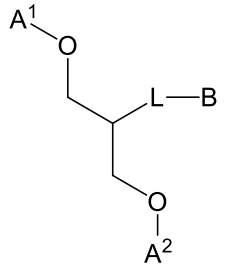
CLAIMS

1. A compound represented by the following formula (I):


(I)

wherein:

$A^1$ represents a protective group of a hydroxy group selected from trityl, 4-methoxytrityl, 4,4'-dimethoxytrityl (DMTr) and 4,4',4''-trimethoxytrityl;

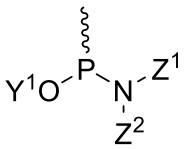
$A^2$ represents a phosphorus functional group, a protective group of a hydroxy group or -C(=O)$CH_2CH_2$COOH;

B represents a nucleobase; and

L represents -$OCH_2CH_2$- or -$CH_2OCH_2$-;

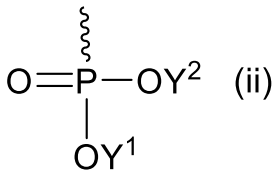
or a salt thereof;

wherein the phosphorus functional group in $A^2$ is selected from a phosphorus functional group represented by the following formula (i):


(i)

wherein $Y^1$ represents a protective group of a phosphoric acid; $Z^1$ and $Z^2$ each independently represent a $C_{1\text{-}6}$ alkyl or $Z^1$ and $Z^2$ form, together with a nitrogen atom to which $Z^1$ and $Z^2$ bind, a 5- to 7-membered nitrogen-containing heterocyclic ring which may further contain 1 to 3 heteroatoms;

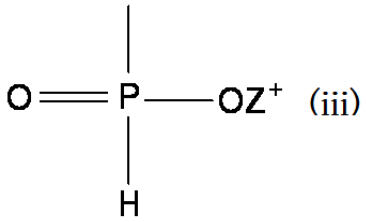
a phosphorus functional group represented by the following formula (ii):



(ii)

wherein $Y^1$ represents a protective group of phosphoric acid; and $Y^2$ represents a hydrogen atom or a protective group of phosphoric acid; and

a phosphorus functional group represented by the following formula (iii):



(iii)

wherein $Z^+$ represents a cation;wherein the protective group of phosphoric acid is selected from

a protective group that can be eliminated by β-elimination;

a protective group that can be eliminated with a fluoride ion;

a protective group that can be eliminated by cyclisation reaction;

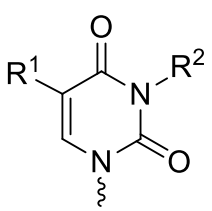
a protective group that can be eliminated by nucleophilic substitution reaction on a carbon atom;

a protective group that can be eliminated by hydrogenolysis; and

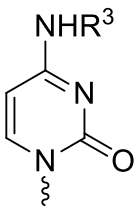
a protective group that can be eliminated by substitution reaction using a palladium catalyst;

wherein the protective group of a hydroxy group in $A^2$ is selected from a silyl protective group, a trityl protective group, a heterocyclic protective group, a benzyl protective group, an aliphatic acyl protective group, an aromatic acyl protective group, an ether protective group, a carbamoyl protective group, an sulphonyl protective group and an alkoxycarbonyl protective group,

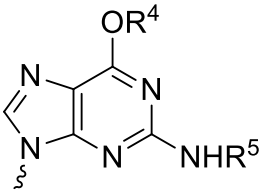
wherein the nucleobase in B is selected from the following formulae (II), (III), (IV) and (V):



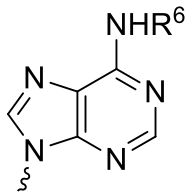

(II)




(III)




(IV)




(V)

wherein:

$R^1$ represents a hydrogen atom or methyl;

$R^2$ and $R^4$ each independently represent a hydrogen atom, $C_{1-6}$ alkyl, $C_{3-6}$ alkenyl, $C_{3-6}$ alkynyl, $C_{1-6}$ alkyl-carbonyl, $C_{1-6}$ alkylsulphonyl, $C_{6-14}$ aryloxy-carbonyl, $C_{6-14}$ aryl-carbonyl, $C_{6-14}$ arylsulphonyl or a protective group; and

$R^3$, $R^5$ and $R^6$ each independently represent $C_{1-6}$ alkyl, $C_{3-6}$ alkenyl, $C_{3-6}$ alkynyl, $C_{1-6}$ alkyl-carbonyl, $C_{1-6}$ alkylsulphonyl, $C_{6-14}$ aryloxy-carbonyl, $C_{6-14}$ aryl-carbonyl, $C_{6-14}$ arylsulphonyl or a protective group;

wherein the protective groups in $R^2$, $R^3$, $R^5$ and $R^6$ are each independently selected from a carbamate protective group, an acyl protective group, an imide protective group and a benzyl protective group, and

the protective group in $R^4$ is selected from a silyl protective group, a trityl protective group, a heterocyclic protective group, a benzyl protective group, an aliphatic acyl protective group, an aromatic acyl protective group, an ether protective group, a carbamoyl protective group and an alkoxycarbonyl protective group.

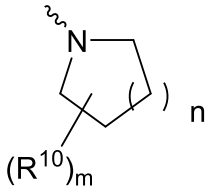
2. The compound according to claim 1 or a salt thereof, wherein L is $-OCH_2CH_2-$.

3. The compound according to claim 1 or 2 or a salt thereof, wherein $A^2$ is a phosphorus functional group.

4. The compound according to any one of claims 1 to 3 or a salt thereof, wherein $A^2$ is -P(-$OR^7$)-$NR^8R^9$, wherein

$R^7$ represents $C_{1-6}$ alkyl or 2-cyanoethyl; and

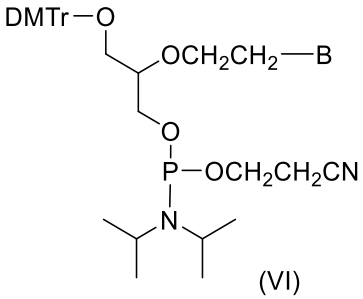
$R^8$ and $R^9$ are each independently $C_{1-6}$ alkyl, or -$NR^8R^9$ is integrated to form



wherein $R^{10}$ represents $C_{1-3}$ alkyl; m represents an integer of 0 to 4; and n represents an integer of 1 to 3.

5. The compound according to any one of claims 1 to 4 or a salt thereof, wherein $A^2$ is -$C(=O)CH_2CH_2COOH$.

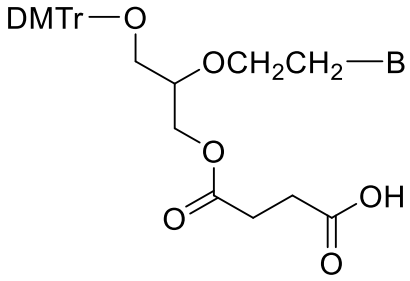
6. The compound according to claim 1 or a salt thereof, wherein the compound is represented by the following formula (VI):



(VI)

wherein B is a nucleobase selected from the formulae (II), (III), (IV) and (V).

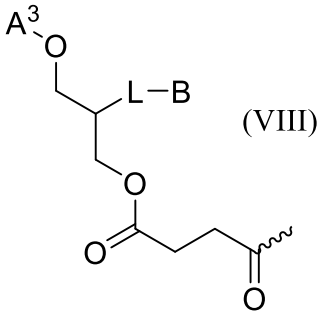
7. The compound according to claim 1 or a salt thereof, wherein the compound is represented by the following formula (VII):




(VII)

wherein B is a nucleobase selected from the formulae (II), (III), (IV) and (V).

8. A modified nucleic acid monomer-carrying substance, comprising a monovalent group derived from a modified nucleic acid monomer compound represented by the following formula (VIII) supported on a solid carrier through an amino group on the carrier,



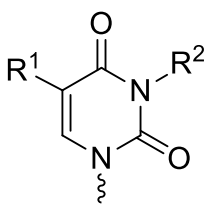

(VIII)

wherein:

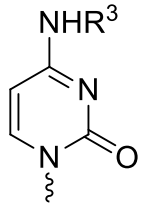
$A^3$ is a hydrogen atom or a protective group of a hydroxy group selected from trityl, 4-methoxytrityl, 4,4'-dimethoxytrityl (DMTr) and 4,4',4''-trimethoxytrityl;

L represents $-OCH_2CH_2-$ or $-CH_2OCH_2-$; and

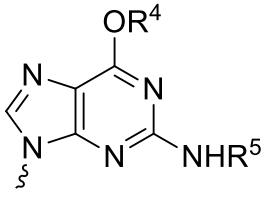
B is a nucleobase selected from the following formulae (II), (III), (IV) and (V):




(II)




(III)




(IV)




(V)

wherein:

$R^1$ represents a hydrogen atom or methyl;

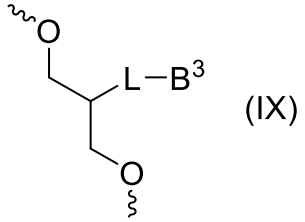
$R^2$ and $R^4$ each independently represent a hydrogen atom, $C_{1-6}$ alkyl, $C_{1-6}$ alkoxy, $C_{3-6}$ alkenyl, $C_{3-6}$ alkynyl, $C_{1-6}$ alkyl-carbonyl, $C_{1-6}$ alkylsulphonyl, $C_{6-14}$ aryloxy-carbonyl, $C_{6-14}$ aryl-carbonyl, $C_{6-14}$ arylsulphonyl or a protective group; and

$R^3$, $R^5$ and $R^6$ each independently represent $C_{1-6}$ alkyl, $C_{1-6}$ alkoxy, $C_{3-6}$ alkenyl, $C_{3-6}$ alkynyl, $C_{1-6}$ alkyl-carbonyl, $C_{1-6}$ alkylthio, $C_{1-6}$ alkylsulphonyl, $C_{6-14}$ aryloxy-carbonyl, $C_{6-14}$ aryl-carbonyl, $C_{6-14}$ arylsulphonyl or a protective group,

wherein the protective groups in $R^2$, $R^3$, $R^5$ and $R^6$ are each independently selected from a carbamate protective group, an acyl protective group, an imide protective group and a benzyl protective group, and

the protective group in $R^4$ is selected from a silyl protective group, a trityl protective group, a heterocyclic protective group, a benzyl protective group, an aliphatic acyl protective group, an aromatic acyl protective group, an ether protective group, a carbamoyl protective group and an alkoxycarbonyl protective group.

9. An oligonucleic acid analogue comprising one or more partial structures represented by the following formula (IX) or a salt thereof,



(IX)

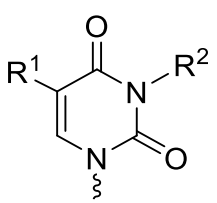
wherein:

$B^3$ represents a nucleobase; and

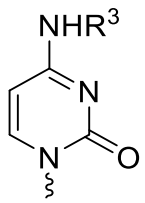
L represents $-OCH_2CH_2-$ or $-CH_2OCH_2-$; provided that when two or more partial structures are included, $B^3$ and L in the partial structures may be respectively the same or

different,

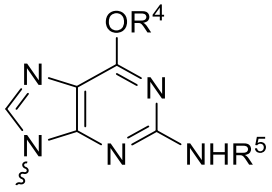
wherein $B^3$ is a nucleobase selected from the following formulae (II)', (III)', (IV)' and (V)':



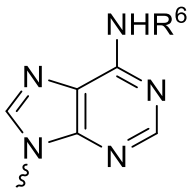

(II)'




(III)'




(IV)'




(V)'

wherein:

$R^1$ represents a hydrogen atom or methyl;

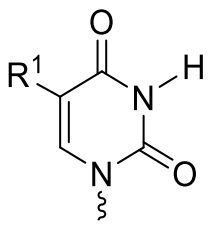
$R^2$ and $R^4$ each independently represent a hydrogen atom, $C_{1-6}$ alkyl, $C_{1-6}$ alkoxy, $C_{3-6}$ alkenyl, $C_{3-6}$ alkynyl, $C_{1-6}$ alkyl-carbonyl, $C_{1-6}$ alkylsulphonyl, $C_{6-14}$ aryloxy-carbonyl, $C_{6-14}$ aryl-carbonyl, $C_{6-14}$ arylsulphonyl or a protective group; and

$R^3$, $R^5$ and $R^6$ each independently represent a hydrogen atom, $C_{1-6}$ alkyl, $C_{3-6}$ alkenyl, $C_{3-6}$ alkynyl, $C_{1-6}$ alkyl-carbonyl, $C_{1-6}$ alkylsulphonyl, $C_{6-14}$ aryloxy-carbonyl, $C_{6-14}$ aryl-carbonyl, $C_{6-14}$ arylsulphonyl or a protective group,

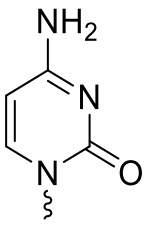
wherein the protective groups in $R^2$, $R^3$, $R^5$ and $R^6$ are each independently selected from a carbamate protective group, an acyl protective group, an imide protective group and a benzyl protective group, and

the protective group in $R^4$ is selected from a silyl protective group, a trityl protective group, a heterocyclic protective group, a benzyl protective group, an aliphatic acyl protective group, an aromatic acyl protective group, an ether protective group, a carbamoyl protective group and an alkoxycarbonyl protective group.

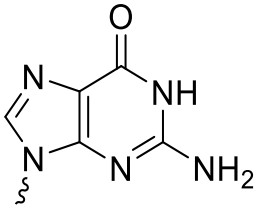
10. The oligonucleic acid analogue according to claim 9 or a salt thereof, wherein $B^3$ is selected from the following formulae (X), (XI), (XII) and (XIII):



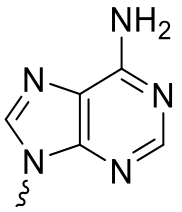

(X)




(XI)




(XII)




(XIII)

wherein $R^1$ is as defined above.

11. The oligonucleic acid analogue according to claim 9 or 10 or a salt thereof, wherein L is $-OCH_2CH_2-$.

12. The oligonucleic acid analogue according to any one of claims 9 to 11 or a salt thereof, wherein the oligonucleic acid analogue contains 4 to 100 nucleobase units in total per strand.

13. The oligonucleic acid analogue according to any one of claims 9 to 12 or a salt thereof, wherein the oligonucleic acid analogue contains 4 to 30 nucleobase units in total per strand.