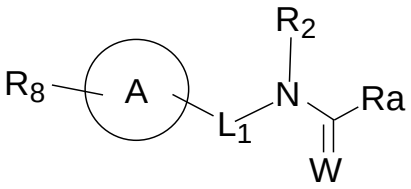
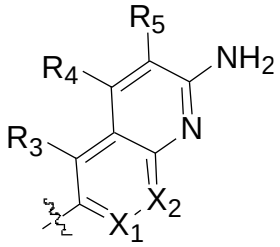
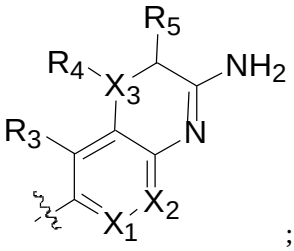
# CLAIMS

1. A compound of formula I, or a pharmaceutically acceptable salt thereof or a deuterated product thereof:



I

wherein,

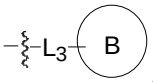
Ra is selected from the group consisting of  and ;

W is O or S;

$X_1$, $X_2$ are each independently selected from the group consisting of CR and N; $X_3$ is N;

$L_1$ is -CHR- or -C(R)R-;

Ring A is selected from the group consisting of: substituted or unsubstituted 8-12 membered fused bicyclic heterocyclyl which is a five-membered fused six-membered ring and substituted or unsubstituted 7-10 membered fused bicyclic heteroaryl which is a five-membered fused six-membered ring;

$R_8$ is selected from the group consisting of: H, deuterium, halogen, cyano, amino, nitro, hydroxyl, thiol, aldehyde, carboxyl, $C_2$-$C_6$ alkynyl, $SF_5$, substituted or unsubstituted or halogenated $C_1$-$C_6$ alkyl, and unsubstituted or halogenated $C_1$-$C_6$ alkoxyl, or $R_8$ is ;

$L_3$ is selected from the group consisting of: chemical bonds, -O-, -CHR-, -C(R)R-, carbonyl, S, and -NH-;

Ring B is selected from the group consisting of: substituted or unsubstituted benzene ring, substituted or unsubstituted 5-6-membered heteroaromatic ring, substituted or unsubstituted $C_3$-$C_6$ carbocycle (including saturated and partially unsaturated situations), substituted or unsubstituted 3-7-membered heterocycle (including saturated and partially unsaturated situations);

$R_2$ is selected from the group consisting of: $R_7$, and -$L_2R_7$; wherein, $L_2$ is selected from the group consisting of: -O-, -CHR-, -C(R)R-, and carbonyl; wherein, $R_7$ is selected from the group consisting of: hydrogen, none, substituted or unsubstituted $C_1$-$C_6$ alkyl, substituted or unsubstituted $C_{6-10}$ aromatic ring, and substituted or unsubstituted 5-12 membered (preferably 5-6 membered or 8-10 membered) heteroaromatic ring, substituted or unsubstituted $C_3$-$C_{10}$ carbocycle (including saturated and partially unsaturated situations, including single ring, fused ring, spiro ring and bridged

ring), and substituted or unsubstituted 3-10 membered heterocycle (including saturated and partially unsaturated situations, including single ring, fused ring, spiro ring and bridged ring);

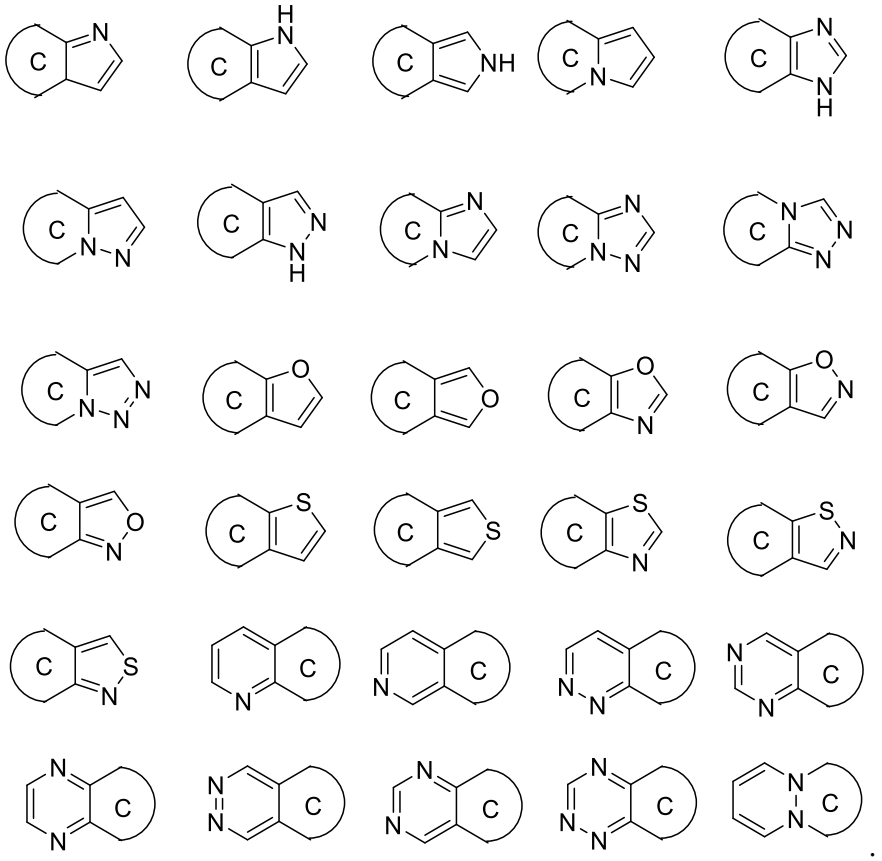
$R_3$ is selected from the group consisting of H, deuterium, halogen, cyano, and substituted or unsubstituted $C_1$-$C_6$ alkyl;

$R_4$ and $R_5$ together with the connected ring atom form a 5-12 membered saturated or unsaturated ring, and the ring can be substituted or unsubstituted;

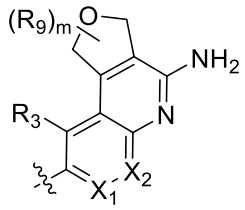
R is H, deuterium, halogen, substituted or unsubstituted $C_1$-$C_4$ alkyl, substituted or unsubstituted $C_1$-$C_4$ alkoxyl, and substituted or unsubstituted $C_3$-$C_6$ cycloalkyl;

unless otherwise specified, in the above formulas, the substituted refers to hydrogen atoms on the corresponding group are substituted by one or more substituents selected from the group consisting of: deuterium, tritium, halogen, hydroxyl, carboxyl, thiol, benzyl, $C_1$-$C_{12}$ alkoxycarbonyl, $C_1$-$C_6$ aldehyde, amino, $C_1$-$C_6$ amide, nitro, cyano, unsubstituted or halogenated $C_1$-$C_6$ alkyl, unsubstituted or halogenated $C_3$-$C_8$ cycloalkyl, $C_2$-$C_{10}$ alkenyl, $C_1$-$C_6$ alkoxyl, $C_1$-$C_6$ alkyl-amino, $C_6$-$C_{10}$ aryl, five-membered or six-membered heteroaryl, five-membered or six-membered non-aromatic heterocyclyl, -O-($C_6$-$C_{10}$ aryl), -O- (five-membered or six-membered heteroaryl), $C_1$-$C_{12}$ alkylamino carbonyl, unsubstituted or halogenated $C_2$-$C_{10}$ acyl, sulfonyl (-$SO_2$-OH), phosphoryl-(-$PO_3$-OH), unsubstituted or halogenated $C_1$-$C_4$ alkyl-$S(O)_2$-, unsubstituted or halogenated $C_1$-$C_4$ alkyl-SO-, and -$SF_5$.

2. The compound according to claim 1, or a pharmaceutically acceptable stereoisomer, a salt or a deuterated product thereof, wherein, Ring A is selected from the group consisting of:



3. The compound according to claim 1, or a pharmaceutically acceptable salt or a deuterated product thereof, wherein, Ra is selected from the group consisting of: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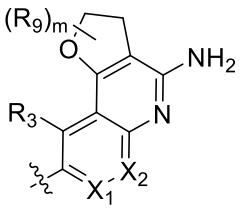
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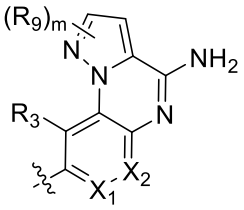
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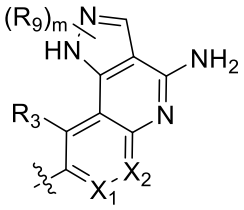
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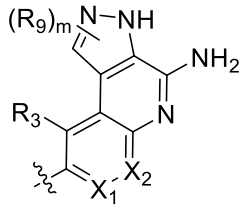
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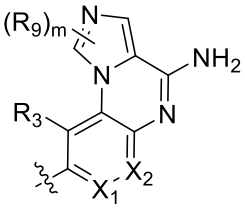
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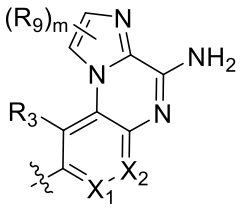
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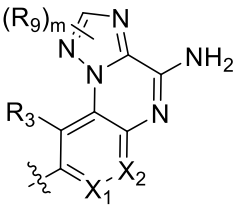
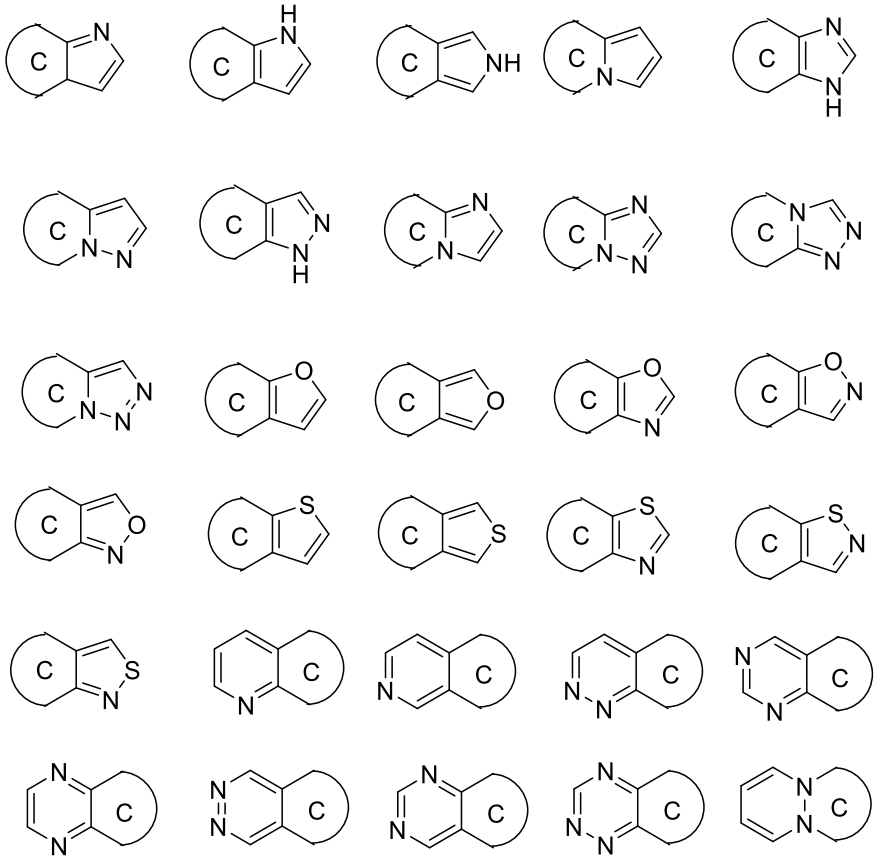

;

wherein, $R_9$ is selected from the group consisting of: deuterium, tritium, halogen, hydroxyl, carboxyl, unsubstituted or halogenated $C_1$-$C_6$ alkyl, unsubstituted or halogenated $C_1$-$C_6$ alkoxyl, unsubstituted or halogenated $C_1$-$C_6$ alkyl-OH, - NH (unsubstituted or halogenated $C_1$-$C_6$ alkyl), and-N (unsubstituted or halogenated $C_1$-$C_6$ alkyl)$_2$; m is selected from 0, 1, 2, and 3.

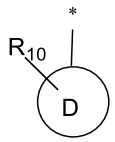
4. The compound according to claim 1, or a pharmaceutically acceptable salt or a deuterated product thereof, wherein, $L_1$ is -$CH_2$-, or -$CH(CH_3)$-; ring A is selected from the group consisting of:



wherein ring C is selected from the group consisting of: substituted or unsubstituted benzene ring, substituted or unsubstituted 5-6-membered heteroaromatic ring, substituted or unsubstituted $C_3$-$C_6$ carbocycle (including saturated and partially unsaturated situations), and substituted or

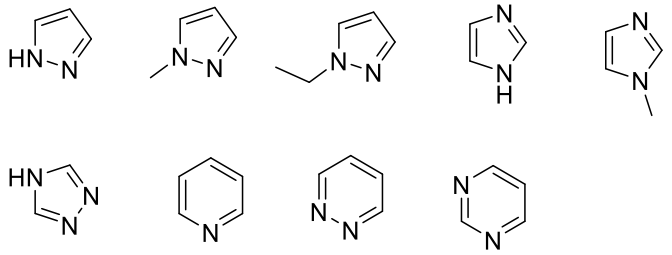
unsubstituted 3-6-membered heterocycle (including saturated and partially unsaturated situations).

5. The compound according to claim 1, or a pharmaceutically acceptable stereoisomer, a salt or a deuterated product thereof, wherein, $R_2$ is ortho-substituted 5-membered or 6-membered heteroaromatic ring, as shown below:

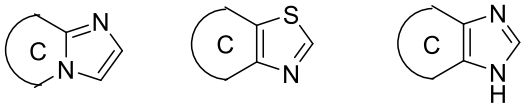



wherein, $R_{10}$ is a substituent located adjacent to the connecting site, and selected from the group consisting of: hydrogen, deuterium, halogen, unsubstituted or halogenated $C_1$-$C_3$ alkyl, and unsubstituted or halogenated $C_1$-$C_3$ alkoxyl;

preferably, ring D is selected from the group consisting of: substituted or unsubstituted benzene ring, substituted or unsubstituted 5-6 membered heteroaromatic ring, more preferably, ring D is selected from the group consisting of:



and ring A is selected from the group consisting of:



wherein ring C is selected from the group consisting of substituted or unsubstituted benzene ring, and substituted or unsubstituted 5-6 membered heteroaryl ring; and $R_8$ is $CF_3$.

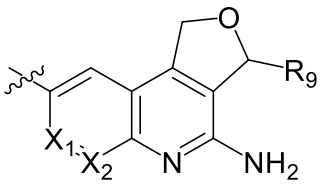
6. The compound according to claim 1, or a pharmaceutically acceptable stereoisomer, a salt or a deuterated product thereof, wherein, $R_2$ is selected from the group consisting of: $R_7$, and $-L_2R_7$; wherein, $L_2$ is selected from the group consisting of: -O-, -CHR-, carbonyl, S, and -NH-; wherein, $R_7$ is selected from the group consisting of: substituted or unsubstituted $C_1$-$C_6$ alkyl, substituted or unsubstituted $C_{6\text{-}10}$ aromatic ring, and substituted or unsubstituted 5-12 membered heteroaromatic ring.

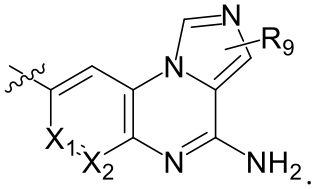
7. The compound according to claim 1, or a pharmaceutically acceptable stereoisomer, a salt or a deuterated product thereof, wherein, $R_7$ is selected from the group consisting of: substituted or unsubstituted $C_1$-$C_6$ alkyl, substituted or unsubstituted phenyl, and substituted or unsubstituted 5-7 membered heteroaromatic ring.

8. The compound according to claim 1, or a pharmaceutically acceptable stereoisomer, a salt or a deuterated product thereof, wherein, $R_2$ is selected from the group consisting of $R_7$, and $-(CHR)R_7$; wherein, $R_7$ is selected from the group consisting of: substituted or unsubstituted $C_{6\text{-}10}$ aromatic ring, and substituted or unsubstituted 5-12 membered heteroaromatic ring.

9. The compound according to claim 1, or a pharmaceutically acceptable stereoisomer, a salt or a deuterated product thereof, wherein, $R_2$ is substituted or unsubstituted 5-7 membered heteroaromatic ring; ring A is selected from the group consisting of: substituted or unsubstituted 7-10 membered fused bicyclic heteroaryl; and $R_8$ is $CF_3$.

10. The compound according to claim 1, or a pharmaceutically acceptable stereoisomer, a salt or a deuterated product thereof, wherein, Ra has a structure as shown in the following formula:



or


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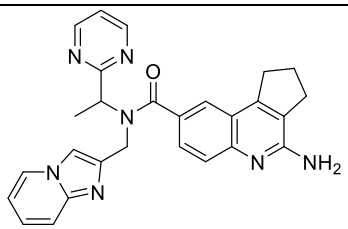
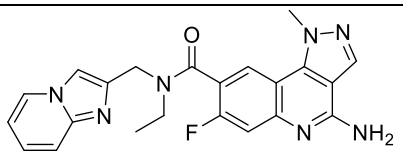
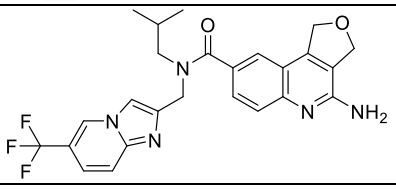
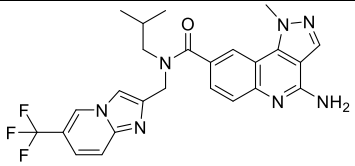
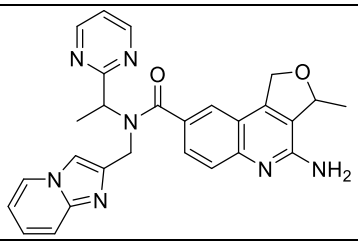
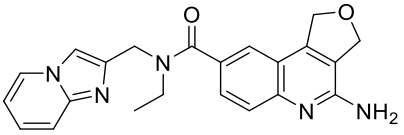
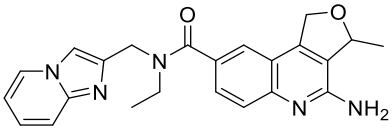
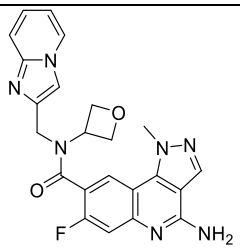
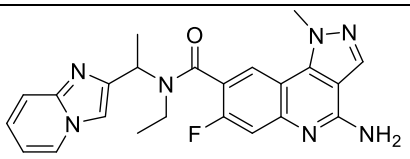
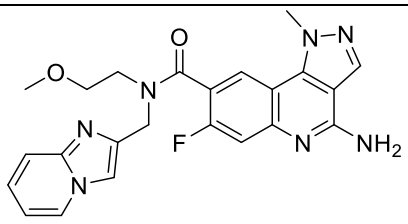
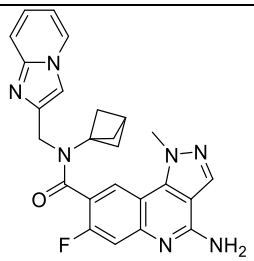
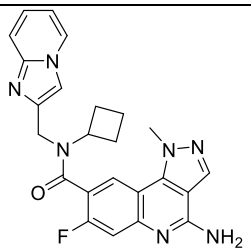
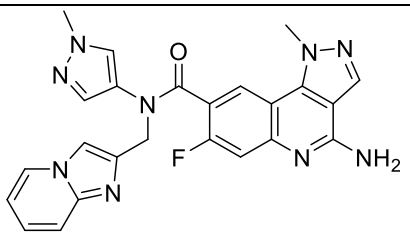
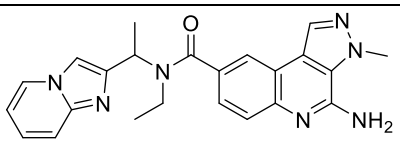
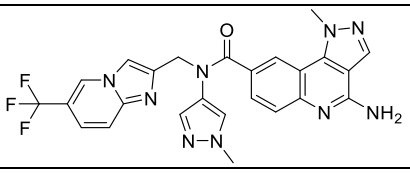
11. The compound according to any one of claims 1-10, or a pharmaceutically acceptable stereoisomer, a salt or a deuterated product thereof, wherein, the compound has a structure selected from the following table:

Table 1

| NO. | Structure | NO. | Structure |
|---|---|---|---|
| 1 |  | 2 |  |
| 3 |  | 4 |  |
| 5 |  | 6 |  |
| 7 |  | | |
| 9 |  | 10 |  |
| 11 |  | 12 |  |
| 13 |  | 14 |  |
| 15 |  | 16 |  |

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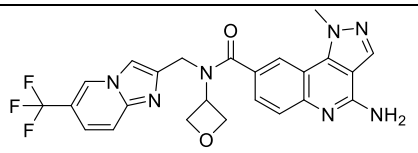
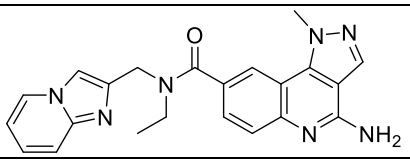
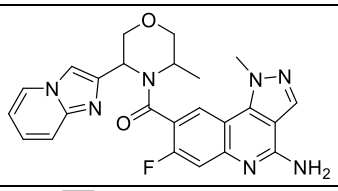
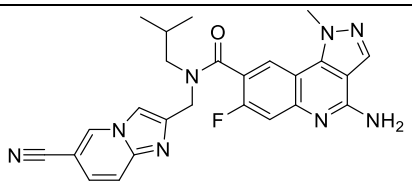
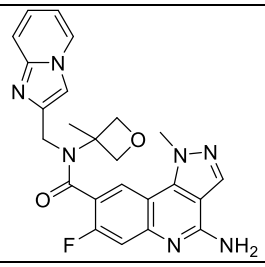
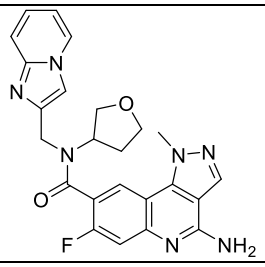
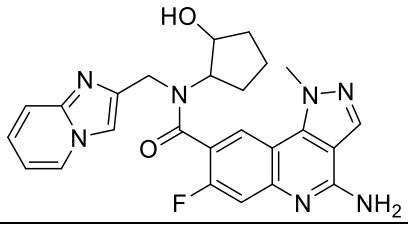
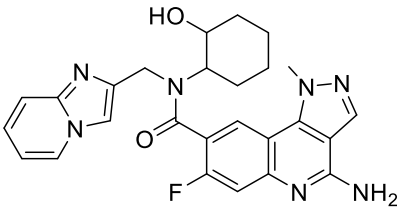
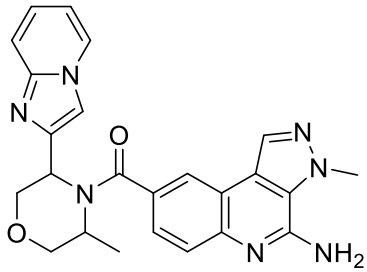
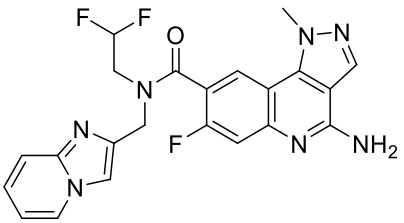
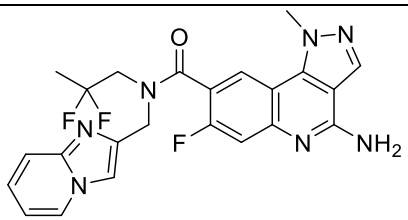
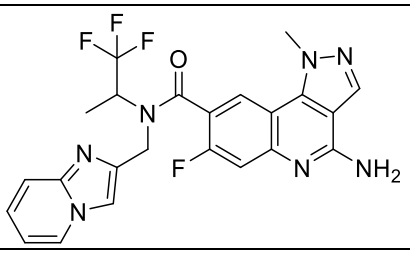
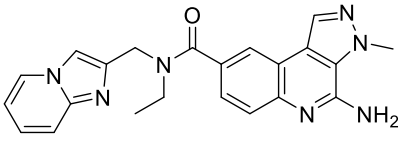
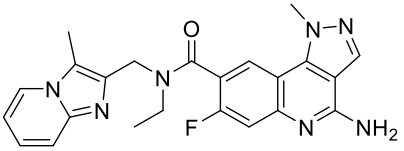
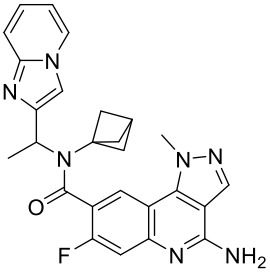
| 17 |  | 18 |  |
| 19 |  | 20 |  |
| 21 |  | 22 |  |
| 23 |  | 24 |  |
| 25 |  | 26 |  |
| 27 |  | 28 |  |
| 29 |  | 30 |  |
| 31 |  | | |

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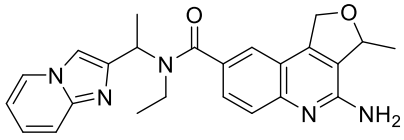
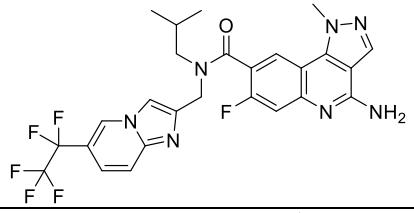
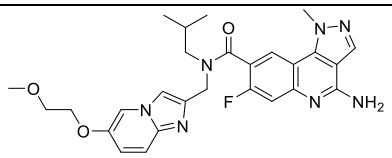
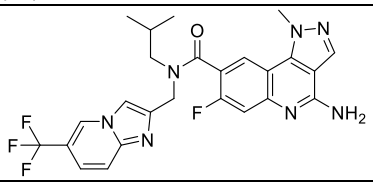
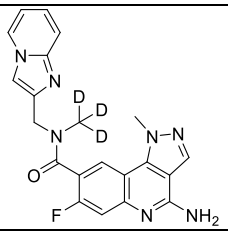
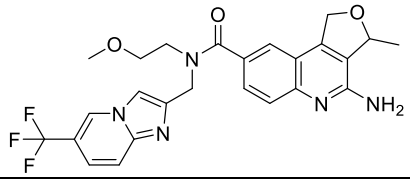
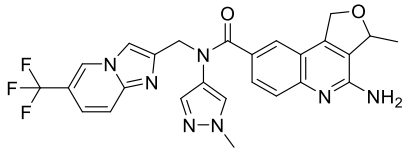
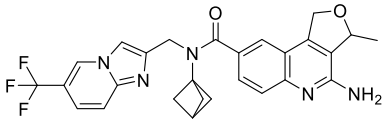
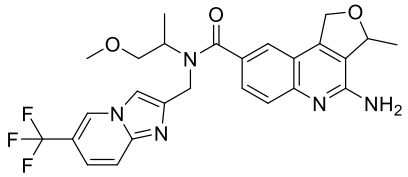
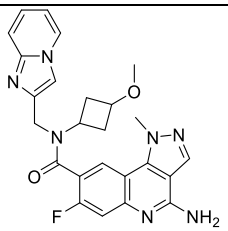
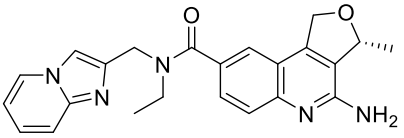
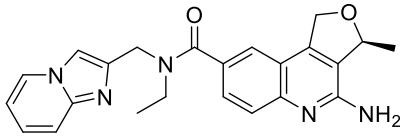
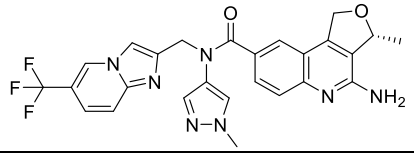
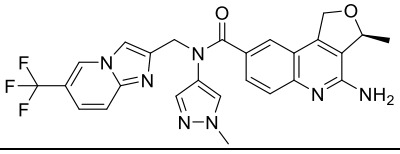
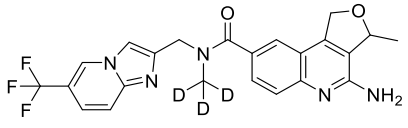
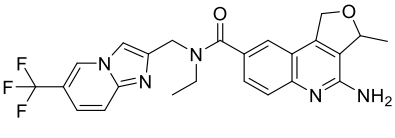
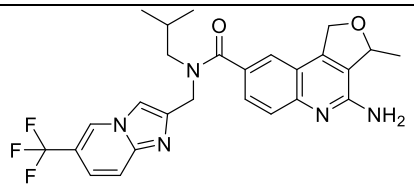
| 33 |  | 34 |  |
| 35 |  | 36 |  |
| 37 |  | | |
| 41 |  | 42 |  |
| 43 |  | 44 |  |
| 45 |  | 46 |  |
| 47 |  | 48 |  |
| 49 |  | 50 |  |
| 51 |  | 52 |  |

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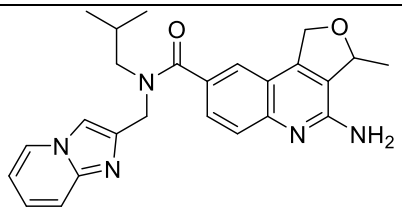
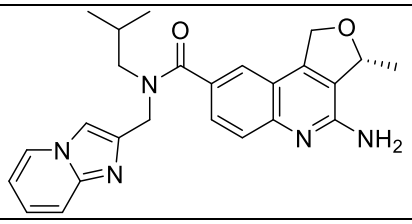
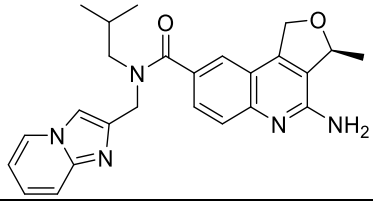
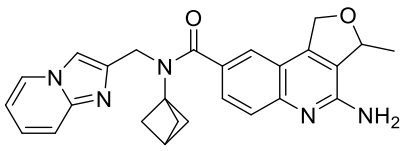
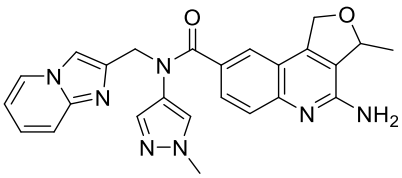
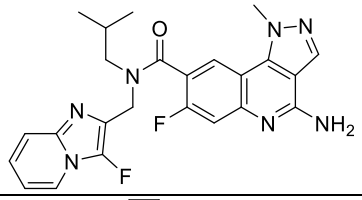
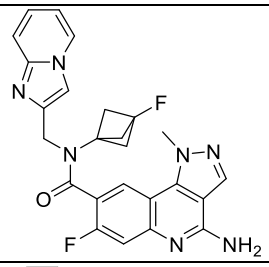
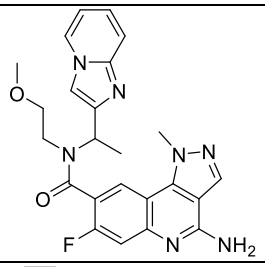
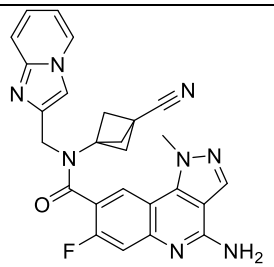
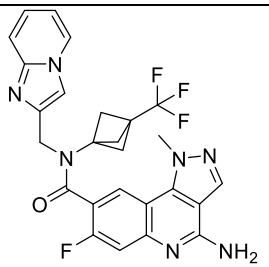
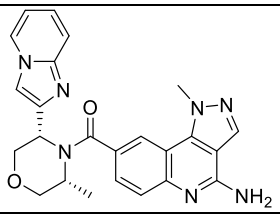
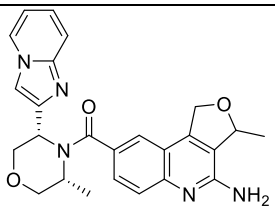
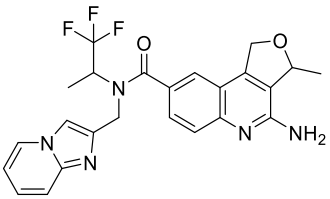
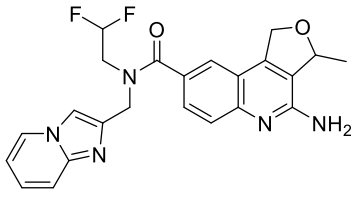
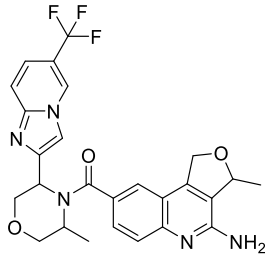
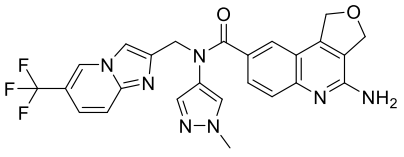
| 53 |  | 54 |  |
| 55 |  | 56 |  |
| 57 |  | 58 |  |
| 59 |  | 60 |  |
| 61 |  | 62 |  |
| 63 |  | 64 |  |
| 65 |  | 66 |  |
| 67 |  | 68 |  |

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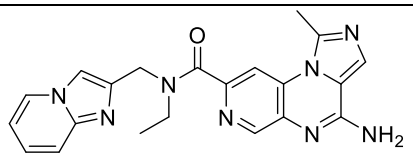
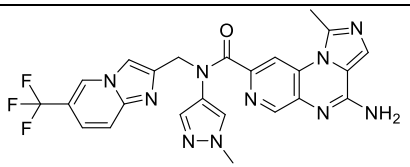
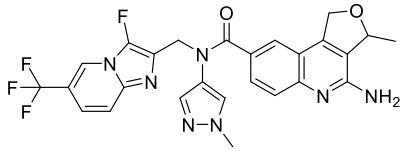
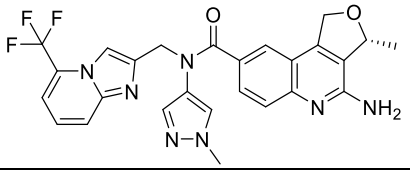
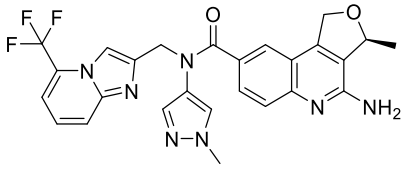
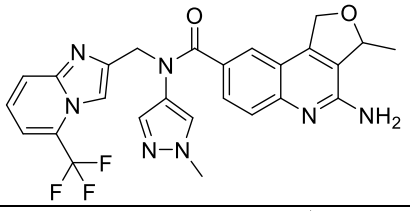
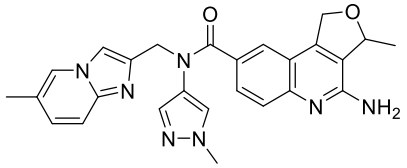
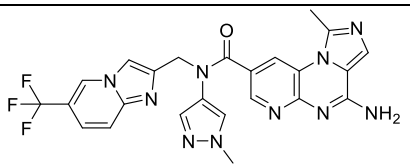
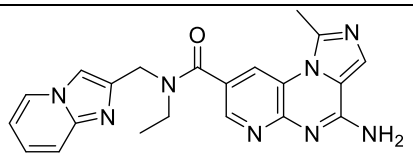
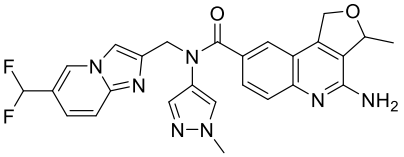
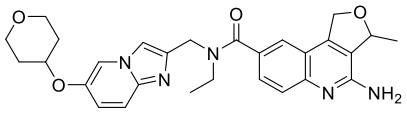
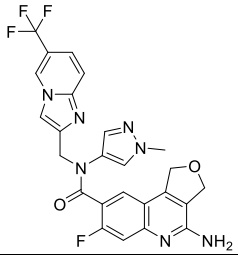
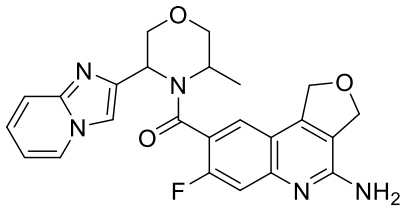
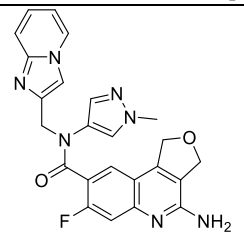
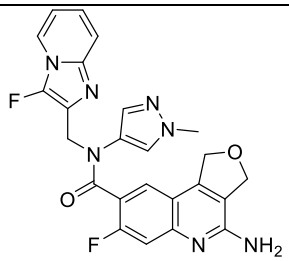
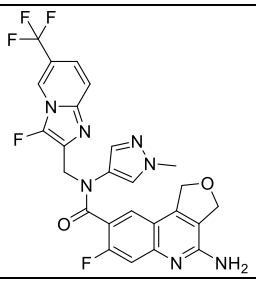
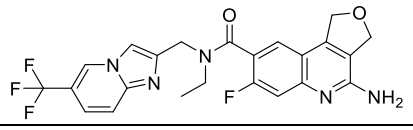
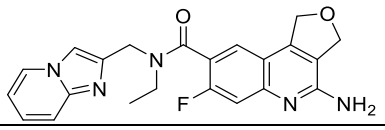
| 69 |  | 70 |  |
| 71 |  | 72 |  |
| 73 |  | 74 |  |
| 75 |  | 76 |  |
| 77 |  | 78 |  |
| 79 |  | 80 |  |
| 81 |  | 82 |  |
| 83 |  | 84 |  |
| 85 |  | 86 |  |

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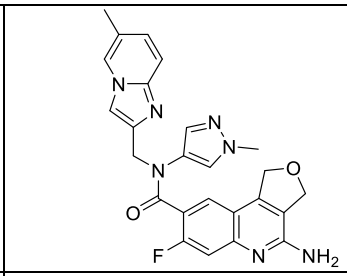
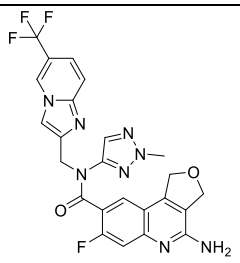
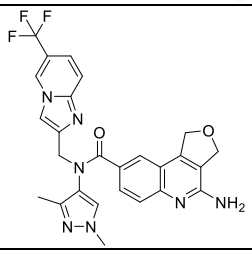
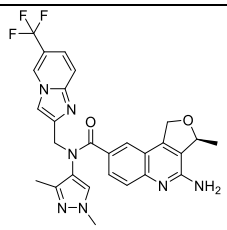
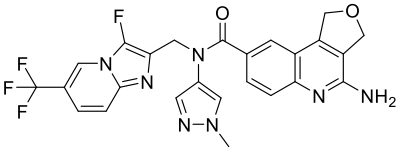
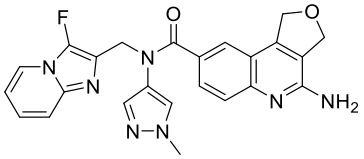
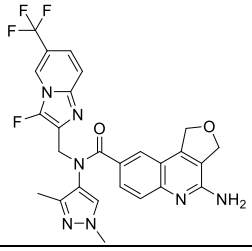
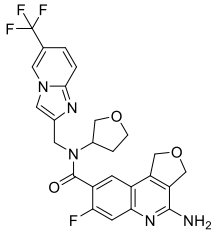
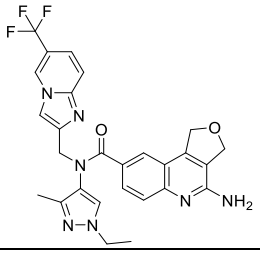
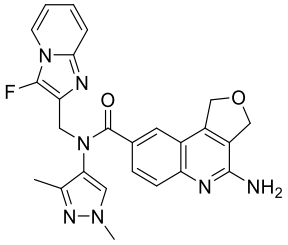
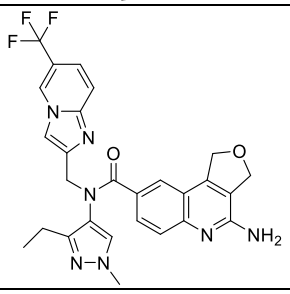
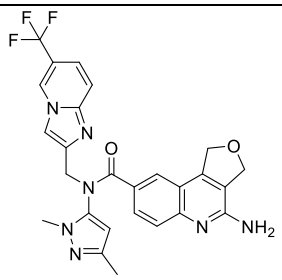
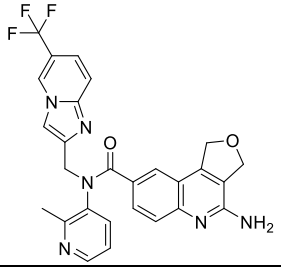
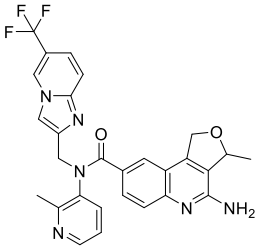
| 87 |  | 88 |  |
| 89 |  | 90 |  |
| 91 |  | 92 |  |
| 93 |  | 94 |  |
| 95 |  | 96 |  |
| 97 |  | 98 |  |
| 99 |  | 100 |  |

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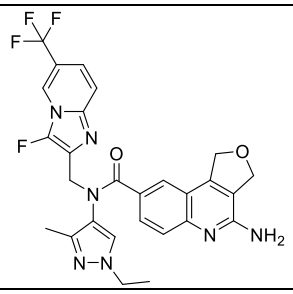
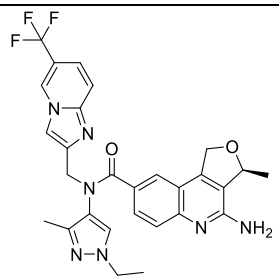
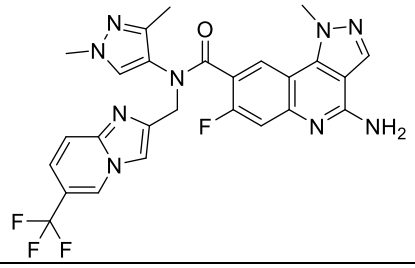
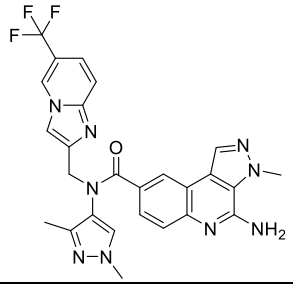
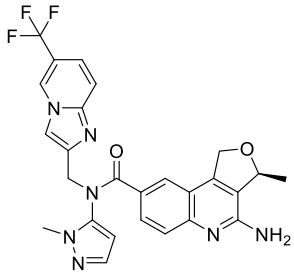
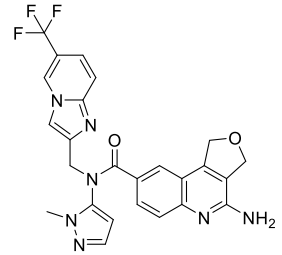
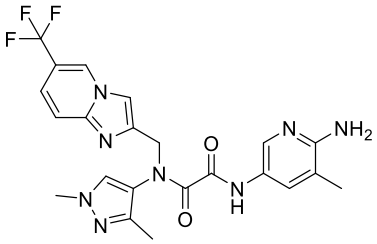
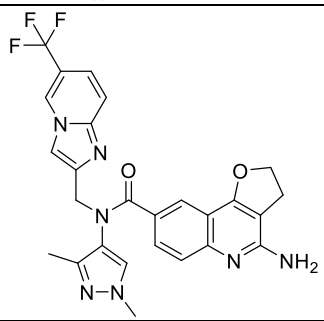
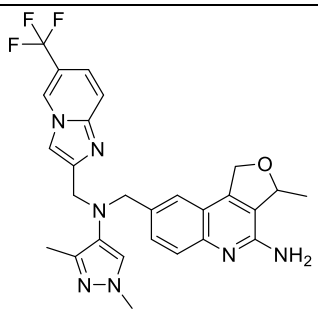
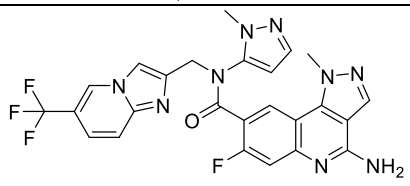
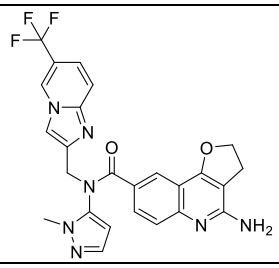
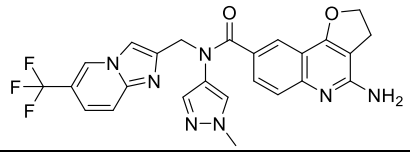
| 101 |  | 102 |  |
| | | 104 |  |
| 105 |  | 106 |  |
| 107 |  | 108 |  |
| 109 |  | 110 |  |
| 111 |  | 112 |  |
| 113 |  | | |

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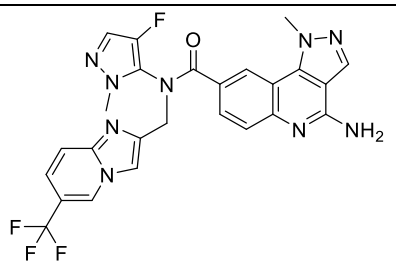
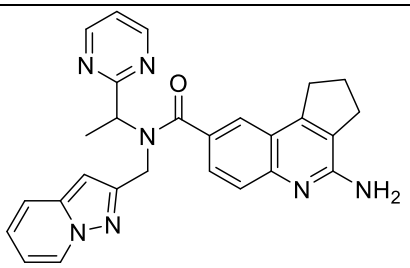
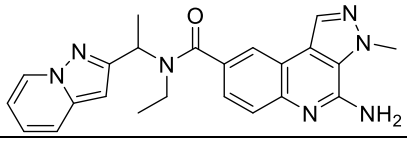
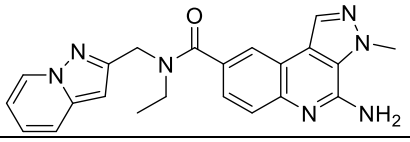
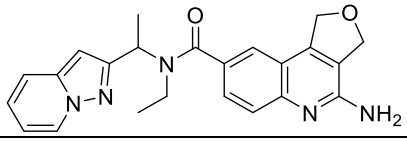
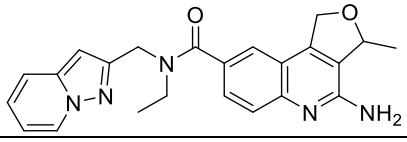
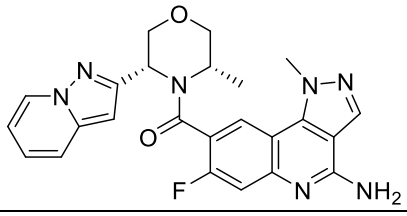
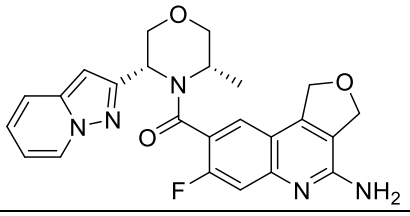
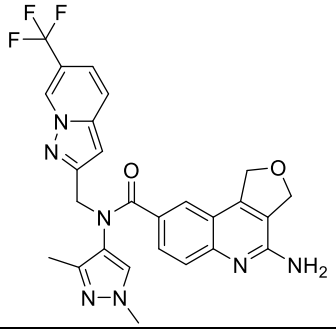
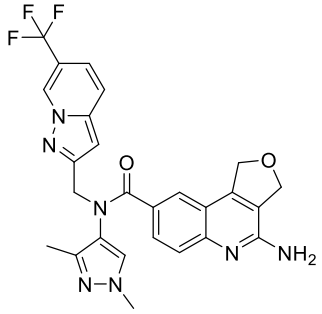
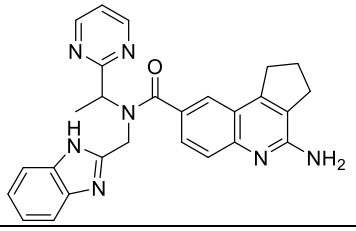
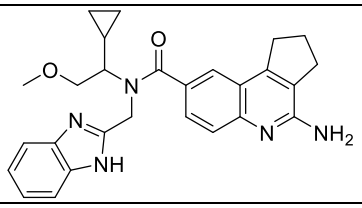
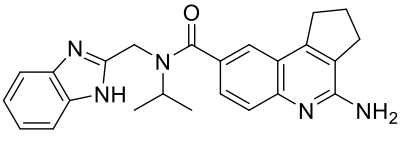
| 115 |  | 116 |  |
| 117 |  | 118 |  |
| 119 |  | | |
| 121 |  | | |
| 123 |  | 124 |  |
| 125 |  | 126 |  |
| | | 128 |  |
| 129 |  | 130 |  |

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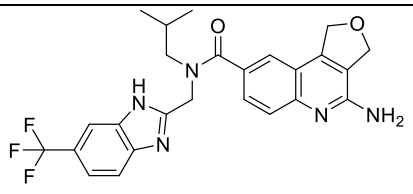
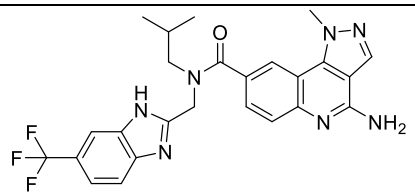
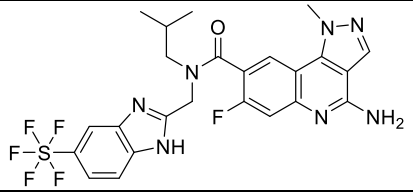
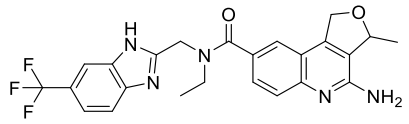
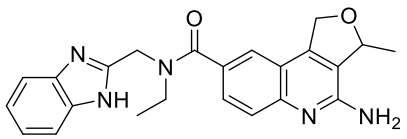
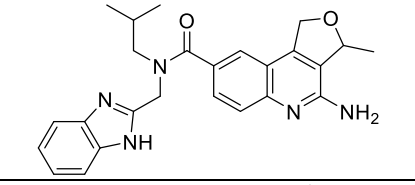
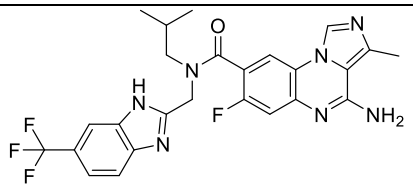
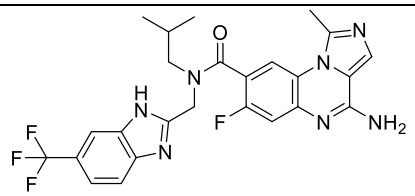
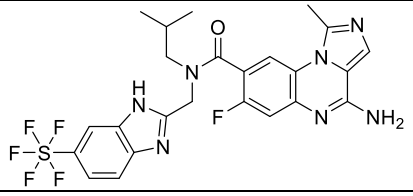
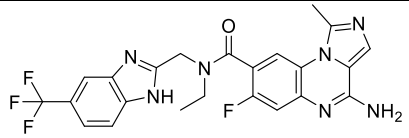
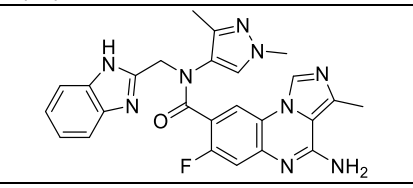
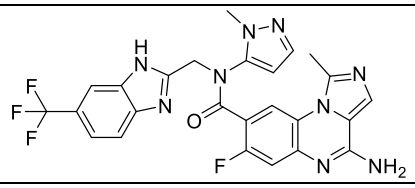
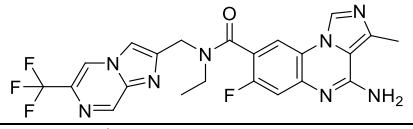
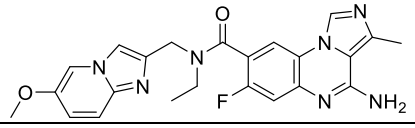
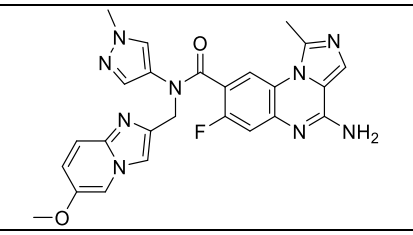
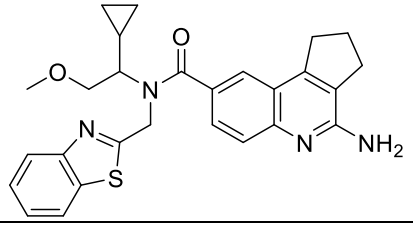
| 131 |  | 132 |  |
| 133 |  | 134 |  |
| 135 |  | 136 |  |
| 137 |  | 138 |  |
| 139 |  | 140 |  |
| 141 |  | 142 |  |
| 143 |  | 144 |  |
| 145 |  | | |
| 147 |  | | |

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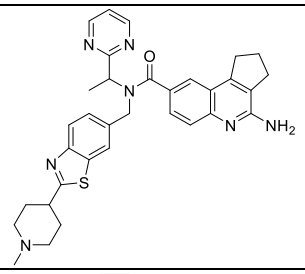
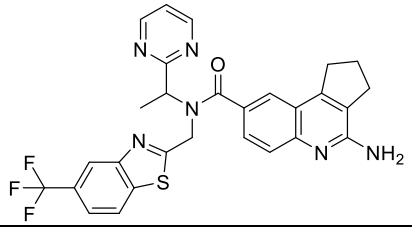
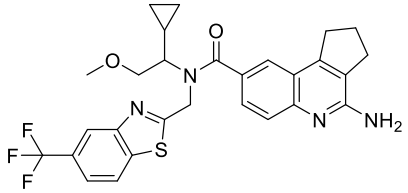
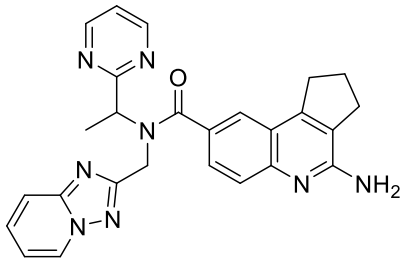
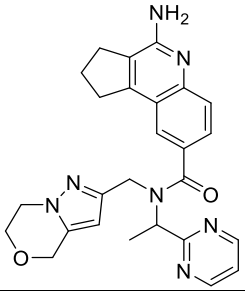
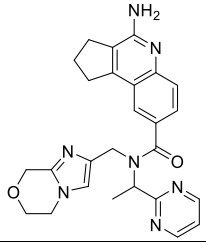
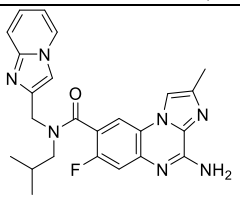
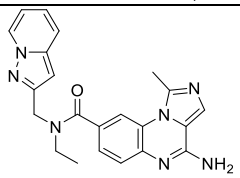
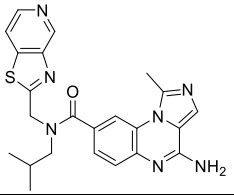
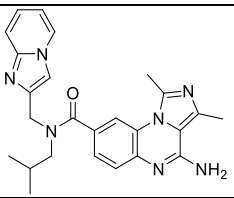
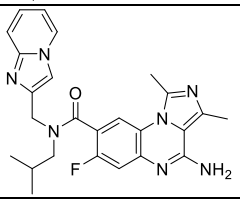
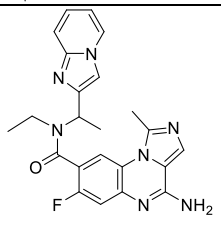
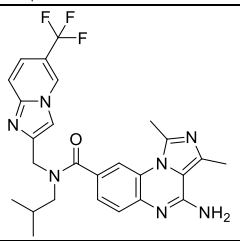
| | | 152 |  |
| 153 |  | 154 |  |
| 155 |  | 156 |  |
| 157 |  | 158 |  |
| 159 |  | 160 |  |
| 161 |  | 162 |  |
| 163 |  | 164 |  |

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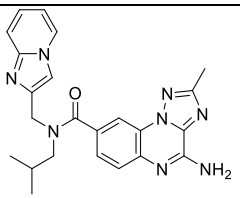
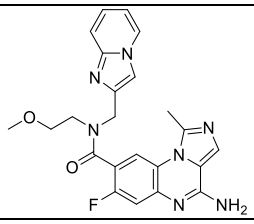
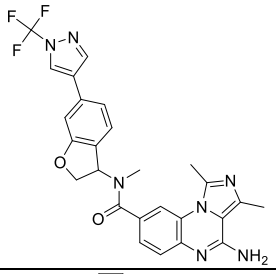
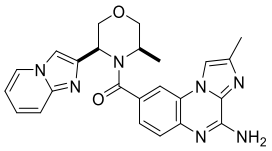
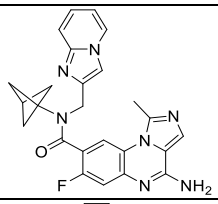
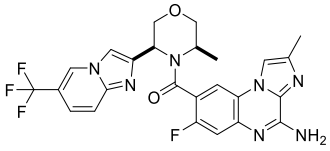
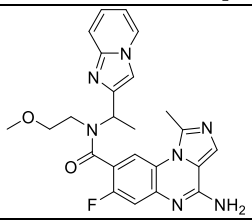
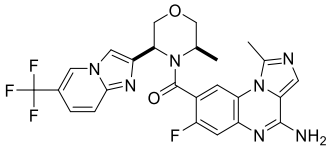
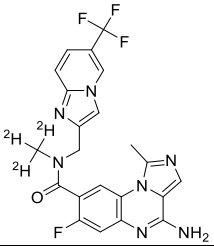
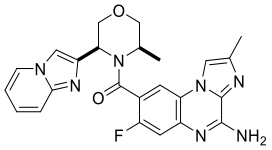
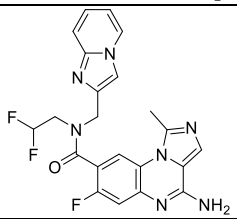
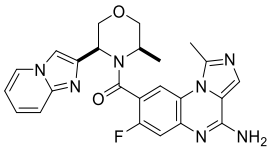
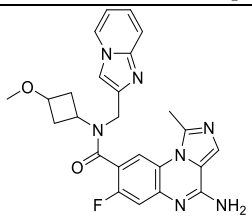
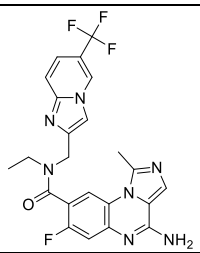
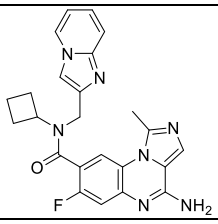
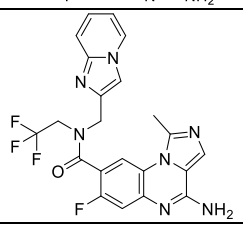
| 165 |  | 166 |  |
| 167 |  | 168 |  |
| 169 |  | 170 |  |
| 171 |  | 172 |  |
| 173 |  | 174 |  |
| 175 |  | 176 |  |
| 177 |  | 178 |  |
| 179 |  | 180 |  |

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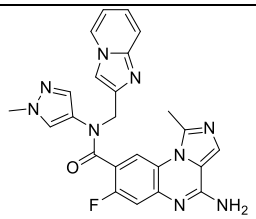
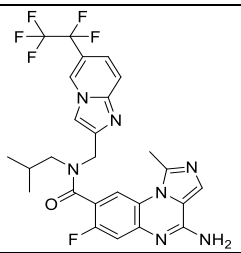
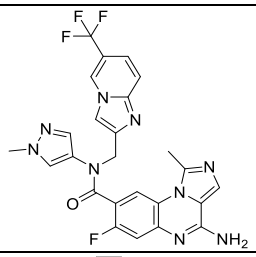
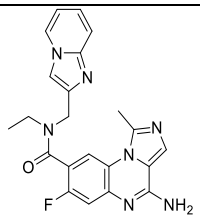
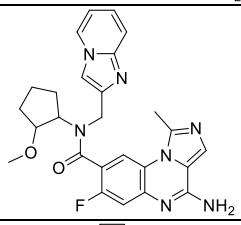
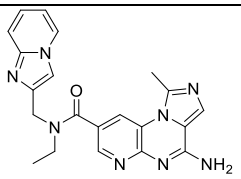
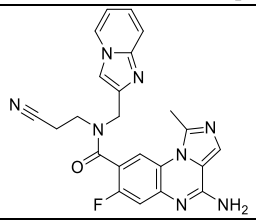
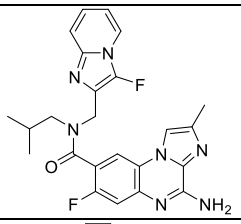
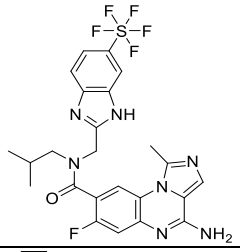
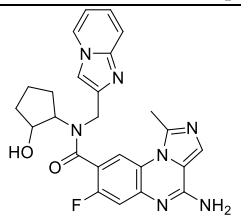
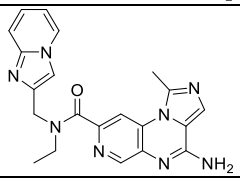
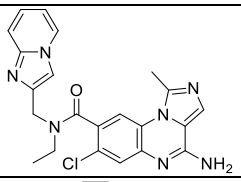
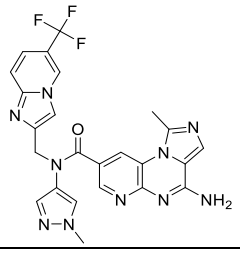
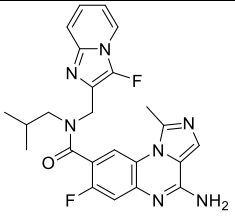
| 181 |  | 182 |  |
| 183 |  | 184 |  |
| 185 |  | 186 |  |
| 187 |  | 188 |  |
| 189 |  | 190 |  |
| 191 |  | 192 |  |
| 193 |  | 194 |  |

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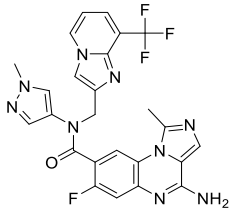
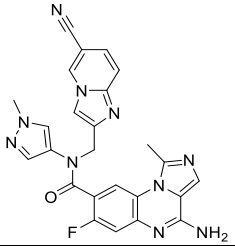
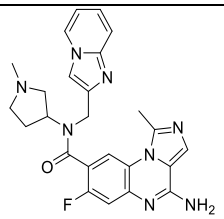
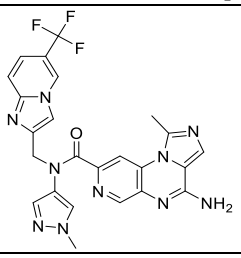
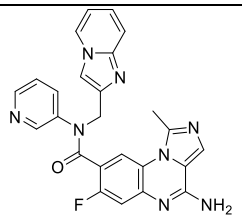
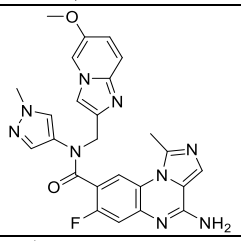
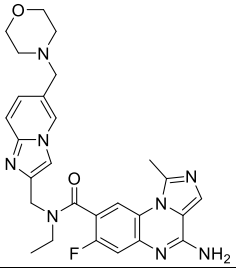
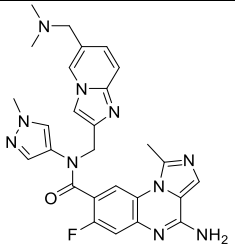
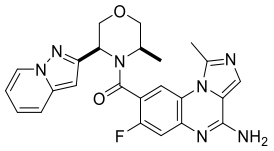
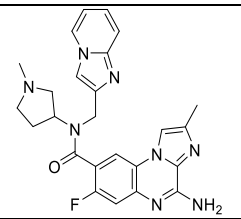
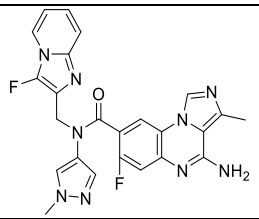
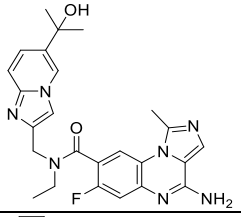
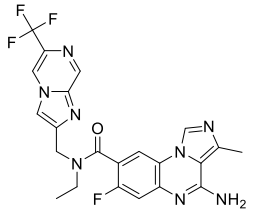
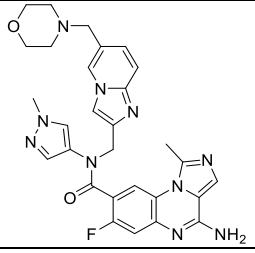
| 195 |  | 196 |  |
| 197 |  | 198 |  |
| 199 |  | 200 |  |
| 201 |  | 202 |  |
| 203 |  | 204 |  |
| 205 |  | 206 |  |
| 207 |  | 208 |  |

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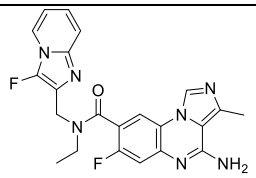
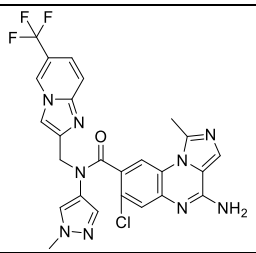
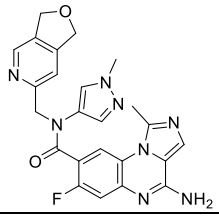
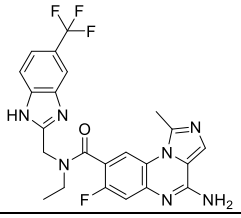
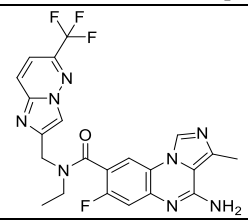
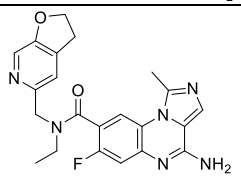
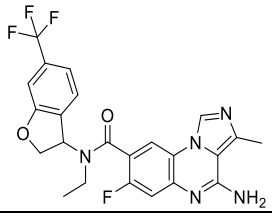
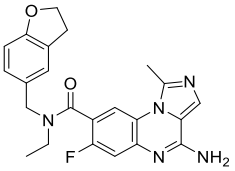
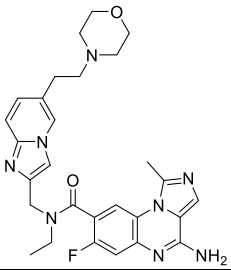
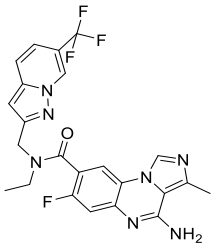
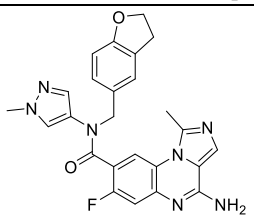
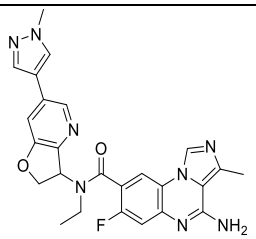
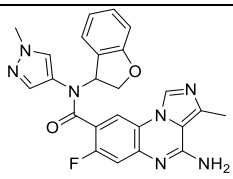
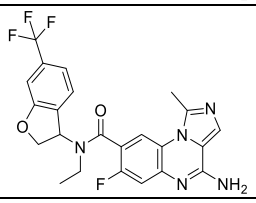
| 209 |  | 210 |  |
| 211 |  | 212 |  |
| 213 |  | 214 |  |
| 215 |  | 216 |  |
| 217 |  | 218 |  |
| 219 |  | 220 |  |
| 221 |  | 222 |  |

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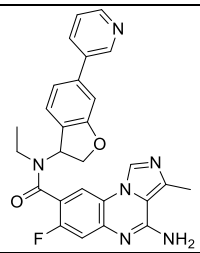
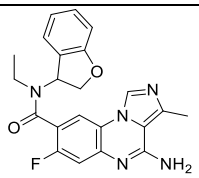
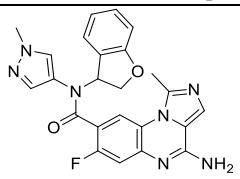
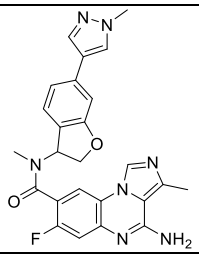
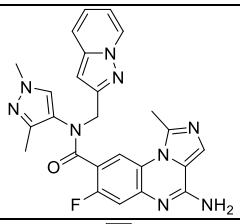
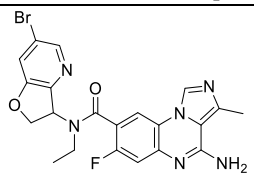
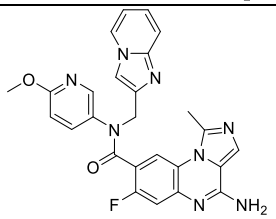
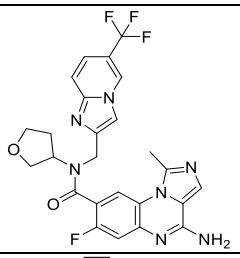
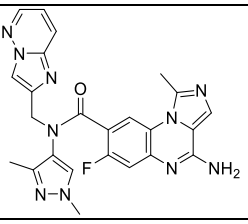
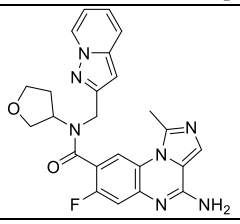
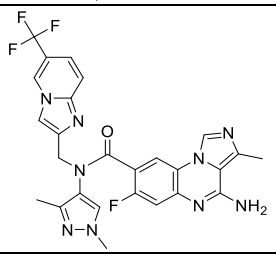
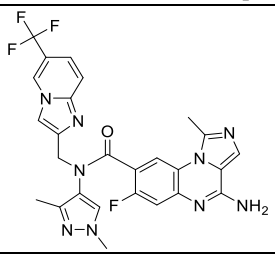
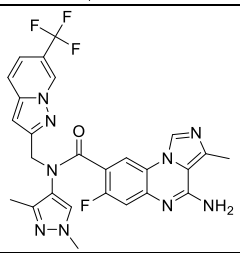
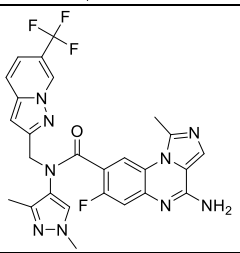
| 223 |  | 224 |  |
| 225 |  | 226 |  |
| 227 |  | 228 |  |
| 229 |  | 230 |  |
| 231 |  | 232 |  |
| 233 |  | 234 |  |
| 235 |  | 236 |  |

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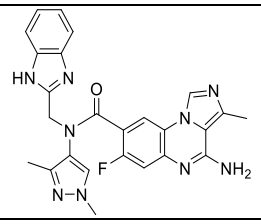
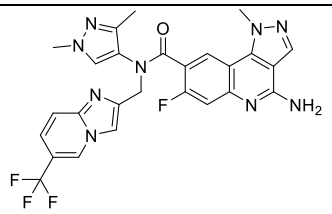
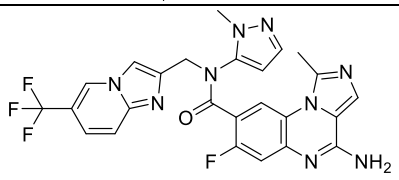
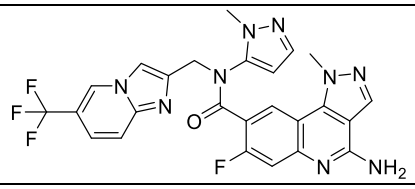
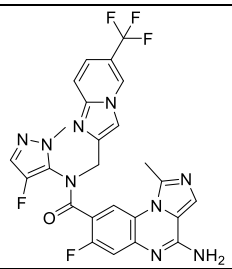
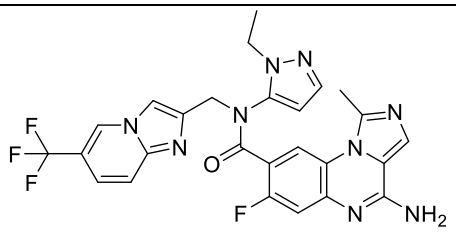
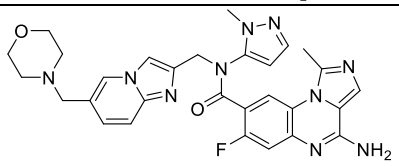
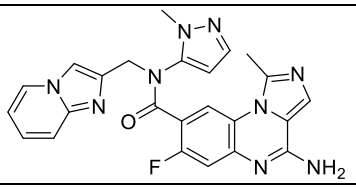
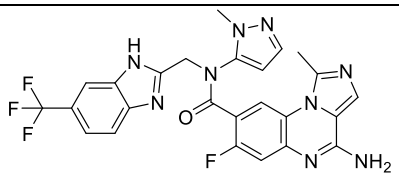
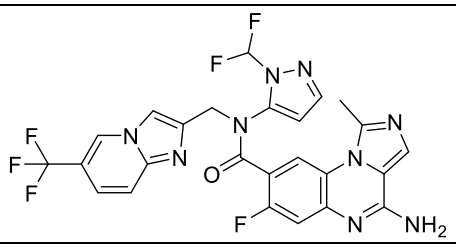
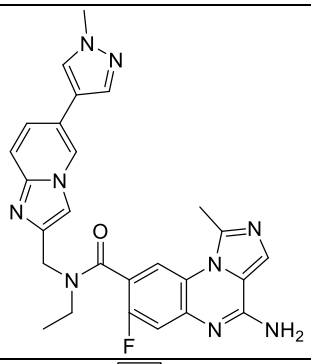
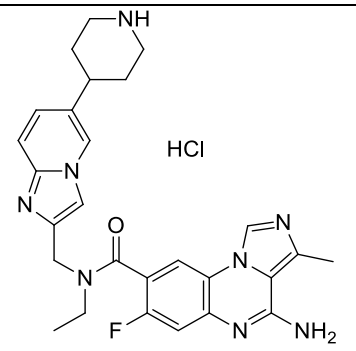
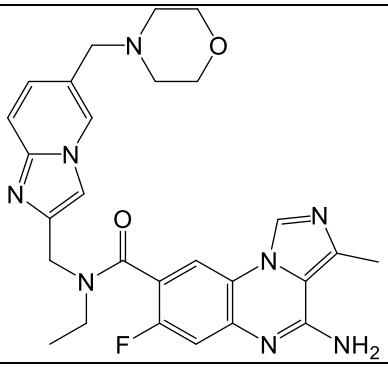
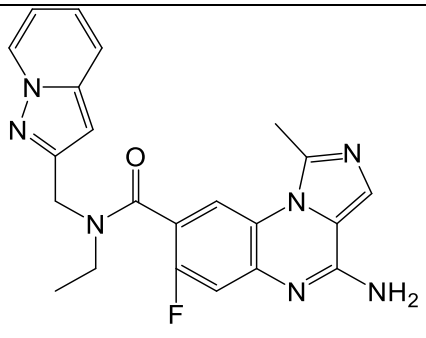
| 237 |  | 238 |  |
| 239 |  | 240 |  |
| 241 |  | 242 |  |
| 243 |  | 244 |  |
| 245 |  | 246 |  |
| 247 |  | 248 |  |
| 249 |  | 250 |  |

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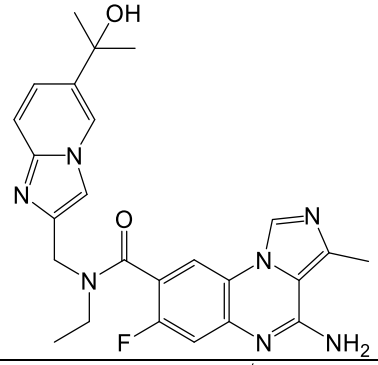
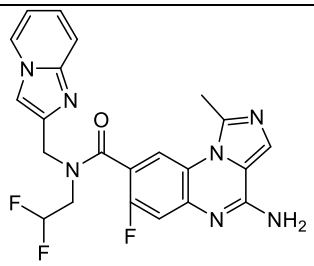
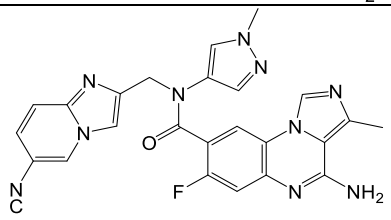
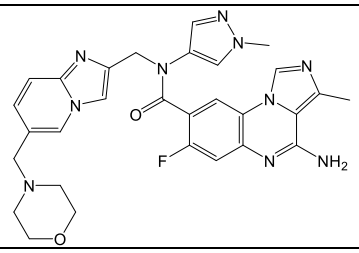
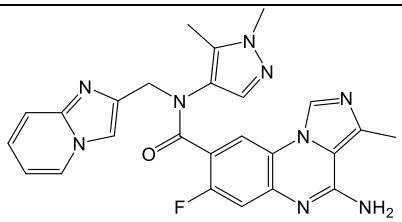
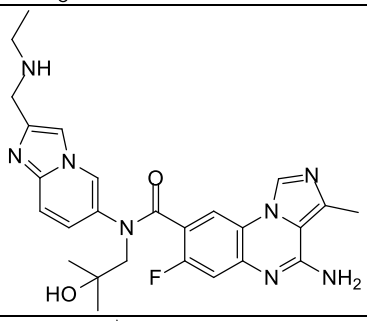
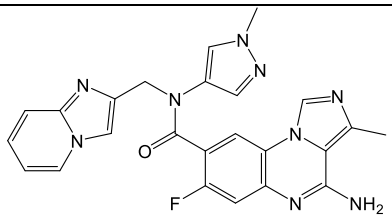
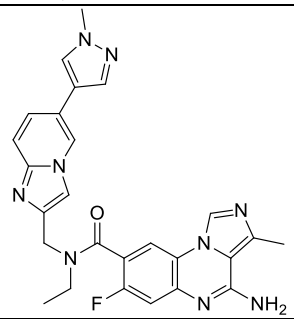
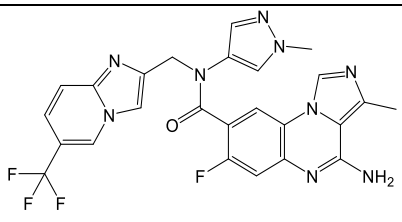
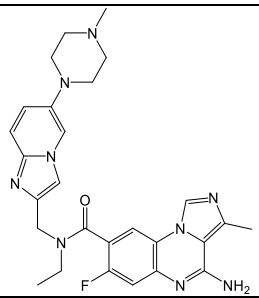
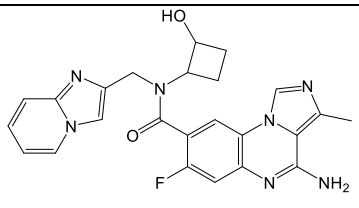
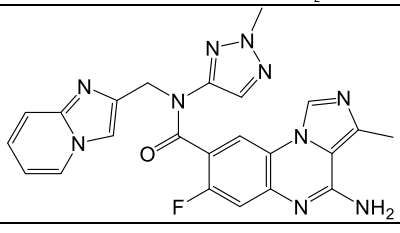
| 251 |  | 252 |  |
| 253 |  | 254 |  |
| 255 |  | 256 |  |
| 257 |  | 258 |  |
| 259 |  | 260 |  |
| 261 |  | 262 |  |

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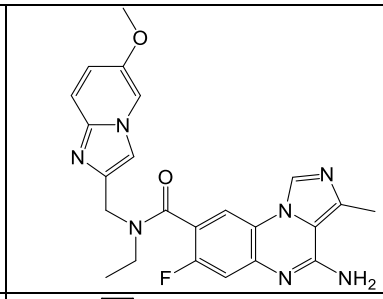
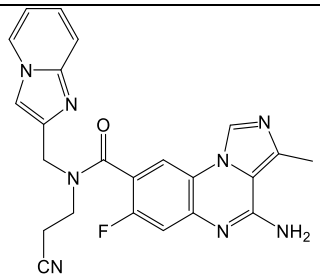
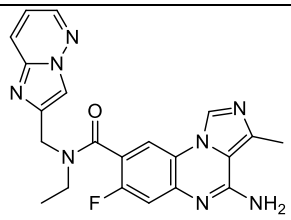
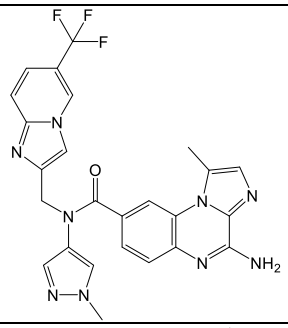
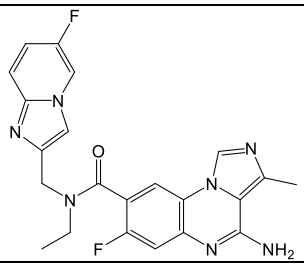
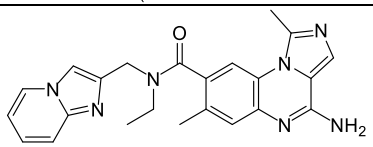
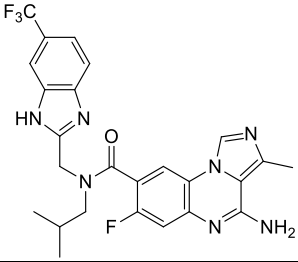
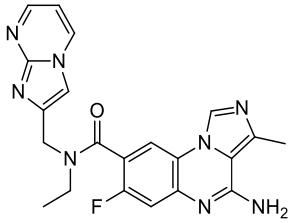
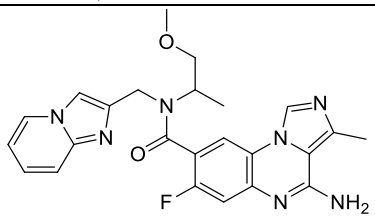
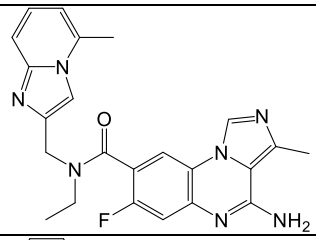
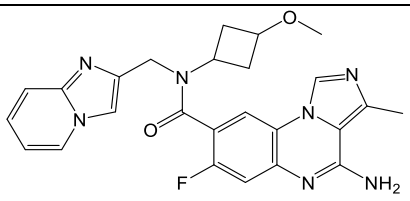
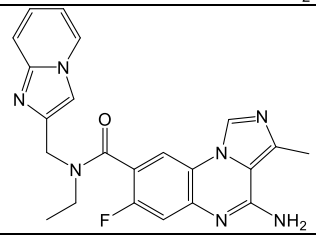
| 263 |  | 264 |  |
| 265 |  | 266 |  |
| 267 |  | 268 |  |
| 269 |  | 270 |  |
| 271 |  | 272 |  |
| 273 |  | 274 |  |

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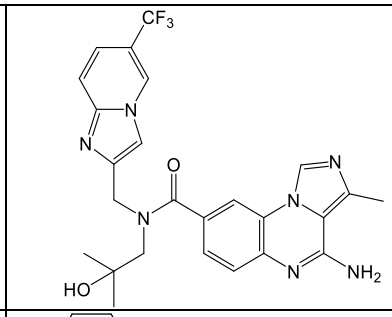
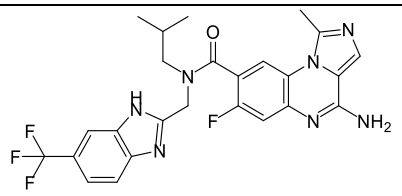
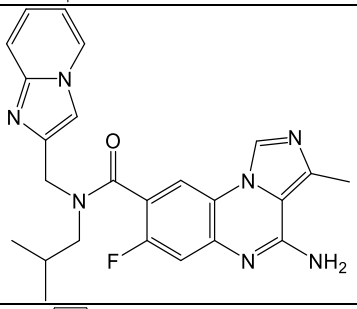
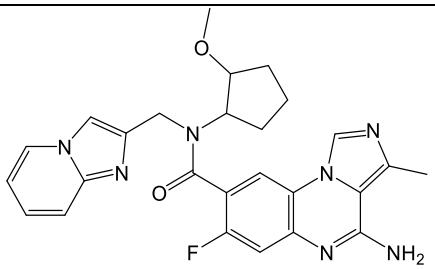
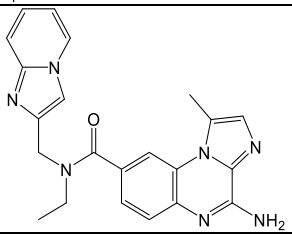
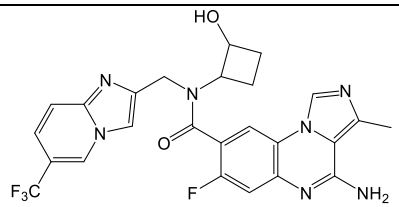
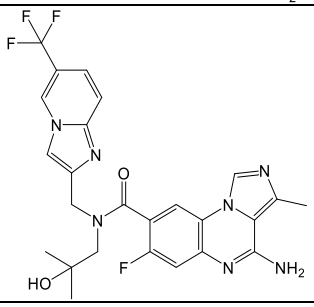
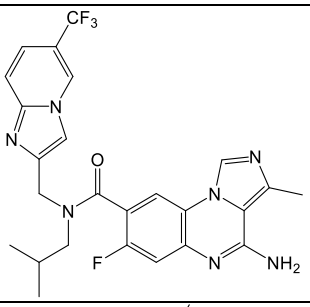
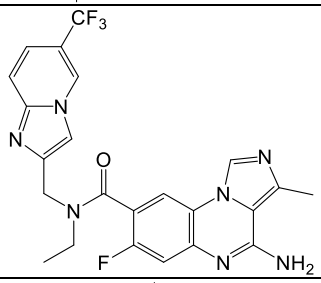
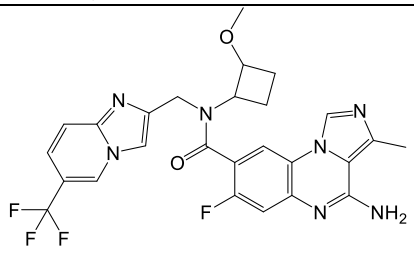
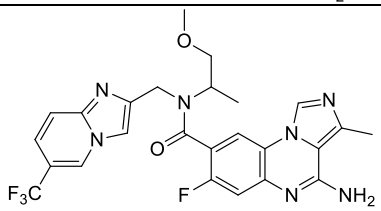
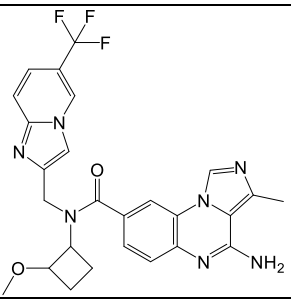
| 275 |  | 276 |  |
| 277 |  | 278 |  |
| 279 |  | 280 |  |
| 281 |  | 282 |  |
| 283 |  | 284 |  |
| 285 |  | 286 |  |

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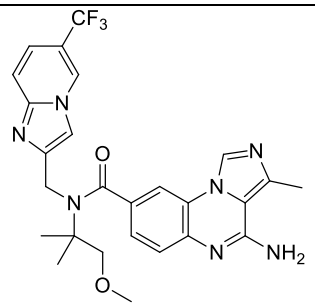
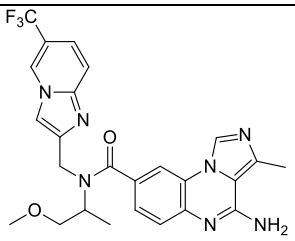
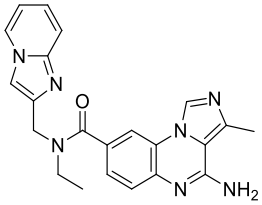
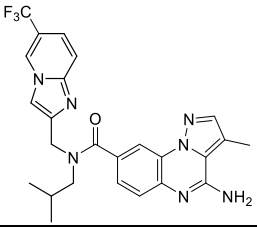
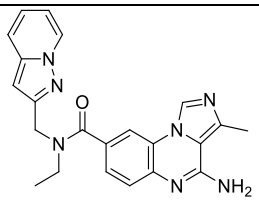
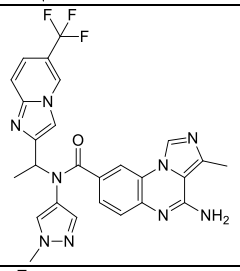
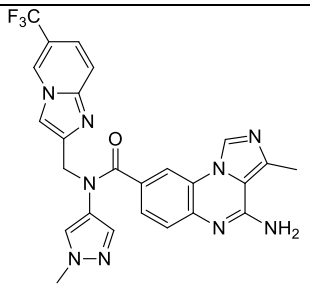
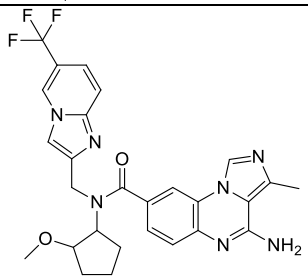
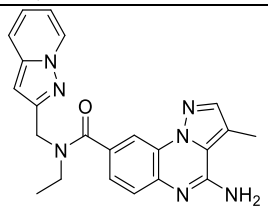
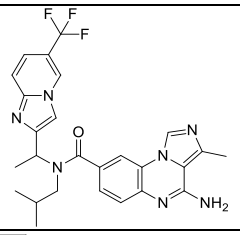
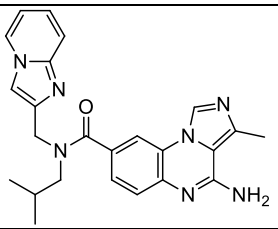
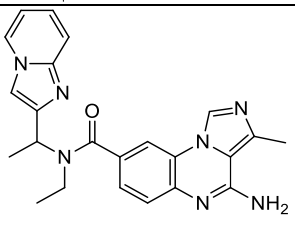
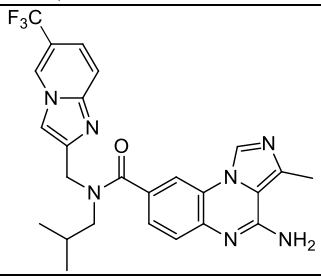
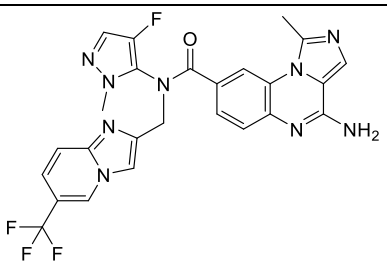
| 287 |  | 288 |  |
| 289 |  | 290 |  |
| 291 |  | 292 |  |
| 293 |  | 294 |  |
| 295 |  | 296 |  |
| 297 |  | 298 |  |
| 299 |  | 300 |  |

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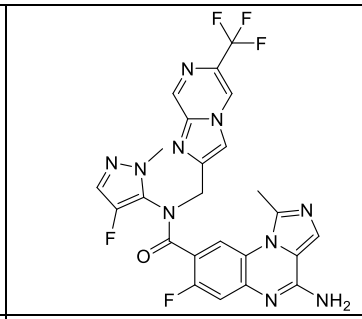
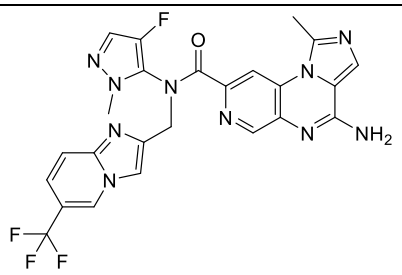
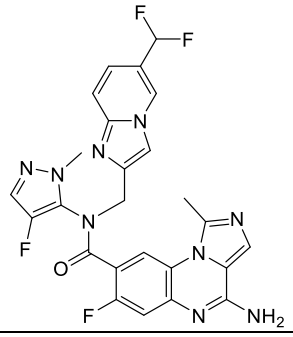
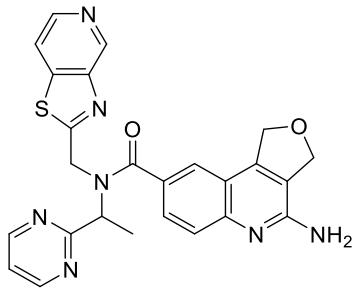
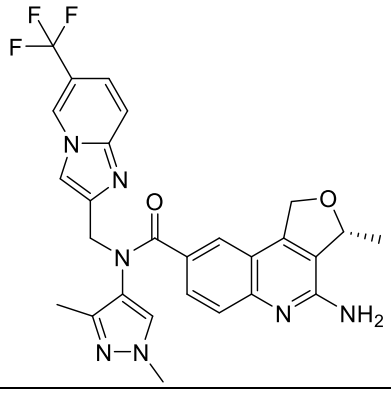
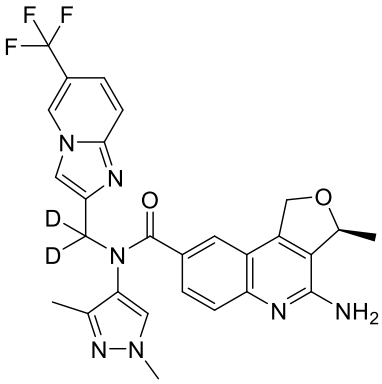
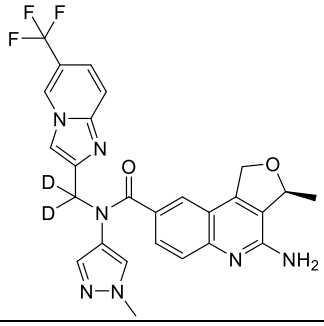
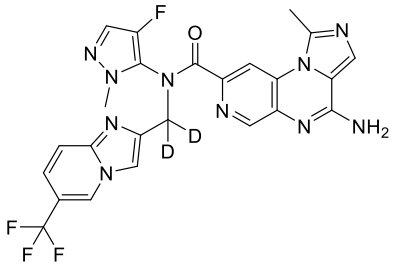
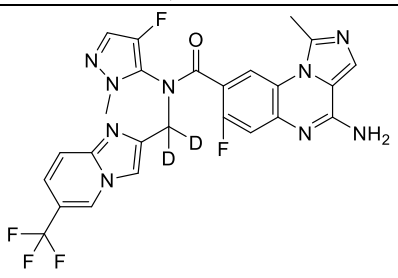
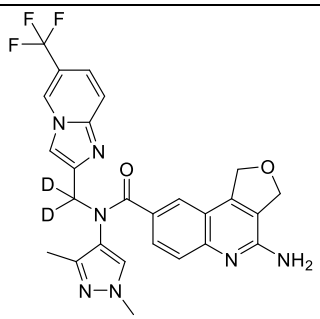
| 301 |  | 302 |  |
| 303 |  | 304 |  |
| 305 |  | 306 |  |
| 307 |  | 308 |  |
| 309 |  | 310 |  |

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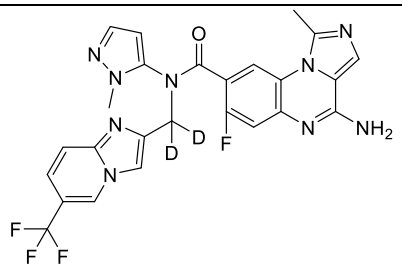
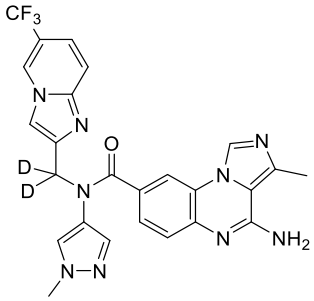
| 311 |  | 312 |  |

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12. A pharmaceutical composition comprising a therapeutically effective amount of one or more of the compounds according to any one of claims 1-11, a pharmaceutically acceptable salt, a racemate, an optical isomer, a stereoisomer, or a tautomer thereof, and one or more pharmaceutically acceptable carriers, excipients, adjuvants, accessories, and/or diluents.

13. A use of the compound according to any one of claims 1-11, a racemate, a stereoisomer, or a pharmaceutically acceptable salt thereof in the preparation of drugs for the treatment or prevention of diseases associated with abnormal gene levels or abnormal expression of PRMT5(such as corresponding nucleic acid mutations, deletions, or abnormal MTAP gene level, or the methyltransferase is ectopic or fused or overexpressed).

14. The use according to claim 13, wherein, the disease is selected from the group consisting of: the disease or disorder ovarian cancer, esophageal cancer, lung cancer, lymphatic cancer, glioblastoma, colon cancer, melanoma, gastric cancer, pancreatic cancer or bladder cancer.