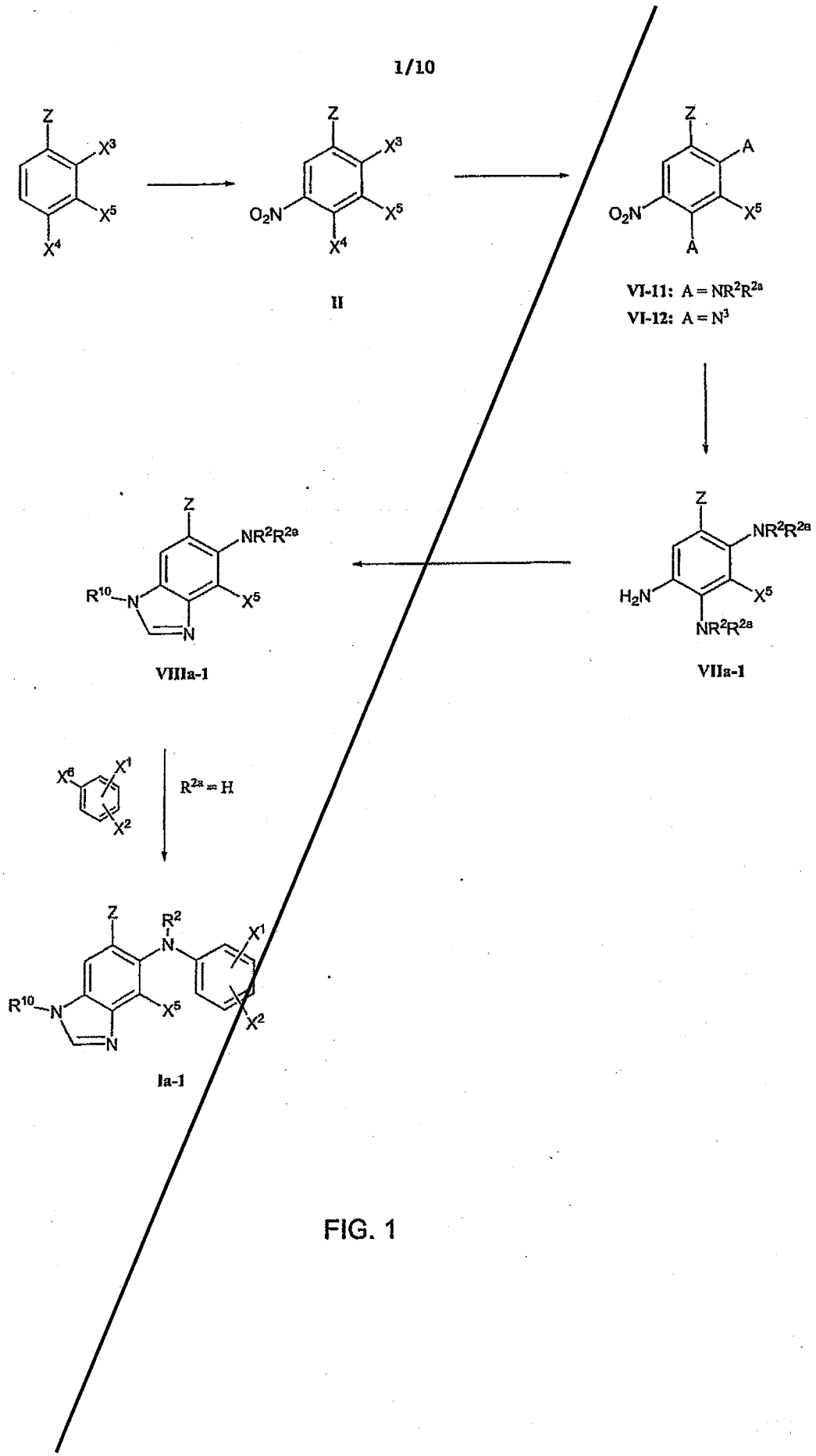

Z
X3
X5
X4
O2N
II
A
VI-11: A = NR2R2a
VI-12: A = N3
NR2R2a
H2N
VIIa-1
R10
N
VIIIa-1
X6
X1
X2
R2a = H
R2
Ia-1

FIG. 1

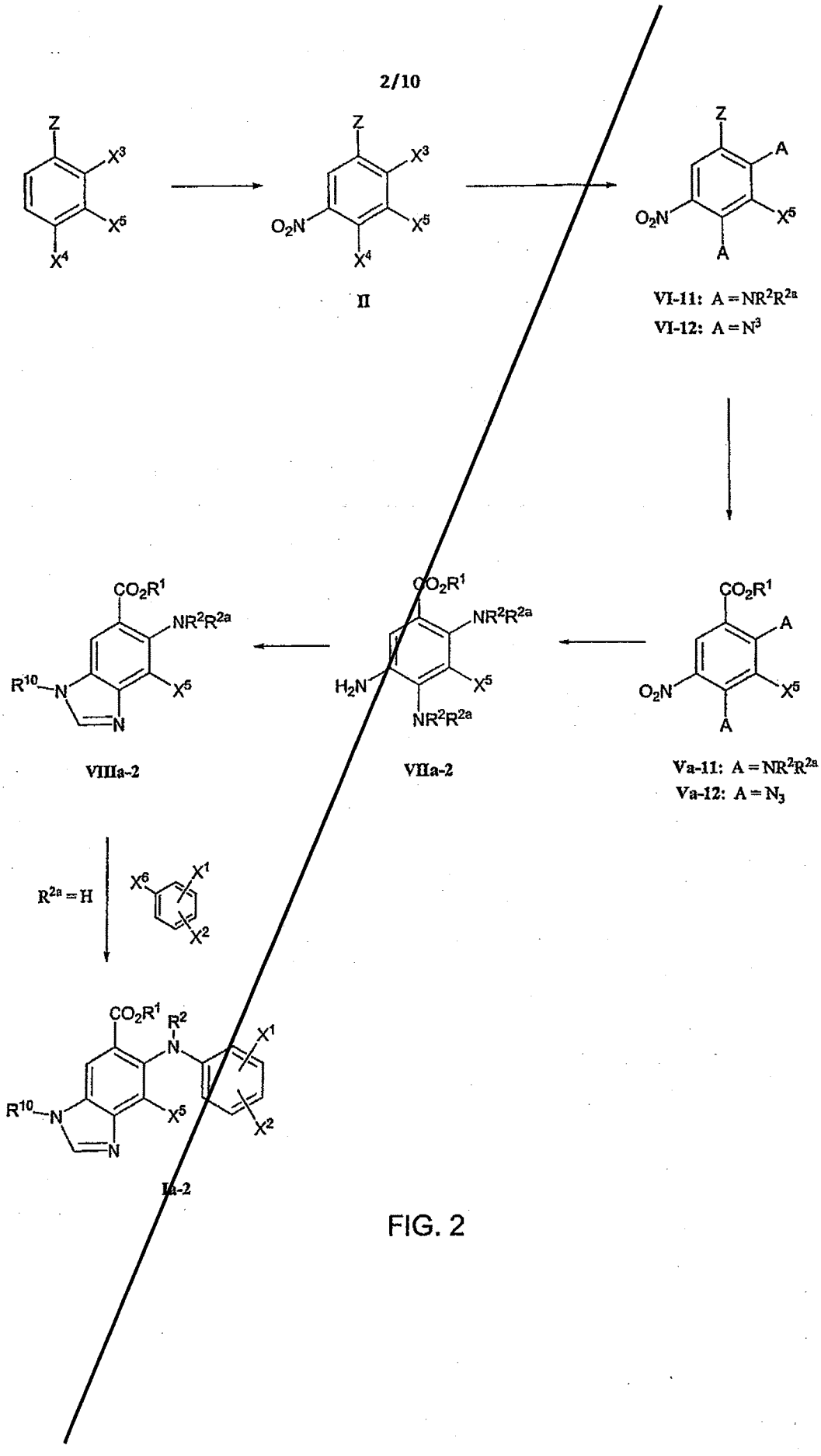

II
VI-11: A = NR2R2a
VI-12: A = N3
Va-11: A = NR2R2a
Va-12: A = N3
VIIa-2
VIIIa-2
R2a = H
Ia-2

FIG. 2

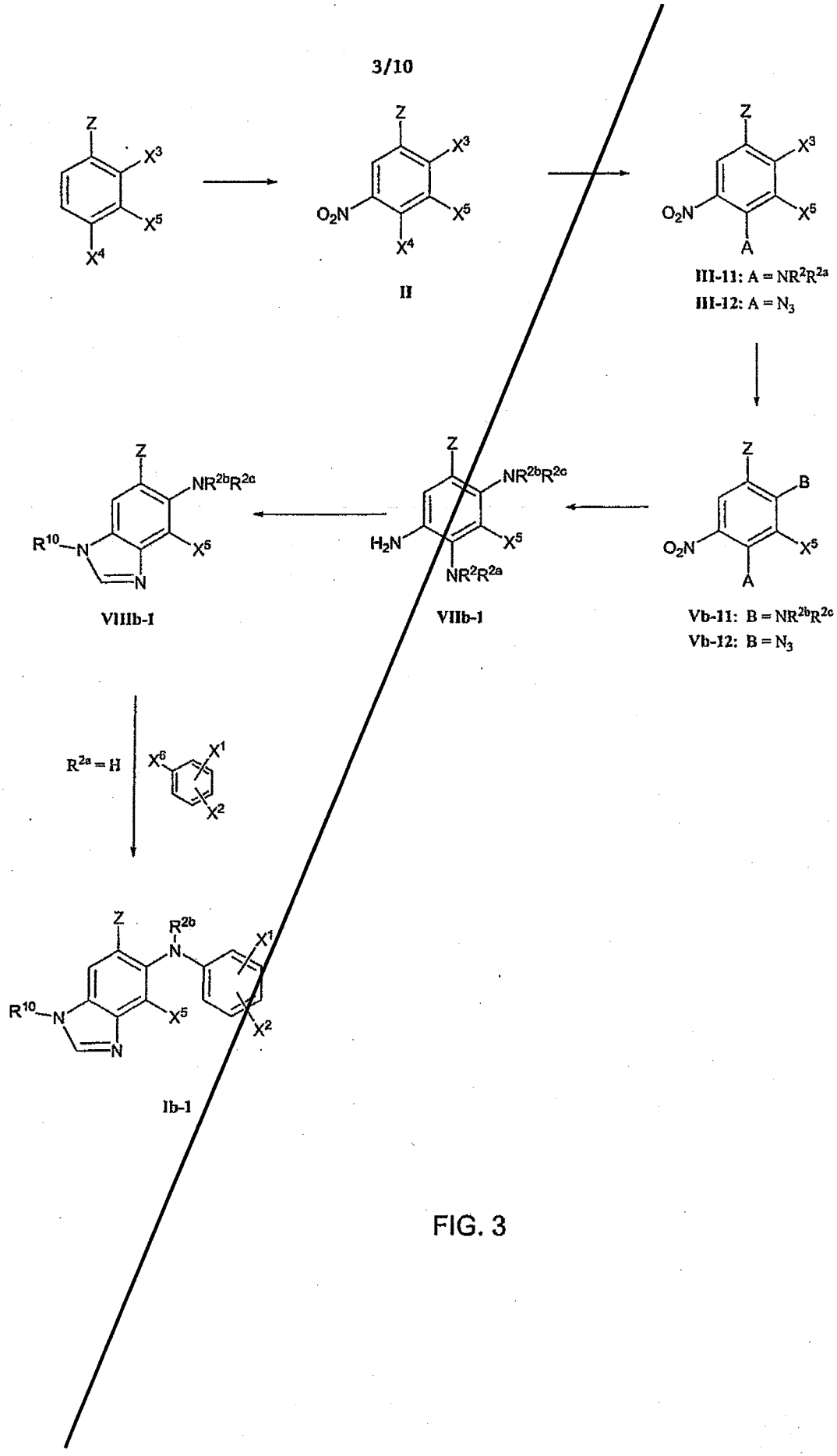

II
III-11: A = NR2R2a
III-12: A = N3
Vb-11: B = NR2bR2c
Vb-12: B = N3
VIIIb-1
VIIb-1
R2a = H
Ib-1

FIG. 3

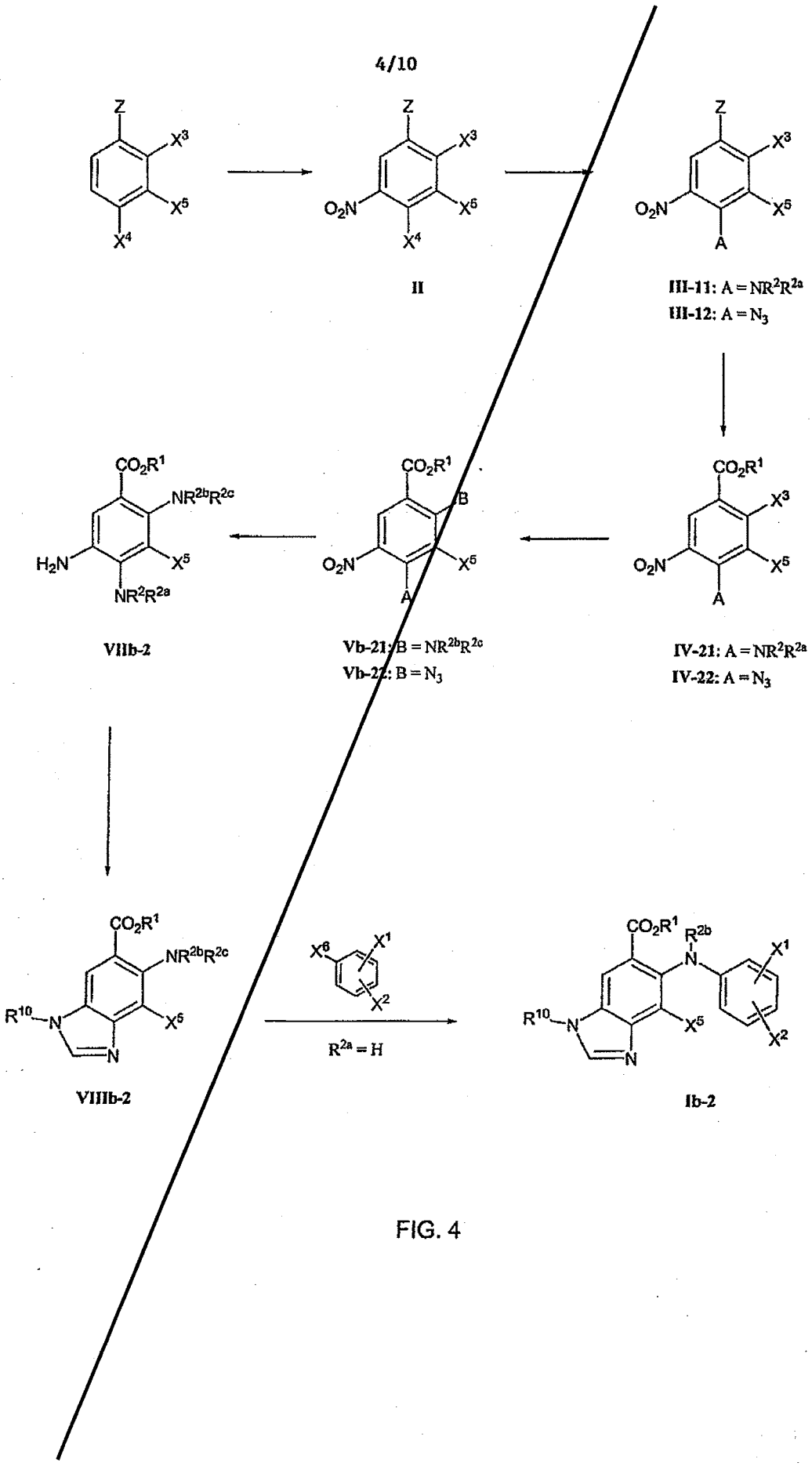
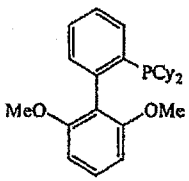
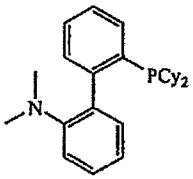

II
III-11: A = NR2R2a
III-12: A = N3
IV-21: A = NR2R2a
IV-22: A = N3
Vb-21: B = NR2bR2c
Vb-22: B = N3
VIIb-2
VIIIb-2
R2a = H
Ib-2

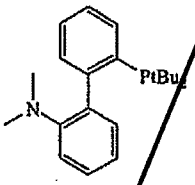
FIG. 4



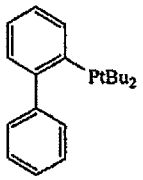
S Phos



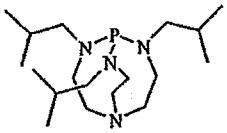
Cycloh_B



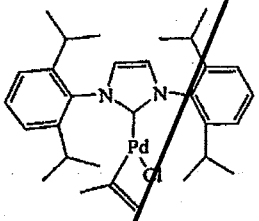
tB_A_B



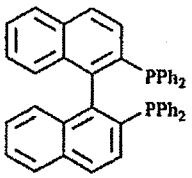
tBut_B



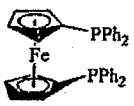
VerK B



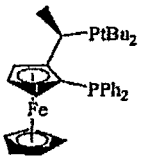
Carbene



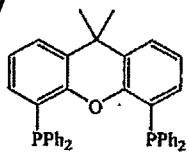
Rac-BINAP



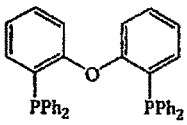
DPPF



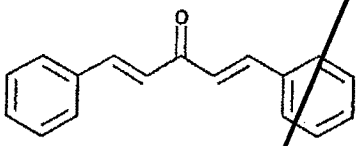
FC_B



XANTPHOS



DPE-PHOS



dba
(dibenzylideneacetone)

Fig. 5

Method A

R^2, R^{2a} = H

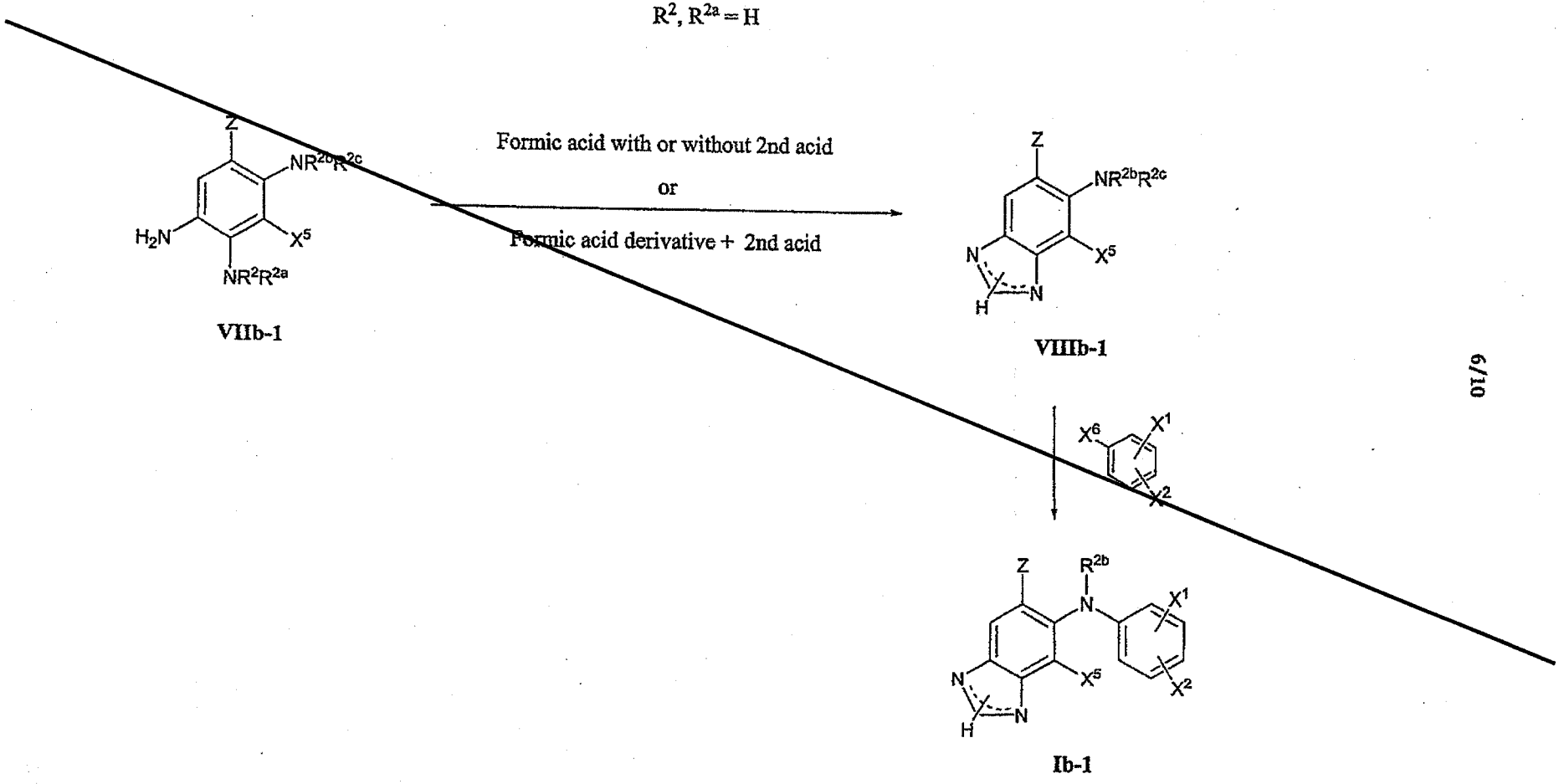


FIG. 6

Method B

$R^2 \neq H$

$R^{2a} = H$

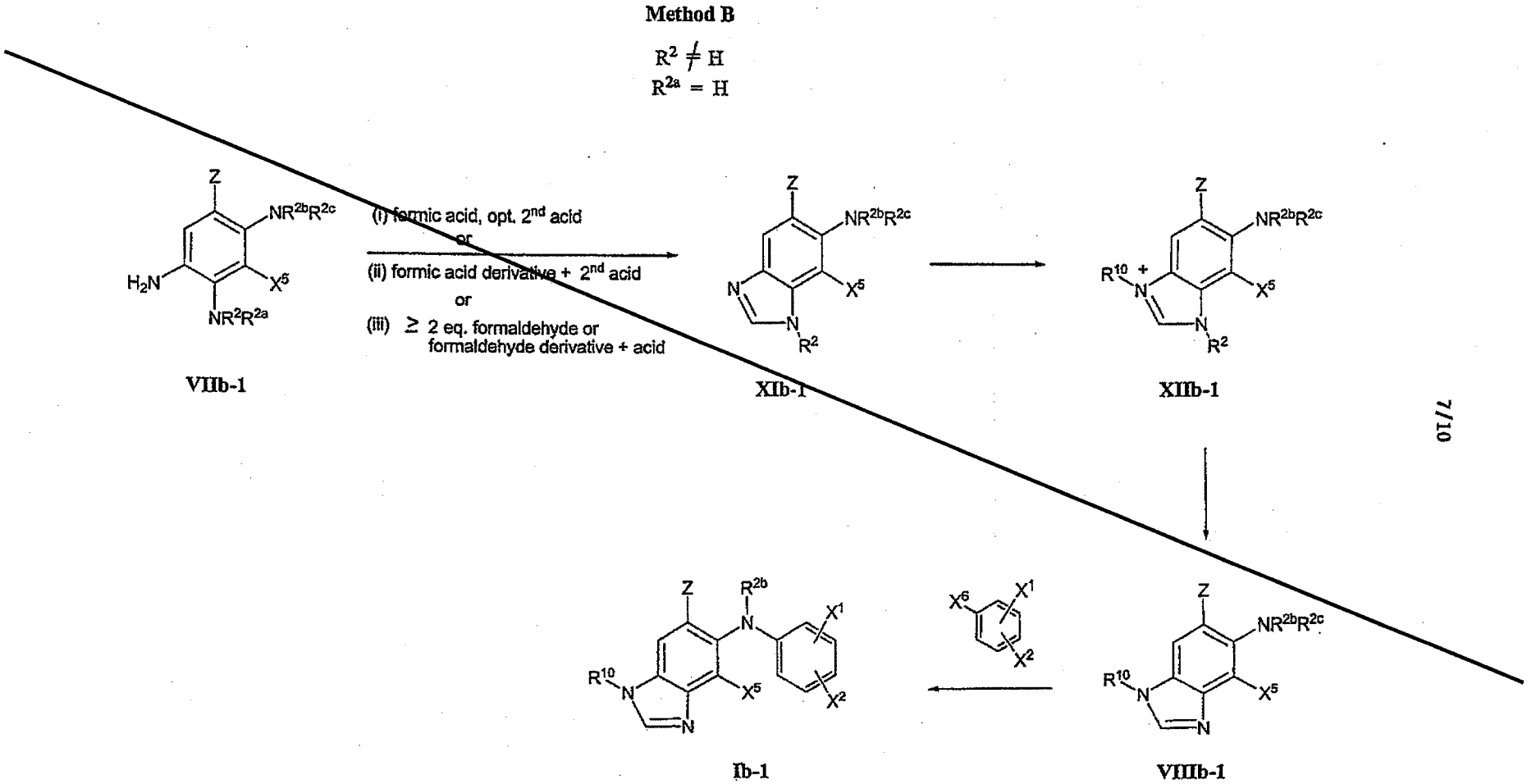
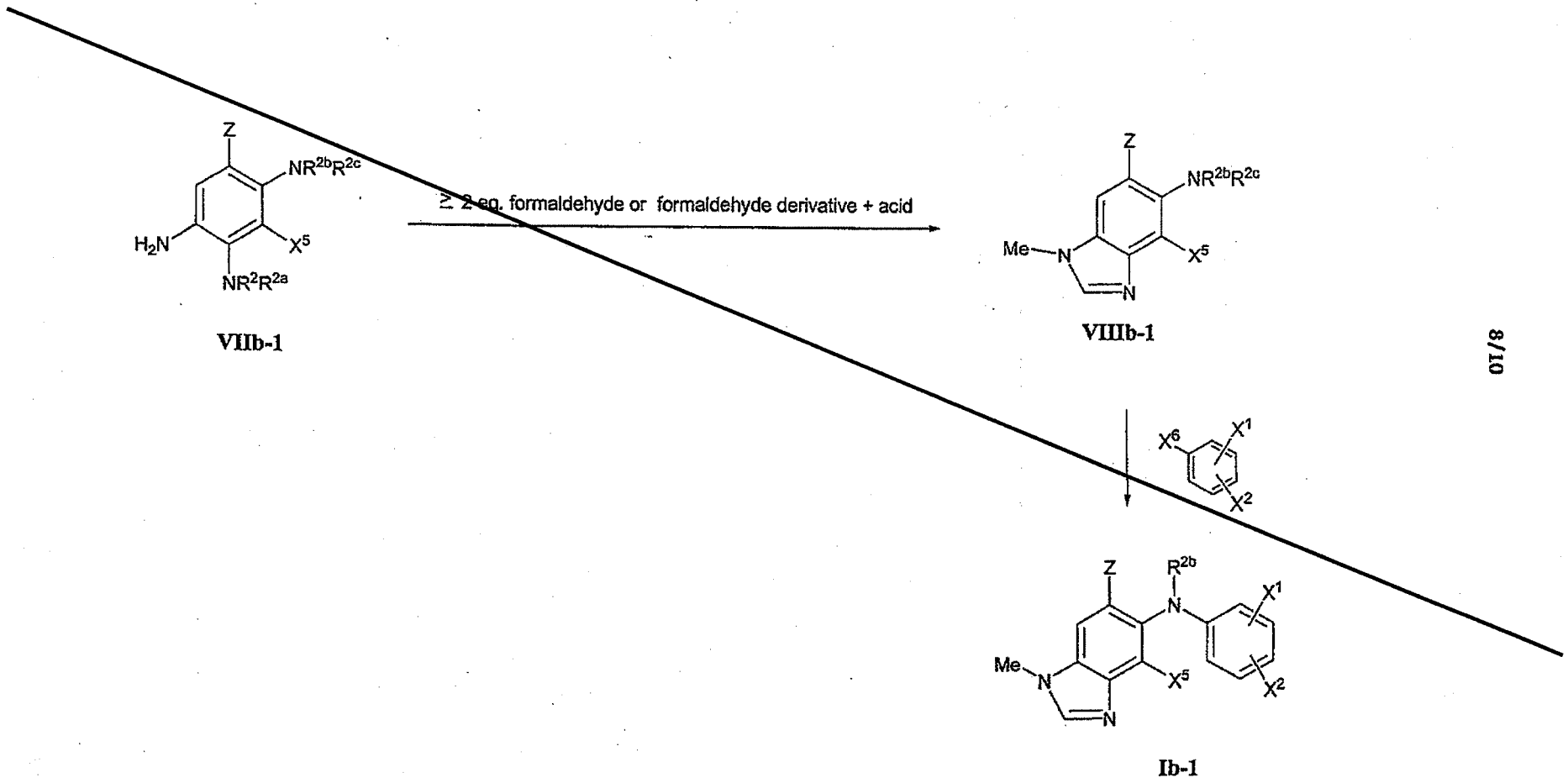


FIG. 7

Method C

R^2, R^{2a} = H



VIIb-1

VIIIb-1

Ib-1

FIG. 8

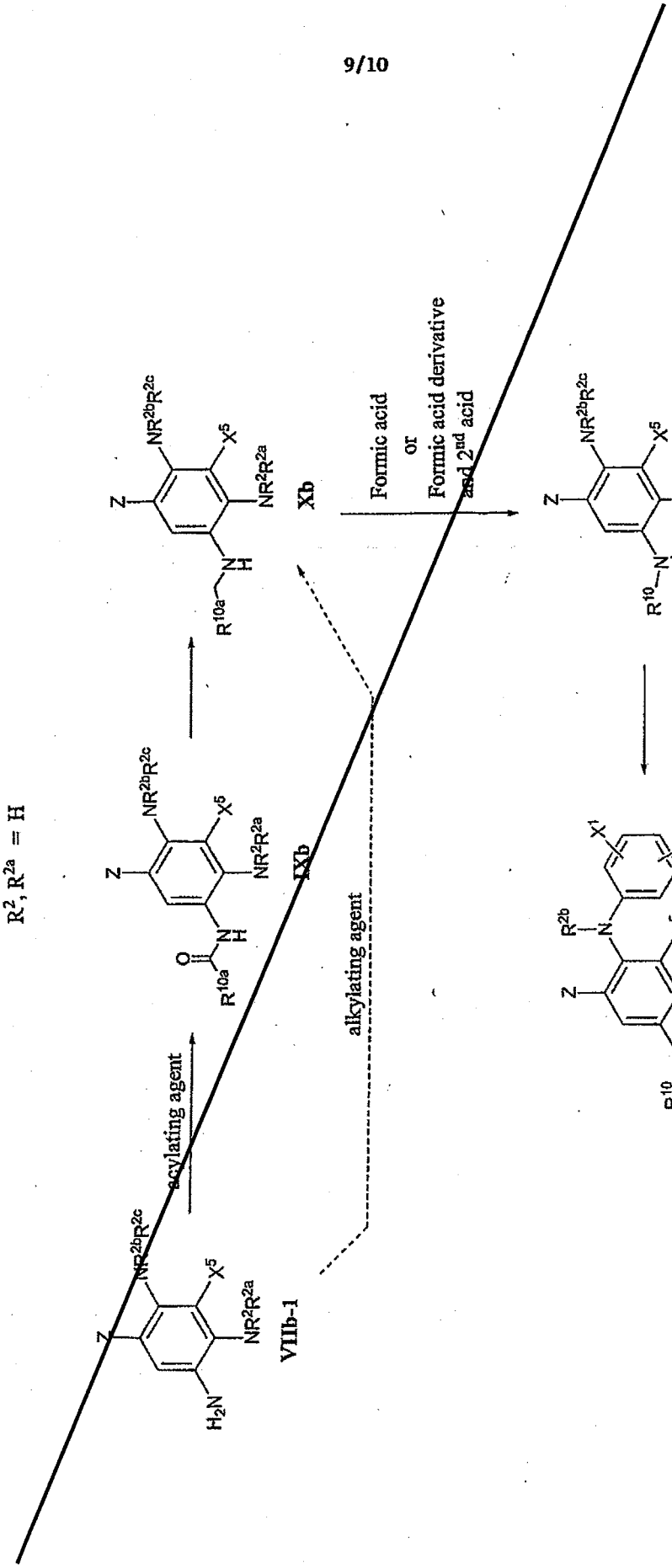

Method D
R2, R2a = H
acylating agent
alkylating agent
Formic acid
or
Formic acid derivative
and 2nd acid
VIIb-1
IXb
Xb
VIIIb-1
Ib-1

FIG. 9

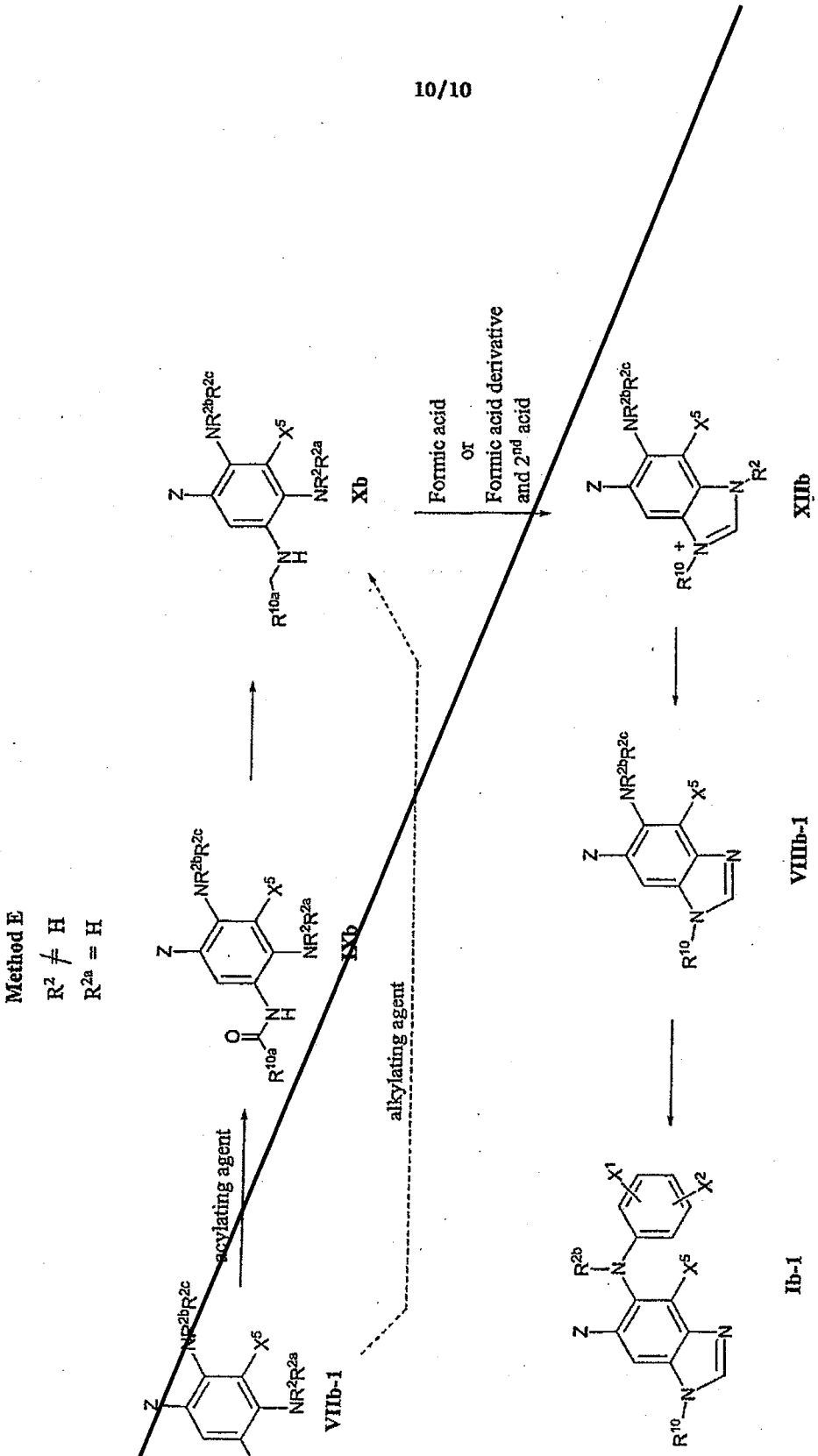

Method E
$R^2 \neq H$
$R^{2a} = H$
acylating agent
alkylating agent
Formic acid
or
Formic acid derivative
and 2nd acid
VIIb-1
XIb
Xb
VIIIb-1
XIIb
Ib-1

FIG. 10

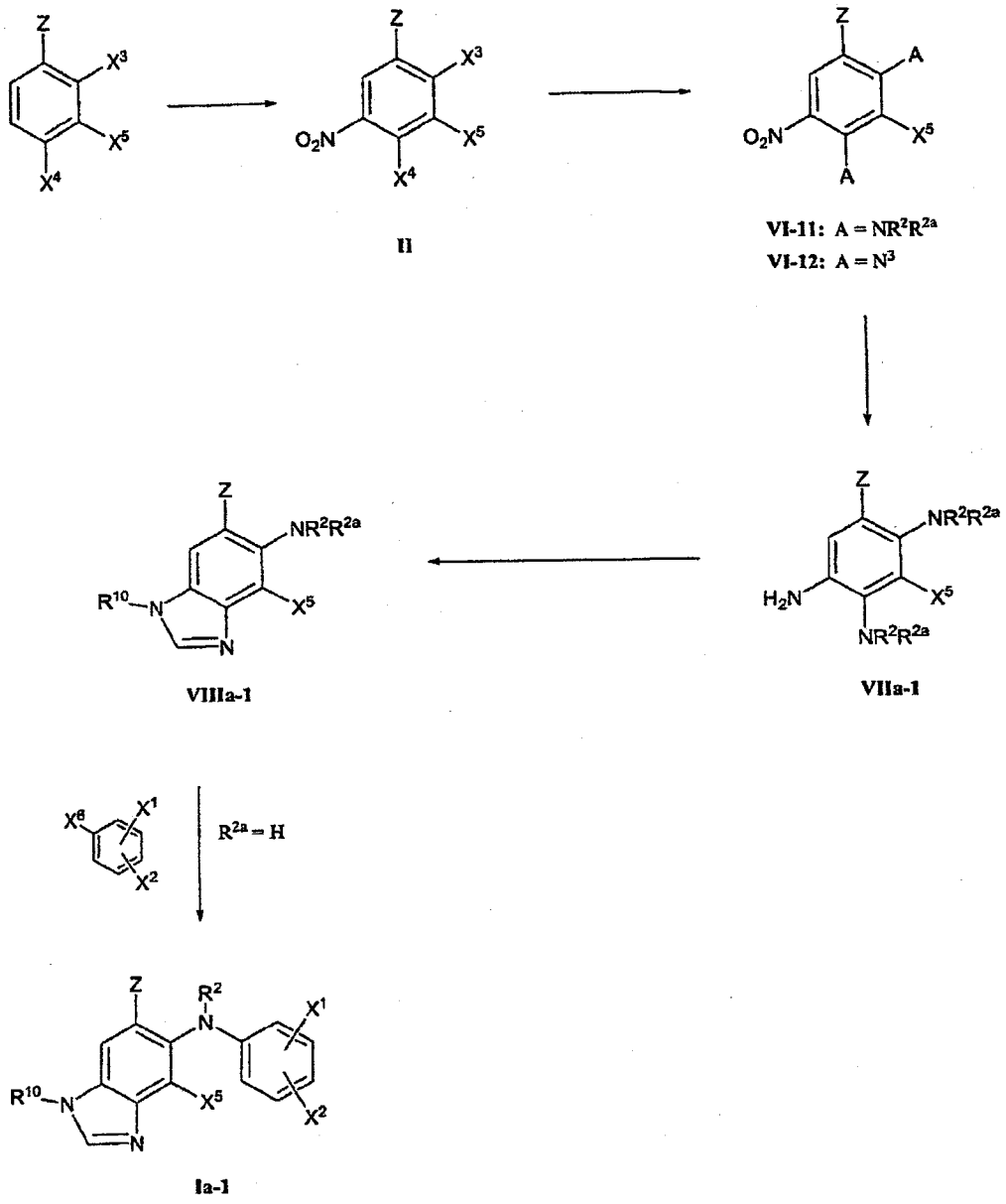

Z
X3
X5
X4
O2N
II
A
VI-11: A = NR2R2a
VI-12: A = N3
NR2R2a
H2N
VIIa-1
R10
N
VIIIa-1
X6
X1
X2
R2a = H
R2
Ia-1

FIG. 1

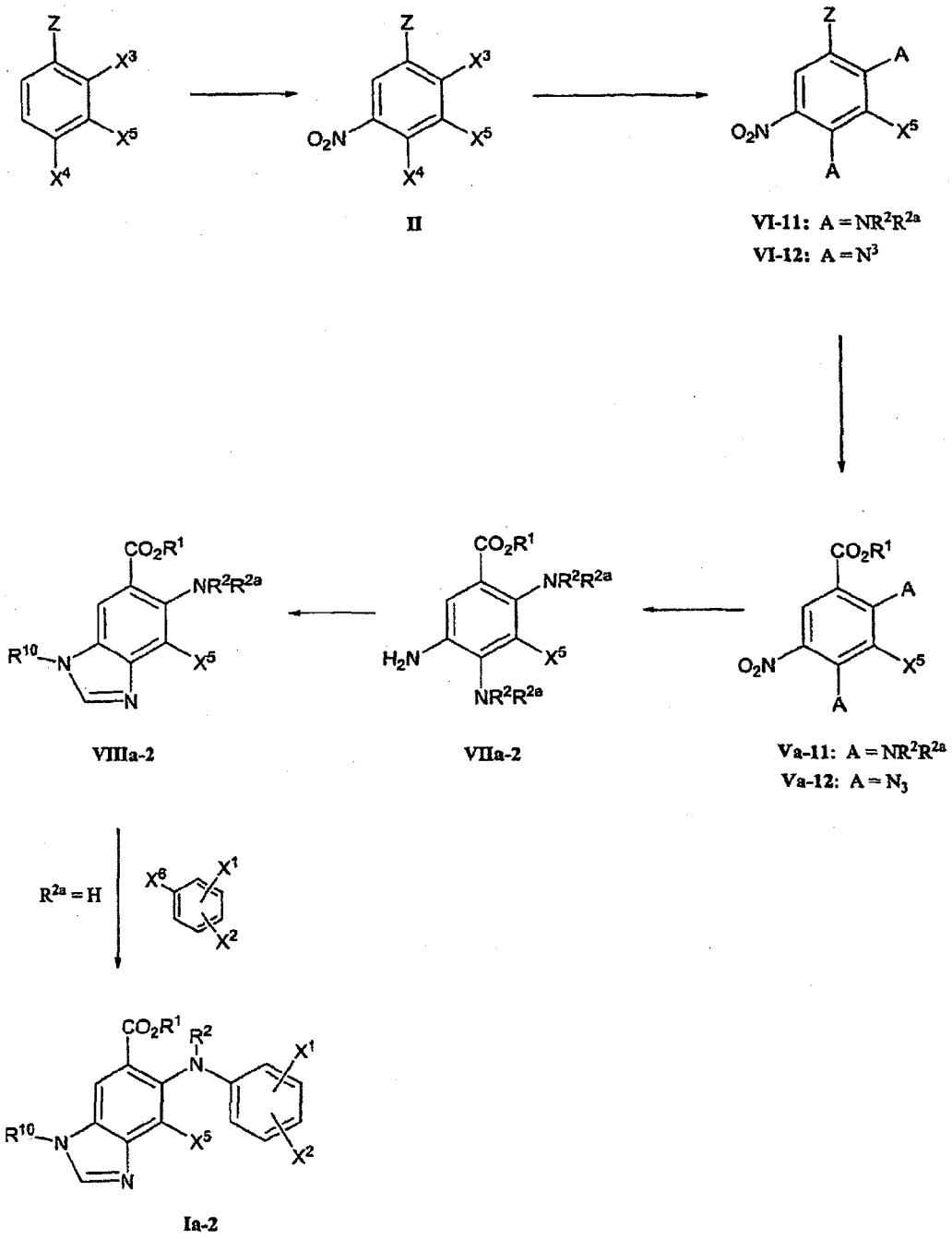

II
VI-11: A = NR2R2a
VI-12: A = N3
Va-11: A = NR2R2a
Va-12: A = N3
VIIa-2
VIIIa-2
R2a = H
Ia-2

FIG. 2

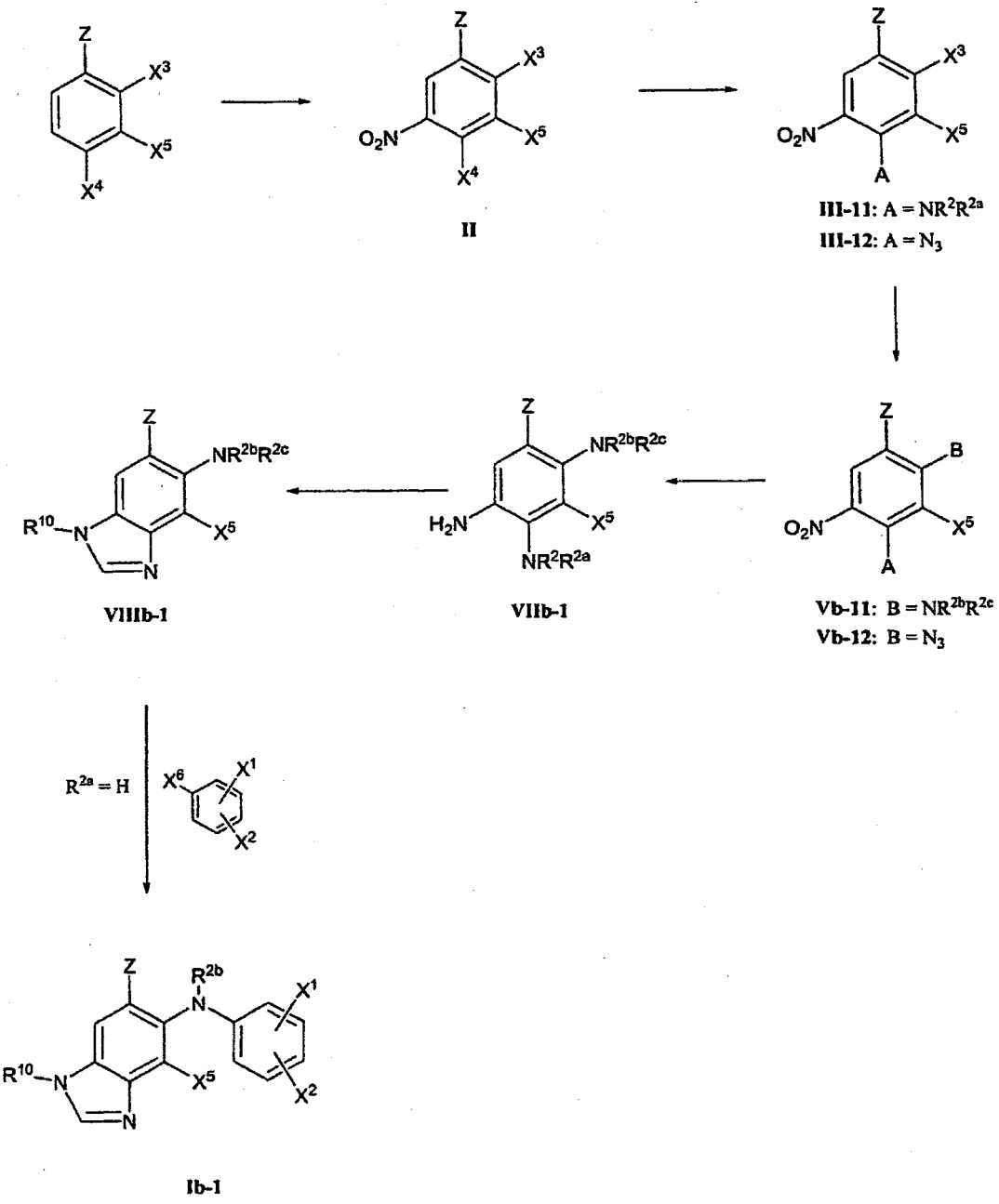

II
III-11: A = NR2R2a
III-12: A = N3
Vb-11: B = NR2bR2c
Vb-12: B = N3
VIIb-1
VIIIb-1
R2a = H
Ib-1

FIG. 3

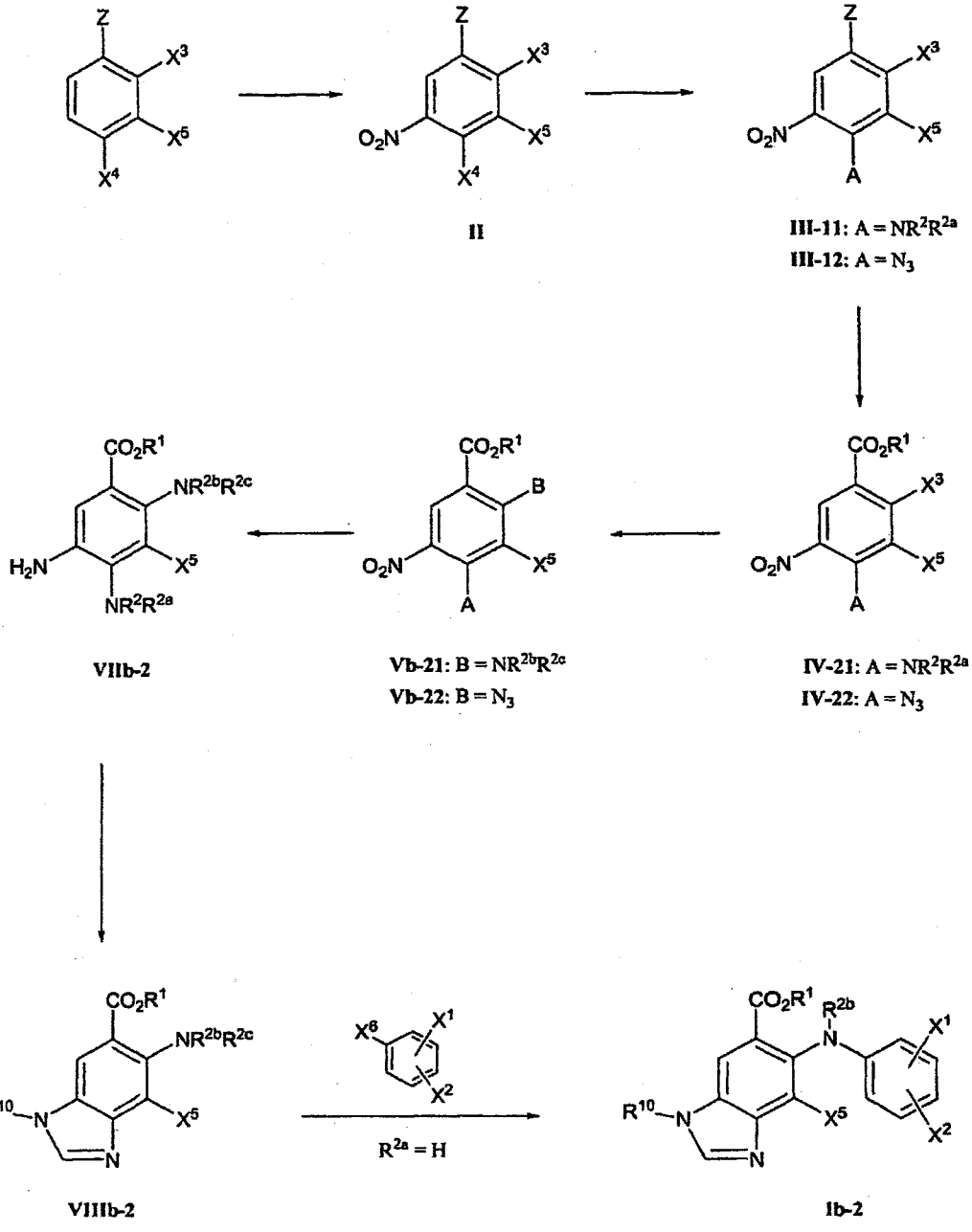
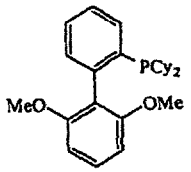
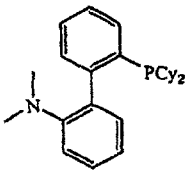

II
III-11: A = NR2R2a
III-12: A = N3
IV-21: A = NR2R2a
IV-22: A = N3
Vb-21: B = NR2bR2c
Vb-22: B = N3
VIIb-2
VIIIb-2
R2a = H
Ib-2

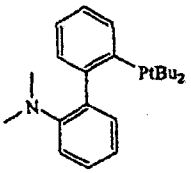
FIG. 4



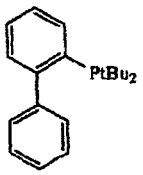
S Phos



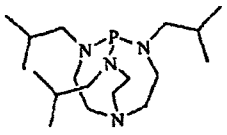
Cycloh_B



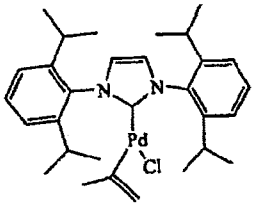
tB_A_B



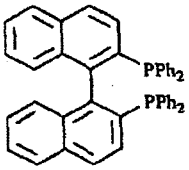
tBut_B



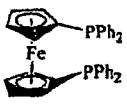
VerK B



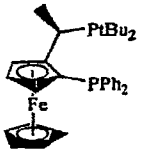
Carbene



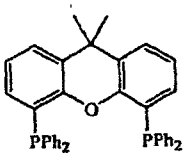
Rac-BINAP



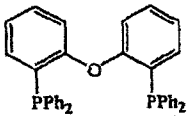
DPPF



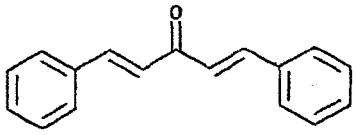
FC_B



XANTPHOS



DPE-PHOS

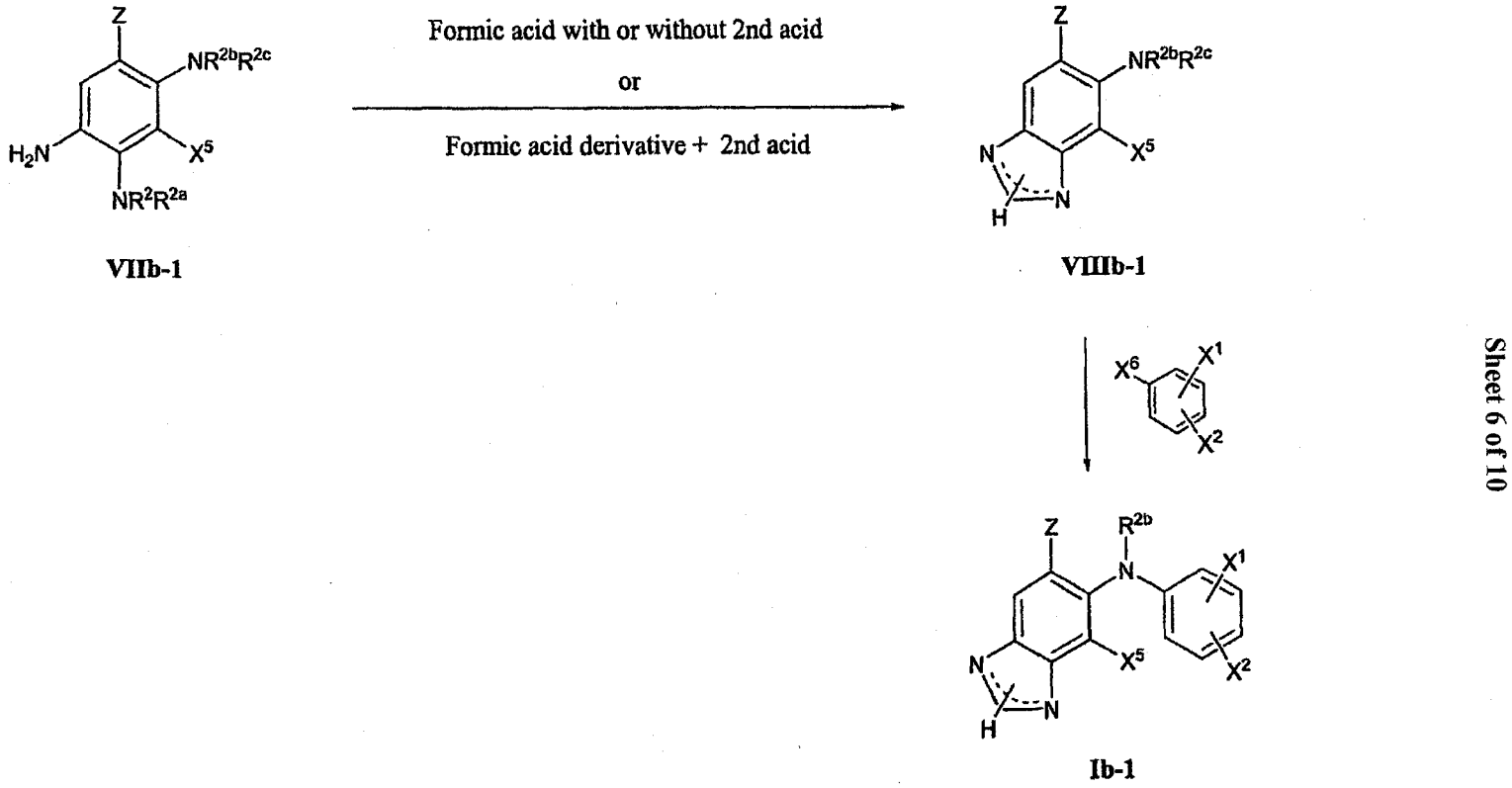


dba
(dibenzylideneacetone)

Fig. 5

Method A

R^2, R^{2a} = H



VIIb-1

VIIIb-1

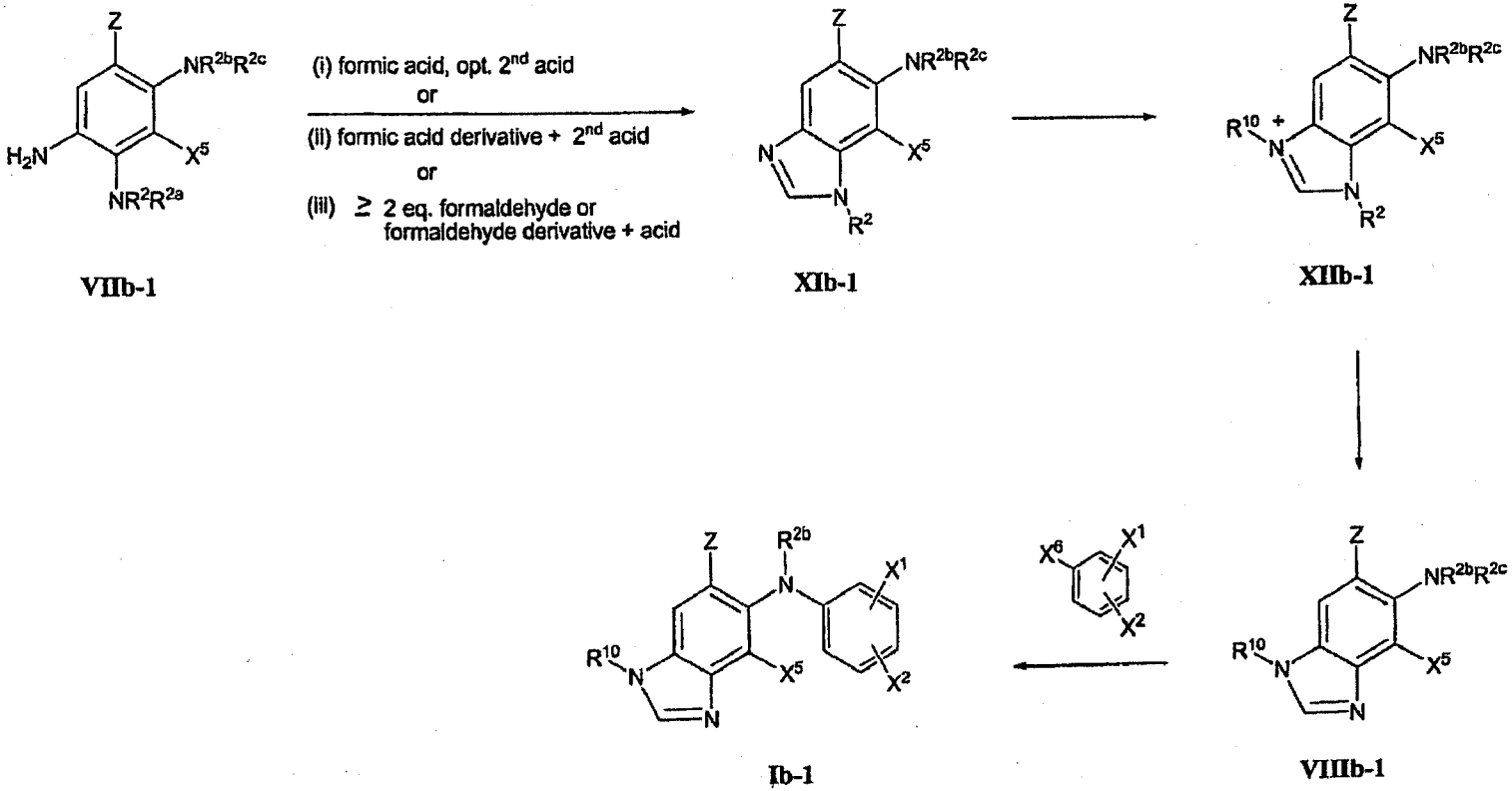
Ib-1

FIG. 6

Method B

$R^2 \neq H$

$R^{2a} = H$



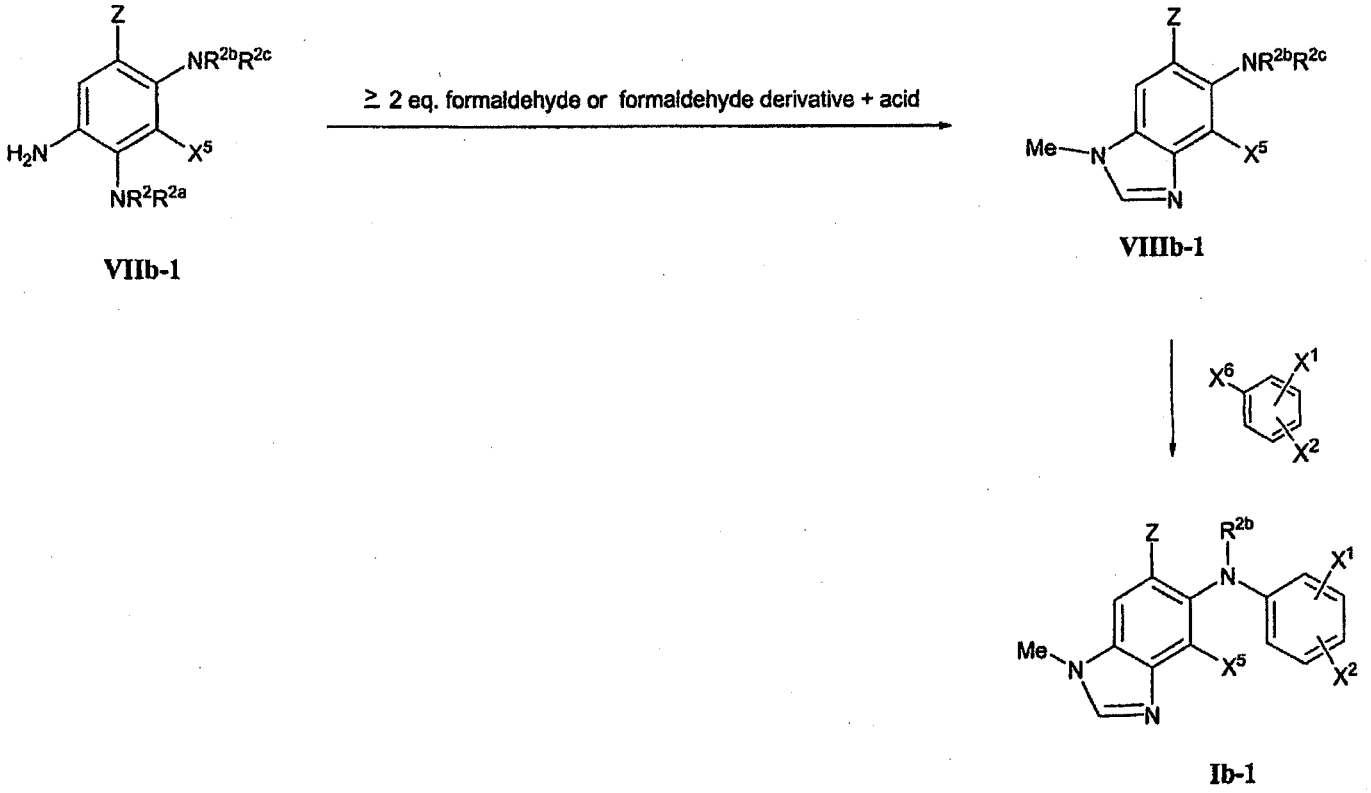
VIIb-1 XIb-1 XIIb-1

VIIIb-1 Ib-1

FIG. 7

Method C

R^2, R^{2a} = H



VIIb-1

VIIIb-1

Ib-1

FIG. 8

Method D

R^2, R^{2a} = H

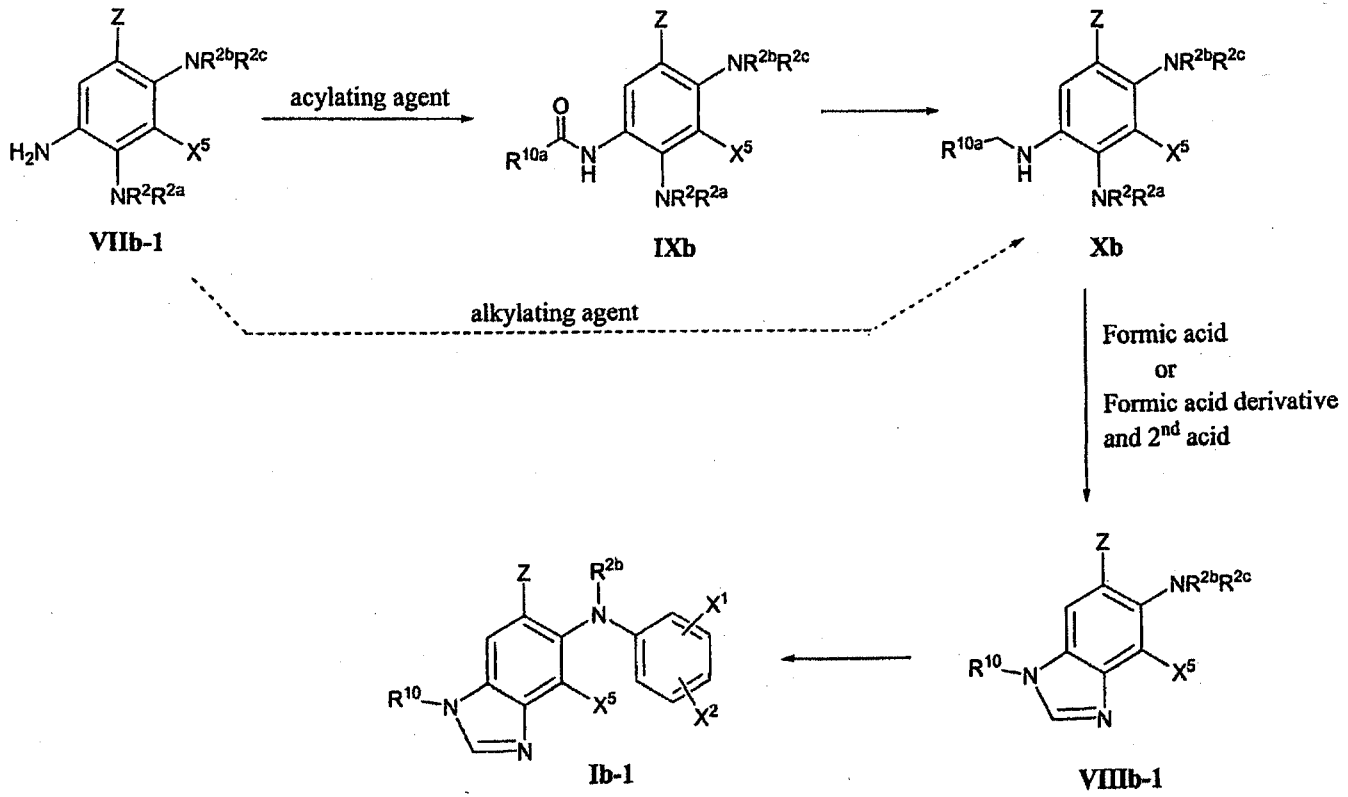


FIG. 9

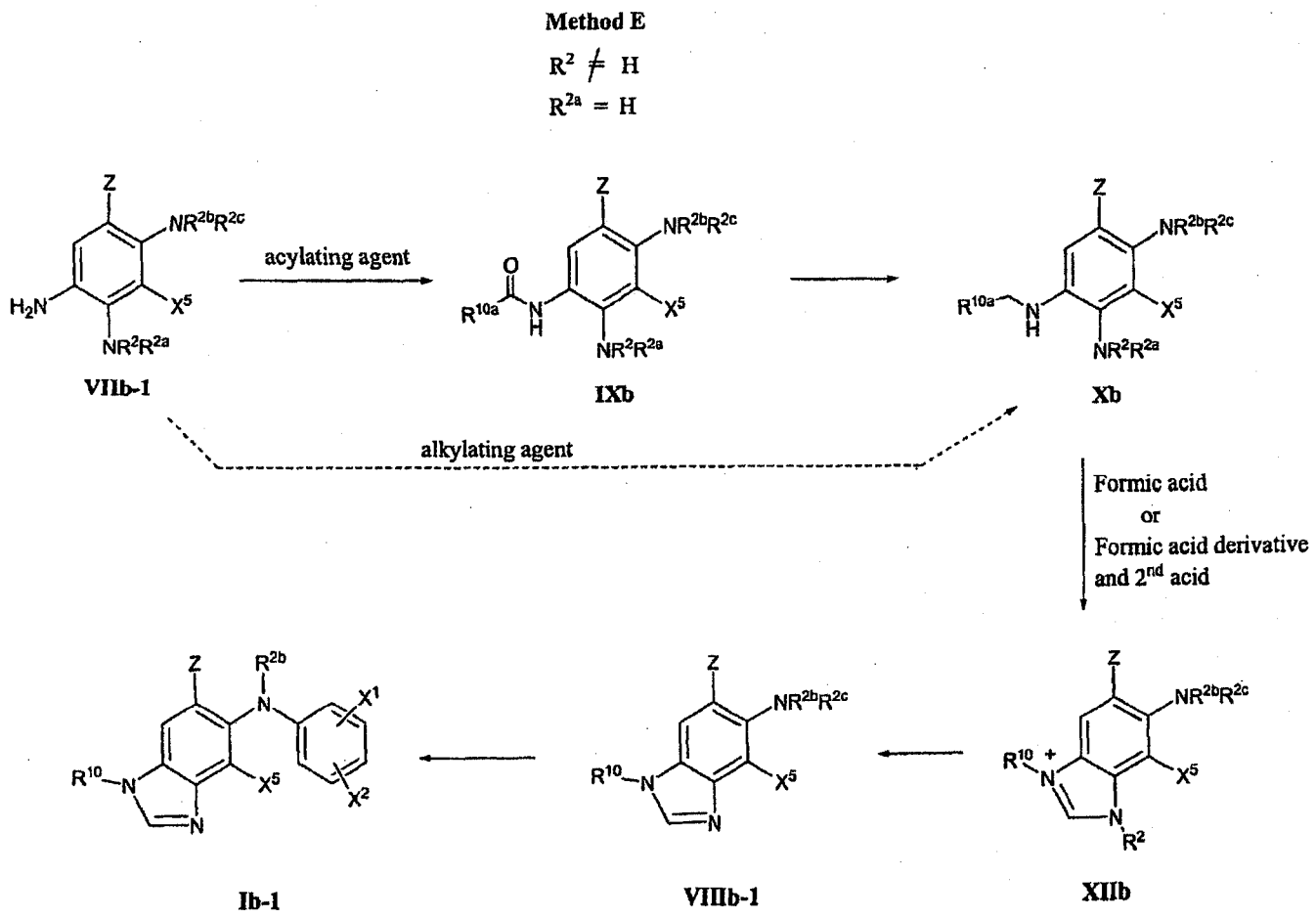

Method E
$R^2 \neq H$
$R^{2a} = H$
acylating agent
alkylating agent
Formic acid
or
Formic acid derivative
and 2nd acid
VIIb-1
IXb
Xb
XIIb
VIIIb-1
Ib-1

FIG. 10