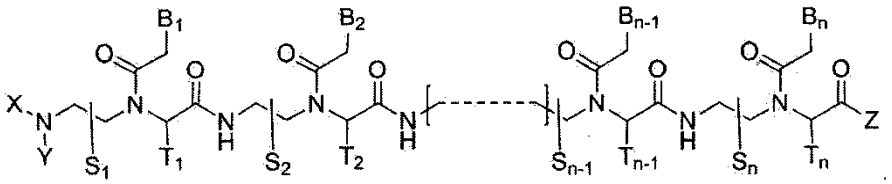
Claims

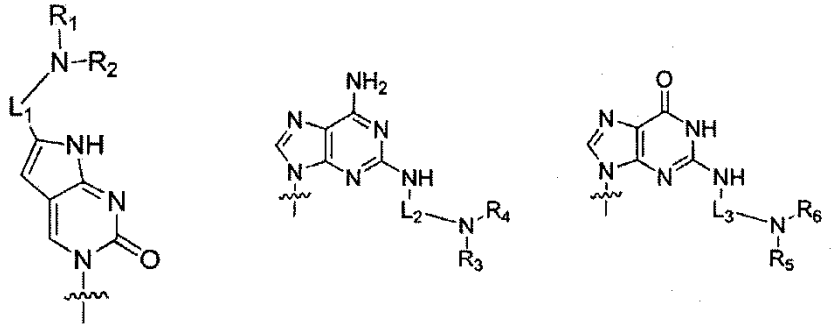
1. A peptide nucleic acid derivative represented by **Formula I,** or a pharmaceutically acceptable salt



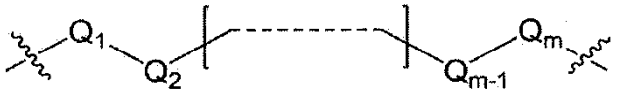
thereof: **[Formula I]**
wherein, n is an integer between 10 and 21; the compound of **Formula I** possesses at least a 10-mer complementary overlap with the 18-mer pre-mRNA sequence of [(5' → 3') GGCCAUUUCGUCAGUAUC] in the human ACC2 pre-mRNA; the compound of **Formula I** is fully complementary to the human ACC2 pre-mRNA, or partially complementary to the human ACC2 pre-mRNA with one or two mismatches; S_1, S_2, …, S_{n-1}, S_n, T_1, T_2, …, T_{n-1}, and T_n independently represent hydrido, deuterido, substituted or non-substituted alkyl, or substituted or non-substituted aryl radical; X and Y independently represent hydrido, deuterido, formyl [H-C(=O)-], aminocarbonyl [NH_2-C(=O)-], aminothiocarbonyl [NH_2-C(=S)-], substituted or non-substituted alkyl, substituted or non-substituted aryl, substituted or non-substituted alkyloxy, substituted or non-substituted aryloxy, substituted or non-substituted alkylacyl, substituted or non-substituted arylacyl, substituted or non-substituted alkyloxycarbonyl, substituted or non-substituted aryloxycarbonyl, substituted or non-substituted alkylaminocarbonyl, substituted or non-substituted arylaminocarbonyl, substituted or non-substituted alkylaminothiocarbonyl, substituted or non-substituted arylaminothiocarbonyl, substituted or non-substituted alkyloxythiocarbonyl, substituted or non-substituted aryloxythiocarbonyl, substituted or non-substituted alkylsulfonyl, substituted or non-substituted arylsulfonyl, substituted or non-substituted alkylphosphonyl, or substituted or non-substituted arylphosphonyl radical; Z represents hydrido, deuterido, hydroxy, substituted or non-substituted alkyloxy, substituted or non-substituted aryloxy, substituted or non-substituted amino, substituted or non-substituted alkyl, or substituted or non-substituted aryl radical; B_1, B_2, …, B_{n-1}, and B_n are independently selected from natural nucleobases including adenine, thymine, guanine, cytosine and uracil, and unnatural nucleobases; and, at least four of B_1, B_2, …, B_{n-1}, and B_n are independently selected from unnatural nucleobases with a substituted or non-substituted amino radical covalently linked to the nucleobase moiety.

2. The peptide nucleic acid derivative according to claim 1, or a pharmaceutical salt thereof: wherein, n is an integer between 10 and 21; the compound of **Formula I** possesses at least a 10-mer complementary overlap with the 18-mer pre-mRNA sequence of [(5' → 3') GGCCAUUUCGUCAGUAUC] in the human ACC2 pre-mRNA; the compound of **Formula I** is fully complementary to the human ACC2 pre-mRNA, or partially complementary to the human ACC2 pre-mRNA with one or two mismatches; S_1, S_2, …, S_{n-1}, S_n, T_1, T_2, …, T_{n-1}, and T_n independently represent hydrido, deuterido radical; X and Y independently represent hydrido, deuterido, formyl [H-C(=O)-], aminocarbonyl [NH_2-C(=O)-], aminothiocarbonyl [NH_2-C(=S)-], substituted or non-substituted alkyl, substituted or non-substituted aryl, substituted or non-substituted alkyloxy, substituted or non-substituted aryloxy, substituted or non-substituted alkylacyl, substituted or non-substituted arylacyl, substituted or non-substituted alkyloxycarbonyl, substituted or non-substituted aryloxycarbonyl, substituted or non-substituted alkylaminocarbonyl, substituted or non-substituted arylaminocarbonyl, substituted or non-substituted alkylaminothiocarbonyl, substituted or non-substituted arylaminothiocarbonyl, substituted or non-substituted alkyloxythiocarbonyl, substituted or non-substituted aryloxythiocarbonyl, substituted or non-substituted alkylsulfonyl, substituted or non-substituted arylsulfonyl, substituted or non-substituted alkylphosphonyl, or substituted or non-substituted arylphosphonyl radical; Z represents hydrido, hydroxy, substituted or non-substituted alkyloxy, substituted or non-substituted aryloxy, or substituted or non-substituted amino radical; B_1, B_2, …, B_{n-1}, and B_n are independently selected from natural nucleobases including adenine, thymine, guanine, cytosine and uracil, and unnatural nucleobases; at least four of B_1, B_2, …, B_{n-1}, and B_n are independently selected from unnatural nucleobases represented by **Formula Ⅱ, Formula Ⅲ,** or **Formula Ⅳ**

[Formula II] [Formula III] [Formula IV]



: wherein, R_1, R_2, R_3, R_4, R_5 and R_6 are independently selected from hydrido and substituted or non-substituted alkyl radical; L_1, L_2 and L_3 are a covalent linker represented by **Formula V** covalently linking the basic amino group to the nucleobase moiety:**[Formula**



V] wherein, Q_1 and Q_m are substituted or non-substituted methylene ($-CH_2-$) radical, and Q_m is directly linked to the basic amino group; Q_2, Q_3, …, and Q_{m-1} are independently selected from substituted or non-substituted methylene, oxygen (-O-), sulfur (-S-), and substituted or non-substituted amino radical [-N(H)-, or -N(substituent)-]; and, m is an integer between 1 and 15.

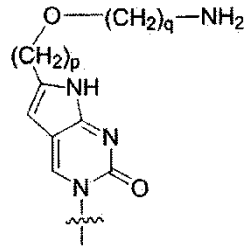
3. The peptide nucleic acid derivative according to claim 2, or a pharmaceutical salt thereof: wherein, n is an integer between 11 and 16; the compound of **Formula I** possesses at least a 10-mer complementary overlap with the 18-mer pre-mRNA sequence of [(5' → 3') GGCCAUUUCGUCAGUAUC] in the human ACC2 pre-mRNA; the compound of **Formula I** is fully complementary to the human ACC2 pre-mRNA; S_1, S_2, …, S_{n-1}, S_n, T_1, T_2, …, T_{n-1}, and T_n are hydrido radical; X and Y independently represent hydrido, substituted or non-substituted alkylacyl, or substituted or non-substituted alkyloxycarbonyl radical; Z represents substituted or non-substituted amino radical; B_1, B_2, …, B_{n-1}, and B_n are independently selected from natural nucleobases including adenine, thymine, guanine, cytosine and uracil, and unnatural nucleobases; at least five of B_1, B_2, …, B_{n-1}, and B_n are independently selected from unnatural nucleobases represented by **Formula Ⅱ, Formula Ⅲ,** or **Formula Ⅳ;** R_1, R_2, R_3, R_4, R_5 and R_6 are hydrido radical; Q_1 and Q_m are methylene radical, and Q_m is directly linked to the basic amino group; Q_2, Q_3, …, and Q_{m-1} are independently selected from methylene and oxygen radical; and, m is an integer between 1 and 9.

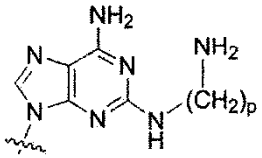
4. The peptide nucleic acid derivative according to claim 3, or a pharmaceutical salt thereof: wherein, n is an integer between 11 and 16; the compound of **Formula I** possesses at least a 10-mer complementary overlap with the 18-mer pre-mRNA sequence of [(5' → 3') GGCCAUUUCGUCAGUAUC] in the human ACC2 pre-mRNA; the compound of **Formula I** is fully complementary to the human ACC2 pre-mRNA; S_1, S_2, …, S_{n-1}, S_n, T_1, T_2, …, T_{n-1}, and T_n are hydrido radical; X is hydrido radical; Y represents substituted or non-substituted alkyloxycarbonyl radical; Z represents substituted or non-substituted amino radical; B_1, B_2, …, B_{n-1}, and B_n are independently selected from natural nucleobases including adenine, thymine, guanine, cytosine and uracil, and unnatural nucleobases; at least five of B_1, B_2, …, B_{n-1}, and B_n are independently selected from unnatural nucleobases represented by **Formula Ⅱ, Formula Ⅲ,** or **Formula Ⅳ**; R_1, R_2, R_3, R_4, R_5 and R_6 are hydrido radical; L_1represents $-(CH_2)_2-O-(CH_2)_2-$, $-CH_2-O-(CH_2)_2-$, $-CH_2-O-(CH_2)_3-$, $-CH_2-O-(CH_2)_4-$, or $-CH_2-O-(CH_2)_5-$; and, L_2 and L_3 are independently selected from $-(CH_2)_2-O-(CH_2)_2-$, $-(CH_2)_3-O-(CH_2)_2-$, $-(CH_2)_2-O-(CH_2)_3-$, $-(CH_2)_2-$, $-(CH_2)_3-$, $-(CH_2)_4-$, $-(CH_2)_5-$, $-(CH_2)_6-$, $-(CH_2)_7-$, and $-(CH_2)_8-$.

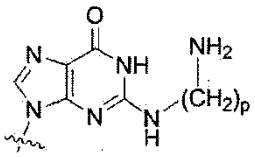
5. The peptide nucleic acid derivative according to claim 4, which is selected from the group of peptide nucleic acid derivatives provided below, or a pharmaceutically acceptable salt thereof: (N→C) Fethoc-CTG(6)-ACG(6)-AA(5)A-TG(6)G-C(1O2)C-NH_2; (N→C) Fethoc-TA(5)C(1O2)-TGA(5)-CGA(5)-AA(5)T-G(6)GC(1O2)-C-NH_2; (N→C) Fethoc-TA(5)C-TG(5)A-C(1O2)GA(5)-AA(5)T-G(5)G-

NH_2; (N→C) Fethoc-AC(1O2)T-GA(5)C-GA(5)A-A(5)TG(5)-GC(1O2)-NH_2; (N→C) Fethoc-CTG(6)-AC(1O2)G-A(5)AA(5)-TG(6)G-NH_2; (N→C) Fethoc-CTG(6)-AC(1O2)G-A(5)AA(5)-TG(6)G-C(1O2)C-NH_2 wherein, A, G, T, and C are monomers of peptide nucleic acid with a natural nucleobase of adenine, thymine, guanine and cytosine, respectively; C(pOq), A(p), and G(p) are monomers of peptide nucleic acid with an unnatural nucleobase represented by **Formula VI, Formula VII, and Formula VIII**

[Formula VI] [Formula VII] [Formula VIII]







, respectively; wherein, p and q are integers, and p is 1 or 5 and q is 2 in (N→C) Fethoc-AC(1O2)T-GA(5)C-GA(5)A-A(5)TG(5)-GC(1O2)-NH_2; and "Fethoc-" is the abbreviation for "[2-(9-fluorenyl)ethyl-1-oxy]carbonyl".

6. Use of the peptide nucleic acid derivative according to claim 1, or a pharmaceutically acceptable salt thereof, in the manufacture of a medicament for the treatment of conditions or disorders associated with the human ACC2 gene transcription.

7. Use of the peptide nucleic acid derivative according to claim 1, or a pharmaceutically acceptable salt thereof, in the manufacture of a medicament for the treatment of skin aging.

8. A pharmaceutical composition for treating conditions or disorders associated with human ACC2 gene transcription, comprising the peptide nucleic acid derivative according to claim 1, or a pharmaceutically acceptable salt thereof.

9. A cosmetic composition for treating conditions or disorders associated with human ACC2 gene transcription, comprising the peptide nucleic acid derivative according to claim 1, or a pharmaceutically acceptable salt thereof.

10. A pharmaceutical composition for treating skin aging, comprising the peptide nucleic acid derivative according to claim 1, or a pharmaceutically acceptable salt thereof.

11. A cosmetic composition for treating skin aging, comprising the peptide nucleic acid derivative according to claim 1, or a pharmaceutically acceptable salt thereof.