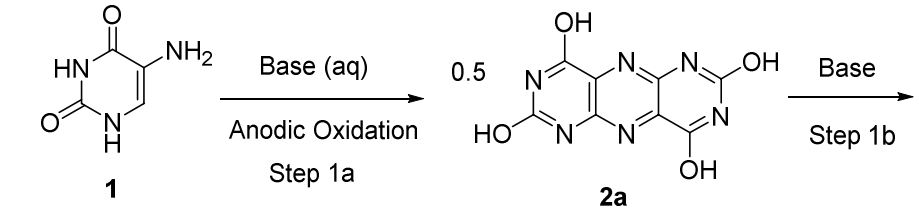
CLAIMS:

1. A process for preparing divalent salts of pyrimido[4,5-*g*]pteridine-2,4,7,9-tetraol, Compound 2, the process comprising step 1a directed to anodic oxidation of 5-aminopyrimidine-2,4(*1H,3H*)-dione, Compound 1, in the presence of an aqueous base to form pyrimido[4,5-*g*]pteridine-2,4,7,9-tetraol, Compound 2a, followed by step 1b directed to treatment of compound 2a with a base to form Compound 2 as follows:

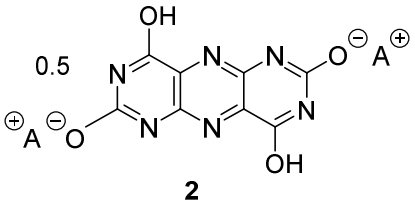


1

5-aminopyrimidine-2,4(1*H*,3*H*)-dione

2a

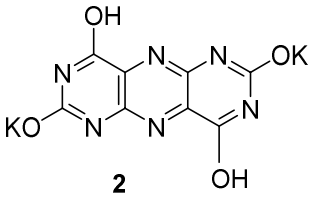
pyrimido[4,5-*g*]pteridine-2,4,7,9-tetraol



2

wherein A^+ is a monovalent cation.

2. The process of claim 1, wherein the base in step 1b is KOH and compound 2 is potassium 4,9-dihydroxypyrimido[4,5-g]pteridine-2,7-bis(olate) of the structure:



2

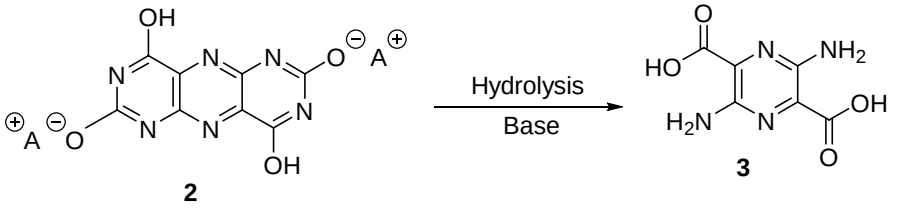
.

3. The process of claim 1, wherein steps 1a and 1b are done in an electrochemical cell.

4. The process of claim 3, wherein the electrochemical cell comprises divided cells.

5. The process of claim 3, wherein the electrochemical cell comprises undivided cells.

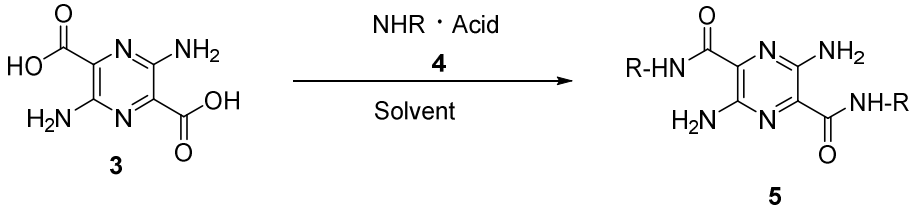
6. The process of claim 1, further comprising hydrolyzing Compound 2, in the presence of a base to form 3,6-diaminopyrazine-2,5-dicarboxylic acid, Compound 3, as follows:



2 **3**

3,6-diaminopyrazine-2,5-dicarboxylic acid .

7. The process of claim 6, further comprising reacting 3,6-diaminopyrazine-2,5-dicarboxylic acid with an acid salt of NHR, Compound 4, to form Compound 5, as follows:



3 **5**

3,6-diaminopyrazine-2,5-dicarboxylic acid

wherein each NHR is independently

(i) a polypeptide chain that includes one or more natural or unnatural α-amino acids linked together by peptide bonds, or

(ii) $NH(R^1)$ wherein:

each R^1 is independently -
$(CH_2)_a(CH_2CH_2O)_b(CH_2)_cNR^{10}CONR^{11}(CH_2)_d(CH_2CH_2O)_eR^{20}$, -
$(CH_2)_a(CH_2CH_2O)_b(CH2)_cNR^{12}CSNR^{13}(CH_2)_d(CH_2CH_2O)_eR^{21}$, -
$(CH_2)_a(CH_2CH_2O)_b(CH_2)_cCONR^{14}(CH_2)_d(CH_2CH_2O)_eR^{22}$, -
$(CH_2)_a(CH_2CH_2O)_b(CH_2)_cNR^{15}SO_2(CH_2)_d(CH_2CH_2O)_eR^{23}$, -
$(CH_2)_a(CH_2CH_2O)_b(CH_2)_cSO_2NR^{16}(CH_2)_d(CH_2CH_2O)_eR^{24}$, -

$(CH2)_a(CH_2CH_2O)_b(CH_2)_cNR^{17}CO(CH_2)_d(CH_2CH_2O)_eR^{25}$, -
$(CH2)_a(CH_2CH_2O)_b(CH_2)_cNR^{18}CO_2(CH_2)_d(CH_2CH_2O)_eR^{26}$, or -
$(CH_2)_a(CH_2CH_2O)_b(CH_2)_cOC(O)NR^{19}CO_2(CH_2)_d(CH_2CH_2O)_eR^{27}$; $-(CH_2)_cOR^{68}$, -
$CH_2(CHOH)_cR^{69}$, $-CH_2(CHOH)_cCO_2H$, $-(CHCO_2H)_cCO_2H$, $-(CH_2)_cNR^{70}R^{71}$, -
$CH[(CH_2)_fNH_2]_cCO_2H$, $-CH[(CH_2)_fNH_2]_cCH_2OH$, $-CH_2(CHNH_2)_cCH2NR^{72}R^{73}$, -
$(CH_2CH_2O)_eR^{74}$, $-(CH_2)_tCO(CH_2CH_2O)_eR^{75}$, -
$(CH_2)_u(CH_2CH_2O)_j(CH_2)_kNR^{58}C(O)NR^{59}(CH_2)_l(CH_2CH_2O)_oR^{76}$, -
$(CH_2)_u(CH_2CH_2O)_j(CH_2)_kNR^{60}C(S)NR^{61}(CH_2)_l(CH_2CH_2O)_oR^{77}$, -
$(CH_2)_u(CH_2CH_2O)_j(CH_2)_kC(O)NR^{62}(CH_2)_l(CH_2CH_2O)_oR^{78}$, -
$(CH_2)_u(CH_2CH_2O)_j(CH_2)_kS(O)_2NR^{63}(CH_2)_l(CH_2CH_2O)_oR^{79}$, -
$(CH_2)_u(CH_2CH_2O)_j(CH_2)_kNR^{64}S(O)_2(CH_2)_l(CH_2CH_2O)_oR^{80}$, -
$(CH_2)_u(CH_2CH_2O)_j(CH_2)_kNR^{65}C(O)(CH_2)_l(CH_2CH_2O)_oR^{81}$, -
$(CH_2)_u(CH_2CH_2O)_j(CH_2)_kNR^{66}C(O)O(CH_2)_l(CH_2CH_2O)_oR^{82}$, or -
$(CH_2)_u(CH_2CH_2O)_j(CH_2)_kOC(O)NR^{67}(CH_2)_l(CH_2CH_2O)_oR^{83}$, $-(CH_2)_aSO_3H$, $-(CH_2)_aSO_3^-$, -
$(CH_2)_aOSO_3H$, $-(CH_2)_aOSO_3^-$, $-(CH_2)_aNHSO_3H$, $-(CH_2)_aNHSO_3^-$, $-(CH_2)_aPO_3H_2$, -
$(CH_2)_aPO_3H^-$, $-(CH_2)_aPO_3^=$, $-(CH_2)_aOPO_3H_2$, $-(CH_2)_aOPO_3H^-$, or $-(CH_2)_aOPO_3^{2-}$;

each of R^{10}, R^{11}, R^{12}, R^{13}, R^{14}, R^{15}, R^{16}, R^{17}, R^{18}, R^{19}, R^{58}, R^{59}, R^{60}, R^{61}, R^{62}, R^{63}, R^{64}, R^{65}, R^{66} and R^{67} is independently -H or $-CH_3$;

each of R^{20}, R^{21}, R^{22}, R^{23}, R^{24}, R^{25}, R^{26}, and R^{27} is independently -H, $-CH_3$, -
$(CH_2)_fNR^{28}C(O)NR^{29}(CH_2)_g(CH_2CH_2O)_hR^{38}$, $-(CH_2)_fNR^{30}CSNR^{31}(CH_2)_g(CH_2CH_2O)_hR^{39}$,
$-(CH_2)_fC(O)NR^{32}(CH_2)_g(CH_2CH_2O)_hR^{40}$, $-(CH_2)_fS(O)_2NR^{33}(CH_2)_g(CH_2CH_2O)_hR^{41}$, -
$(CH_2)_fNR^{34}S(O)_2(CH_2)_g(CH_2CH_2O)_hR^{42}$, $-(CH_2)_fNR^{35}C(O)(CH_2)_g(CH_2CH_2O)_hR^{43}$, -
$(CH_2)_fNR^{36}C(O)O(CH_2)_g(CH_2CH_2O)_hR^{44}$, $-(CH_2)_fOC(O)NR^{37}(CH_2)_g(CH_2CH_2O)_hR^{45}$, -
CO(AA), or -CONH(PS);

each of R^{28}, R^{29}, R^{30}, R^{31}, R^{32}, R^{33}, R^{34}, R^{35}, R^{36}, R^{37}, R^{38}, R^{39}, R^{40}, R^{41}, R^{42}, R^{43}, R^{44}, and R^{45} is independently -H or $-CH_3$; each of R^{68}, R^{69}, R^{70}, R^{71}, R^{72}, R^{73}, R^{74}, R^{75}, R^{76}, R^{77}, R^{78}, R^{79}, and R^{80} is independently -H, $-CH_3$, $-(CH_2)_pS(O)_2NR^{84}(CH_2)_q(CH_2CH_2O)_sR^{81}$,
$-(CH_2)_pNR^{85}S(O)_2(CH_2)_q(CH_2CH_2O)_sR^{83}$, $-(CH_2)_pNR^{86}C(O)(CH_2)_q(CH_2CH_2O)_sR^{85}$, -
$(CH_2)_pNR^{86}C(O)O(CH_2)_q(CH_2CH_2O)_sR^{87}$, or $-(CH_2)_pOC(O)NR^{88}(CH_2)_q(CH_2CH_2O)_sR^{89}$;

each of R^{81}, R^{82}, R^{83}, R^{84}, R^{85}, R^{86}, R^{87}, R^{88}, and R^{89} is independently -H or $-CH_3$;

each (AA) is independently a polypeptide chain that includes one or more natural or unnatural α-amino acids linked together by peptide bonds;

each (PS) is independently a sulfated or non-sulfated polysaccharide chain comprising one or more monosaccharide units connected by glycosidic linkages;

each of t and u is independently 1, 2, 3, 4, or 5;

each of a, d, g, l, and q is independently 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10;

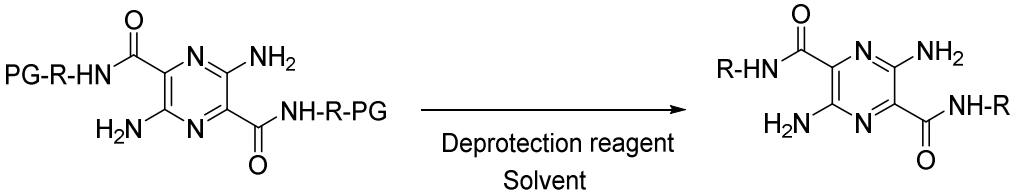
each of c, f, k, and p is independently 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10; and

each of b, j, e, h, o, and s is independently 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99 or 100,

wherein each NHR moiety optionally comprises a protecting group.

8. The process of claim 7, wherein NHR is *D*-serine comprising a benzyl protecting group.

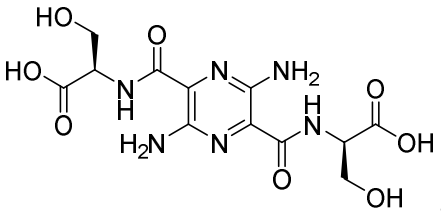
9. The process of claim 7, wherein each NHR moiety comprises a protecting group, PG, and wherein said protecting group is cleaved to form compound 6 as follows:



5 6

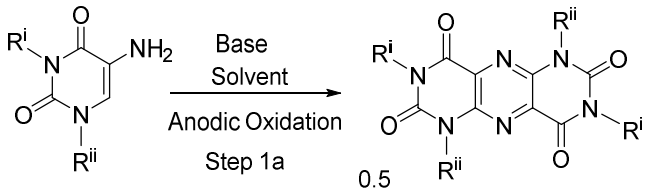
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10. The process of claim 9, wherein NHR is *D*-serine and compound 6 is (2R,2'R)-2,2'-((3,6-diaminopyrazine-2,5-dicarbonyl)bis(azanediyl))bis(3-hydroxypropanoic acid) of the following structure:



.

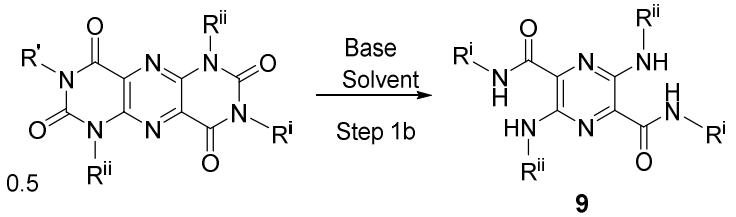
11. A process for preparing a substituted pteridine compound, the process comprising step 1a directed to anodic oxidation of compound 7, or a salt thereof, in the presence of a base and a solvent to form compound 8, or a salt thereof, as follows:



7 **8**

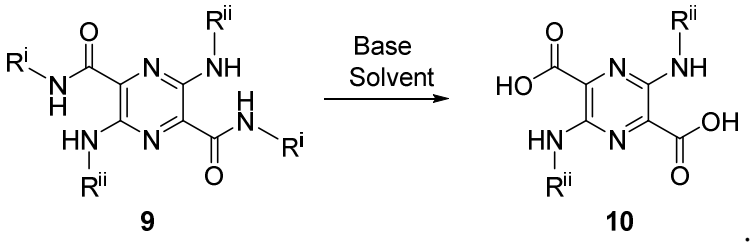
wherein R^i and R^{ii} are independently selected from: hydrogen, where only one of R^i and R^{ii} may be hydrogen; optionally substituted alkyl; optionally substituted ester; optionally substituted cycloalkyl or optionally substituted heterocycloalkyl; optionally substituted aryl or optionally substituted heteroaryl; optionally substituted alkoxy; optionally substituted -C(O)-alkyl; optionally substituted amino; optionally substituted polyol ethers and optionally substituted polyethers; a polypeptide chain (AA); and polysaccharide chain (PS).

12. The process of claim 11, further comprising step 1b directed to contacting compound 8, or a salt thereof, with a base in the presence of a solvent to form pyrazine compound 9, or a salt thereof, as follows



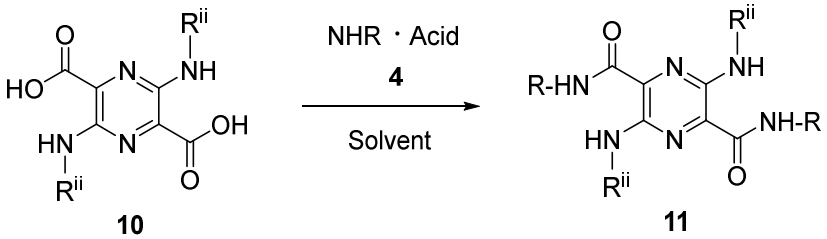
8 **9**

13. The process of claim 12, further comprising contacting compound 9, or a salt thereof, with a base in the presence of a solvent to form pyrazine compound 10, or a salt thereof, as follows



9 10

14. The process of claim 13, further comprising reacting compound 10, or a salt thereof, with NHR acid salt compound 4 in a solvent to form compound 11, or a salt thereof, as follows:



10 11

wherein each NHR is independently

(i) a polypeptide chain that includes one or more natural or unnatural α-amino acids linked together by peptide bonds, or

(ii) NH(R^1) wherein:

each R^1 is independently -
$(CH_2)_a(CH_2CH_2O)_b(CH_2)_cNR^{10}CONR^{11}(CH_2)_d(CH_2CH_2O)_eR^{20}$, -
$(CH_2)_a(CH_2CH_2O)_b(CH2)_cNR^{12}CSNR^{13}(CH_2)_d(CH_2CH_2O)_eR^{21}$, -
$(CH_2)_a(CH_2CH_2O)_b(CH_2)_cCONR^{14}(CH_2)_d(CH_2CH_2O)_eR^{22}$, -
$(CH_2)_a(CH_2CH_2O)_b(CH_2)_cNR^{15}SO_2(CH_2)_d(CH_2CH_2O)_eR^{23}$, -
$(CH_2)_a(CH_2CH_2O)_b(CH_2)_cSO_2NR^{16}(CH_2)_d(CH_2CH_2O)_eR^{24}$, -
$(CH2)_a(CH_2CH_2O)_b(CH_2)_cNR^{17}CO(CH_2)_d(CH_2CH_2O)_eR^{25}$, -
$(CH2)_a(CH_2CH_2O)_b(CH_2)_cNR^{18}CO_2(CH_2)_d(CH_2CH_2O)_eR^{26}$, or -
$(CH_2)_a(CH_2CH_2O)_b(CH_2)_cOC(O)NR^{19}CO_2(CH_2)_d(CH_2CH_2O)_eR^{27}$; -$(CH_2)_cOR^{68}$, -
$CH_2(CHOH)_cR^{69}$, -$CH_2(CHOH)_cCO_2H$, -$(CHCO_2H)_cCO_2H$, -$(CH_2)_cNR^{70}R^{71}$, -
$CH[(CH_2)_fNH_2]_cCO_2H$, -$CH[(CH_2)_fNH_2]_cCH_2OH$, -$CH_2(CHNH_2)_cCH2NR^{72}R^{73}$, -
$(CH_2CH_2O)_eR^{74}$, -$(CH_2)_tCO(CH_2CH_2O)_eR^{75}$, -
$(CH_2)_u(CH_2CH_2O)_j(CH_2)_kNR^{58}C(O)NR^{59}(CH_2)_l(CH_2CH_2O)_oR^{76}$, -
$(CH_2)_u(CH_2CH_2O)_j(CH_2)_kNR^{60}C(S)NR^{61}(CH_2)_l(CH_2CH_2O)_oR^{77}$, -

$(CH_2)_u(CH_2CH_2O)_j(CH_2)_kC(O)NR^{62}(CH_2)_l(CH_2CH_2O)_oR^{78}$, -
$(CH_2)_u(CH_2CH_2O)_j(CH_2)_kS(O)_2NR^{63}(CH_2)_l(CH_2CH_2O)_oR^{79}$, -
$(CH_2)_u(CH_2CH_2O)_j(CH_2)_kNR^{64}S(O)_2(CH_2)_l(CH_2CH_2O)_oR^{80}$, -
$(CH_2)_u(CH_2CH_2O)_j(CH_2)_kNR^{65}C(O)(CH_2)_l(CH_2CH_2O)_oR^{81}$, -
$(CH_2)_u(CH_2CH_2O)_j(CH_2)_kNR^{66}C(O)O(CH_2)_l(CH_2CH_2O)_oR^{82}$, or -
$(CH_2)_u(CH_2CH_2O)_j(CH_2)_kOC(O)NR^{67}(CH_2)_l(CH_2CH_2O)_oR^{83}$, $-(CH_2)_aSO_3H$, $-(CH_2)_aSO_3^-$, -
$(CH_2)_aOSO_3H$, $-(CH_2)_aOSO_3^-$, $-(CH_2)_aNHSO_3H$, $-(CH_2)_aNHSO_3^-$, $-(CH_2)_aPO_3H_2$, -
$(CH_2)_aPO_3H^-$, $-(CH_2)_aPO_3^=$, $-(CH_2)_aOPO_3H_2$, $-(CH_2)_aOPO_3H^-$, or $-(CH_2)_aOPO_3^{2-}$;

each of R^{10}, R^{11}, R^{12}, R^{13}, R^{14}, R^{15}, R^{16}, R^{17}, R^{18}, R^{19}, R^{58}, R^{59}, R^{60}, R^{61}, R^{62}, R^{63}, R^{64}, R^{65}, R^{66} and R^{67} is independently -H or $-CH_3$;

each of R^{20}, R^{21}, R^{22}, R^{23}, R^{24}, R^{25}, R^{26}, and R^{27} is independently -H, $-CH_3$, -
$(CH_2)_fNR^{28}C(O)NR^{29}(CH_2)_g(CH_2CH_2O)_hR^{38}$, $-(CH_2)_fNR^{30}CSNR^{31}(CH_2)_g(CH_2CH_2O)_hR^{39}$,
$-(CH_2)_fC(O)NR^{32}(CH_2)_g(CH_2CH_2O)_hR^{40}$, $-(CH_2)_fS(O)_2NR^{33}(CH_2)_g(CH_2CH_2O)_hR^{41}$, -
$(CH_2)_fNR^{34}S(O)_2(CH_2)_g(CH_2CH_2O)_hR^{42}$, $-(CH_2)_fNR^{35}C(O)(CH_2)_g(CH_2CH_2O)_hR^{43}$, -
$(CH_2)_fNR^{36}C(O)O(CH_2)_g(CH_2CH_2O)_hR^{44}$, $-(CH_2)_fOC(O)NR^{37}(CH_2)_g(CH_2CH_2O)_hR^{45}$, -
CO(AA), or -CONH(PS);

each of R^{28}, R^{29}, R^{30}, R^{31}, R^{32}, R^{33}, R^{34}, R^{35}, R^{36}, R^{37}, R^{38}, R^{39}, R^{40}, R^{41}, R^{42}, R^{43}, R^{44}, and R^{45} is independently -H or $-CH_3$; each of R^{68}, R^{69}, R^{70}, R^{71}, R^{72}, R^{73}, R^{74}, R^{75}, R^{76}, R^{77}, R^{78}, R^{79}, and R^{80} is independently -H, $-CH_3$, $-(CH_2)_pS(O)_2NR^{84}(CH_2)_q(CH_2CH_2O)_sR^{81}$,
$-(CH_2)_pNR^{85}S(O)_2(CH_2)_q(CH_2CH_2O)_sR^{83}$, $-(CH_2)_pNR^{86}C(O)(CH_2)_q(CH_2CH_2O)_sR^{85}$, -
$(CH_2)_pNR^{86}C(O)O(CH_2)_q(CH_2CH_2O)_sR^{87}$, or $-(CH_2)_pOC(O)NR^{88}(CH_2)_q(CH_2CH_2O)_sR^{89}$;

each of R^{81}, R^{82}, R^{83}, R^{84}, R^{85}, R^{86}, R^{87}, R^{88}, and R^{89} is independently -H or $-CH_3$;

each (AA) is independently a polypeptide chain that includes one or more natural or unnatural α-amino acids linked together by peptide bonds;

each (PS) is independently a sulfated or non-sulfated polysaccharide chain comprising one or more monosaccharide units connected by glycosidic linkages;

each of t and u is independently 1, 2, 3, 4, or 5;

each of a, d, g, l, and q is independently 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10;

each of c, f, k, and p is independently 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10; and

each of b, j, e, h, o, and s is independently 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,

38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99 or 100,

wherein each NHR moiety optionally comprises a protecting group.