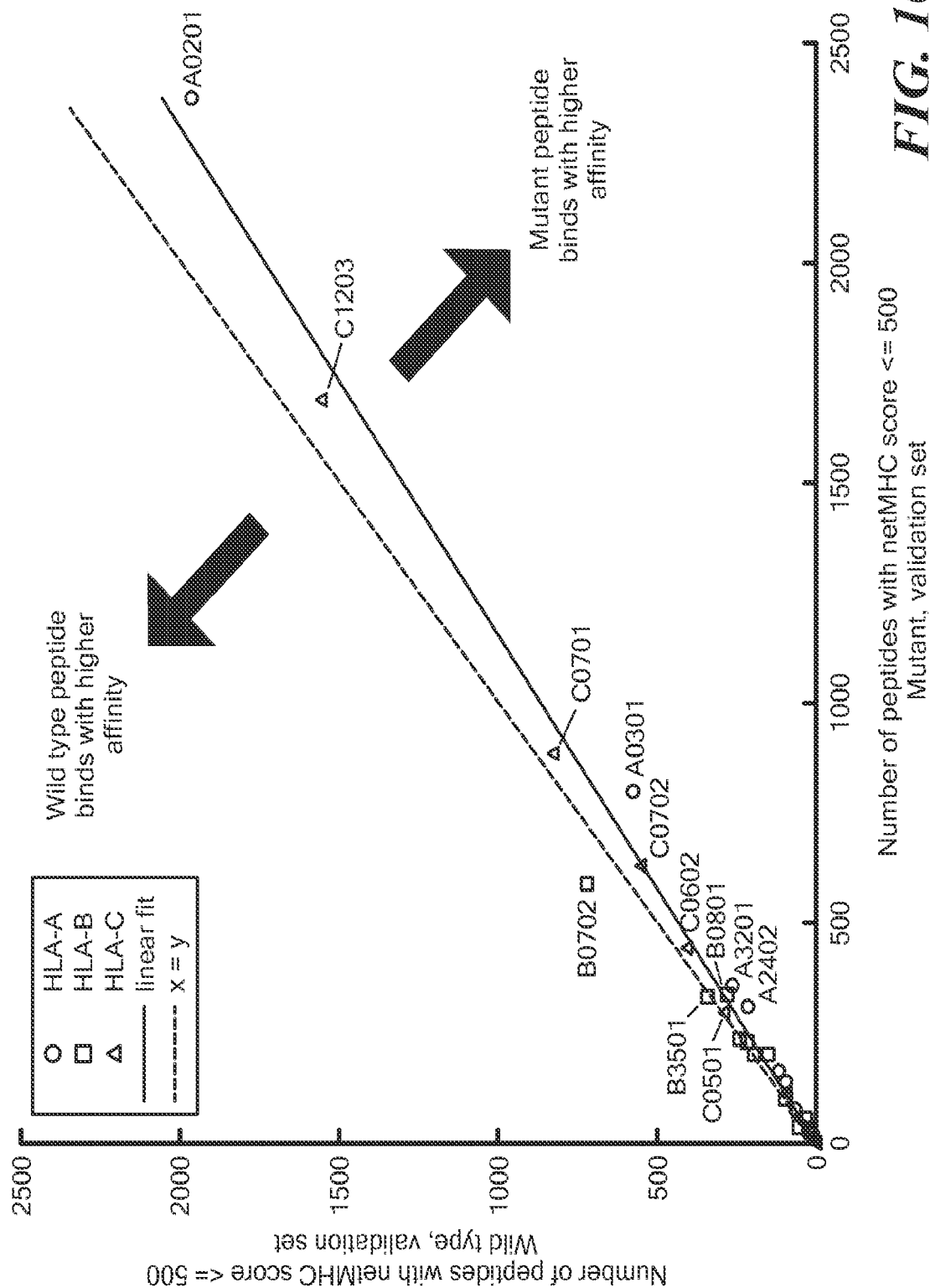


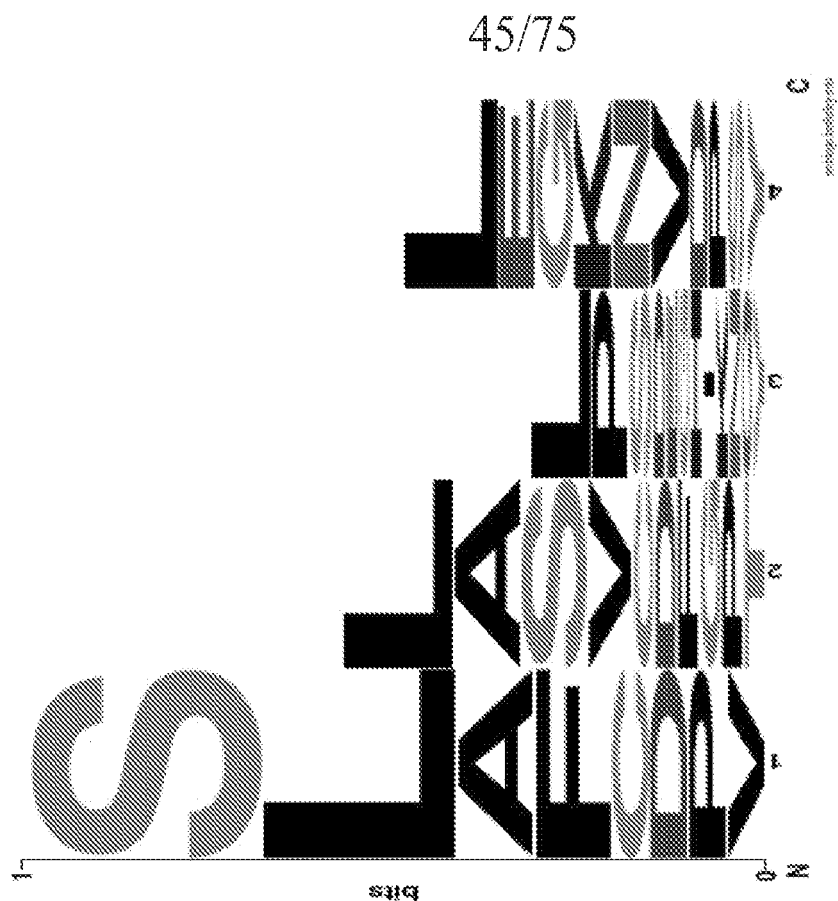
**FIG. 10F**

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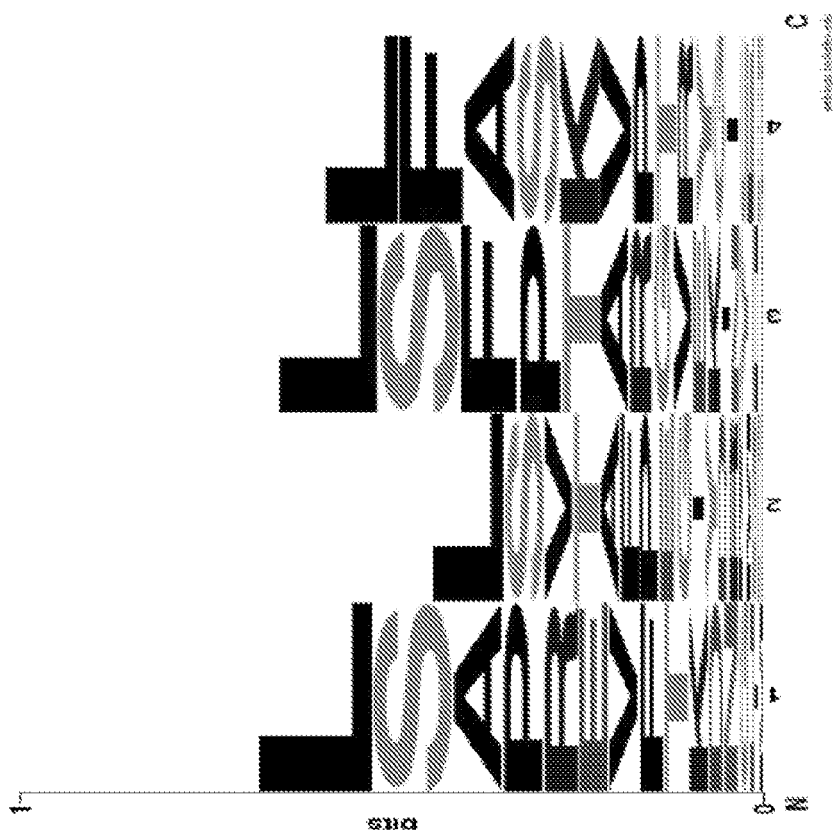
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Amino Acid Position in Tetrapeptide,  
Minimal or No Benefit Group

**FIG. 10J**



Amino Acid Position in Tetrapeptide  
Long-term Benefit Group

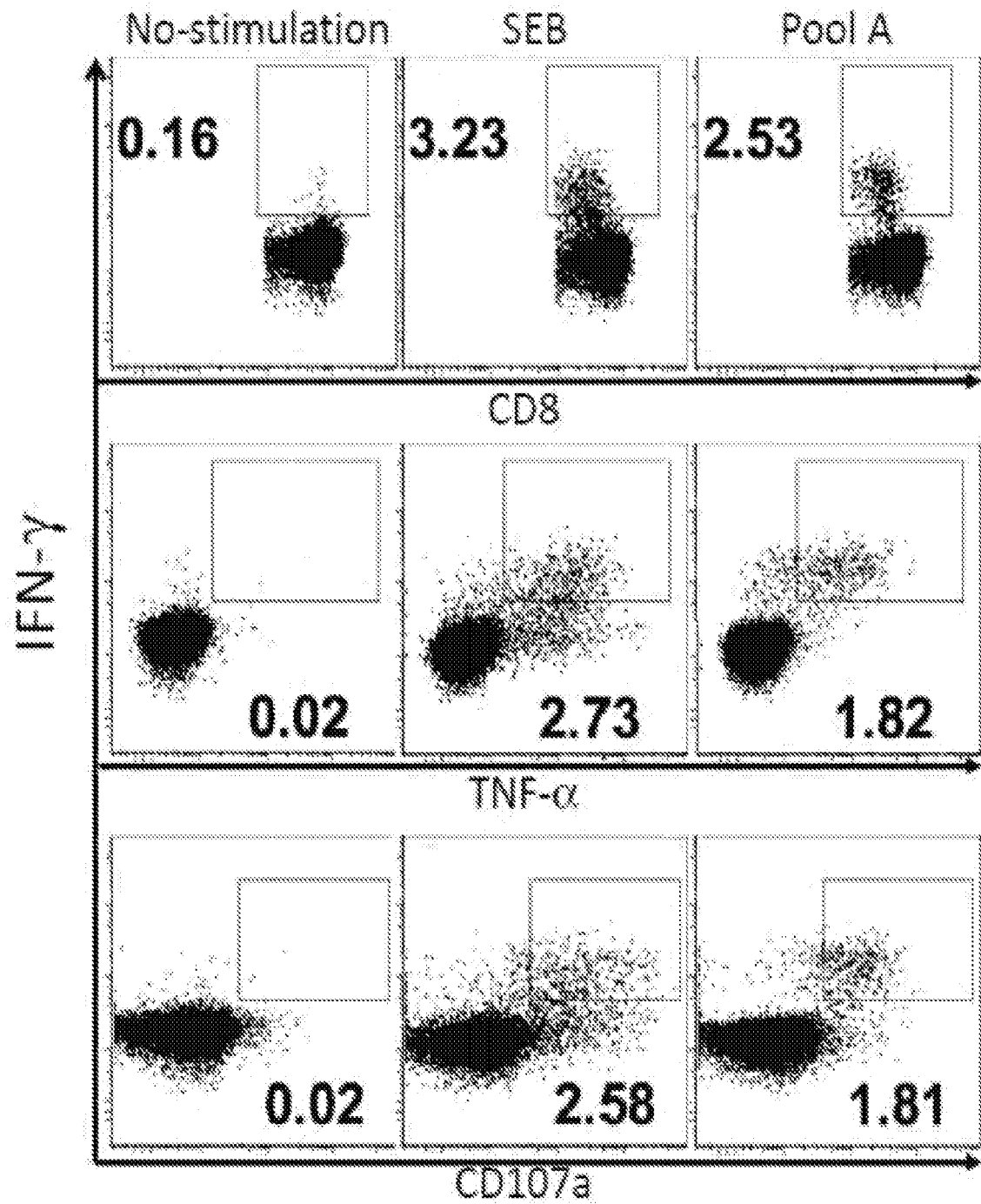
**FIG. 10I**

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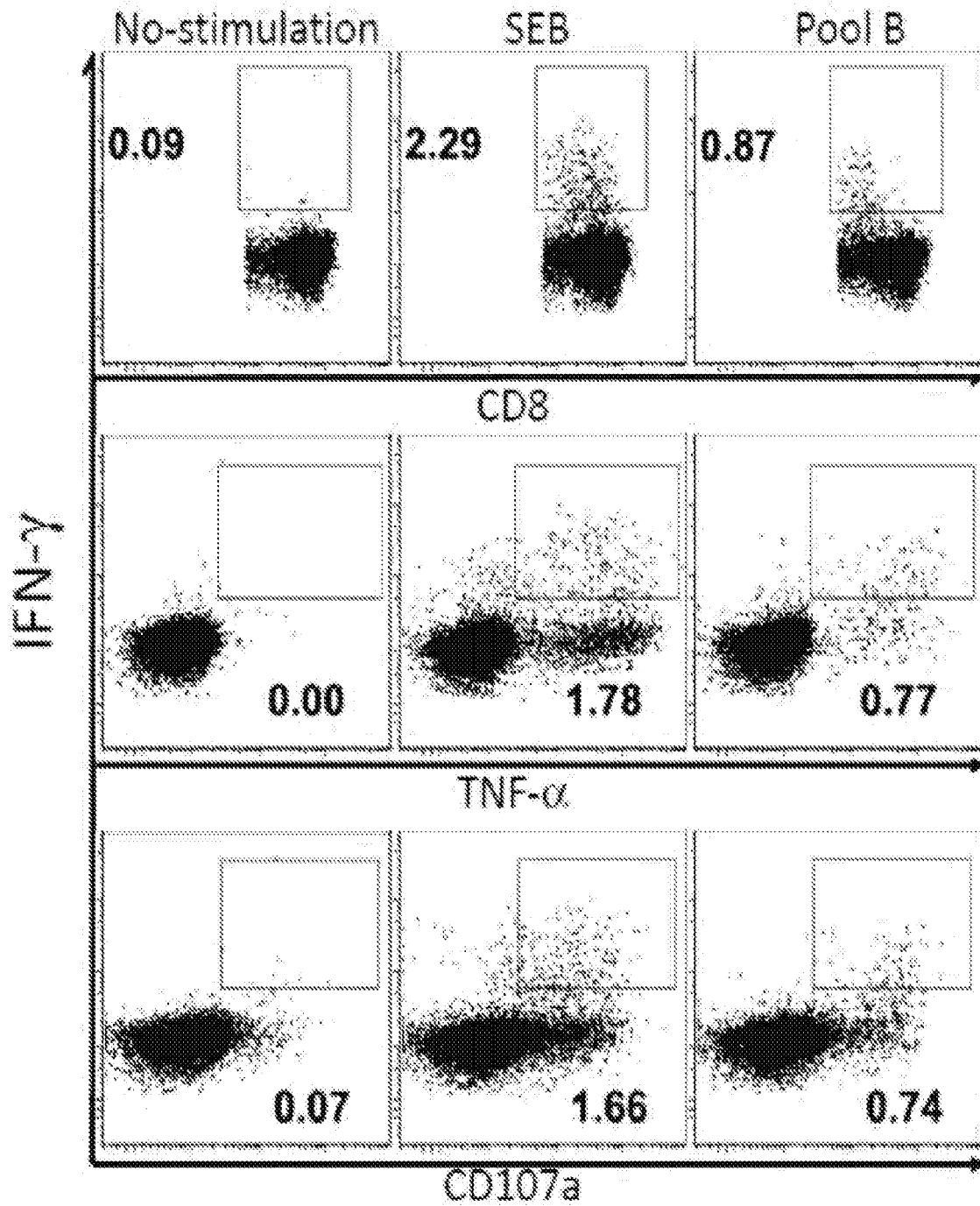
| Pathogen                           | LB | NB |
|------------------------------------|----|----|
| Adeno-associated virus-2           |    |    |
| Adenovirus                         |    |    |
| Aspergillus fumigatus              |    |    |
| Bacillus anthracis                 |    |    |
| BK polyomavirus                    |    |    |
| Bordetella pertussis               |    |    |
| Borrelia burgdorferi               |    |    |
| Burkholderia pseudomallei          |    |    |
| C. diphtheriae                     |    |    |
| C. tetani                          |    |    |
| C. trachomatis                     |    |    |
| Candida albicans                   |    |    |
| Coxsackievirus B4                  |    |    |
| Dengue virus                       |    |    |
| Francisella tularensis             |    |    |
| Group A Strep                      |    |    |
| H. pylori                          |    |    |
| Hantaan virus                      |    |    |
| Hepatitis B virus                  |    |    |
| Hepatitis C virus                  |    |    |
| Hepatitis E virus                  |    |    |
| Human herpesvirus 1                |    |    |
| Human herpesvirus 2                |    |    |
| Human herpesvirus 3                |    |    |
| Human herpesvirus 4                |    |    |
| Human herpesvirus 5                |    |    |
| Human herpesvirus 6                |    |    |
| Human herpesvirus 8                |    |    |
| Human papillomavirus 16            |    |    |
| Human papillomavirus 33            |    |    |
| Human papillomavirus 6             |    |    |
| Human papillomavirus 1a            |    |    |
| HTLV-1                             |    |    |
| Influenza A                        |    |    |
| Japanese encephalitis virus        |    |    |
| JC polyomavirus                    |    |    |
| Lymphocytic choriomeningitis virus |    |    |
| M. bovis                           |    |    |
| M. leprae                          |    |    |
| Major prion protein                |    |    |
| Measles virus                      |    |    |
| Modified Vaccinia Ankara virus     |    |    |
| M. Tuberculosis                    |    |    |
| Mupapillomavirus                   |    |    |
| Mupapillomavirus 1                 |    |    |
| P. falciparum                      |    |    |
| P. vivax                           |    |    |
| Porphyromonas gingivatis           |    |    |
| Rift Valley Fever virus            |    |    |
| Rubella virus                      |    |    |
| SARS coronavirus                   |    |    |
| Sin nombre virus                   |    |    |
| Streptococcus pyogenes             |    |    |
| Streptococcus mutans               |    |    |
| Tick-borne encephalitis virus      |    |    |
| Torque teno virus                  |    |    |
| Toxoplasma gondii                  |    |    |
| Trypanosoma cruzi                  |    |    |
| Vaccinia virus                     |    |    |
| Varicella minor                    |    |    |
| West Nile virus                    |    |    |
| Yellow fever virus                 |    |    |
| Yersinia enterocolitica            |    |    |

**FIG. 10K**

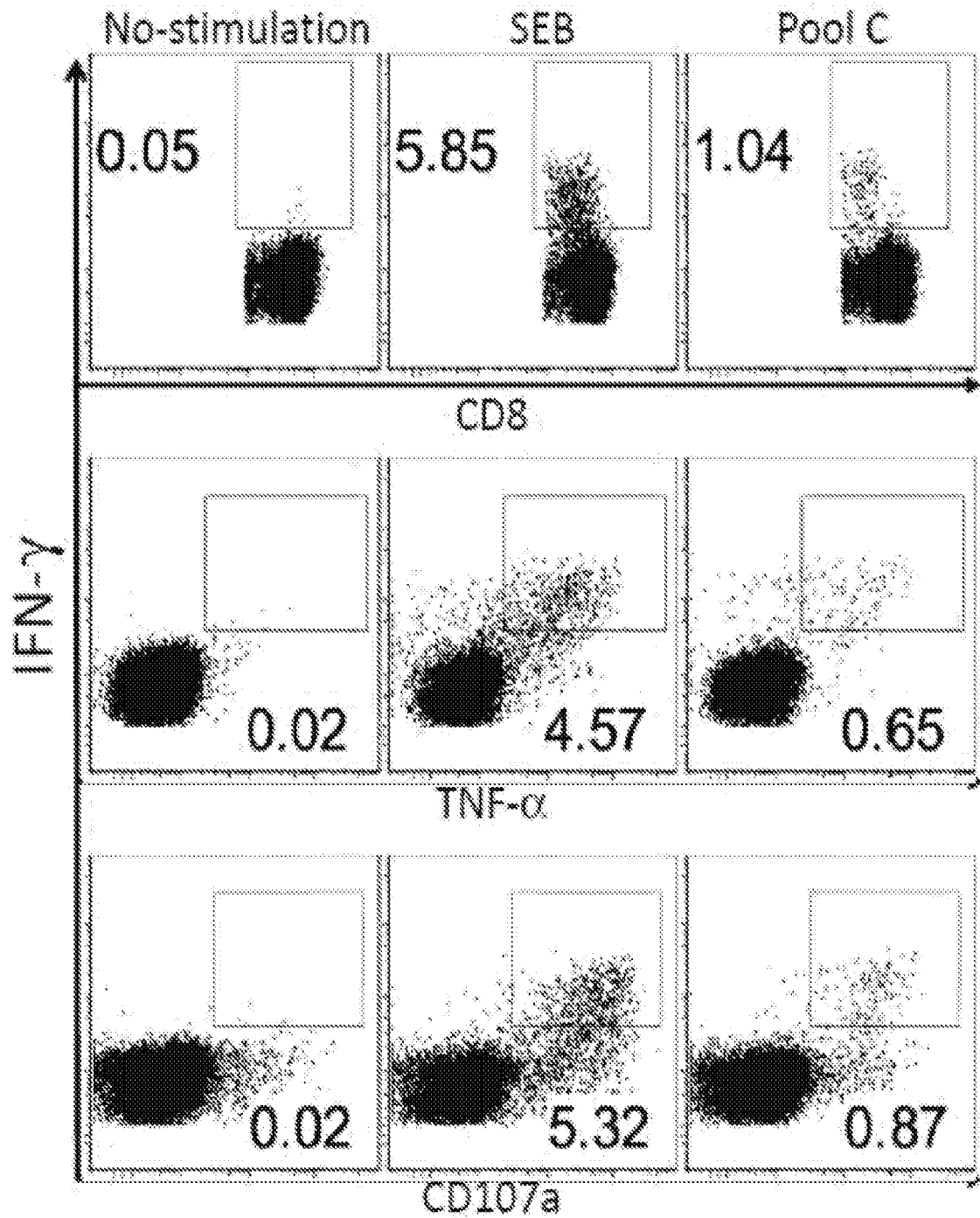
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*FIG. 11A*

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**FIG. 11B**

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**FIG. 11C**

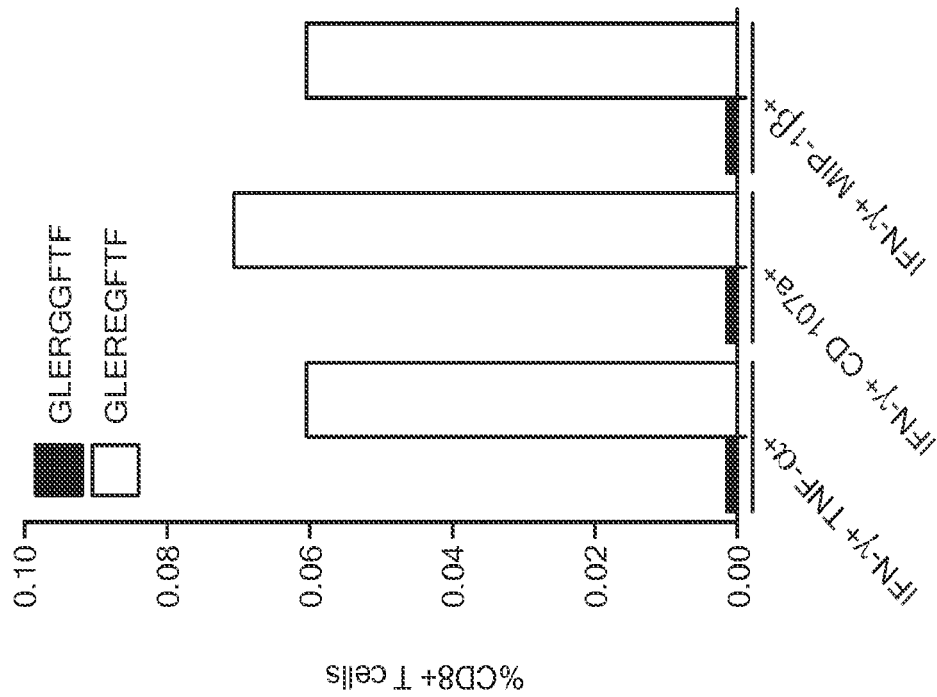


FIG. 11D

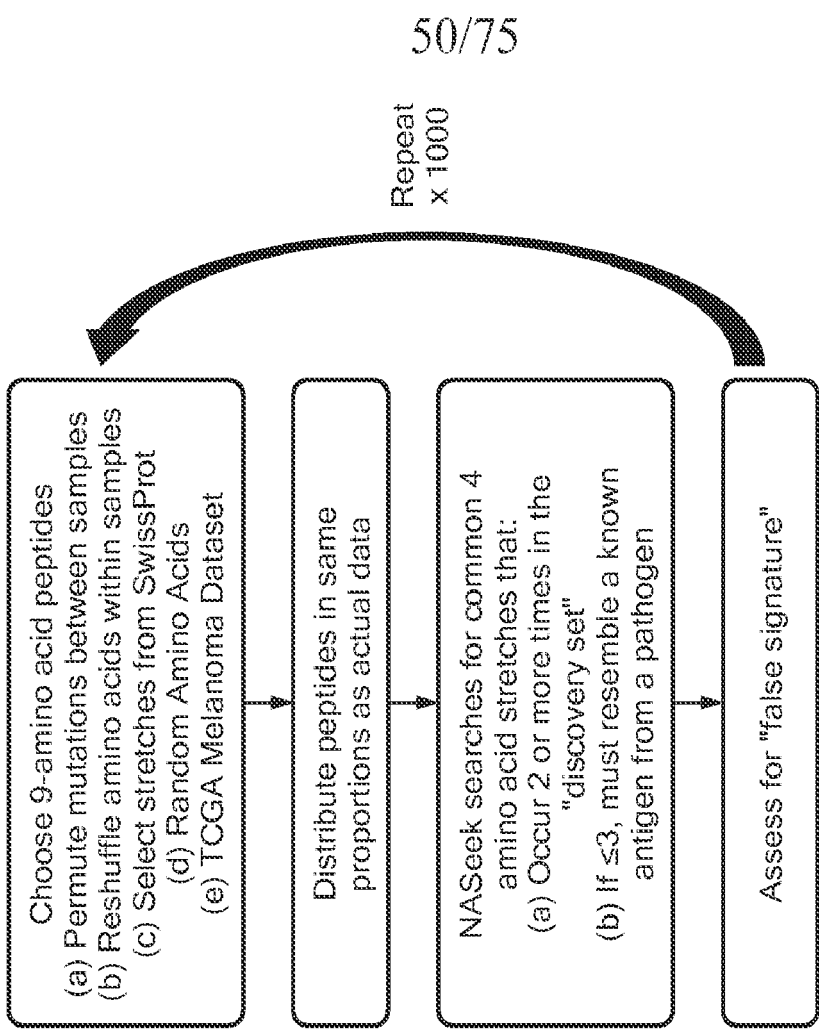


FIG. 12

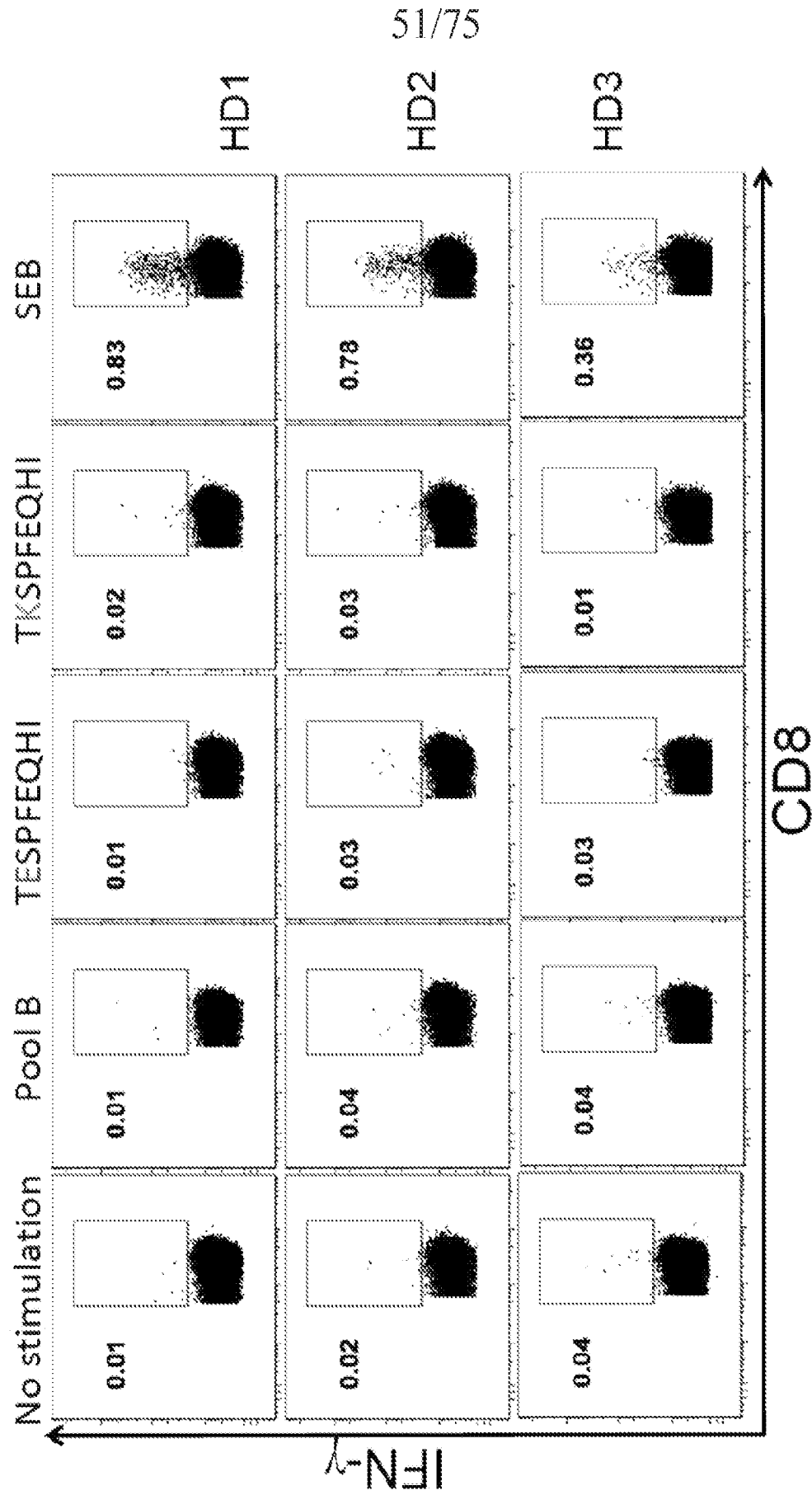
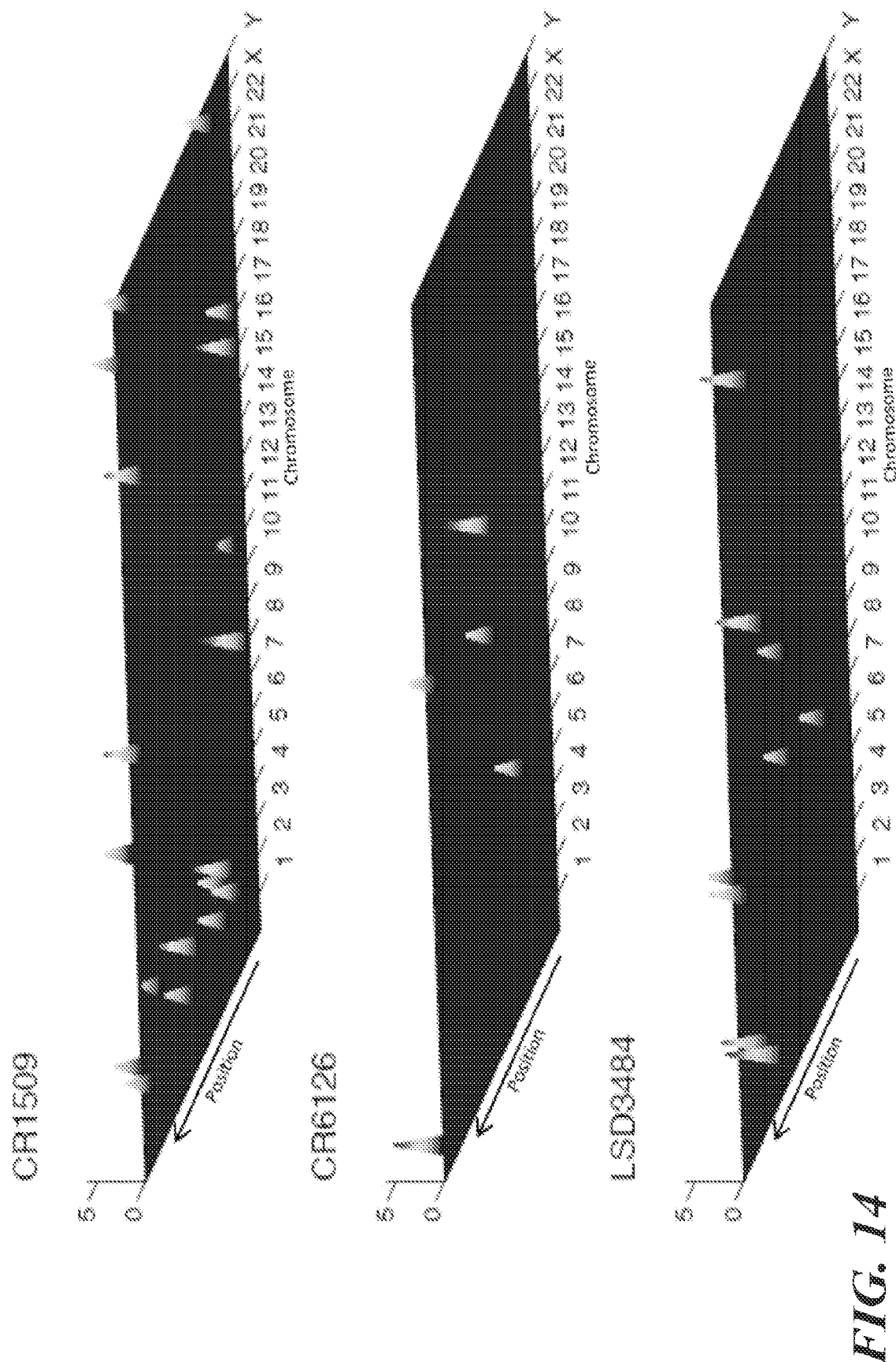


FIG. 13

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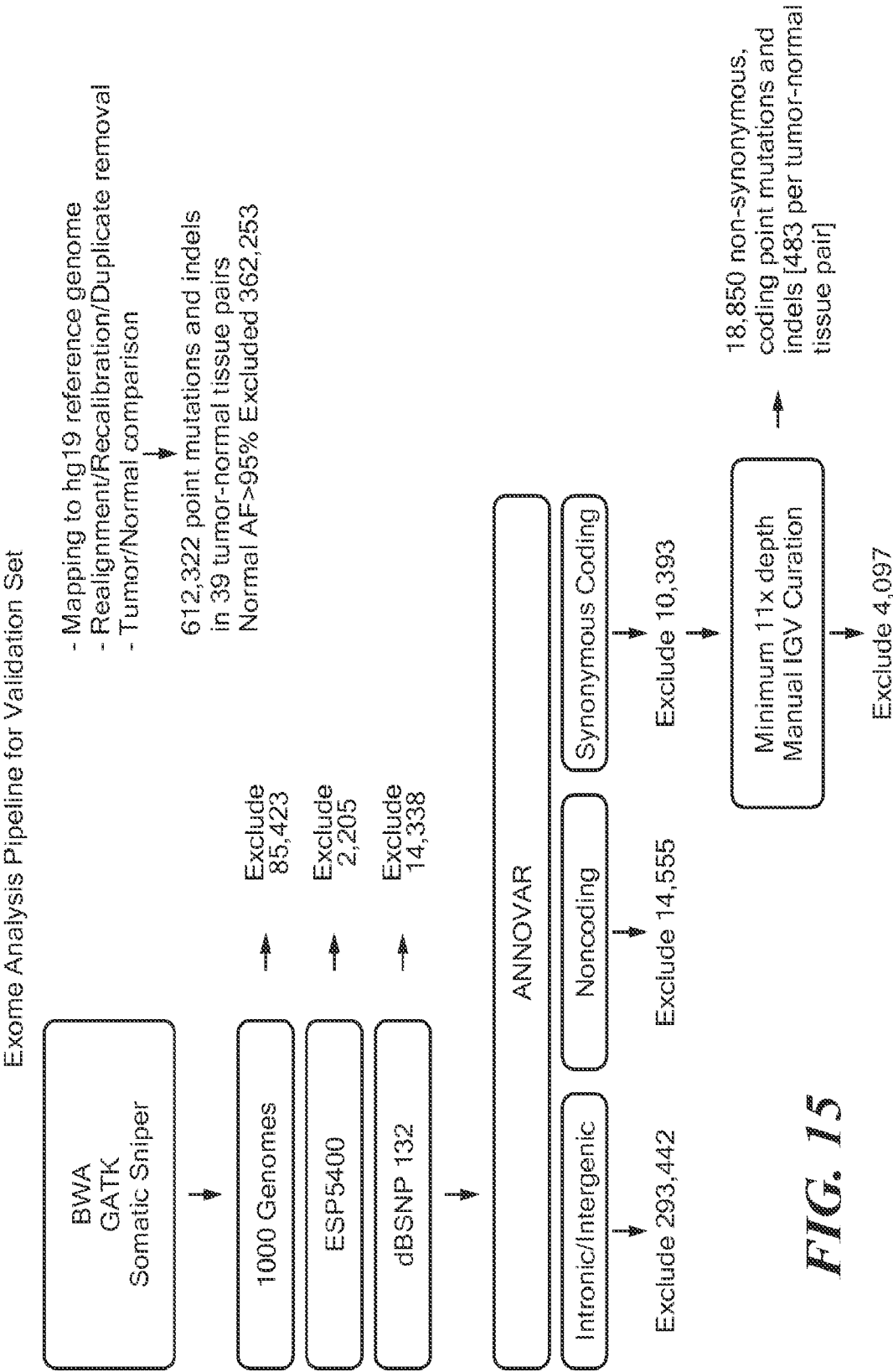


**FIG. 15**

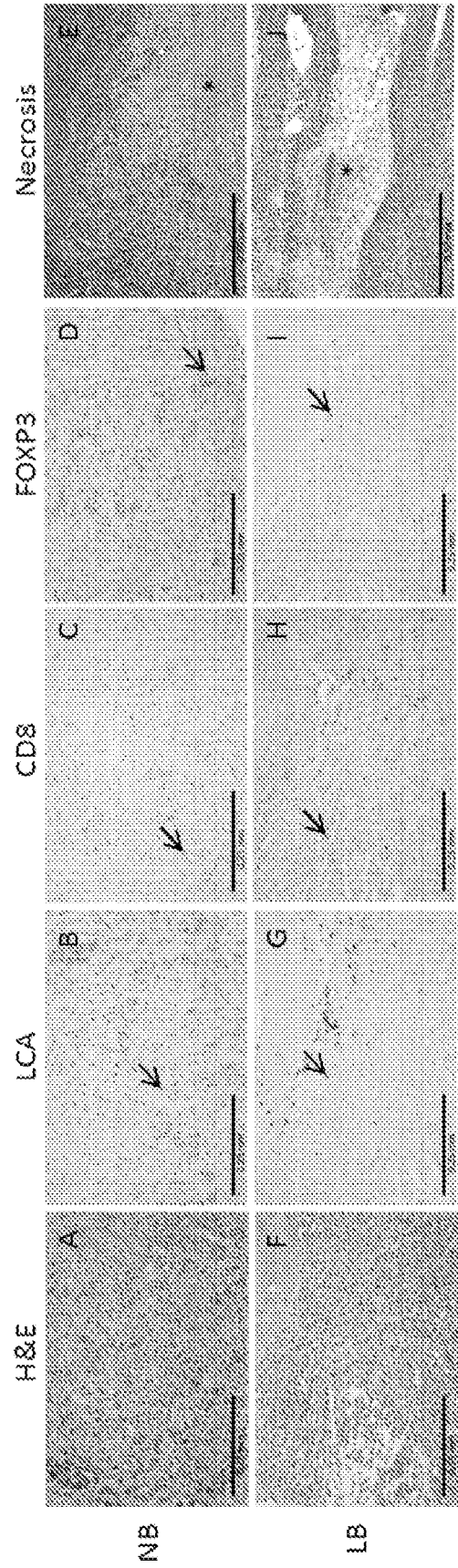


*FIG. 16A*

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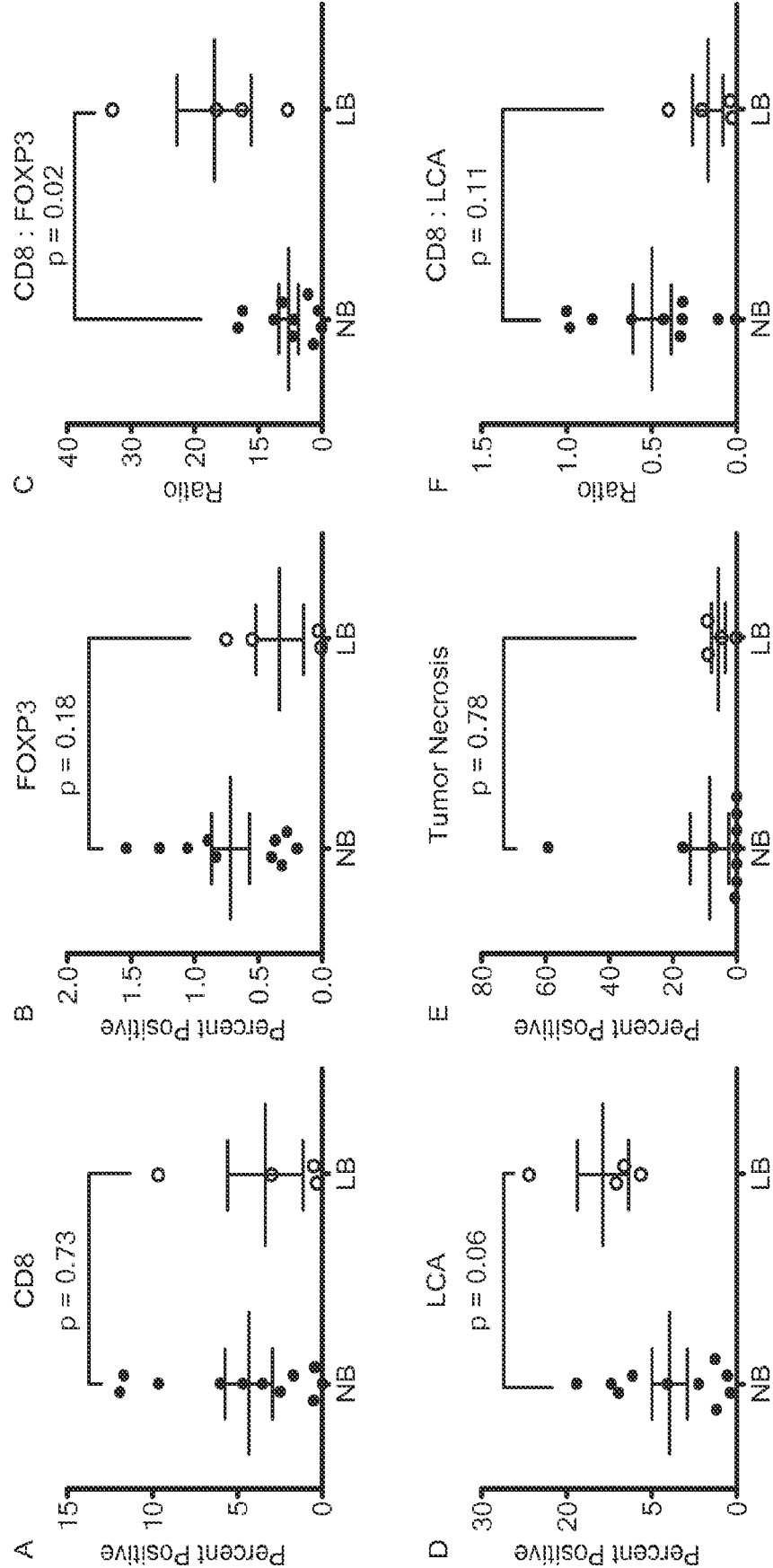


**FIG. 16B**

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| Study ID    | Age | Gender | Primary Melanoma type | M stage | Priors | Therapy (n mg/kg x no. doses)*^  | Response duration (weeks) | LDH (normal <256) | BRAF/NRAS status | OS (yr) | Biospy pre or post ipi |
|-------------|-----|--------|-----------------------|---------|--------|----------------------------------|---------------------------|-------------------|------------------|---------|------------------------|
| CR04885*    | 49  | F      | cutaneous             | Mlc     | 0      | Tremelimumab 15x4                | 85                        | not available     | WT BRAF, WT NRAS | 2.1     | pre                    |
| CR06670^^   | 79  | F      | cutaneous             | Mlc     | 0      | Tremelimumab 15x4                | 168                       | not available     | BRAF V600K       | 3.7     | post                   |
| CR22640*    | 71  | M      | cutaneous             | M1c     | 1      | 3x4                              | 216                       | not available     | WT BRAF, WT NRAS | 4.3     | pre                    |
| CR6126*     | 66  | F      | cutaneous             | M1b     | 1      | 3x4                              | 101                       | 211               | NRAS Q61K        | 1.9     | pre                    |
| CR6161^^    | 81  | M      | cutaneous             | M1b     | 0      | 3x4                              | 136                       | not available     | NRAS Q61L        | 2.6     | pre                    |
| CRNR0244*   | 49  | M      | unknown               | M1c     | 0      | 3x4                              | 109                       | 180               | BRAF V600E       | 2.1     | post                   |
| CRNR2472*   | 71  | M      | cutaneous             | M1c     | 0      | randomized 3 vs 10 x4            | 89                        | 129               | WT BRAF, NRAS    | 1.7     | post                   |
| CRNR 4941*  | 40  | F      | unknown               | M1c     | 0      | 10x20 then 3x1                   | 376                       | not available     | WT BRAF, NRAS    | 7.2     | post                   |
| LSD0167^    | 39  | M      | cutaneous             | M1c     | 0      | 3x3                              | 140                       | 156               | BRAF V600E       | 2.7     | pre                    |
| LSD2057*    | 36  | F      | cutaneous             | M1c     | 0      | 3x4                              | 64                        | 327               | BRAF V600E       | 3.3     | pre                    |
| LSD3484*    | 74  | M      | cutaneous             | M1c     | 1      | 3x4                              | 154                       | 664               | WT BRAF, NRAS    | 2.9     | pre                    |
| LSD4691*    | 62  | M      | cutaneous             | M1c     | 2      | 3x14                             | 383                       | not available     | WT BRAF, NRAS    | 7.3     | post                   |
| LSD4744*    | 52  | M      | cutaneous             | M1c     | 0      | 3x7                              | 80                        | 250               | NRAS Q61K        | 2.1     | pre                    |
| LSD6819*    | 55  | M      | acral                 | M1c     | 0      | 3x3                              | 67                        | 178               | BRAF V600E       | 3.4     | pre                    |
| LSDNR 1120* | 68  | M      | unknown               | M1a     | 0      | 10x13                            | 242                       | 178               | NRAS Q61R        | 4.6     | pre                    |
| LSDNR 1650  | 71  | F      | uveal                 | M1c     | 0      | 3x7                              | 73                        | 286               | WT BRAF, NRAS    | 2.7     | post                   |
| LSDNR 3086  | 43  | M      | cutaneous             | M1c     | 2      | randomized 0.3, 3 or 10x4; 10x10 | 135                       | not available     | BRAF V600E       | 2.6     | post                   |
| LSDNR 9298* | 82  | F      | cutaneous             | M1c     | 1      | 3x4                              | 217                       | 232               | BRAF L597R       | 4.2     | post                   |
| NR2137      | 18  | M      | cutaneous             | M1c     | 0      | 3x4                              | 8                         | 293               | BRAF V600E       | 0.8     | pre                    |
| NR4018      | 55  | M      | not available         | M1C     | YES    | 10X4                             | 11                        | not available     | BRAF V600K       | 0.3     | pre                    |
| NR4045      | 42  | M      | cutaneous             | M1c     | 0      | 3x4                              | 11                        | 237               | BRAF V600E       | 1.7     | post                   |
| NR4083      | 54  | M      | not available         | M1C     | 0      | 3X4                              | 12                        | not available     | NRAS Q61K        | 0.2     | pre                    |
| NR4631      | 59  | M      | cutaneous             | M1c     | 1      | 3x4                              | 13                        | 341               | WT BRAF, NRAS    | 0.5     | post                   |
| NR6689      | 46  | F      | cutaneous             | M1c     | 2      | 3X4                              | 11                        | 209               | WT BRAF, WT NRAS | 1.2     | post                   |
| NR6721      | 64  | M      | cutaneous             | M1a     | 2      | 10x4                             | 3                         | 144               | NRAS Q61R        | 0.8     | post                   |
| NR6842      | 64  | M      | cutaneous             | M1c     | 0      | 3x4 then 3x3                     | 12                        | 176               | WT BRAF, WT NRAS | 0.8     | pre                    |
| NR8815      | 67  | F      | cutaneous             | M1b     | 3      | 3x4                              | 9                         | 180               | BRAF S363F       | 1.2     | post                   |
| NR9445      | 50  | M      | cutaneous             | M1c     | 0      | 3x3+vem                          | 8                         | 2502              | BRAF V600E       | 0.2     | pre                    |
| NR9449      | 64  | F      | cutaneous             | M1c     | 0      | 3x4                              | 10                        | 202               | NRAS Q61R        | 0.6     | post                   |
| NR9521      | 74  | M      | cutaneous             | M1b     | 0      | 3x4                              | 12                        | 169               | NRAS Q61L        | 2.7     | post                   |
| NR9705      | 63  | F      | acral                 | M1c     | 0      | 3x4                              | 29                        | 167               | BRAF V600E       | 1.2     | post                   |
| NR9765      | 38  | F      | cutaneous             | M1b     | 1      | 3x4 then                         | 22                        | 187               | BRAF V600E       | 2.1     | pre                    |
| PR03809^^   | 90  | M      | cutaneous             | Mlc     | 2      | Tremelimumab 10x6                | 236                       | not available     | BRAF A652T       | 7.9     | post                   |
| PR12117     | 66  | M      | cutaneous             | M1c     | 0      | Tremelimumab 15x4                | 73                        | not available     | BRAF V600K       | 1.6     | pre                    |
| PR4035*     | 78  | M      | not available         | M1c     | YES    | 3X6                              | 219                       | not available     | BRAF G469E       | 4.2     | pre                    |
| PR4046*     | 44  | M      | not available         | M1a     | YES    | 10X5                             | 110                       | not available     | BRAF V600E       | 2.1     | pre                    |
| PR4077*     | 75  | M      | not available         | M1c     | YES    | 10X4                             | 315                       | not available     | BRAF, WT NR      | 6.1     | pre                    |
| PR4091*     | 65  | F      | not available         | M1a     | YES    | 3X4                              | 314                       | not available     | BRAF V600E       | 6.0     | pre                    |
| PR4092*     | 57  | F      | not available         | M1a     | YES    | 10X4                             | 315                       | not available     | BRAF V600E       | 6.1     | pre                    |

FIG. 17

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| <u>Discovery Set</u>  |           | <u>Validation Set</u> |           |
|-----------------------|-----------|-----------------------|-----------|
| Sample                | Mutations | Sample                | Mutations |
| Long-Term Benefit     |           | Long-Term Benefit     |           |
| SD2056                | 115       | PR4046                | 106       |
| CR3665                | 120       | LSD2057               | 109       |
| CR0095                | 198       | LSD0167               | 152       |
| CR6336                | 256       | CR22640               | 192       |
| CR1509                | 344       | LSD6819               | 200       |
| CR4880                | 527       | PR4091                | 259       |
| SD0346                | 540       | CR06670               | 315       |
| SD1494                | 858       | CR6126                | 442       |
| CR9699                | 1188      | PR4035                | 485       |
| CR9306                | 1304      | LSD4691               | 491       |
|                       |           | LSD3484               | 495       |
| Sample                | Mutations | CR6161                | 603       |
| Minimal or No Benefit |           | PR11217               | 980       |
| NR8727                | 1         | LSD4744               | 1037      |
| NR3156                | 2         | PR4092                | 1108      |
| NR5784                | 3         | PR4077                | 1371      |
| NR9341                | 19        | CR04885               | 1875      |
| NR1867                | 28        |                       |           |
| NR5118                | 39        | Sample                | Mutations |
| SD2051                | 39        | Minimal or No Benefit |           |
| CR7623                | 99        | NR6689                | 3         |
| SD5934                | 112       | NR6842                | 3         |
| SD5038                | 245       | CRNR4941              | 29        |
| NR4810                | 307       | PR03803               | 34        |
| NR3549                | 364       | LSDNR1650             | 42        |
| NR4949                | 484       | LSDNR3086             | 48        |
| SD6494                | 529       | NR9705                | 49        |
| SD7357                | 1028      | NR9765                | 70        |
|                       |           | NR6721                | 98        |
|                       |           | CRNR2472              | 102       |
|                       |           | NR4018                | 114       |
|                       |           | LSDNR1120             | 198       |
|                       |           | CRNR0244              | 211       |
|                       |           | NR4083                | 218       |
|                       |           | NR9445                | 250       |
|                       |           | NR9449                | 278       |
|                       |           | NR4045                | 330       |
|                       |           | LSDNR9298             | 342       |
|                       |           | NR2137                | 598       |
|                       |           | NR9521                | 1026      |
|                       |           | NR4631                | 1116      |
|                       |           | NR8815                | 1625      |

**FIG. 18**

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| 4mer | Sample  | Chr   | Position  | Gene      | Mutation  | Amino Acid | WTSeq      | MTSeq     |
|------|---------|-------|-----------|-----------|-----------|------------|------------|-----------|
| AALL |         |       |           |           |           |            |            |           |
| AALL | CR9699  | chrX  | 14708901  | GLRA2     | c.G1000A  | p.E334K    | fvfaallEy  | fvfaallKy |
| AALL | SD1494  | chr9  | 94486131  | ROR2      | c.C2645T  | p.S882F    | Smadraall  | Fmadraall |
| AALL | CR0095  | chrX  | 11197491  | ARHGAP6   | c.G1411A  | p.E471K    | aalikEflr  | aalikKflr |
| AALL | CR04885 | chr19 | 8389389   | KANK3     | c.G2326A  | p.D776N    | Devaallha  | Nevaallha |
| AALL | PR11217 | chr19 | 50209622  | CPT1C     | c.C1295T  | p.S432L    | dpaalSiday | dpaalIday |
| AATA |         |       |           |           |           |            |            |           |
| AATA | CR9699  | chr22 | 32555082  | C22orf42  | c.C121T   | p.P41S     | etvaataPa  | etvaataSa |
| AATA | SD1494  | chr20 | 61528063  | DIDO1     | c.C1874T  | p.S625F    | apaaataa5  | apaaataaf |
| AATA | CR4880  | chrX  | 24382384  | FAM48B1   | c.G1507A  | p.A503T    | aiaaaAaaa  | aiaaaTaaa |
| AATA | LSD3484 | chr20 | 44580928  | ZNF335    | c.C3047T  | p.S1016L   | saataa5kk  | saataaLkk |
| AFPS |         |       |           |           |           |            |            |           |
| AFPS | CR9699  | chr10 | 63852764  | ARID5B    | c.C3542T  | p.S1181F   | afpssqis5  | afpssqisF |
| AFPS | SD1494  | chr7  | 12409653  | VWDE      | c.C2279T  | p.P760L    | fpPlfafps  | fpLlfafps |
| AFPS | LSD4691 | chr3  | 188202427 | LPP       | c.241C>T  | p.L81F     | aLpsisgnf  | aFpsisgnf |
| AFPS | PR4092  | chr2  | 237076596 | GBX2      | c.C19T    | p.P7S      | aafpPslmm  | aafpSslmm |
| AGAA |         |       |           |           |           |            |            |           |
| AGAA | CR9699  | chr14 | 94909083  | SERPINA11 | c.C1129T  | p.L377F    | teagaasgl  | teagaasgF |
| AGAA | SD1494  | chr19 | 10946865  | TMED1     | c.G3A     | p.M1I      | Mmaagaala  | Imaagaala |
| AGAA | LSD3484 | chr7  | 27282896  | EVX1      | c.G247A   | p.E83K     | Epqvagaam  | Kpqvagaam |
| ALLK |         |       |           |           |           |            |            |           |
| ALLK | CR9699  | chrX  | 14708901  | GLRA2     | c.G1000A  | p.E334K    | fvfaallEy  | fvfaallKy |
| ALLK | CR0095  | chrX  | 11197491  | ARHGAP6   | c.G1411A  | p.E471K    | aalikEflr  | aalikKflr |
| ALLK | CR04885 | chrX  | 122801099 | THOC2     | c.G1048A  | p.E350K    | gllEallki  | gllKallki |
| ALLN |         |       |           |           |           |            |            |           |
| ALLN | CR9699  | chr12 | 29596410  | OVCH1     | c.C3041T  | p.P1014L   | wrlvaPlnh  | wrlvalinh |
| ALLN | SD0346  | chr19 | 11132542  | SMARCA4   | c.G2758A  | p.E920K    | Elwallnfl  | Klwallnfl |
| ALLN | CR0095  | chr7  | 142638364 | KEL       | c.C2174T  | p.P725L    | gallnPssr  | gallnLssr |
| ALPA |         |       |           |           |           |            |            |           |
| ALPA | SD0346  | chr1  | 228480244 | OBSCN     | c.G10624A | p.E3542K   | ralparfiE  | ralparfiK |
| ALPA | SD1494  | chr10 | 55587247  | PCDH15    | c.G4060A  | p.A1354T   | alpaakpAv  | alpaakpTv |
| ALPA | CR04885 | chr14 | 73958585  | C14orf169 | c.C863T   | p.P288L    | alpaawSl   | alpaawLi  |
| ANLA |         |       |           |           |           |            |            |           |
| ANLA | CR9699  | chr10 | 115388765 | NRAP      | c.G2056A  | p.D686N    | ykaDlawmk  | ykaNlawmk |
| ANLA | CR9306  | chr21 | 30949420  | GRIK1     | c.C1949T  | p.S650F    | Sytaniaaf  | Fytaniaaf |
| ANLA | PR4092  | chr7  | 36445925  | ANLN      | c.C623T   | p.T208I    | rlanlaaTi  | rlanlaali |
| ASHL |         |       |           |           |           |            |            |           |

*FIG. 19A*

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|      |         |       |           |          |           |          |            |            |
|------|---------|-------|-----------|----------|-----------|----------|------------|------------|
| ASHL | CR9699  | chr19 | 48244574  | EHD2     | c.T1517A  | p.F506Y  | eeFaiaShi  | eeYaiaShi  |
| ASHL | SD1494  | chr19 | 48244597  | EHD2     | c.G1540A  | p.E514K  | alashliEa  | alashliKa  |
| ASHL | CRO4885 | chr19 | 48197717  | GLT5CR1  | c.C2629T  | p.P877S  | gplppaPhl  | gplppaShl  |
| ASHL | PR4092  | chr17 | 73914062  | FBF1     | c.C2291T  | p.T764I  | rveashliT  | rveashliI  |
| ATAA |         |       |           |          |           |          |            |            |
| ATAA | SD1494  | chr20 | 61528063  | DIDO1    | c.C1874T  | p.S625F  | apaaataaS  | apaaataaF  |
| ATAA | SD6336  | chr1  | 179659981 | TDRD5    | c.G3011A  | p.R1004Q | ipRstataa  | ipQstataa  |
| ATAA | CR4880  | chrX  | 24382384  | FAM48B1  | c.G1507A  | p.A503T  | aiaaaAaaa  | aiaaaTaaa  |
| ATAA | LS03484 | chr20 | 44580928  | ZNF335   | c.C3047T  | p.S1016L | saataaSkk  | saataaLkk  |
| ATAA | CRO6670 | chr1  | 25812259  | TMEM57   | c.G1469C  | p.R490P  | eeataaRav  | eeataaPav  |
| DLFF |         |       |           |          |           |          |            |            |
| DLFF | CR1509  | chr3  | 100014010 | TBC1D23  | c.C680T   | p.P227L  | dPffiyflm  | dlffiyflm  |
| DLFF | CR9699  | chr1  | 67313257  | WDR78    | c.C1201T  | p.H401Y  | kfHgdlffm  | kfyqdlffm  |
| DLFF | CR9306  | chr6  | 159029368 | TMEM181  | c.C1088T  | p.P363L  | lyndPffpl  | lyndLffpl  |
| DLFF | LS03484 | chr7  | 138967933 | UBN2     | c.C2282T  | p.S761F  | dsldedlSf  | dsldedlFf  |
| DSLQ |         |       |           |          |           |          |            |            |
| DSLQ | CR1509  | chr2  | 219128379 | GPBAR1   | c.C932T   | p.P311L  | dsPgpsiay  | dsLgpsiay  |
| DSLQ | CR9699  | chr5  | 137537135 | CDC23    | c.C418T   | p.P140S  | etvdsLgPl  | etvdsLgSl  |
| DSLQ | CRO6670 | chr20 | 58587745  | CDH26    | c.C2459T  | p.P820L  | dsLgskatP  | dsLgskatL  |
| DSLY |         |       |           |          |           |          |            |            |
| DSLY | CR1509  | chrX  | 131188855 | MST4     | c.C239T   | p.S80L   | visqcdsSy  | visqcdsLy  |
| DSLY | SD1494  | chr12 | 50185650  | NCKAP5L  | c.C3977T  | p.S1326L | slsdslydS  | slsdslydL  |
| DSLY | CR9306  | chr3  | 62180758  | PTPRG    | c.C1241T  | p.S414L  | vSpdslylf  | vLpdslylf  |
| EILF |         |       |           |          |           |          |            |            |
| EILF | SD0346  | chr12 | 55714592  | OR6C1    | c.C209T   | p.S70L   | sileiSftt  | sileilftt  |
| EILF | SD1494  | chrX  | 140969364 | MAGEC3   | c.G691A   | p.E231K  | Efieilfgi  | Kfieilfgi  |
| EILF | CRO6670 | chr8  | 55542837  | RP1      | c.A6395T  | p.N2132I | fegeliifiw | fegeliifiw |
| EKVL |         |       |           |          |           |          |            |            |
| EKVL | CR9699  | chr11 | 106810262 | GUCY1A2  | c.G1130A  | p.R377K  | tfeRvllrl  | tfeKvllrl  |
| EKVL | CRO095  | chr11 | 61915971  | INCENP   | c.C2228T  | p.A743V  | lqerekAlr  | lqerekVlr  |
| EKVL | PR11217 | chr13 | 28624307  | FLT3     | c.G667A   | p.E223K  | keekvlihl  | keekvlihl  |
| EPLK |         |       |           |          |           |          |            |            |
| EPLK | CR9699  | chr4  | 79369245  | FRAS1    | c.G6049A  | p.E2017K | rqtaseplE  | rqtaseplK  |
| EPLK | CR4880  | chr18 | 54362273  | WDR7     | c.C1201T  | p.P401S  | iPnsneplk  | iSnsneplk  |
| EPLK | PR4092  | chr5  | 38407973  | EGFLAM   | c.C1214T  | p.S405F  | vtfeplknS  | vtfeplknF  |
| ESPF |         |       |           |          |           |          |            |            |
| ESPF | SD1494  | chr2  | 74275277  | TET3     | c.C1828T  | p.P610S  | lpaPespfa  | lpaSespfa  |
| ESPF | CR4880  | chr9  | 79321681  | PRUNE2   | c.G5509A  | p.G1837R | eGrliespF  | eRrliespF  |
| ESPF | CR9306  | chr7  | 120991214 | FAM3C    | c.A577G   | p.K193E  | tKspfeqhi  | tEspfeqhi  |
| ESSA |         |       |           |          |           |          |            |            |
| ESSA | SD1494  | chr8  | 2836196   | CSMD1    | c.G8504A  | p.G2835E | ylfGssalt  | ylfEssalt  |
| ESSA | CR9306  | chr2  | 207833051 | CPO      | c.G842A   | p.G281E  | vGssadily  | vEssadily  |
| ESSA | PR4092  | chr3  | 122414465 | PARP14   | c.T791C   | p.F264S  | yFpeassal  | ySpeassal  |
| ETLV |         |       |           |          |           |          |            |            |
| ETLV | CR1509  | chr2  | 61298844  | KIAA1841 | c.C254T   | p.A85V   | spvetlAty  | spvetlVty  |
| ETLV | CR9699  | chr4  | 123269787 | KIAA1109 | c.C13195T | p.P4399S | tPwetlvvf  | tSwetlvvf  |
| ETLV | CRO4885 | chr7  | 149191085 | ZNF746   | c.C401T   | p.S134F  | yetlvSldy  | yetlvFldy  |

FIG. 19B

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## FAGV

|      |         |       |           |         |         |         |           |           |
|------|---------|-------|-----------|---------|---------|---------|-----------|-----------|
| FAGV | SD0346  | chr3  | 33134448  | TMPPE   | c.C829G | p.L277V | lInpfagL  | lInpfagV  |
| FAGV | SD1494  | chr17 | 55068515  | SCPEP1  | c.C602T | p.S201F | fagvalgdS | fagvalgdF |
| FAGV | PR11217 | chr6  | 137243796 | SLC35D3 | c.C230T | p.S77F  | slarSfagv | slarFfagv |

## FHFY

|      |         |       |           |      |          |         |           |           |
|------|---------|-------|-----------|------|----------|---------|-----------|-----------|
| FHFY | CR3665  | chr17 | 80047175  | FASN | c.C2051T | p.S684F | gmafhSyfm | gmafhFyfm |
| FHFY | CR9699  | chr1  | 210522381 | HHAT | c.C62T   | p.S21F  | slgfhfySf | slgfhfyFf |
| FHFY | CR9306  | chr1  | 210522381 | HHAT | c.C62T   | p.S21F  | slgfhfySf | slgfhfyFf |
| FHFY | CR06670 | chr15 | 83456063  | FSD2 | c.A80T   | p.Y27F  | fhfyhmdlY | fhfyhmdlF |

## FLGL

|      |        |       |           |         |          |         |           |            |
|------|--------|-------|-----------|---------|----------|---------|-----------|------------|
| FLGL | CR9699 | chr17 | 7605749   | WRAP53  | c.C1043T | p.S348F | grSlglyaw | grFglglyaw |
| FLGL | SD0346 | chr7  | 141423024 | WEE2    | c.C971T  | p.S324F | illqiSlgl | illqiFgl   |
| FLGL | SD1494 | chr17 | 45367057  | ITGB3   | c.C950T  | p.S317F | SlgImtekl | FglImtekl  |
| FLGL | CR4880 | chr13 | 84455321  | SLITRK1 | c.G322A  | p.V108M | afglqlVlk | afglqlMk   |

## FLNL

|      |        |       |           |           |         |         |          |          |
|------|--------|-------|-----------|-----------|---------|---------|----------|----------|
| FLNL | CR1509 | chr11 | 120702563 | GRIK4     | c.C514T | p.L172F | Linleklr | Finleklr |
| FLNL | CR9699 | chr10 | 96707646  | CYP2C9    | c.A592T | p.M198L | qfnlMekl | qfnlLekl |
| FLNL | PR4092 | chr10 | 15138408  | C10orf111 | c.C416T | p.P139L | ylPpfnll | ylLpfnll |

## FYFF

|      |         |       |           |         |         |         |           |           |
|------|---------|-------|-----------|---------|---------|---------|-----------|-----------|
| FYFF | CR9699  | chr1  | 210522381 | HHAT    | c.C62T  | p.S21F  | slgfhfySf | slgfhfyFf |
| FYFF | CR9306  | chr1  | 210522381 | HHAT    | c.C62T  | p.S21F  | slgfhfySf | slgfhfyFf |
| FYFF | CR04885 | chrX  | 106065412 | TBC1D8B | c.C566T | p.S189F | flsfySfl  | flsfyFfl  |
| FYFF | PR11217 | chr14 | 20665925  | OR11G2  | c.C431T | p.S144F | lqfyffSl  | lqfyffFl  |

## GQPA

|      |        |       |           |        |          |          |           |           |
|------|--------|-------|-----------|--------|----------|----------|-----------|-----------|
| GQPA | SD0346 | chr18 | 34850797  | CELF4  | c.C1003T | p.P335S  | Ppqangqpa | Spqangqpa |
| GQPA | SD0346 | chr4  | 87691045  | PTPN13 | c.C4040T | p.P1347L | klfpGqpaa | klfLgqpaa |
| GQPA | SD1494 | chr9  | 134074163 | NUP214 | c.C5282T | p.S1761F | vpafgqpaS | vpafgqpaF |

## GSTL

|      |        |       |           |         |           |          |           |           |
|------|--------|-------|-----------|---------|-----------|----------|-----------|-----------|
| GSTL | SD2056 | chr8  | 110504194 | PKHD1L1 | c.A10207G | p.S3403G | nrkdlSstl | nrkdlGstl |
| GSTL | CR9306 | chr17 | 48166555  | ITGA3   | c.C3127A  | p.P1043T | ryPppgstl | ryTppgstl |
| GSTL | CR9306 | chr7  | 141635657 | CLEC5A  | c.G302A   | p.G101E  | kGkgstlai | kEkgstlai |

## HFYF

|      |        |       |           |      |          |         |           |           |
|------|--------|-------|-----------|------|----------|---------|-----------|-----------|
| HFYF | CR3665 | chr17 | 80047175  | FASN | c.C2051T | p.S684F | gmafhSyfm | gmafhFyfm |
| HFYF | CR9699 | chr1  | 210522381 | HHAT | c.C62T   | p.S21F  | slgfhfySf | slgfhfyFf |
| HFYF | CR9306 | chr1  | 210522381 | HHAT | c.C62T   | p.S21F  | slgfhfySf | slgfhfyFf |

## IFFA

|      |        |       |          |         |          |          |           |           |
|------|--------|-------|----------|---------|----------|----------|-----------|-----------|
| IFFA | CR1509 | chr3  | 38739301 | SCN10A  | c.C5410T | p.L1804F | hcdilLaf  | hcdilFaf  |
| IFFA | CR9699 | chr19 | 14744049 | EMR3    | c.C1550T | p.S517F  | ifSanlvlf | ifFanlvlf |
| IFFA | SD1494 | chr14 | 77605618 | ZDHHC22 | c.C464T  | p.S155F  | iSfahplaf | ifFahplaf |
| IFFA | CR4880 | chr11 | 58190112 | OR5B2   | c.T623C  | p.V208A  | iffVilvif | ifFAlvif  |

## KFLK

|      |         |       |          |       |          |          |           |           |
|------|---------|-------|----------|-------|----------|----------|-----------|-----------|
| KFLK | SD2056  | chr2  | 21230262 | APOB  | c.G9478A | p.E3160K | ktgikEflk | ktgikKflk |
| KFLK | SD0346  | chr5  | 78324306 | DMGDH | c.C1982T | p.S661F  | flqtKSlkv | flqtKFlkv |
| KFLK | CR22640 | chr13 | 25376549 | RNF17 | c.G1789A | p.E597K  | Eflkmvnnk | Kflkmvnnk |

## KLLS

|      |        |       |          |          |          |         |           |           |
|------|--------|-------|----------|----------|----------|---------|-----------|-----------|
| KLLS | CR3665 | chr19 | 30935897 | ZNF536   | c.G1428A | p.M476I | kllspissM | kllspissI |
| KLLS | SD6336 | chr11 | 65713252 | TSGA10IP | c.G106A  | p.G36R  | Gllkllstv | Rllkllstv |

**FIG. 19C**

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|      |         |       |           |          |           |          |           |           |
|------|---------|-------|-----------|----------|-----------|----------|-----------|-----------|
| KLLS | CR04885 | chr11 | 59620709  | TCN1     | c.G1207A  | p.E403K  | Ellsggepl | Kllsggepl |
| KLLS | PR4077  | chr1  | 196459020 | KCNT2    | c.T223G   | p.L75V   | slklscLi  | slklscVi  |
| KVLK |         |       |           |          |           |          |           |           |
| KVLK | CR1509  | chr17 | 685413    | GLOD4    | c.G83A    | p.G28E   | dvlGmkvlr | dvlEmkvlr |
| KVLK | SD0346  | chr6  | 158923106 | TULP4    | c.C2411T  | p.A804V  | kAlrptpqI | kVlrptpqI |
| KVLK | CR0095  | chr11 | 61915971  | INCENP   | c.C2228T  | p.A743V  | lqerekAlr | lqerekVlr |
| KYFQ |         |       |           |          |           |          |           |           |
| KYFQ | CR1509  | chrX  | 19984255  | CKorf23  | c.C554T   | p.S185F  | eeKySqstr | eeKyFqstr |
| KYFQ | CR3665  | chr3  | 151156186 | IGSF10   | c.G6163T  | p.D2055Y | vlhgkDfqv | vlhgkYfqv |
| KYFQ | LSD4691 | 17    | 61615575  | KCNH6    | c.T282G>A | p.E428K  | leYfqhaw  | leKyfqhaw |
| LATV |         |       |           |          |           |          |           |           |
| LATV | SD1494  | chr2  | 202074201 | CASP10   | c.C1331T  | p.P444L  | llglatvP  | llglatvL  |
| LATV | SD6336  | chr12 | 20874827  | SLCO1C1  | c.G865A   | p.A289T  | giollaAv  | giollaTv  |
| LATV | CR04885 | chr2  | 183848046 | NCKAP1   | c.C1087T  | p.L363F  | alkeLatvL | alkeLatvF |
| LDKK |         |       |           |          |           |          |           |           |
| LDKK | CR4880  | chr14 | 23857401  | MYH6     | c.C4322T  | p.A1441V | aaAaIdkk  | aaVaIdkk  |
| LDKK | CR0095  | chr10 | 133948560 | JAKMIP3  | c.G865A   | p.E289K  | qqIdEkdar | qqIdKkdar |
| LDKK | LSD4744 | chr12 | 66638947  | IRAK3    | c.G1036A  | p.V346M  | fldkkVppc | fldkkMppc |
| LDKK | CR6161  | chrX  | 105449561 | MUM1L1   | c.G136A   | p.E46K   | lsIdEkkl  | lsIdKklkl |
| LDKK | CR04885 | chrX  | 140984916 | MAGEC3   | c.G1372A  | p.E458K  | aldEkvael | aldKkvael |
| LDPL |         |       |           |          |           |          |           |           |
| LDPL | CR9699  | chr15 | 56981277  | ZNF280D  | c.C742T   | p.H248Y  | iHfnldpl  | iYfnldpl  |
| LDPL | SD0346  | chrX  | 122551389 | GRIA3    | c.C1637T  | p.S546L  | gvfSfldpl | gvfLfldpl |
| LDPL | PR11217 | chr9  | 131038615 | SWI5     | c.C191T   | p.P64L   | Palldplpl | Laldplpl  |
| LDTL |         |       |           |          |           |          |           |           |
| LDTL | SD2056  | chr2  | 1204859   | SNTG2    | c.C662T   | p.S221F  | krwldtlSv | krwldtlFv |
| LDTL | SD1494  | chr1  | 201190860 | IGFN1    | c.C10187T | p.A3396V | saldtlvqA | saldtlvqV |
| LDTL | CR04885 | chr15 | 45895336  | PLDN     | c.A263T   | p.E88V   | vlldtleqE | vlldtleqV |
| LDTL | PR11217 | chr2  | 228883477 | SPHKAP   | c.C2093T  | p.S698L  | hSseildtl | hLseildtl |
| LEEK |         |       |           |          |           |          |           |           |
| LEEK | CR9699  | chr10 | 61843365  | ANK3     | c.G1487A  | p.G496E  | evleGkpiy | evleEkpiy |
| LEEK | SD0346  | chr1  | 17690111  | PADI4    | c.C1853T  | p.S618F  | cleekvcSl | cleekvcFl |
| LEEK | LSD0167 | chr8  | 116599568 | TRPS1    | c.A2360G  | p.D787G  | kleekDgik | kleekGgik |
| LEES |         |       |           |          |           |          |           |           |
| LEES | CR1509  | chr18 | 61325797  | SERPINB3 | c.C419T   | p.P140L  | fanaPeesr | fanaLeesr |
| LEES | SD2056  | chr11 | 66472841  | SPTBN2   | c.C1906T  | p.R636W  | rraRleesr | rraWleesr |
| LEES | CR06670 | chr16 | 24826503  | TNRC6A   | c.C4708T  | p.P1570S | frleesPfv | frleesSfv |
| LEES | PR4035  | chr10 | 26822444  | APBB1IP  | c.C890T   | p.S297F  | Slleesfcg | Fleesfcg  |
| LEKL |         |       |           |          |           |          |           |           |
| LEKL | CR1509  | chr11 | 120702563 | GRIK4    | c.C514T   | p.L172F  | Linleklr  | Flnleklr  |
| LEKL | CR9699  | chr10 | 96707646  | CYP2C9   | c.A592T   | p.M198L  | qfinlMekl | qfinlLekl |
| LEKL | PR4091  | chr1  | 53544404  | PODN     | c.G1309A  | p.E437K  | fleElnsy  | fleKlnsy  |
| LEKL | PR4092  | chr1  | 86905990  | CLCA2    | c.G1363A  | p.E455K  | saapnleEl | saapnlekl |
| LFFV |         |       |           |          |           |          |           |           |
| LFFV | CR9699  | chr4  | 39436053  | KLB      | c.C1049T  | p.S350F  | mrkkHSvl  | mrkkIFvl  |
| LFFV | CR0095  | chr19 | 52714697  | PPP2R1A  | c.C455T   | p.S152F  | glfSvcpv  | glfFvcpv  |
| LFFV | CR6126  | chr11 | 56949669  | LRRCS5   | c.C302T   | p.S101F  | cssqrIfsv | cssqrIfv  |

**FIG. 19D**

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## LFNI

|      |         |       |           |          |          |         |           |           |
|------|---------|-------|-----------|----------|----------|---------|-----------|-----------|
| LFNI | SD0346  | chr5  | 115323616 | AQPEP    | c.G1085A | p.S362N | dlniNysl  | dlniNysl  |
| LFNI | SD6336  | chr17 | 40639291  | ATP6V0A1 | c.G929T  | p.C310F | tlniCnidv | tlniFnidv |
| LFNI | PR11217 | chr8  | 39645760  | ADAM2    | c.C653T  | p.S218L | vSfntiil  | vLntiil   |

## LGST

|      |         |       |           |         |           |          |           |           |
|------|---------|-------|-----------|---------|-----------|----------|-----------|-----------|
| LGST | CR9699  | chr11 | 89896757  | NAAIAD2 | c.G1250A  | p.G417E  | fGlgstew  | fElgstew  |
| LGST | SD2056  | chr8  | 110504194 | PKHD1L1 | c.A10207G | p.S3403G | nrkdiSstl | nrkdiGstl |
| LGST | LSD2057 | chr7  | 142749763 | OR6V1   | c.C326T   | p.S109F  | slgstSfli | slgstFfli |
| LGST | PR4092  | chr11 | 123909399 | OR10G7  | c.C310T   | p.H104Y  | Hflgstecf | Yflgstecf |

## LLPK

|      |         |       |           |       |          |          |           |           |
|------|---------|-------|-----------|-------|----------|----------|-----------|-----------|
| LLPK | CR9699  | chr9  | 27197325  | TEK   | c.C1637T | p.P546L  | Prglnilpk | Lrglnilpk |
| LLPK | SD2056  | chr1  | 220298644 | IAR52 | c.C1706T | p.P569L  | lPpeqlipk | lLpeqlipk |
| LLPK | LSD4744 | chr12 | 124821593 | NCOR2 | c.C5821T | p.R1941W | llpkeapRv | llpkeapWv |
| LLPK | PR11217 | chr3  | 33106995  | GLB1  | c.C422T  | p.P141L  | vllpkmkPl | vllpkmkLl |

## LLRI

|      |        |       |          |         |         |         |           |           |
|------|--------|-------|----------|---------|---------|---------|-----------|-----------|
| LLRI | SD0346 | chr11 | 63137755 | SLC22A9 | c.C227T | p.S76F  | allriSipl | allriFipl |
| LLRI | CR9306 | chr19 | 8321888  | CERS4   | c.C668T | p.S223F | Sysanilri | Fysanilri |
| LLRI | CR6161 | chr20 | 25398764 | GIN51   | c.G263A | p.R88K  | llriRairw | llriKalrw |

## LLSE

|      |        |       |          |          |          |          |           |           |
|------|--------|-------|----------|----------|----------|----------|-----------|-----------|
| LLSE | CR4880 | chr16 | 84522897 | KIAA1609 | c.C516G  | p.D172E  | aaqlsDrnk | aaqlsEmk  |
| LLSE | CR4880 | chr4  | 55956220 | KDR      | c.G3095A | p.R1032Q | aRnillsek | aQnillsek |
| LLSE | CR0095 | chr20 | 2636301  | NOP56    | c.C818T  | p.P273L  | rvvSlseyr | rvvLlseyr |

## LLSP

|      |         |       |          |        |          |          |           |           |
|------|---------|-------|----------|--------|----------|----------|-----------|-----------|
| LLSP | CR3665  | chr19 | 30935897 | ZNF536 | c.G1428A | p.M476I  | klispissM | klispissl |
| LLSP | CR9306  | chr17 | 62049773 | SCN4A  | c.C331T  | p.L111F  | Lyllspfsv | Fyllspfsv |
| LLSP | PR11217 | chr14 | 95572107 | DICER1 | c.A3001T | p.T1001S | rlnlITprh | rlnlISprh |

## LMPR

|      |        |       |          |        |           |          |           |           |
|------|--------|-------|----------|--------|-----------|----------|-----------|-----------|
| LMPR | CR1509 | chr22 | 46761515 | CELSR1 | c.C8372T  | p.S2791F | epdaSlmpr | epdaFimpr |
| LMPR | SD1494 | chr8  | 2824146  | CSMD1  | c.A9046C  | p.T3016P | glmTrhcta | glmPrhcta |
| LMPR | CR4880 | chr19 | 9068409  | MUC16  | c.C19037T | p.S6346L | tSmprssam | tlmprssam |

## LRFL

|      |        |       |           |          |         |         |            |           |
|------|--------|-------|-----------|----------|---------|---------|------------|-----------|
| LRFL | CR9699 | chr11 | 111796877 | C11orf52 | c.C326T | p.P109L | lrflPqatpr | lrflQatpr |
| LRFL | CR4880 | chr4  | 46995365  | GABRA4   | c.C76A  | p.L26M  | fallrficL  | fallrficM |
| LRFL | PR4091 | chr9  | 27949714  | LINGO2   | c.G956A | p.G319E | hsfqGlrfl  | hsfqEtrfl |

## LRPT

|      |        |      |           |       |          |         |           |           |
|------|--------|------|-----------|-------|----------|---------|-----------|-----------|
| LRPT | SD0346 | chr6 | 158923106 | TULP4 | c.C2411T | p.A804V | kAlrptpqj | kVlrptpqj |
| LRPT | SD1494 | chr1 | 152733398 | KPRP  | c.G1334A | p.R445Q | alrptpRpv | alrptpQpv |
| LRPT | PR4077 | chr2 | 70917932  | ADD2  | c.G835A  | p.G279R | lGptckily | lRptckily |

## LSFA

|      |         |       |           |        |          |         |           |           |
|------|---------|-------|-----------|--------|----------|---------|-----------|-----------|
| LSFA | CR9699  | chr5  | 178392595 | ZNF454 | c.C1190T | p.S397L | frdnSsfar | frdnLsfar |
| LSFA | SD0346  | chr10 | 21962359  | MLLT10 | c.A1132G | p.T378A | flsfTdsdl | flsfAdsdL |
| LSFA | LSD4744 | chr5  | 178392595 | ZNF454 | c.C1190T | p.S397L | Ssfarhrki | Lsfarhrki |

## LSVL

|      |         |       |           |         |          |         |           |           |
|------|---------|-------|-----------|---------|----------|---------|-----------|-----------|
| LSVL | SD0346  | chr11 | 123676589 | OR6M1   | c.C469T  | p.P157S | flsvlfPti | flsvlfSti |
| LSVL | SD1494  | chr19 | 8320744   | CERS4   | c.G449A  | p.G150D | fvgGlsvly | fvgDlsvly |
| LSVL | PR11217 | chrX  | 151900131 | MAGEA12 | c.G670A  | p.E224K | kiweElsvl | kiweKlsvl |
| LSVL | PR4092  | chr2  | 135199369 | MGAT5   | c.C1910T | p.A637V | vmwppisAl | vmwppisVi |

**FIG. 19E**

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## LTAT

|      |         |       |           |        |          |         |           |           |
|------|---------|-------|-----------|--------|----------|---------|-----------|-----------|
| LTAT | CR1509  | chr16 | 396856    | AXIN1  | c.C170T  | p.S57L  | etStatpr  | etltatpr  |
| LTAT | CR4880  | chr2  | 228883099 | SPHKAP | c.C2471T | p.S824L | sStatssk  | sltattssk |
| LTAT | CR04885 | chr10 | 20432254  | PLXDC2 | c.G572A  | p.R191Q | Rmtatqyi  | Qmtatqyi  |
| LTAT | PR4035  | chr15 | 91312735  | BLM    | c.C2474T | p.P825L | Pvmtatata | Lvmtatata |

## LVAF

|      |         |       |           |         |          |          |           |           |
|------|---------|-------|-----------|---------|----------|----------|-----------|-----------|
| LVAF | CR1509  | chr9  | 140943746 | CACNA1B | c.C3689T | p.A1230V | vvsgAlvaf | vvsgVlvaf |
| LVAF | CR9306  | chr20 | 8609038   | PLCB1   | c.C344T  | p.S115F  | iShlnlvaf | iFhlnlvaf |
| LVAF | LSD3484 | chr8  | 139164989 | FAM135B | c.G1729A | p.E577K  | lvafnaqhE | lvafnaqhK |

## LVCF

|      |        |      |           |         |          |         |           |           |
|------|--------|------|-----------|---------|----------|---------|-----------|-----------|
| LVCF | CR9699 | chr1 | 235316029 | RBM34   | c.C649T  | p.R217C | vrfRslvcf | vrfCslvcf |
| LVCF | SD2056 | chr3 | 193182748 | ATP13A4 | c.A1442G | p.N481S | qlNlvcfdk | qlSlvcfdk |
| LVCF | SD1494 | chr4 | 110447532 | SEC24B  | c.C2942T | p.A981V | slvcfqtAl | slvcfqtVi |

## LVVV

|      |         |       |           |        |          |          |           |           |
|------|---------|-------|-----------|--------|----------|----------|-----------|-----------|
| LVVV | SD2056  | chr1  | 248004462 | OR11L1 | c.C737T  | p.A246V  | hlAvvtlyy | hlVvvtlyy |
| LVVV | SD1494  | chr21 | 33689013  | URB1   | c.C6398T | p.P2133L | hilphPvvv | hilphlvvv |
| LVVV | PR11217 | chr19 | 49926533  | PTH2   | c.C64G   | p.L22V   | lllvvpwgv | llVvvpwgv |

## MGLA

|      |         |       |          |       |          |         |           |            |
|------|---------|-------|----------|-------|----------|---------|-----------|------------|
| MGLA | SD0346  | chr2  | 15768938 | DDX1  | c.C1850T | p.S617F | rmglaiSlv | rmglaiFlv  |
| MGLA | SD6336  | chr14 | 73418535 | DCAF4 | c.C575T  | p.P192L | clmglaetP | clmglaetL  |
| MGLA | LSD3484 | chr11 | 65779543 | CST6  | c.C28A   | p.L10M  | lplalglal | lplalMglal |

## NILL

|      |         |       |           |        |          |          |           |           |
|------|---------|-------|-----------|--------|----------|----------|-----------|-----------|
| NILL | CR4880  | chr4  | 55956220  | KDR    | c.G3095A | p.R1032Q | aRnillsek | aQnillsek |
| NILL | CR9306  | chr2  | 69759293  | AAK1   | c.T536C  | p.V179A  | Venillhdr | Aenillhdr |
| NILL | CR9306  | chr2  | 148657367 | ACVR2A | c.C428T  | p.S143F  | yynillySl | yynillyFl |
| NILL | PR11217 | chr20 | 6065834   | FERMT1 | c.C1472T | p.S491L  | vlnilSlr  | vlnilflr  |

## NKSF

|      |         |       |           |            |          |          |           |           |
|------|---------|-------|-----------|------------|----------|----------|-----------|-----------|
| NKSF | CR9699  | chr2  | 168106685 | XIRP2      | c.C8117T | p.S2706F | itqnksffS | itqnksffF |
| NKSF | SD1494  | chr21 | 47697629  | MCM3AP     | c.C1670T | p.S557F  | slnksSpv  | slnksFpv  |
| NKSF | CR06670 | chr2  | 160676423 | LY75-CD302 | c.C3967T | p.L1323F | ityrnksLm | ityrnksFm |

## NVT5

|      |        |       |           |        |         |         |           |           |
|------|--------|-------|-----------|--------|---------|---------|-----------|-----------|
| NVT5 | SD0346 | chr17 | 4836677   | GP1BA  | c.G778A | p.A260T | amtsnvAsv | amtsnvFsv |
| NVT5 | SD1494 | chr7  | 141478878 | TAS2R4 | c.C590T | p.S197F | fiinvtsaS | fiinvtsaF |
| NVT5 | CR4880 | chr1  | 227921252 | JMJD4  | c.G823A | p.D275N | lpyDvtspa | lpyNvtspa |

## PGST

|      |        |       |           |         |          |          |           |           |
|------|--------|-------|-----------|---------|----------|----------|-----------|-----------|
| PGST | CR4880 | chr20 | 61528271  | DIDO1   | c.G1666A | p.A556T  | ktappgsAv | ktappgsTv |
| PGST | CR9306 | chr17 | 48166555  | ITGA3   | c.C3127A | p.P1043T | ryPpggstl | ryTpggstl |
| PGST | PR4092 | chr5  | 101794186 | SLCO6A1 | c.G1031A | p.R344Q  | nnmpgstRi | nnmpgstQi |

## PLAG

|      |        |       |          |         |          |          |            |            |
|------|--------|-------|----------|---------|----------|----------|------------|------------|
| PLAG | SD1494 | chr11 | 66189614 | NPAS4   | c.G199A  | p.G67R   | tplagptGl  | tplagptRl  |
| PLAG | CR4880 | chr20 | 464670   | CSNK2A1 | c.C703T  | p.P235S  | gplagsPvi  | gplagsSvi  |
| PLAG | PR4035 | chr1  | 8419972  | RERE    | c.C3470T | p.S1157F | fmpilagSkI | fmpilagFkl |

## PLLK

|      |        |       |          |          |          |         |           |           |
|------|--------|-------|----------|----------|----------|---------|-----------|-----------|
| PLLK | CR1509 | chr11 | 8953807  | C11orf16 | c.G49A   | p.V17M  | mpllkycsV | mpllkycsM |
| PLLK | CR4880 | chr1  | 6279370  | RNF207   | c.G1808C | p.G603A | Glseepllk | Alseepllk |
| PLLK | CR4880 | chr20 | 58559795 | CDH26    | c.G643A  | p.E215K | isqtpllkE | isqtpllkK |

## PPGP

**FIG. 19F**

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|      |         |       |           |          |           |          |           |           |
|------|---------|-------|-----------|----------|-----------|----------|-----------|-----------|
| PPGP | SD0346  | chr1  | 103461577 | COL11A1  | c.C2299G  | p.P767A  | gpppgqgPi | gpppgqgAi |
| PPGP | CR0095  | chr19 | 41133045  | LTBP4    | c.C4150T  | p.P1384S | Pyppppgpi | Syppppgpi |
| PPGP | PR4092  | chr11 | 67267634  | PITPNM1  | c.C899T   | p.S300F  | eappgpdaS | eappgpdaF |
| PPSY |         |       |           |          |           |          |           |           |
| PPSY | SD1494  | chr11 | 60482834  | MS4A8B   | c.G700A   | p.E234K  | Epvtspssy | Kpvtspssy |
| PPSY | SD6336  | chr19 | 40151075  | LGALS16  | c.G344A   | p.R115Q  | fvhRiapsy | fvhQiapsy |
| PPSY | CR04885 | chr12 | 57181053  | HSD17B6  | c.T881C   | p.L294P  | ffipLsyl  | ffipPsyl  |
| PSLL |         |       |           |          |           |          |           |           |
| PSLL | SD1494  | chr2  | 239033956 | ESPNL    | c.C1033T  | p.P345S  | fpppPliat | fpppSliat |
| PSLL | CR9306  | chr12 | 48919977  | OR8S1    | c.C563T   | p.S188F  | empslilpS | empslilpF |
| PSLL | PR4092  | chr3  | 126291205 | TXNRD3NB | c.C182T   | p.P61L   | fgqgfpSPl | fgqgfpSli |
| PVFF |         |       |           |          |           |          |           |           |
| PVFF | SD1494  | chr13 | 38266339  | TRPC4    | c.C1031T  | p.S344F  | glfpvfSv  | glfpvfFv  |
| PVFF | CR9306  | chr2  | 30966427  | CAPN13   | c.C1267T  | p.P423S  | fPgvffssf | fSgvffssf |
| PVFF | LSD3484 | chr8  | 69058575  | PREX2    | c.C4219T  | p.L1407F | hgvLfaqaL | hgvFfaqaL |
| PVTS |         |       |           |          |           |          |           |           |
| PVTS | CR1509  | chr3  | 195510707 | MUC4     | c.T7744C  | p.S2582P | lpvtsTssa | lpvtsPssa |
| PVTS | SD0346  | chr6  | 39311572  | KIF6     | c.T2341A  | p.S781T  | ipkrpVSi  | ipkrpVSi  |
| PVTS | SD1494  | chr11 | 60482834  | MS4A8B   | c.G700A   | p.E234K  | Epvtspssy | Kpvtspssy |
| RILK |         |       |           |          |           |          |           |           |
| RILK | CR9699  | chr19 | 8131060   | FBN3     | c.G8173A  | p.E2725K | graeriEl  | graeriKl  |
| RILK | SD1494  | chr20 | 47991189  | KCNB1    | c.G908A   | p.R303Q  | mRilrikl  | mQilrikl  |
| RILK | PR11217 | chr2  | 40656427  | SLC8A1   | c.G994A   | p.E332K  | rilkElkqk | rilkKlkqk |
| RLIE |         |       |           |          |           |          |           |           |
| RLIE | SD1494  | chr2  | 179584548 | TTN      | c.A19939C | p.I6647L | rliEkepm  | rliEkepm  |
| RLIE | CR4880  | chr9  | 79321681  | PRUNE2   | c.G5509A  | p.G1837R | eRliespf  | eRliespf  |
| RLIE | LSD4744 | chr1  | 207639988 | CR2      | c.G176A   | p.G59E   | riEeksl   | riEeksl   |
| RPPS |         |       |           |          |           |          |           |           |
| RPPS | SD0346  | chrX  | 19568102  | SH3KBP1  | c.C1373T  | p.S458F  | grppsqSi  | grppsqFi  |
| RPPS | CR9306  | chr10 | 123969975 | TACC2    | c.C269T   | p.P90L   | Pfrppshsf | Lfrppshsf |
| RPPS | PR4077  | chr11 | 56258054  | OR5M8    | c.G793A   | p.E265K  | lrppskEsv | lrppskKsv |
| RRRP |         |       |           |          |           |          |           |           |
| RRRP | CR9699  | chr11 | 92623974  | FAT3     | c.C13369T | p.H4457Y | rrrpqfHps | rrrpqfYps |
| RRRP | SD0346  | chr2  | 202899974 | F2D7     | c.G604A   | p.G202R  | grGrpalpf | grRrpalpf |
| RRRP | LSD4744 | chr1  | 152484264 | LCE5A    | c.C254T   | p.S85F   | slrrpqsS  | slrrpqsF  |
| RRRP | CR04885 | chr16 | 28936429  | RABEP2   | c.G56A    | p.G19E   | rrrpGaal  | rrrpEaal  |
| RSQR |         |       |           |          |           |          |           |           |
| RSQR | CR9699  | chr16 | 3078222   | CCDC64B  | c.A1412G  | p.E471G  | lrsqrqkEl | lrsqrqkGl |
| RSQR | CR4880  | chr15 | 71535130  | THSD4    | c.G607A   | p.G203R  | srhsrsqGa | srhsrsqRa |
| RSQR | LSD0167 | chr6  | 94066492  | EPHA7    | c.G1267A  | p.D423N  | sDisrsqrI | sNlsrsqrI |
| RTFS |         |       |           |          |           |          |           |           |
| RTFS | CR9699  | chr11 | 118243875 | UBE4A    | c.C796T   | p.P266S  | eevrtfPev | eevrtfSev |
| RTFS | SD1494  | chr21 | 45924705  | TSPEAR   | c.C1814T  | p.S605F  | Sfdgrtfsv | Ffdgrtfsv |
| RTFS | PR4092  | chr20 | 35675503  | RBL1     | c.C1558T  | p.P520S  | rtfPwiiev | rtfSwiiev |
| RYLL |         |       |           |          |           |          |           |           |
| RYLL | CR9699  | chr14 | 31952774  | GPR33    | c.C398T   | p.P133L  | rylltlhPv | rylltlhLv |
| RYLL | CR9306  | chr1  | 9100180   | SLC2A5   | c.C640T   | p.P214S  | PespryIli | SespryIli |

**FIG. 19G**

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|      |         |       |           |          |          |          |             |            |
|------|---------|-------|-----------|----------|----------|----------|-------------|------------|
| RYLL | CR9306  | chr17 | 73658885  | RECQL5   | c.C445T  | p.H149Y  | rHllsylvv   | rYllsylvv  |
| RYLL | PR4092  | chr4  | 8229546   | SH3TC1   | c.T2125C | p.C709R  | wlsdCylll   | wlsdRylll  |
| SESP |         |       |           |          |          |          |             |            |
| SESP | SD1494  | chr2  | 74275277  | TET3     | c.C1828T | p.P610S  | lpaPespfa   | lpaSespfa  |
| SESP | CR9306  | chr1  | 9100180   | SLC2A5   | c.C640T  | p.P214S  | Pesprylll   | šesprylll  |
| SESP | CR06670 | chr3  | 184039531 | EIF4G1   | c.C898T  | p.P300S  | cPsespvpi   | cšsespvpi  |
| SIFL |         |       |           |          |          |          |             |            |
| SIFL | SD0346  | chr1  | 158326293 | CD1E     | c.T745A  | p.Y249N  | mrggYsifl   | mrggNsisfl |
| SIFL | CR4880  | chr15 | 79586810  | ANKRD34C | c.C1184T | p.S395F  | nsišlesgk   | nsifšlesgk |
| SIFL | CR06570 | chr1  | 53542960  | PODN     | c.A767T  | p.N256I  | lssNflrhv   | lssifšrhv  |
| SIFL | PR4091  | chr16 | 75563904  | CHST5    | c.G379A  | p.D127N  | siflcdmDv   | siflšcdmNv |
| SLGF |         |       |           |          |          |          |             |            |
| SLGF | CR9699  | chr1  | 210522381 | HHAT     | c.C62T   | p.S21F   | slgfhfySf   | slgfhfyFf  |
| SLGF | CR9306  | chr1  | 210522381 | HHAT     | c.C62T   | p.S21F   | slgfhfySf   | slgfhfyFf  |
| SLGF | CR6126  | chr13 | 103703659 | SLC10A2  | c.G709A  | p.G237S  | aGyslgfll   | aSyslgfll  |
| SLRF |         |       |           |          |          |          |             |            |
| SLRF | CR1509  | chr4  | 153691936 | TIGD4    | c.C221T  | p.P74L   | eslrfdPkr   | eslrfdLkr  |
| SLRF | CR1509  | chr4  | 153691937 | TIGD4    | c.C220T  | p.P74S   | eslrfdPkr   | eslrfdŠkr  |
| SLRF | SD1494  | chr12 | 10962383  | TAS2R9   | c.T292C  | p.W98R   | fannssiWf   | fannssiRf  |
| SLSV |         |       |           |          |          |          |             |            |
| SLSV | CR9699  | chr8  | 69031678  | PREX2    | c.C3433T | p.P1145S | delPlsvri   | delšlsvri  |
| SLSV | SD1494  | chr10 | 25887245  | GPR158   | c.C2690T | p.S897L  | šmlqksšsv   | Lmlqksšsv  |
| SLSV | CR6126  | chr14 | 44975064  | PSCB     | c.C1127T | p.P376L  | æksPšvel    | æksššvel   |
| SLSV | CR6161  | chr12 | 7528442   | CD163L1  | c.G2540A | p.G847E  | islsvGdhf   | islšvEdhf  |
| SLSV | CR04885 | chr14 | 64408423  | SYNE2    | c.C152T  | p.P51L   | arhtsPšvi   | arhtšLšvi  |
| SLVC |         |       |           |          |          |          |             |            |
| SLVC | CR9699  | chr1  | 235316029 | RBM34    | c.C649T  | p.R217C  | vrfRšlvcf   | vrfCšlvcf  |
| SLVC | SD2056  | chr3  | 193182748 | ATP13A4  | c.A1442G | p.N481S  | qlNlvcfdk   | qlšlvcfdk  |
| SLVC | SD1494  | chr4  | 110447532 | SEC24B   | c.C2942T | p.A981V  | šlvcfqtAl   | šlvcfqtVl  |
| SLYL |         |       |           |          |          |          |             |            |
| SLYL | CR9699  | chr2  | 178095680 | NFE2L2   | c.C1582T | p.H528Y  | gendkslHl   | gendkslYl  |
| SLYL | CR9306  | chr3  | 62180758  | PTPRG    | c.C1241T | p.S414L  | všpdslylf   | vLpdslylf  |
| SLYL | PR4035  | chr4  | 125600025 | ANKRD50  | c.C11T   | p.P4L    | Pqqslyllv   | Lqqslyllv  |
| SMSS |         |       |           |          |          |          |             |            |
| SMSS | CR9699  | chr12 | 57431379  | MYO1A    | c.C2008A | p.L670I  | gelsmssgE   | gelsmssgl  |
| SMSS | SD2056  | chr6  | 105563561 | BVES     | c.C958T  | p.H320Y  | gtšsmssIH   | gtšsmssšY  |
| SMSS | PR4035  | chr2  | 182766586 | SSFA2    | c.G806A  | p.G269E  | qriGsmssv   | qrišsmssv  |
| SPRS |         |       |           |          |          |          |             |            |
| SPRS | SD0346  | chr1  | 234743424 | IRF2BP2  | c.A1175G | p.H392R  | špšsnrttp   | špRšsnrttp |
| SPRS | SD0346  | chr2  | 60695941  | BCL11A   | c.C413T  | p.S138F  | glššsprsah  | glFšsprsah |
| SPRS | CR4880  | chr19 | 55944849  | SHISA7   | c.C1291T | p.P431S  | Pšsprspalpp | šsprspalpp |
| SPRS | CR9306  | chr1  | 236368453 | GPR137B  | c.G994A  | p.G332R  | Gšsprsyllf  | Ršsprsyllf |
| SPRS | LS04744 | chr7  | 150027875 | C7orf29  | c.G382A  | p.G128S  | šplqšprGl   | šplqšprŠl  |
| SPRS | CR04885 | chr1  | 38018280  | SNIP1    | c.G293A  | p.R98Q   | šprškrnRs   | šprškrnQš  |
| SPSA |         |       |           |          |          |          |             |            |
| SPSA | SD0346  | chr4  | 100340221 | ADH7     | c.C943T  | p.P315S  | vvgvšpsak   | vvgvšpsak  |
| SPSA | CR4880  | chr2  | 29294070  | C2orf71  | c.C3058A | p.Q1020K | rpaQšpsa    | rpaKšpsa   |

*FIG. 19H*

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|      |         |       |           |         |           |          |            |            |
|------|---------|-------|-----------|---------|-----------|----------|------------|------------|
| SPSA | LSD0167 | chr12 | 3129847   | TEAD4   | c.G502A   | p.A168T  | apspsappA  | apspsappT  |
| SPSA | LSD3484 | chr13 | 75886912  | TBC1D4  | c.C2345T  | p.S782F  | Spmnkspsa  | Fpmnkspsa  |
| SPSA | PR4035  | chr19 | 5832235   | FUT6    | c.A344G   | p.N115S  | vmyNpsaqI  | vmySpsaqI  |
| SSTT |         |       |           |         |           |          |            |            |
| SSTT | SD0346  | chr17 | 61607835  | KCNH6   | c.G607A   | p.E203K  | hrsssttEi  | hrsssttKi  |
| SSTT | CR4880  | chr19 | 9063678   | MUC15   | c.A23768C | p.D7923A | iDtssttsI  | iAtssttsI  |
| SSTT | LSD4691 | 16    | 22358405  | CDR2    | c.1246C>T | p.P416S  | ssPttppey  | ssSttpppey |
| SSTT | PR11217 | chr11 | 61026248  | VWCE    | c.C2767T  | p.P923S  | rvisPttSr  | rvisSttSr  |
| STLA |         |       |           |         |           |          |            |            |
| STLA | CR4880  | chr19 | 9066259   | MUC15   | c.A21187G | p.T7063A | sttTqrph   | stiAqrph   |
| STLA | CR9306  | chr7  | 141635657 | CLEC5A  | c.G302A   | p.G101E  | kGkgstlai  | kEkgstlai  |
| STLA | LSD4691 | 1     | 17265597  | CROCC   | c.1568T>A | p.L523Q  | csdssttlaI | csdssttiaQ |
| STLA | CR04885 | chr11 | 59210760  | OR5A1   | c.C119G   | p.T40S   | ylTslawnI  | ylStlawnI  |
| STSF |         |       |           |         |           |          |            |            |
| STSF | CR1509  | chr8  | 1719731   | CLN8    | c.C511T   | p.P171S  | llemstPf   | llemstSf   |
| STSF | SD0346  | chr19 | 9061746   | MUC15   | c.C25700T | p.S8567L | Spamtstsf  | Lpamtstsf  |
| STSF | SD1494  | chr20 | 24646031  | SYNDIG1 | c.C668T   | p.S223F  | dlhgastsS  | dlhgastsF  |
| STSF | LSD3484 | chr2  | 179615759 | TTN     | c.C11368T | p.P3790S | eseelPtsf  | eseelStsf  |
| STSF | CR04885 | chr2  | 179616637 | TTN     | c.C10490T | p.S3497F | stsSwpeyf  | stsFwpeyf  |
| SVLY |         |       |           |         |           |          |            |            |
| SVLY | CR9699  | chr12 | 40668499  | LRRK2   | c.C1771T  | p.H591Y  | sviHtlqmy  | sviYtlqmy  |
| SVLY | SD1494  | chr19 | 8320744   | CERS4   | c.G449A   | p.G150D  | fvgGlsvly  | ivgDlsvly  |
| SVLY | LSD3484 | chr1  | 158517061 | OR6Y1   | c.G835A   | p.V279I  | kvVsvlytv  | kvIsvlytv  |
| SVLY | CR04885 | chr1  | 17550161  | PADI1   | c.C319G   | p.R107G  | algRsvlyI  | algGsvlyI  |
| SVLY | PR4077  | chr9  | 21141329  | IFNW1   | c.C241T   | p.H81Y   | kahvmsviH  | kahvmsviY  |
| SVLY | PR4091  | chr7  | 100086830 | NYAP1   | c.C1486T  | p.H496Y  | tekeisviH  | tekeisviY  |
| SVTF |         |       |           |         |           |          |            |            |
| SVTF | CR9699  | chr2  | 174230225 | CDCA7   | c.C940T   | p.L314F  | rrsrsvtL   | rrsrsvtF   |
| SVTF | SD1494  | chr2  | 11725930  | GREB1   | c.G1058A  | p.G353E  | Gpasvtfpv  | Epasvtfpv  |
| SVTF | LSD4744 | chr19 | 59022914  | SLC27A5 | c.G409A   | p.G137R  | Gpgagsvtf  | Rpgagsvtf  |
| SYSG |         |       |           |         |           |          |            |            |
| SYSG | CR0095  | chr10 | 124396799 | DMBT1   | c.C4642T  | p.P1548S | Pysgcgtfk  | Sysgcgtfk  |
| SYSG | CR9306  | chr5  | 170351515 | RANBP17 | c.C1429T  | p.P477S  | Pysgvtvdi  | Sysgvtvdi  |
| SYSG | CR6161  | chr10 | 124396799 | DMBT1   | c.C6496T  | p.P2166S | iPysgcgtf  | iSysgcgtf  |
| SYSG | CR6161  | chr20 | 23064942  | CD93    | c.T1888G  | p.W630G  | naadsysWv  | naadsysGv  |
| TAAF |         |       |           |         |           |          |            |            |
| TAAF | CR9699  | chr9  | 94495705  | ROR2    | c.G636A   | p.M212I  | nritaafIM  | nritaafIL  |
| TAAF | SD1494  | chr20 | 61528063  | DIDO1   | c.C1874T  | p.S625F  | apaaataaS  | apaaataaF  |
| TAAF | SD1494  | chr3  | 11871244  | TAMM41  | c.C506T   | p.P169L  | vtaafimIP  | vtaafimIL  |
| TLKF |         |       |           |         |           |          |            |            |
| TLKF | SD1494  | chr15 | 86940677  | AGBL1   | c.G2317A  | p.E773K  | wvmkgtiEf  | wvmkgtiKf  |
| TLKF | CR4880  | chr3  | 193081122 | ATP13A5 | c.C287A   | p.S96Y   | Stikfpvsk  | Ytikfpvsk  |
| TLKF | CR04885 | chr4  | 170994369 | AADAT   | c.C572T   | p.P191L  | ntPkflytv  | ntIkflytv  |
| TQRL |         |       |           |         |           |          |            |            |
| TQRL | CR1509  | chr3  | 49662596  | BSN     | c.C413T   | p.S138L  | dsrtqrSgr  | dsrtqrIgr  |
| TQRL | SD0346  | chr8  | 22332474  | PPP3CC  | c.C57A    | p.S19R   | vPfpptqrl  | vRfpptqrl  |
| TQRL | CR04885 | chr3  | 44776017  | ZNF501  | c.C104T   | p.S35L   | kfttqrSsl  | kfttqrIsl  |

**FIG. 19I**

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## TSFK

|      |        |       |           |        |           |          |           |           |
|------|--------|-------|-----------|--------|-----------|----------|-----------|-----------|
| TSFK | CR1509 | chr2  | 133541142 | NCKAP5 | c.C3242T  | p.S1081F | eplemtsSk | eplemtsFk |
| TSFK | SD0346 | chr10 | 26463019  | MYO3A  | c.G3826A  | p.E1276K | laEnetsfk | laKnetsfk |
| TSFK | CR6126 | chr6  | 38942156  | DNAH8  | c.C12685T | p.L4229F | itlqtsLk  | itlqtsFk  |

## TTSS

|      |         |       |           |         |           |           |           |           |
|------|---------|-------|-----------|---------|-----------|-----------|-----------|-----------|
| TTSS | SD0346  | chr19 | 9046526   | MUC16   | c.C35105A | p.S11702Y | pvSrttssf | pvYrttssf |
| TTSS | SD6336  | chr3  | 195508070 | MUC4    | c.C10381A | p.P3461T  | lpvtDtssa | lpvtTtssa |
| TTSS | CR4880  | chr2  | 228883099 | SPHKAP  | c.C2471T  | p.S824L   | sStattssk | sttattssk |
| TTSS | CR6126  | chr1  | 247695581 | OR2C3   | c.T233G   | p.I785    | ttslvpqll | ttsSvpqll |
| TTSS | PR11217 | chrX  | 154158785 | F8      | c.G3280A  | p.E1094K  | kttssknmE | kttssknmK |
| TTTS | SD6336  | chr3  | 195508070 | MUC4    | c.C10381A | p.P3461T  | lpvtDtssa | lpvtTtssa |
| TTTS | CR6161  | chr6  | 56035512  | COL21A1 | c.T961A   | p.L321I   | illfttstv | illfttstv |
| TTTS | CR04885 | chr6  | 45514911  | RUNX2   | c.G1369A  | p.G457S   | tttsnGstl | tttsnSstl |
| TTTS | PR11217 | chr11 | 40136495  | LRRC4C  | c.C1348T  | p.P450S   | aatttPfsy | aatttSfsy |

## VAIC

|      |         |       |           |        |         |         |           |           |
|------|---------|-------|-----------|--------|---------|---------|-----------|-----------|
| VAIC | CR9699  | chr9  | 35957729  | OR252  | c.C367T | p.R123C | Ryvaicnpl | Cyvaicnpl |
| VAIC | SD1494  | chr1  | 248756685 | OR2Y10 | c.C385T | p.P129S | vaichPlry | vaichSlry |
| VAIC | CR9306  | chr14 | 20389150  | OR4K5  | c.C385T | p.P129S | ryvaickPl | ryvaickSl |
| VAIC | LSD6819 | chr11 | 4843021   | OR51F2 | c.C406T | p.R136C | fdRfvaicy | fdCfvaicy |

## VESV

|      |         |       |           |        |          |         |           |           |
|------|---------|-------|-----------|--------|----------|---------|-----------|-----------|
| VESV | SD1494  | chr12 | 13769447  | GRIN2B | c.C1270T | p.P424S | vivesvdPl | vivesvdSl |
| VESV | CR9306  | chr8  | 113812420 | CSMD3  | c.G1823A | p.G608E | desvGsvgf | desvEsvgf |
| VESV | LSD4744 | chr4  | 106292020 | PPA2   | c.C644T  | p.S215L | slvesvssS | slvesvssL |

## VGSI

|      |         |       |           |           |          |         |           |           |
|------|---------|-------|-----------|-----------|----------|---------|-----------|-----------|
| VGSI | SD1494  | chr14 | 77917664  | C14orf133 | c.C209T  | p.S70F  | epvgsswS  | epvgsswF  |
| VGSI | CR0095  | chrX  | 153035987 | PLXNB3    | c.C1969T | p.R657C | Racvgslwr | Cacvgslwr |
| VGSI | CR06670 | chr12 | 29786178  | TMTC1     | c.C1030T | p.P344S | wqvgslPlv | wqvgslSlv |

## VLEP

|      |         |      |          |         |          |         |           |           |
|------|---------|------|----------|---------|----------|---------|-----------|-----------|
| VLEP | CR1509  | chr2 | 33759460 | RASGRP3 | c.C1154T | p.S385F | lvleprnSk | lvleprnFk |
| VLEP | SD1494  | chr6 | 29342932 | OR12D3  | c.G133A  | p.V45M  | VmvvlepqI | MmvvlepqI |
| VLEP | LSD4744 | chr2 | 62067423 | FAM161A | c.C716T  | p.P239L | tvPepfqmm | tvlepqmm  |

## VLLR

|      |         |       |           |         |          |         |           |           |
|------|---------|-------|-----------|---------|----------|---------|-----------|-----------|
| VLLR | CR9699  | chr11 | 106810262 | GUCY1A2 | c.G1130A | p.R377K | tfeRvlrl  | tfeKvlrl  |
| VLLR | CR4880  | chr3  | 193081168 | ATP13A5 | c.G241A  | p.E81K  | tvllrttdE | tvllrttdK |
| VLLR | CR4880  | chr8  | 87076354  | PSKH2   | c.C692T  | p.P231L | iaPevllrk | iaLevllrk |
| VLLR | LSD4744 | chr1  | 247921663 | OR1C1   | c.G46A   | p.G16R  | vllGlpssa | vllRlpssa |
| VLLR | LSD4744 | chr20 | 58514589  | PPP1R3D | c.C398T  | p.S133L | lhvISrlai | lhvIRlai  |

## VTSV

|      |         |       |           |       |          |         |           |           |
|------|---------|-------|-----------|-------|----------|---------|-----------|-----------|
| VTSV | SD0346  | chr17 | 4836677   | GP1BA | c.G778A  | p.A260T | amtsnvAsv | amtsnvTsv |
| VTSV | SD1494  | chr14 | 61180493  | SIX4  | c.A1978T | p.N660Y | tvtsvntN  | tvtsvntY  |
| VTSV | CR04885 | chr9  | 126794916 | LHX2  | c.C1151T | p.S384F | tvtsvltSv | tvtsvltFv |

**FIG. 19J**

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| <u>Gene Name</u> | <u>Mean Expression</u> |
|------------------|------------------------|
| AADAT            | 111.43                 |
| AAK1             | 884.00                 |
| ACVR2A           | 257.69                 |
| ADAM2            | 0.00                   |
| ADD2             | 103.07                 |
| ADH7             | 35.97                  |
| AGBL1            | 104.73                 |
| ANK3             | 164.70                 |
| ANKRD34C         | 16.36                  |
| ANKRD50          | 1301.51                |
| ANLN             | 1316.31                |
| APBB1IP          | 369.96                 |
| APOB             | 45.58                  |
| AQPEP            | 335.50                 |
| ARHGAP6          | 142.42                 |
| ARID5B           | 1790.27                |
| ATP13A4          | 68.88                  |
| ATP13A5          | 48.97                  |
| ATP6V0A1         | 3337.35                |
| AXIN1            | 1121.68                |
| BCL11A           | 128.48                 |
| BLM              | 317.51                 |
| BSN              | 71.81                  |
| BVES             | 310.79                 |
| C10orf111        | 11.84                  |
| C11orf16         | 0.00                   |
| C11orf52         | 30.42                  |
| C14orf133        | 588.74                 |
| C14orf169        | 520.01                 |
| C22orf42         | 0.00                   |
| C2orf71          | 24.45                  |
| C7orf29          | 168.21                 |
| CACNA1B          | 80.52                  |
| CAPN13           | 29.03                  |
| CASP10           | 209.01                 |
| CCDC64B          | 145.70                 |
| CD163L1          | 112.19                 |
| CD1E             | 43.83                  |

***FIG. 20A***

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|         |          |
|---------|----------|
| CD93    | 1064.01  |
| CDC23   | 768.52   |
| CDCA7   | 336.40   |
| CDH26   | 23.52    |
| CDR2    | 545.50   |
| CELF4   | 40.86    |
| CELSR1  | 1394.02  |
| CERS4   | 882.04   |
| CHST5   | 18.71    |
| CLCA2   | 911.37   |
| CLEC5A  | 71.69    |
| CLN8    | 473.46   |
| COL11A1 | 1821.15  |
| COL21A1 | 40.50    |
| CPO     | 15.23    |
| CPT1C   | 133.77   |
| CR2     | 1144.47  |
| CROCC   | 672.58   |
| CSMD1   | 322.88   |
| CSMD3   | 101.10   |
| CSNK2A1 | 1555.32  |
| CST6    | 715.66   |
| CXorf23 | 133.04   |
| CYP2C9  | 0.00     |
| DCAF4   | 374.38   |
| DDX1    | 2462.15  |
| DICER1  | 1233.93  |
| DIDO1   | 1942.29  |
| DMBT1   | 197.41   |
| DMGDH   | 56.59    |
| DNAH8   | 37.79    |
| EGFLAM  | 208.77   |
| EHD2    | 1826.37  |
| EIF4G1  | 11246.04 |
| EMR3    | 15.78    |
| EPHA7   | 162.78   |
| ESPNL   | 55.43    |
| EVX1    | 26.22    |
| F8      | 262.78   |
| FAM135B | 167.90   |
| FAM161A | 178.10   |
| FAM3C   | 1595.78  |
| FAM48B1 | 0.00     |
| FASN    | 13421.22 |
| FAT3    | 156.77   |
| FBF1    | 204.96   |
| FBN3    | 475.81   |

**FIG. 20B**

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|          |         |
|----------|---------|
| FERMT1   | 162.99  |
| FLT3     | 43.27   |
| FRAS1    | 338.32  |
| FSCB     | 0.00    |
| FSD2     | 0.00    |
| FUT6     | 30.16   |
| FZD7     | 1017.65 |
| GABRA4   | 135.53  |
| GBX2     | 44.73   |
| GIN51    | 381.96  |
| GLB1     | 1643.12 |
| GLOD4    | 1371.07 |
| GLRA2    | 178.97  |
| GLTSCR1  | 379.81  |
| GP1BA    | 125.30  |
| GPBAR1   | 30.70   |
| GPR137B  | 2631.83 |
| GPR158   | 261.25  |
| GPR33    | 0.00    |
| GREB1    | 1863.30 |
| GRIA3    | 41.99   |
| GRIK1    | 169.56  |
| GRIK4    | 54.25   |
| GRIN2B   | 33.82   |
| GUCY1A2  | 38.30   |
| HHAT     | 330.03  |
| HSD17B6  | 26.93   |
| IARS2    | 3896.80 |
| IFNW1    | 0.00    |
| IGFN1    | 100.98  |
| IGSF10   | 53.49   |
| INCENP   | 1142.15 |
| IRAK3    | 206.35  |
| IRF2BP2  | 3241.75 |
| ITGA3    | 8376.46 |
| ITGB3    | 3026.49 |
| JAKMIP3  | 24.67   |
| JMJD4    | 702.69  |
| KANK3    | 83.94   |
| KCNB1    | 37.24   |
| KCNH6    | 0.00    |
| KCNT2    | 41.36   |
| KDR      | 625.82  |
| KEL      | 77.69   |
| KIAA1109 | 1136.49 |
| KIAA1609 | 407.46  |
| KIAA1841 | 139.85  |

*FIG. 20C*

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|            |         |
|------------|---------|
| KIF6       | 142.75  |
| KLB        | 27.25   |
| KPRP       | 1938.99 |
| LCE5A      | 74.63   |
| LGALS16    | 0.00    |
| LHX2       | 121.89  |
| LINGO2     | 69.01   |
| LPP        | 219.05  |
| LRRC4C     | 42.26   |
| LRRC55     | 51.73   |
| LRRK2      | 407.38  |
| LTBP4      | 1753.76 |
| LY75-CD302 | 0.00    |
| MAGEA12    | 821.95  |
| MAGEC3     | 50.55   |
| MCM3AP     | 2533.18 |
| MGAT5      | 504.17  |
| MLLT10     | 562.96  |
| MS4A8B     | 194.98  |
| MST4       | 167.95  |
| MUC16      | 68.38   |
| MUC4       | 53.37   |
| MUM111     | 216.16  |
| MYH6       | 23.28   |
| MYO1A      | 18.51   |
| MYO3A      | 85.80   |
| NAA1AD2    | 57.31   |
| NCKAP1     | 3490.43 |
| NCKAP5     | 165.96  |
| NCKAP5L    | 1401.73 |
| NCOR2      | 5198.49 |
| NFE2L2     | 2775.35 |
| NOP56      | 3568.72 |
| NPAS4      | 0.00    |
| NRAP       | 60.56   |
| NUP214     | 2006.26 |
| NYAP1      | 55.52   |
| OBSCN      | 388.46  |
| OR10G7     | 0.00    |
| OR11G2     | 0.00    |
| OR11L1     | 0.00    |
| OR12D3     | 0.00    |
| OR1C1      | 0.00    |
| OR2C3      | 86.18   |
| OR2S2      | 0.00    |
| OR2T10     | 0.00    |
| OR4K5      | 0.00    |

**FIG. 20D**

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|         |         |
|---------|---------|
| OR51F2  | 0.00    |
| OR5A1   | 0.00    |
| OR5B2   | 0.00    |
| OR5M8   | 33.98   |
| OR6C1   | 0.00    |
| OR6M1   | 0.00    |
| OR6V1   | 0.00    |
| OR6Y1   | 0.00    |
| OR8S1   | 40.63   |
| OVCH1   | 15.99   |
| PADI1   | 59.14   |
| PADI4   | 29.03   |
| PARP14  | 2304.96 |
| PCDH15  | 72.32   |
| PITPNM1 | 968.15  |
| PKHD1L1 | 122.73  |
| PLCB1   | 225.64  |
| PLDN    | 1467.10 |
| PLXDC2  | 200.02  |
| PLXNB3  | 1684.27 |
| PODN    | 358.43  |
| PPA2    | 734.41  |
| PPP1R3D | 311.16  |
| PPP2R1A | 7106.96 |
| PPP3CC  | 404.09  |
| PREX2   | 39.11   |
| PRUNE2  | 796.48  |
| PSKH2   | 0.00    |
| PTH2    | 0.00    |
| PTPN13  | 1014.73 |
| PTPRG   | 1140.13 |
| RABEP2  | 516.11  |
| RANBP17 | 150.79  |
| RASGRP3 | 276.12  |
| RBL1    | 276.87  |
| RBM34   | 727.77  |
| RECQL5  | 704.21  |
| RERE    | 3243.22 |
| RNF17   | 231.35  |
| RNF207  | 148.02  |
| ROR2    | 122.56  |
| RP1     | 68.86   |
| RUNX2   | 269.40  |
| SCN10A  | 21.81   |
| SCN4A   | 34.67   |
| SCPEP1  | 1760.51 |
| SEC24B  | 972.42  |

***FIG. 20E***

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|           |         |
|-----------|---------|
| SERPINA11 | 36.31   |
| SERPINB3  | 1423.56 |
| SH3KBP1   | 2460.86 |
| SH3TC1    | 812.89  |
| SHISA7    | 35.45   |
| SIX4      | 68.59   |
| SLC10A2   | 0.00    |
| SLC22A9   | 21.60   |
| SLC27A5   | 139.95  |
| SLC2A5    | 230.84  |
| SLC35D3   | 17.36   |
| SLC8A1    | 169.62  |
| SLCO1C1   | 55.93   |
| SLCO6A1   | 26.11   |
| SLITRK1   | 139.93  |
| SMARCA4   | 4755.57 |
| SNIP1     | 288.13  |
| SNTG2     | 0.00    |
| SPHKAP    | 112.68  |
| SPTBN2    | 884.10  |
| SSFA2     | 3427.29 |
| SWI5      | 411.83  |
| SYNDIG1   | 43.79   |
| SYNE2     | 2231.28 |
| TACC2     | 385.20  |
| TAMM41    | 180.46  |
| TAS2R4    | 10.94   |
| TAS2R9    | 0.00    |
| TBC1D23   | 738.15  |
| TBC1D4    | 1742.64 |
| TBC1D8B   | 176.52  |
| TCN1      | 784.20  |
| TDRD5     | 52.31   |
| TEAD4     | 477.70  |
| TEK       | 112.25  |
| TET3      | 615.54  |
| THOC2     | 1269.42 |
| THSD4     | 129.76  |
| TIGD4     | 25.48   |
| TMED1     | 791.99  |
| TMEM181   | 1171.25 |
| TMEM57    | 701.28  |
| TMPPE     | 59.09   |
| TMTC1     | 483.47  |
| TNRC6A    | 1075.38 |
| TRPC4     | 37.93   |
| TRPS1     | 336.45  |

***FIG. 20F***

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|          |         |
|----------|---------|
| TSGA10IP | 46.11   |
| TSPEAR   | 39.10   |
| TTN      | 149.00  |
| TULP4    | 1299.44 |
| TXNRD3NB | 186.51  |
| UBE4A    | 1558.99 |
| UBN2     | 512.76  |
| URB1     | 1812.42 |
| VWCE     | 36.54   |
| VWDE     | 48.84   |
| WDR7     | 543.47  |
| WDR78    | 45.53   |
| WEE2     | 0.00    |
| WRAP53   | 335.35  |
| XIRP2    | 102.84  |
| ZDHHC22  | 52.66   |
| ZNF280D  | 489.78  |
| ZNF335   | 661.91  |
| ZNF454   | 32.23   |
| ZNF501   | 66.30   |
| ZNF536   | 226.14  |
| ZNF746   | 674.59  |

***FIG. 20G***

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| <u>Patient ID</u> | <u>Sample Site</u>                     | <u>Largest Dimension (cm)</u> | <u>Biospy type</u> |
|-------------------|----------------------------------------|-------------------------------|--------------------|
| CR1509            | gluteal metastasis                     | 2.5                           | resection          |
| CR9306            | coracoid metastasis                    | 4.7                           | resection          |
| CR0095            | groin metastasis                       | 0.8                           | resection          |
| CR4880            | groin metastasis                       | 0.6                           | resection          |
| CR7623            | nonresponding adrenal gland metastasis | 1                             | resection          |
| CR3665            | breast metastasis                      | 21x16                         | resection          |
| CR9699            | portal lymph node metastasis           | not documented                | resection          |
| SD0346            | axillary soft tissue metastasis        | 5                             | excision           |
| SD6336            | gluteal metastasis                     | not documented                | resection          |
| SD1494            | parietal metastasis                    | 2.1                           | resection          |
| SD2056            | lung metastasis                        | 1.5                           | resection          |
| SD2051            | groin lymph node metastases            | 0.5 to 3                      | resection          |
| SD5038            | upper back metastasis                  | 6.5                           | excision           |
| SD5394            | abdominal tumor nodules                | 4.5                           | excision           |
| SD5115            | elbow metastasis                       | 3                             | excision           |
| SD6494            | small bowel metastasis                 | 10                            | resection          |
| SD7357            | skin and breast metastasis             | 12                            | resection          |
| NR3156            | gluteal metastasis                     | 1.4mm                         | excision           |
| NR5764            | axillary lymph nodes                   | 2                             | resection          |
| NR8727            | axillary lymph nodes                   | 0.2 to 2.2                    | resection          |
| NR4649            | parietal metastasis                    | 1.2                           | resection          |
| NR1867            | groin lymph nodes                      | 0.3 to 4                      | resection          |
| NR3549            | inguinal lymph nodes                   | 3.2                           | excision           |
| NR9341            | skin nodules                           | 1.2                           | resection          |
| NR4810            | small bowel metastasis                 | 4.5x3.5x3                     | resection          |
| LSD2057           | left parietal brain metastasis         | 0.5x0.3x0.1                   | excision           |
| LSDNR9298         | lymph node metastasis                  | 2.7x2.7                       | excision           |
| LSD6819           | skin nodule                            | 0.6                           | excision           |
| LSDNR3086         | nonresponding cutaneous metastasis     | 1.6x1.5x1.1                   | excision           |
| CH6161            | left axillary lymph nodes              | 2.6x2x1.5                     | excision           |
| NR6689            | L temporal brain metastasis            | 1.8x1.5x0.5                   | excision           |
| NR2137            | R occipital brain                      | 2x1.3x0.3                     | excision           |
| NR6721            | R chest wall nodular metastasis        | 2.2x2x0.5                     | excision           |
| NR8815            | anterior chest, skin metastasis        | 3.3x2.5                       | excision           |
| NR9445            | abdominal nodule                       | 0.6x0.3x0.3                   | excision           |
| NR6542            | R axillary lymph node metastasis       | 0.2 to 2.5                    | excision           |
| NR9765            | left inguinal lymph nodes              | 0.2 to 3                      | excision           |
| CR22640           | lung metastasis                        | 1.1                           | resection          |
| PR03883           | forearm metastasis                     | 0.6                           | punch              |
| CR06670           | left thigh metastasis                  | 1.4                           | excision           |
| PR12117           | neck lymph node                        | 1                             | excision           |
| CR04885           | scalp metastasis                       | 0.5                           | shave              |
| PR4646            | lymph nodes                            | not available                 | excision           |
| PR4092            | lymph nodes                            | not available                 | resection          |
| PR4091            | skin metastasis                        | not available                 | excision           |
| NR4018            | skin metastasis                        | not available                 | excision           |
| PR4077            | not available                          | not available                 | needle             |
| NR4083            | not available                          | not available                 | needle             |
| PR4035            | soft tissue metastasis                 | not available                 | excision           |
| CHNR2472          | nonresponding spleen metastasis        | 2.8x2.7x2.2                   | excision           |
| CRNR4941          | nonresponding inguinal metastasis      | 3.1x1.1x1.1                   | excision           |
| LSD4691           | vertebral metastases                   | 4.1x2.6x0.6                   | excision           |
| LSD4744           | not available                          | not available                 | not available      |
| LSD0167           | small bowel melanoma                   | 3.5x3x1.5                     | excision           |
| NR4631            | CNS metastasis                         | 3.3x1.7x0.8                   | excision           |
| NR4545            | R elbow metastasis                     | 0.5x0.4x0.4                   | punch              |
| CR6126            | elbow metastasis                       | 1x0.9                         | excision           |
| CRNR0244          | small bowel nonresponding metastasis   | 4x3x1.5                       | excision           |
| LSD3464           | lymph node metastases                  | 0.5 to 3.5                    | excision           |
| LSDNR1230         | L axillary lymph node dissection       | 2.7x2.5x2                     | excision           |
| LSDNR1650         | pubic nonresponding metastasis         | 3.5x3x1.8                     | excision           |
| NR3449            | small bowel resection                  | 0.9 to 1.1                    | excision           |
| NR9521            | L arm melanoma                         | 0.5 to 5.7                    | excision           |
| NR9705            | skin/chest wall metastasis             | 5.2x7.5x7                     | excision           |

**FIG. 21**