FIGURE 1

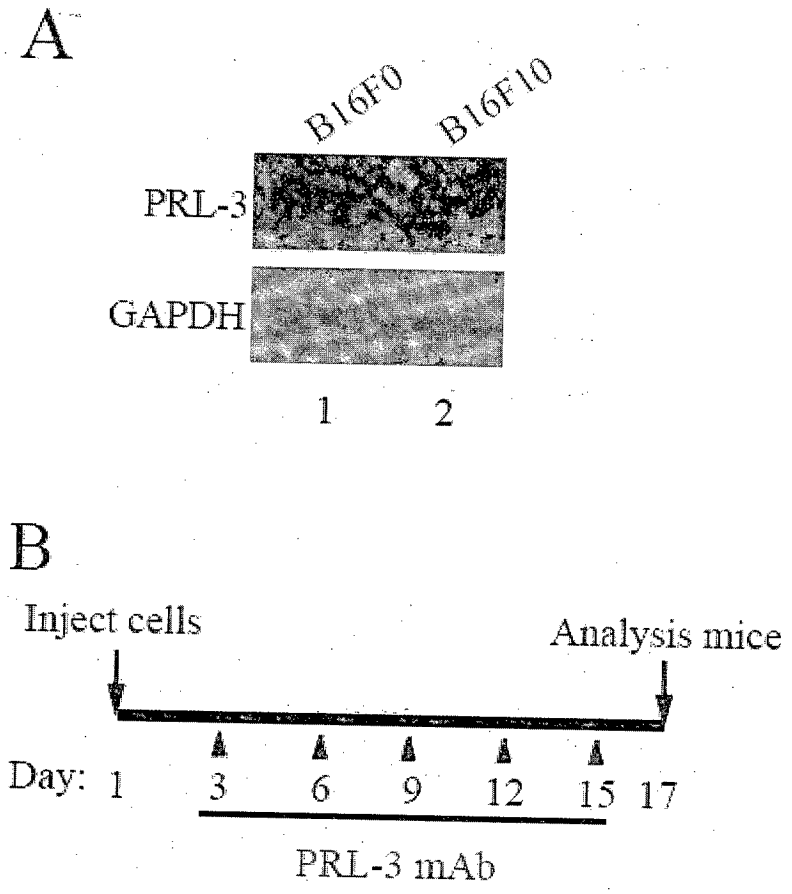

A
B16F0
B16F10
PRL-3
GAPDH
1
2
B
Inject cells
Analysis mice
Day: 1 3 6 9 12 15 17
PRL-3 mAb

FIGURE 1 (CONTINUED)

C

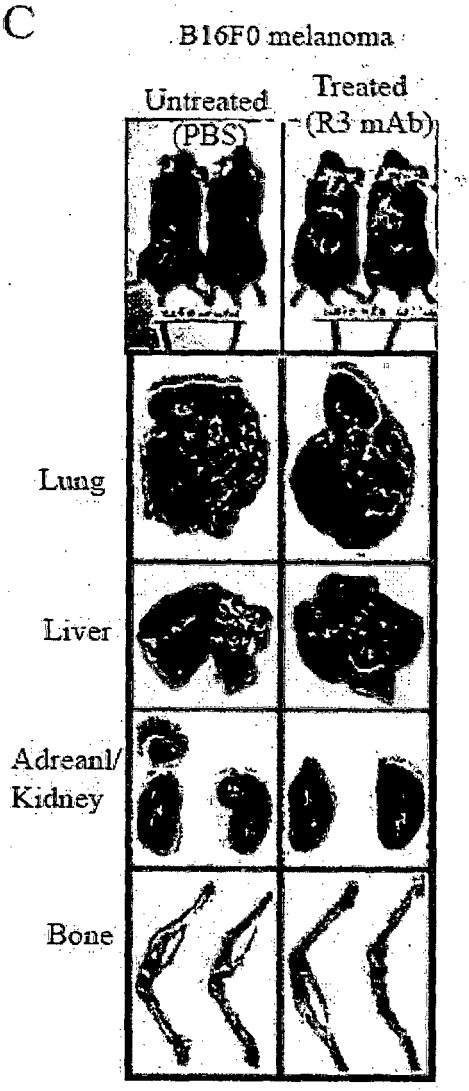


FIGURE 1 (CONTINUED)

D

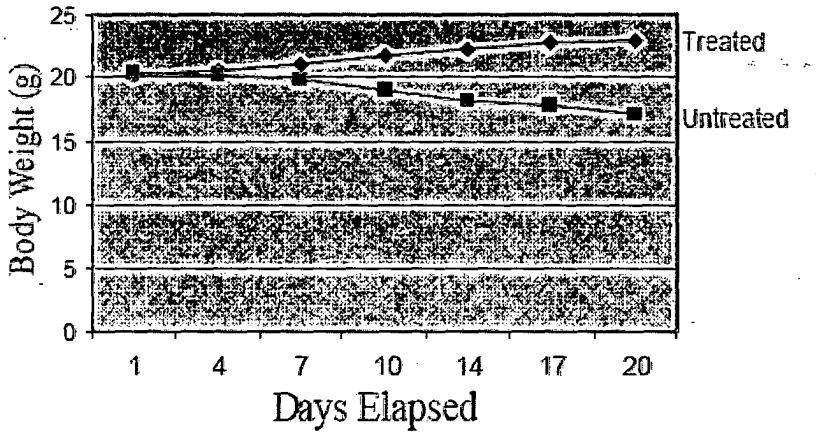


FIGURE 1 (CONTINUED)

E

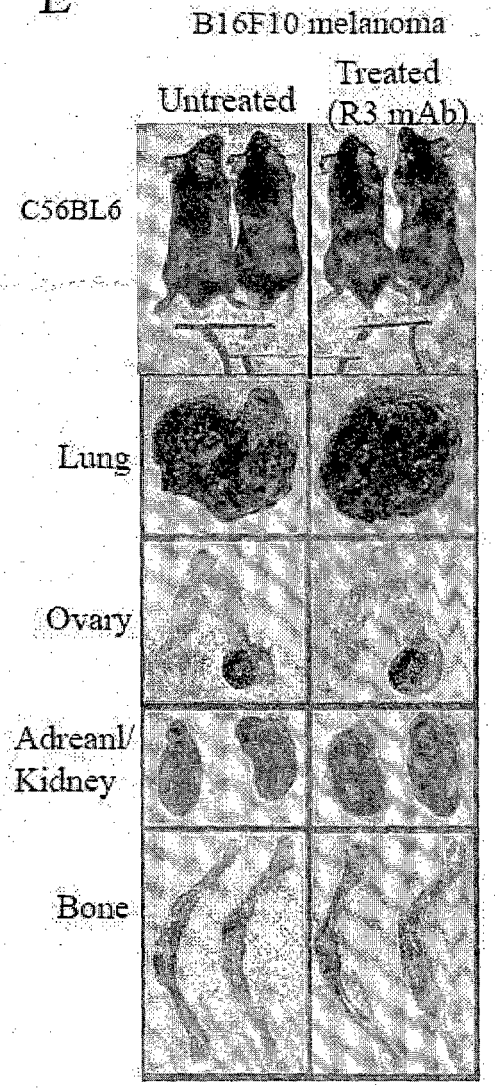


FIGURE 1 (CONTINUED)

F

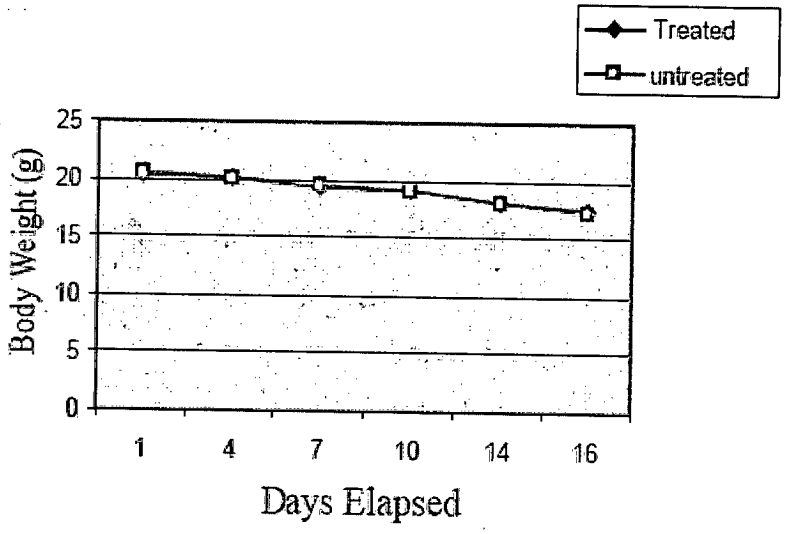


FIGURE 2

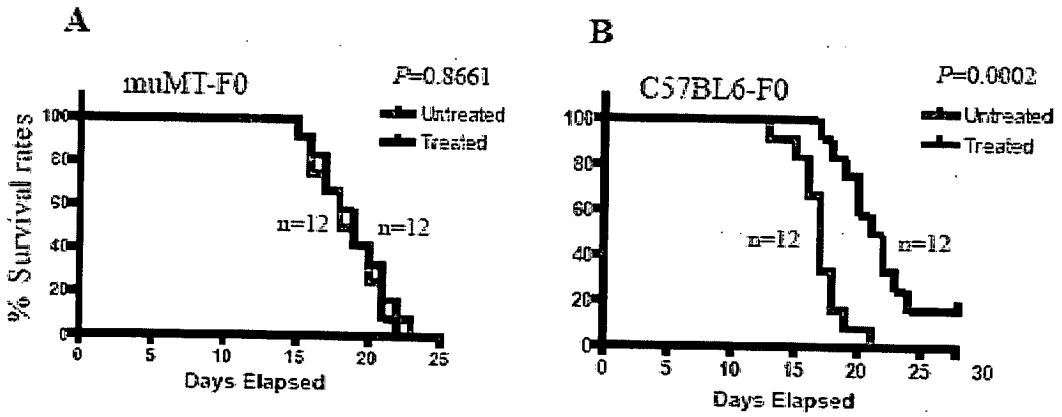
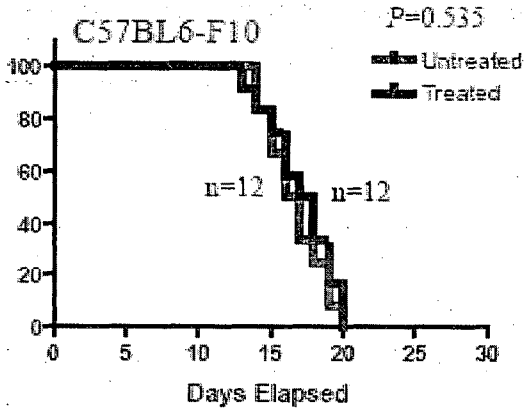


FIGURE 2 (CONTINUED)

C



D

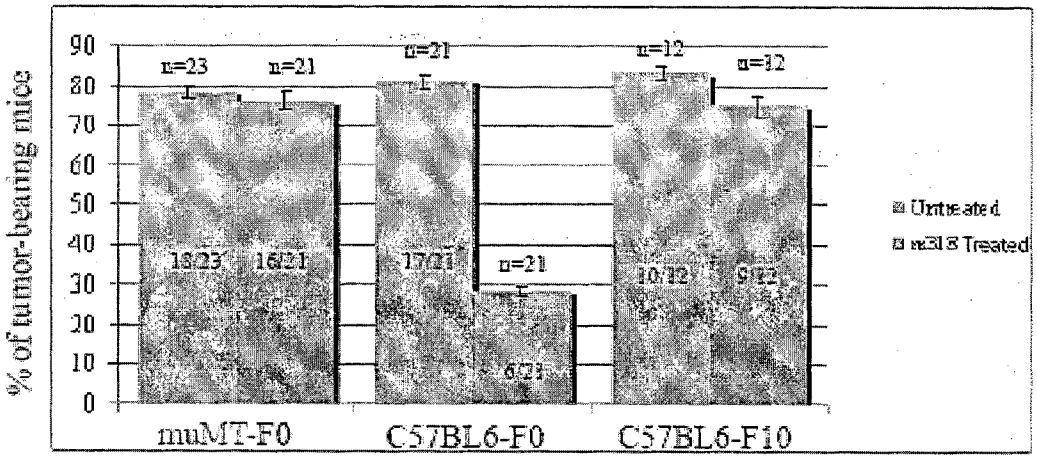


FIGURE 3

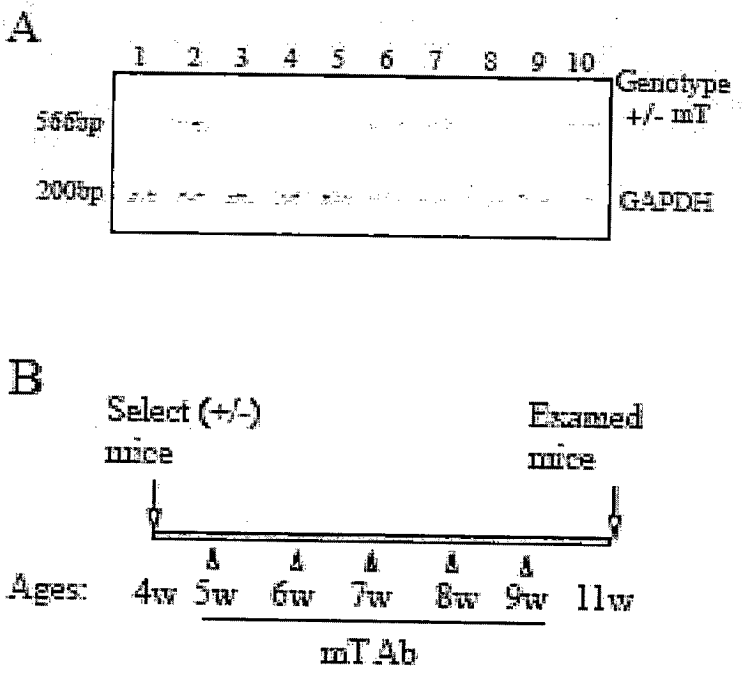
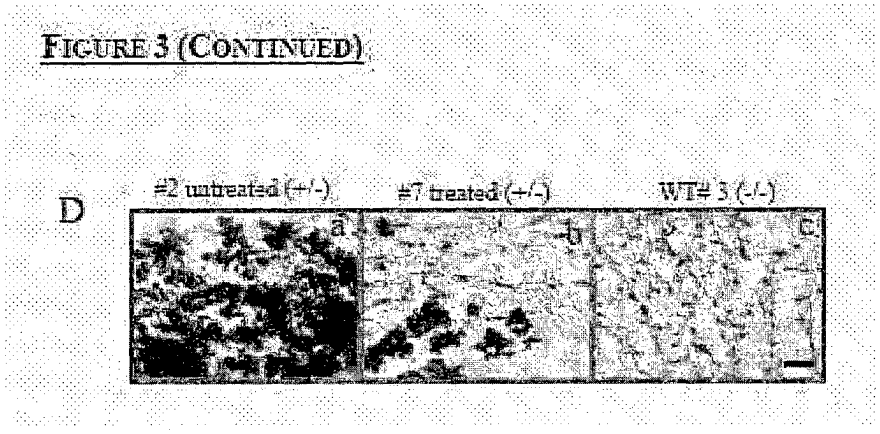
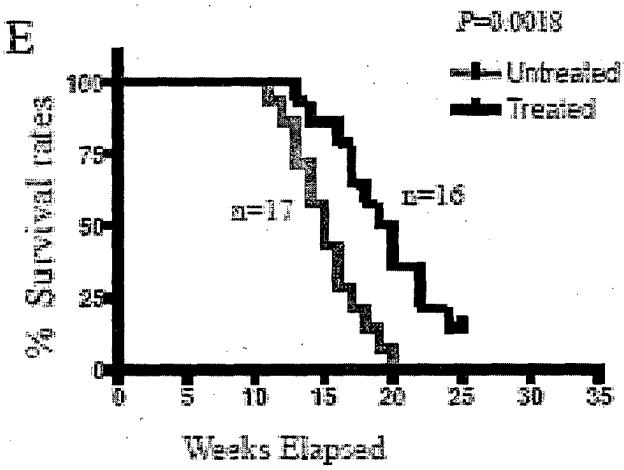

A
1 2 3 4 5 6 7 8 9 10
Genotype
+/- mT
566bp
200bp
GAPDH
B
Select (+/-)
mice
Examed
mice
Ages: 4w 5w 6w 7w 8w 9w 11w
mT Ab
C
Transgenic MMTV-MT (+/-)
Untreated
Treated with mT Ab
WT #3 (-/-)
TG #2
TG #5
TG #7
TG #10
TG #1
TG #6
TG #7
TG #10
WT #3

FIGURE 3 (CONTINUED)





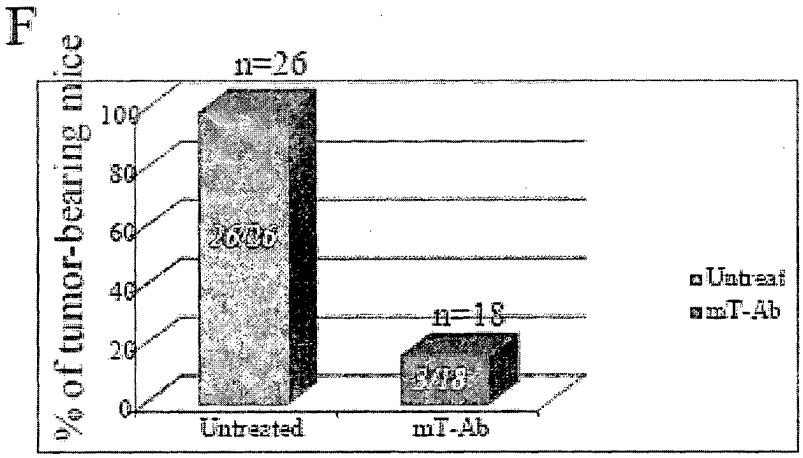
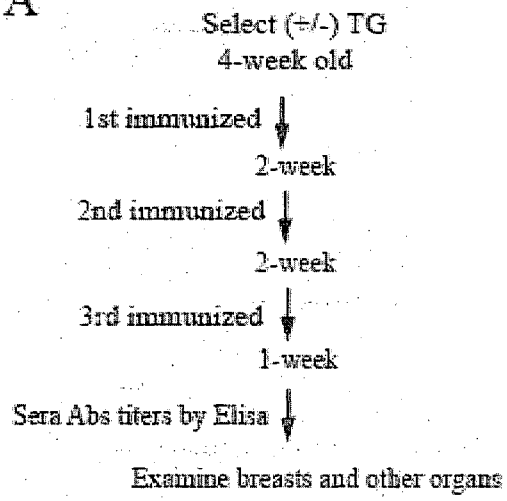


FIGURE 4

A


Select (+/-) TG
4-week old
1st immunized
2-week
2nd immunized
2-week
3rd immunized
1-week
Sera Abs titers by Elisa
Examine breasts and other organs

B

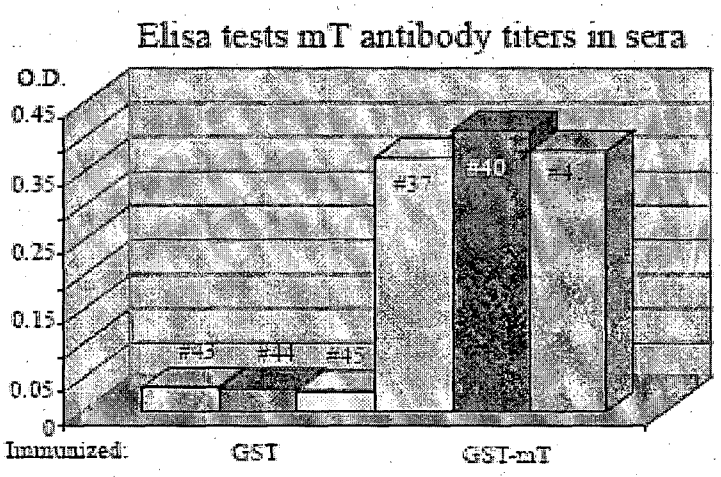
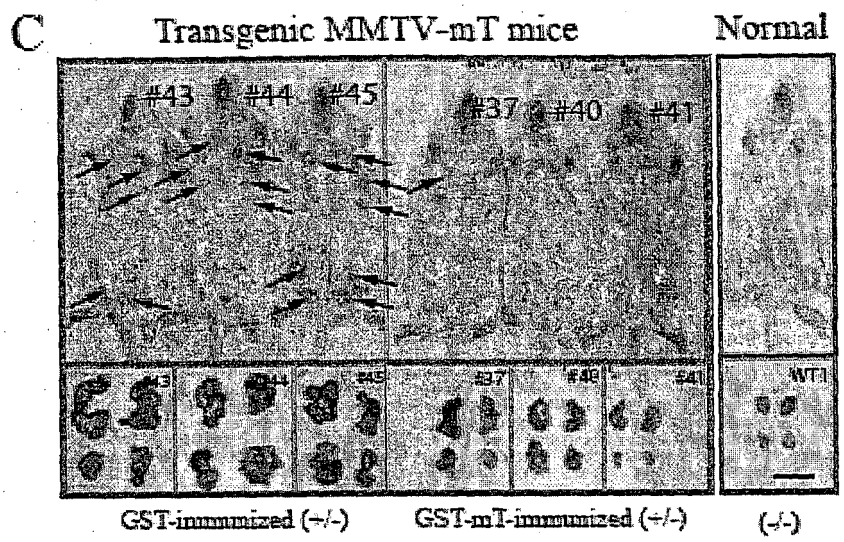

Elisa tests mT antibody titers in sera
O.D.
0.45
0.35
0.25
0.15
0.05
0
#43
#44
#45
#37
#40
#41
Immunized:
GST
GST-mT

FIGURE 4 (CONTINUED)



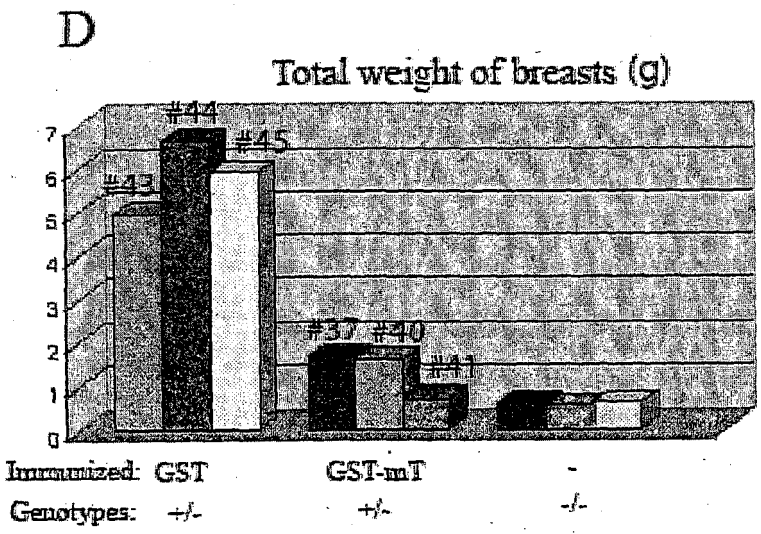
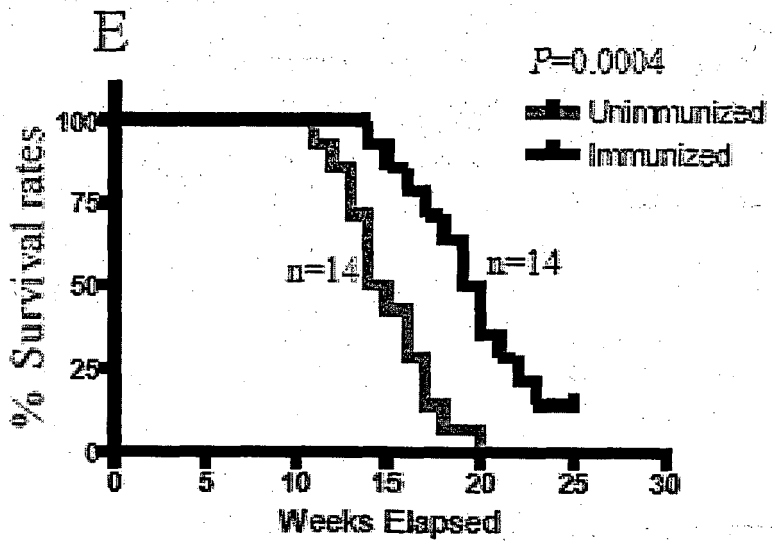


FIGURE 4 (CONTINUED)



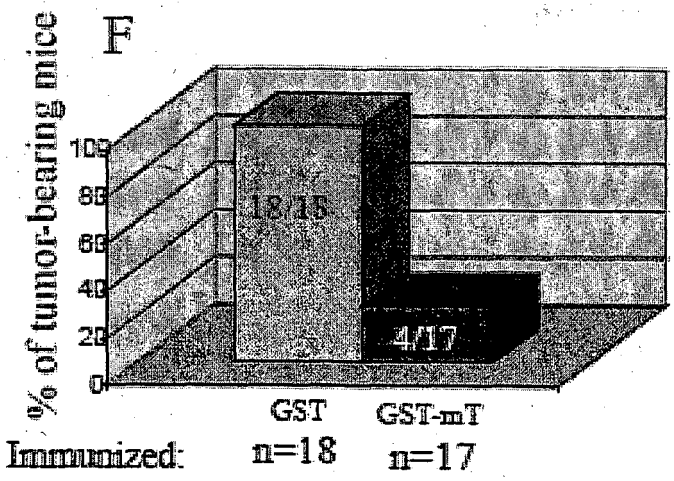


FIGURE 5

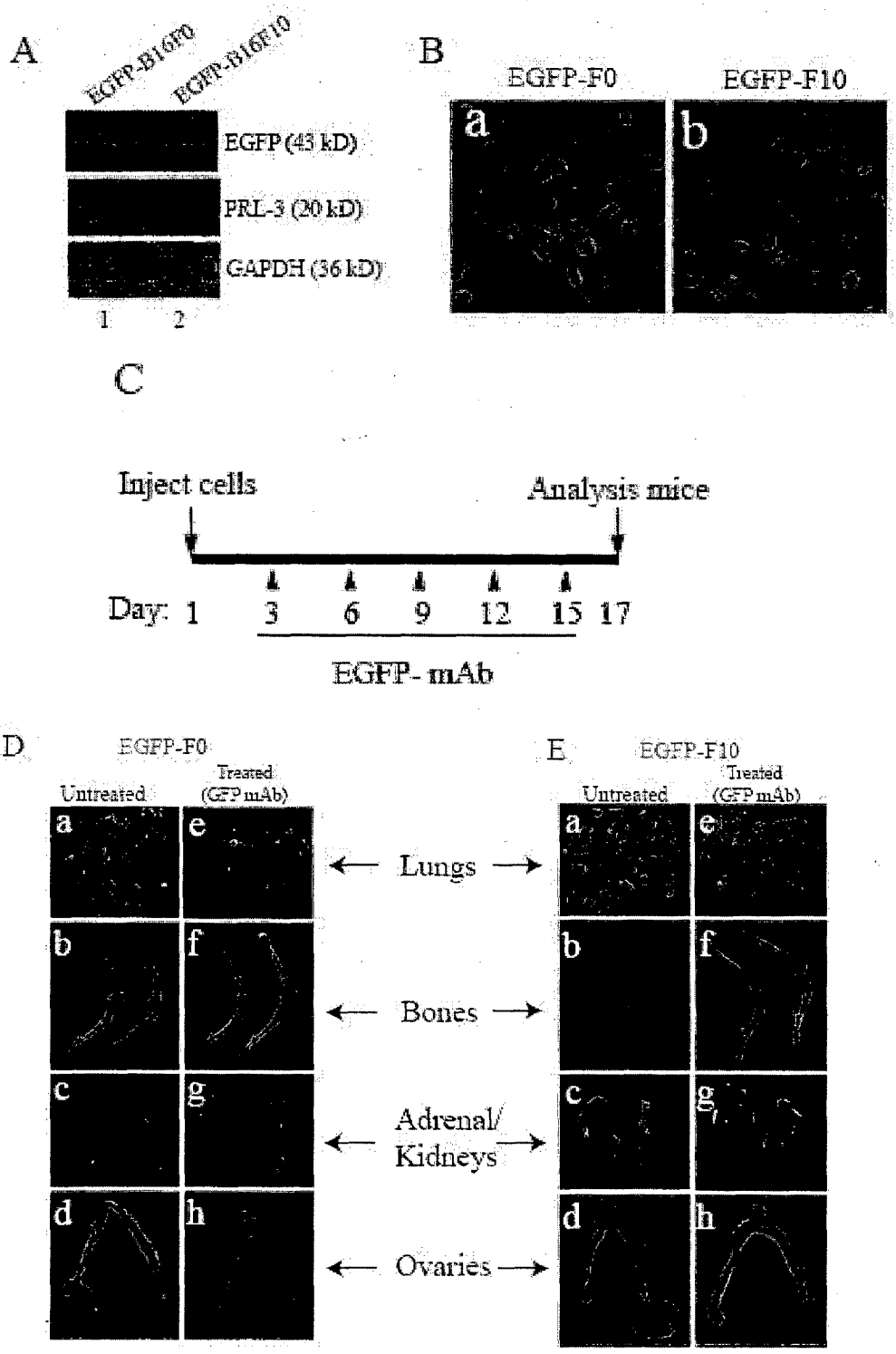
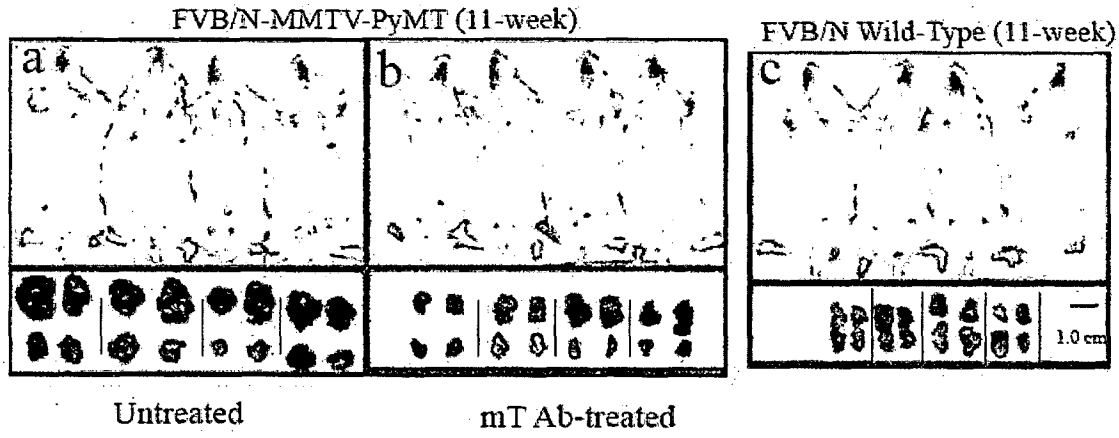

A
EGFP-B16F0
EGFP-B16F10
EGFP (43 kD)
PRL-3 (20 kD)
GAPDH (36 kD)
1
2
B
EGFP-F0
EGFP-F10
a
b
C
Inject cells
Analysis mice
Day: 1 3 6 9 12 15 17
EGFP- mAb
D
EGFP-F0
Untreated
Treated (GFP mAb)
E
EGFP-F10
Untreated
Treated (GFP mAb)
Lungs
Bones
Adrenal/ Kidneys
Ovaries

FIGURE 5 (CONTINUED)

F



G

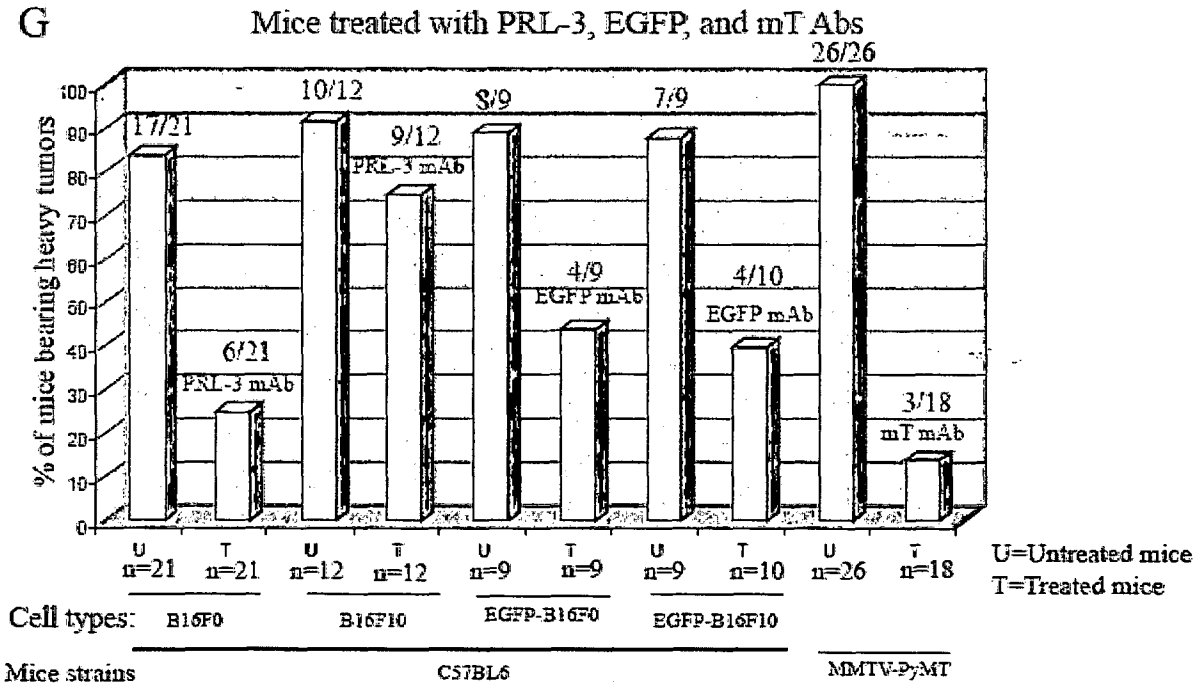
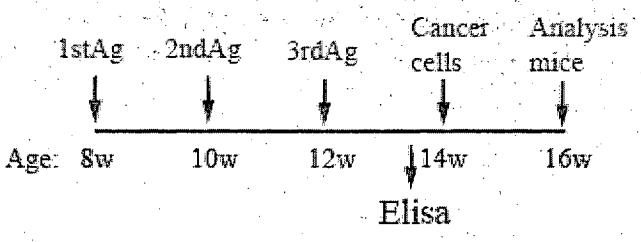


FIGURE 6

A


1stAg
2ndAg
3rdAg
Cancer cells
Analysis mice
Age: 8w
10w
12w
14w
16w
Elisa

B

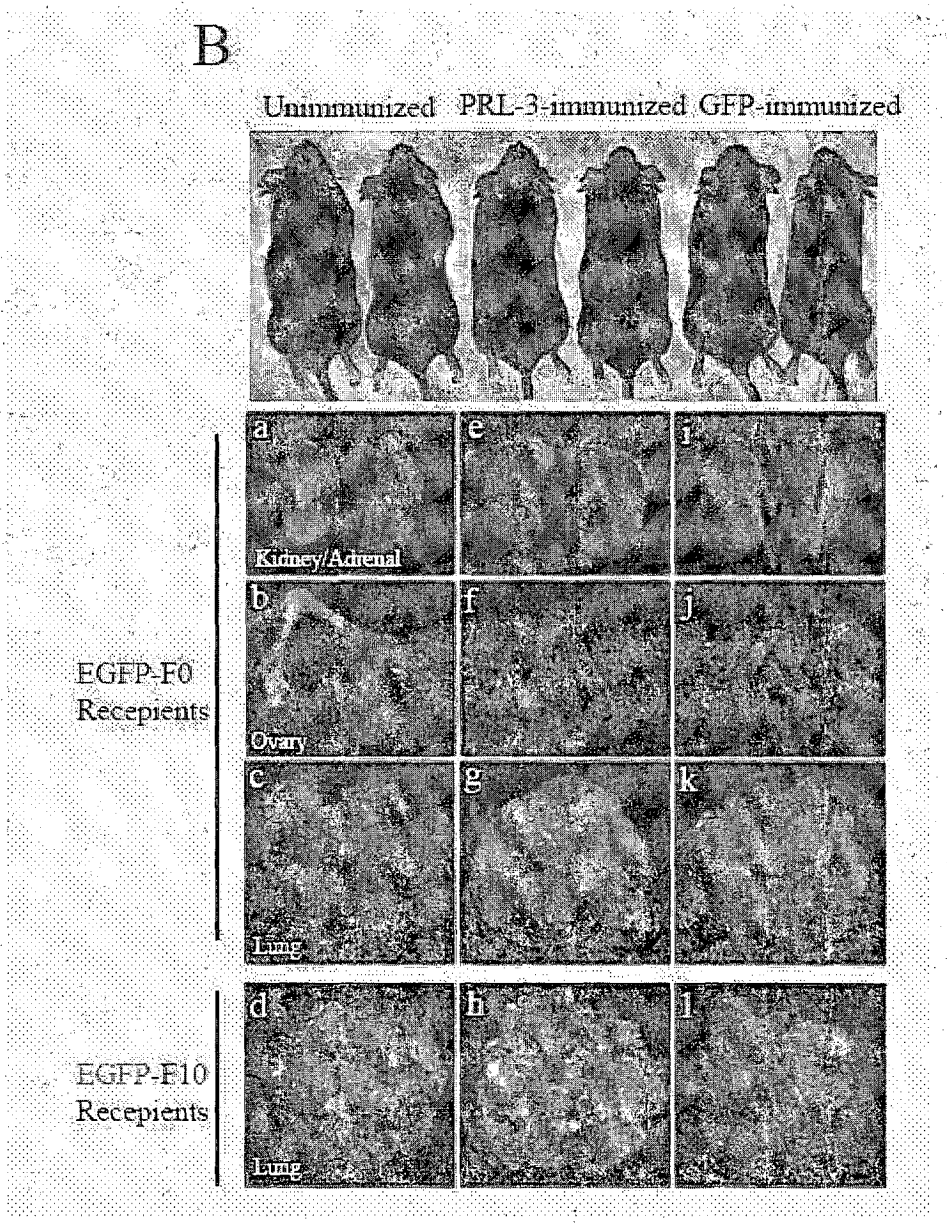
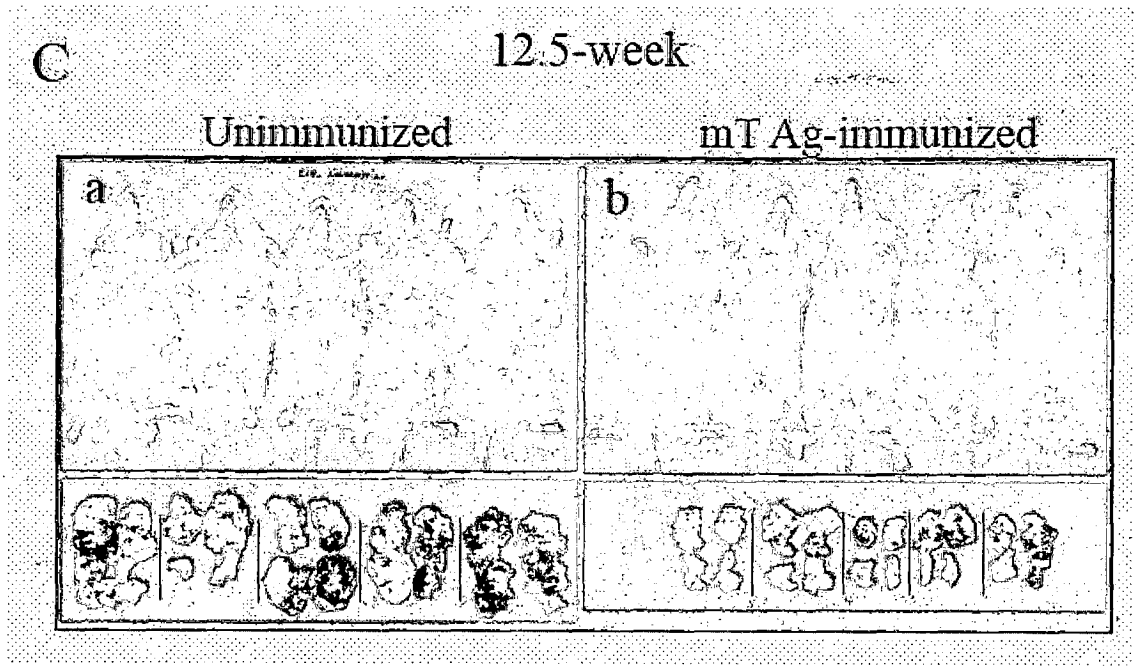
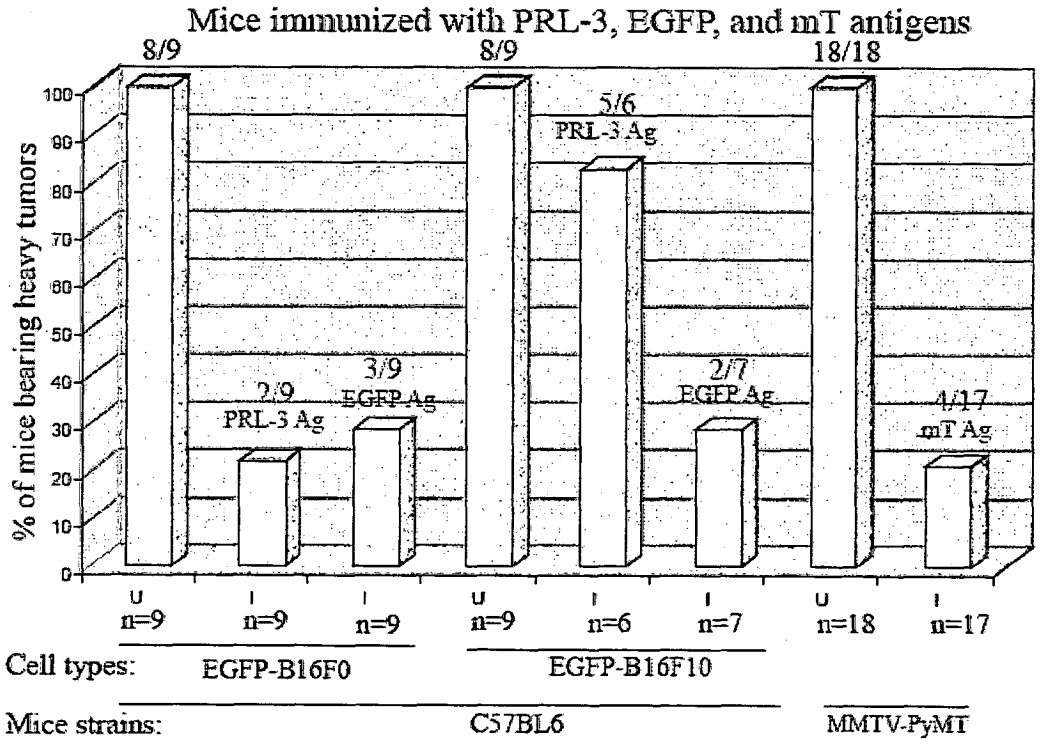

Unimmunized
PRL-3-immunized
GFP-immunized
a
e
i
Kidney/Adrenal
b
f
j
Ovary
c
g
k
Lung
d
h
l
Lung
EGFP-F0 Recepients
EGFP-F10 Recepients

FIGURE 6 (CONTINUED)



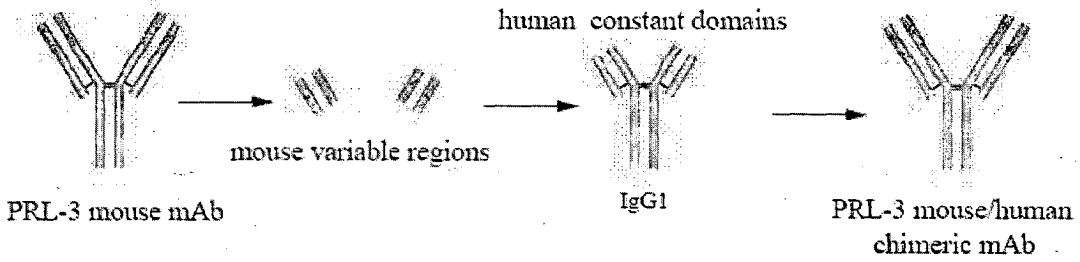
D



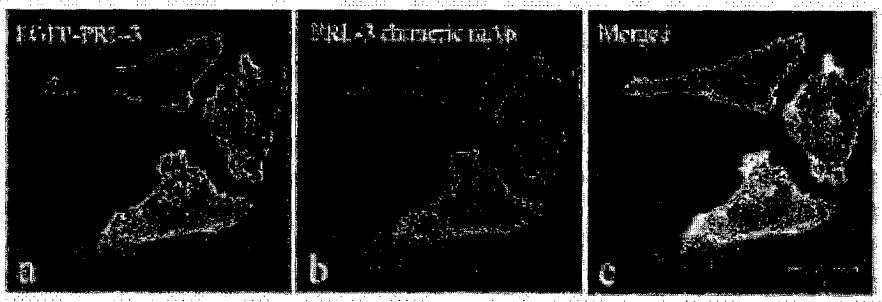
U=Unimmunized mice
I=Immunized mice

FIGURE 7

A Outline of PRL-3 chimeric antibody construction



B



C

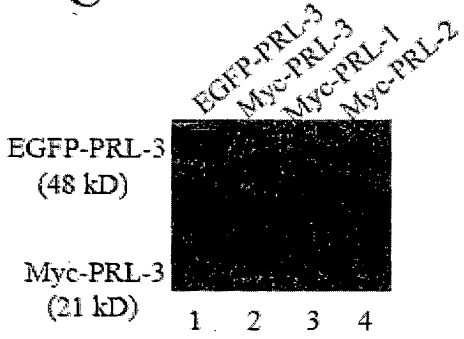


FIGURE 8

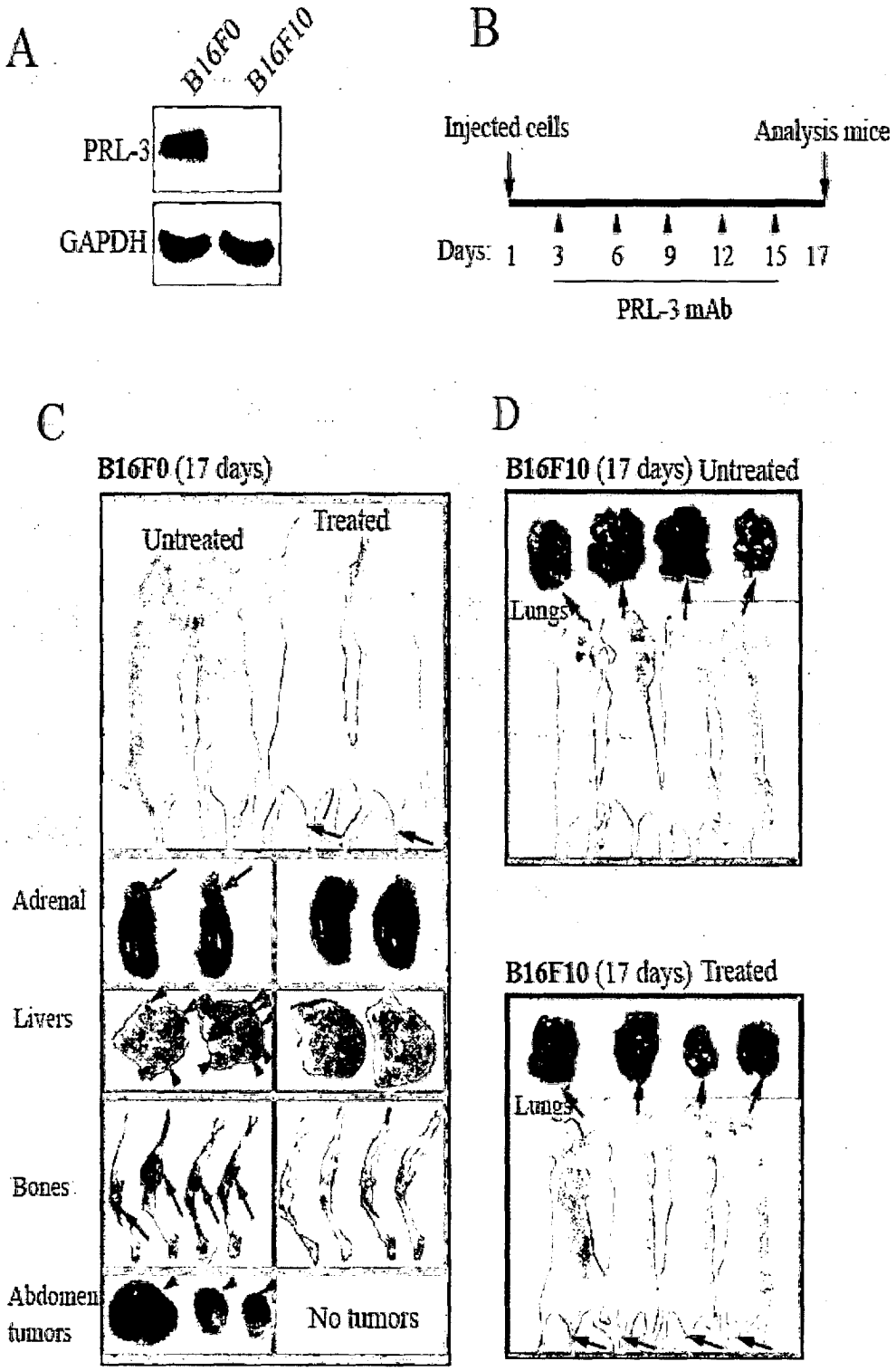

A
B16F0
B16F10
PRL-3
GAPDH
B
Injected cells
Analysis mice
Days: 1 3 6 9 12 15 17
PRL-3 mAb
C
B16F0 (17 days)
Untreated
Treated
Adrenal
Livers
Bones
Abdomen tumors
No tumors
D
B16F10 (17 days) Untreated
Lungs
B16F10 (17 days) Treated
Lungs

FIGURE 8 (CONTINUED)

E

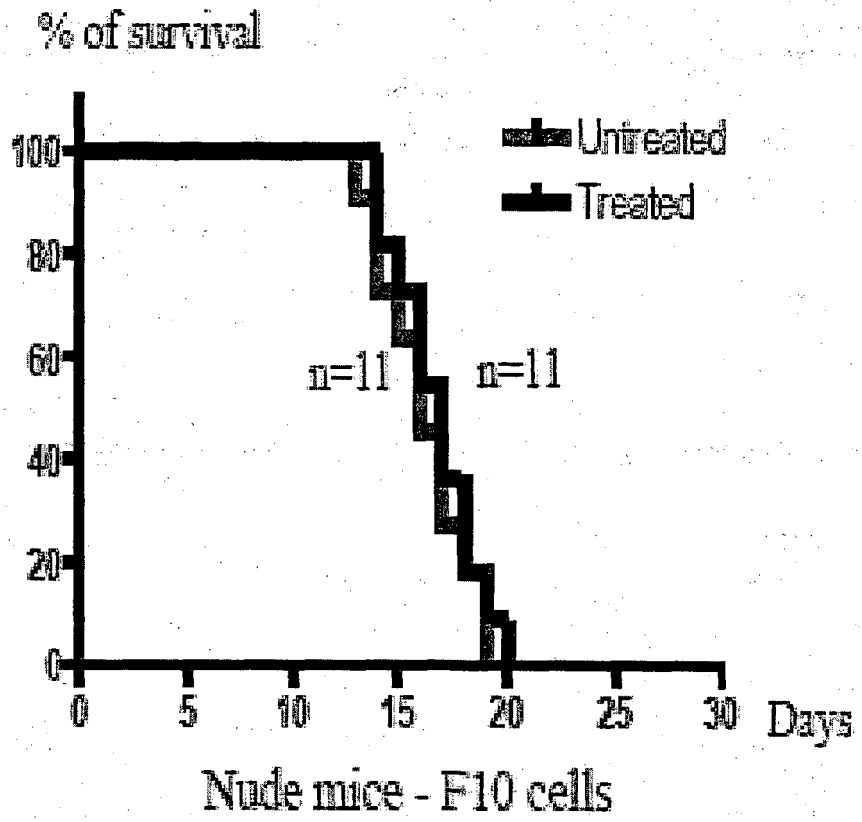


FIGURE 9

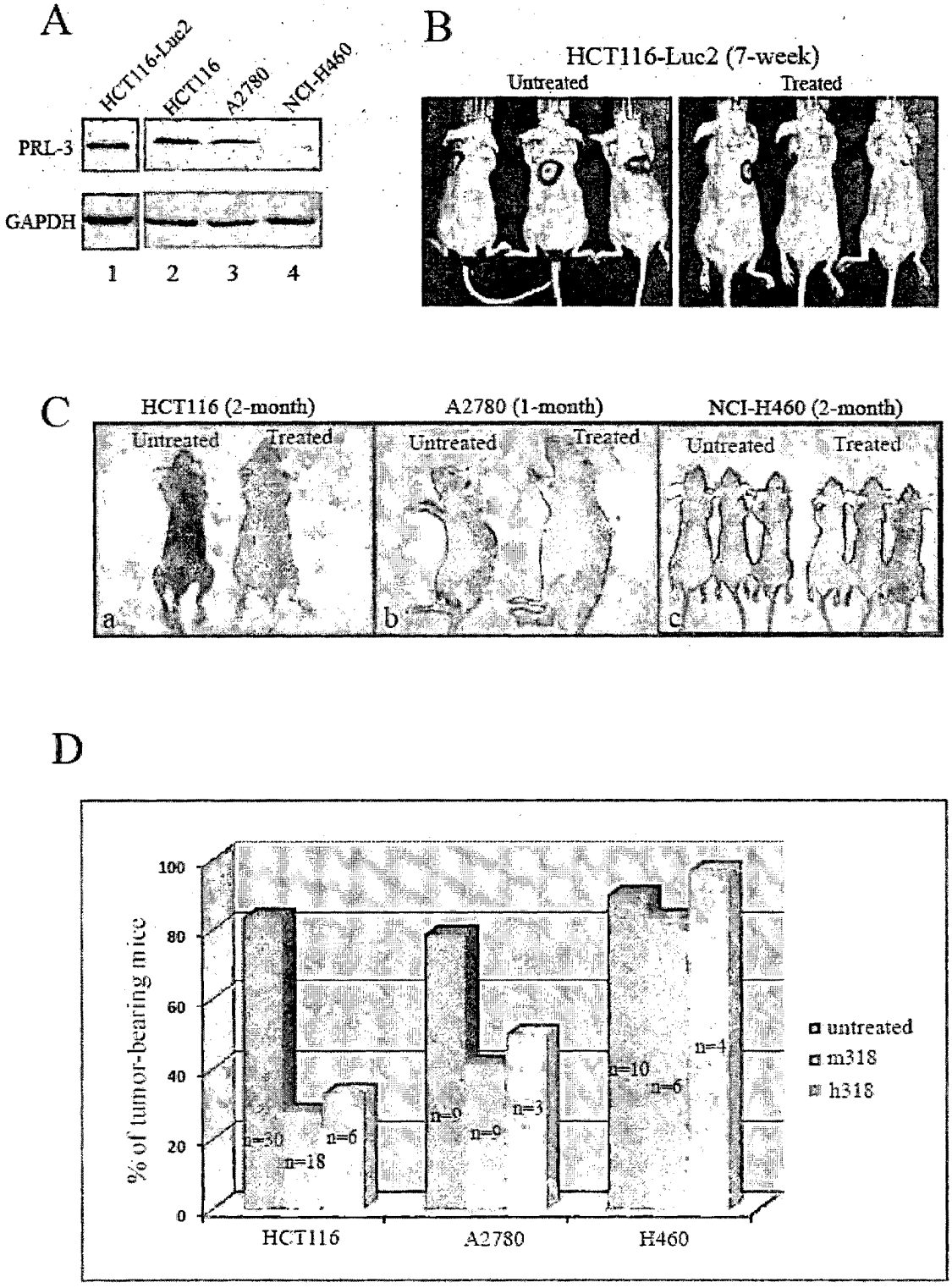
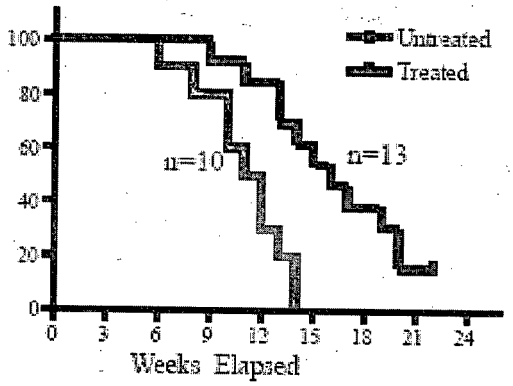

A
HCT116-Luc2
HCT116
A2780
NCI-H460
PRL-3
GAPDH
1 2 3 4
B
HCT116-Luc2 (7-week)
Untreated
Treated
C
HCT116 (2-month)
A2780 (1-month)
NCI-H460 (2-month)
Untreated
Treated
a
b
c
D
% of tumor-bearing mice
100
80
60
40
20
0
n=30
n=18
n=6
n=9
n=3
n=10
n=6
n=4
HCT116
A2780
H460
untreated
m318
h318

FIGURE 10

A

a



b

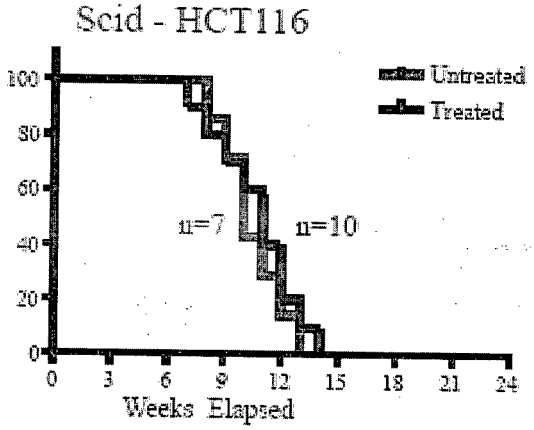
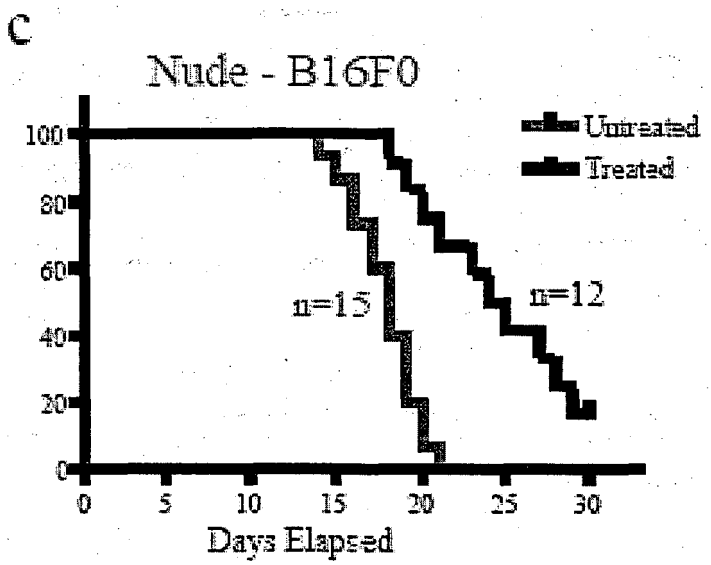


FIGURE 10A (CONTINUED)



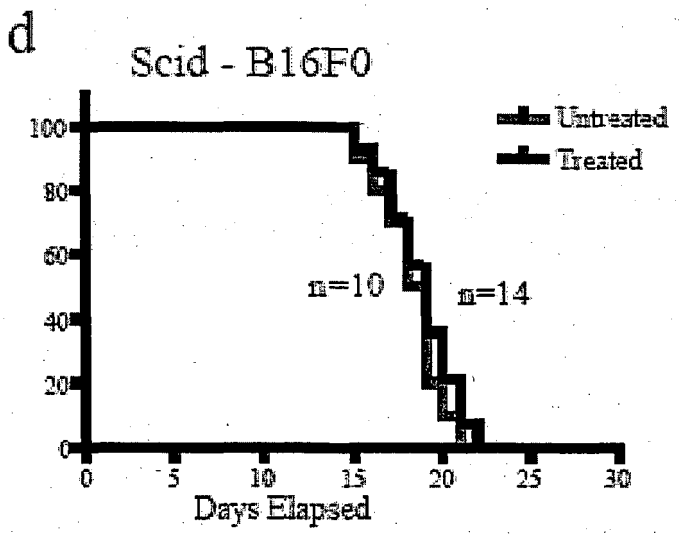


FIGURE 10B

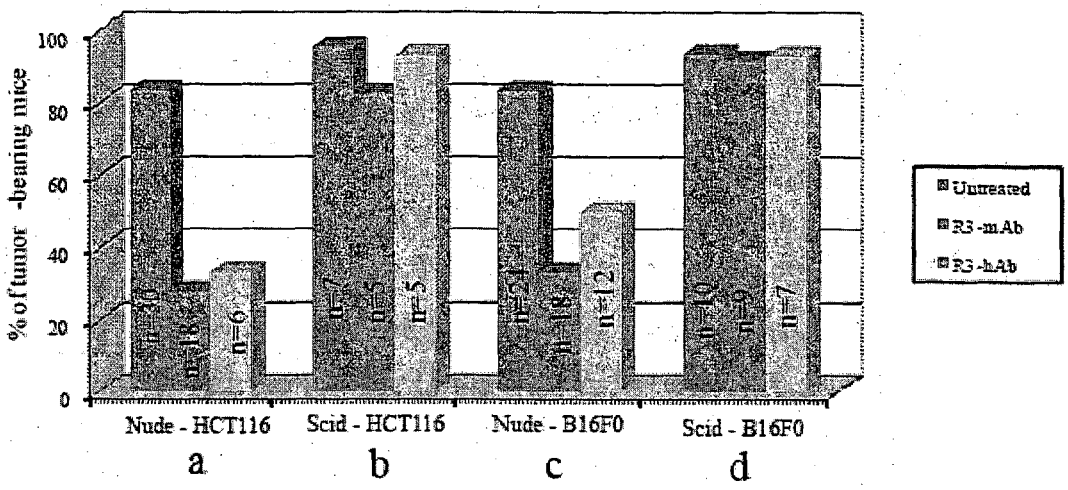

100
80
60
40
20
0
% of tumor -bearing mice
n=30
n=18
n=6
n=7
n=5
n=5
n=21
n=18
n=12
n=10
n=9
n=7
Nude - HCT116
Scid - HCT116
Nude - B16F0
Scid - B16F0
a
b
c
d
Unreated
R3-mAb
R3-hAb

FIGURE 11A

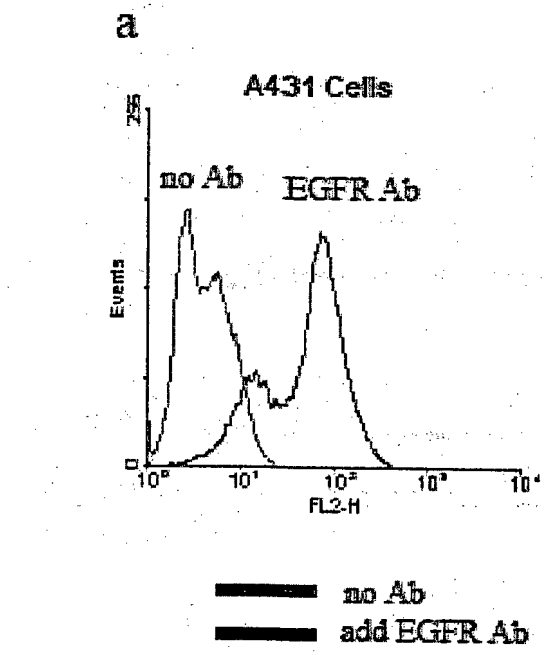

a
A431 Cells
no Ab
EGFR Ab
Events
FL2-H
no Ab
add EGFR Ab
b
B16F0 melanoma Cells
Events
FL2-H
no Ab
add PRL-3 Ab

FIGURE 11A (CONTINUED)

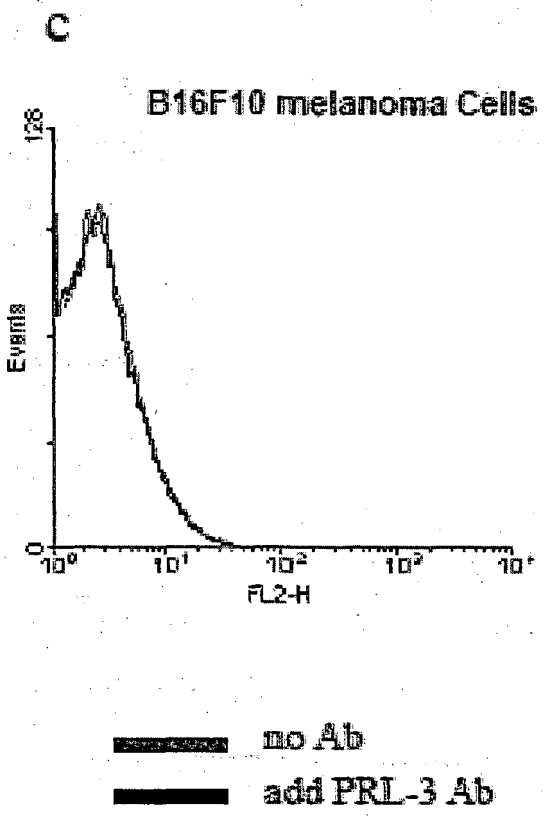


FIGURE 11B

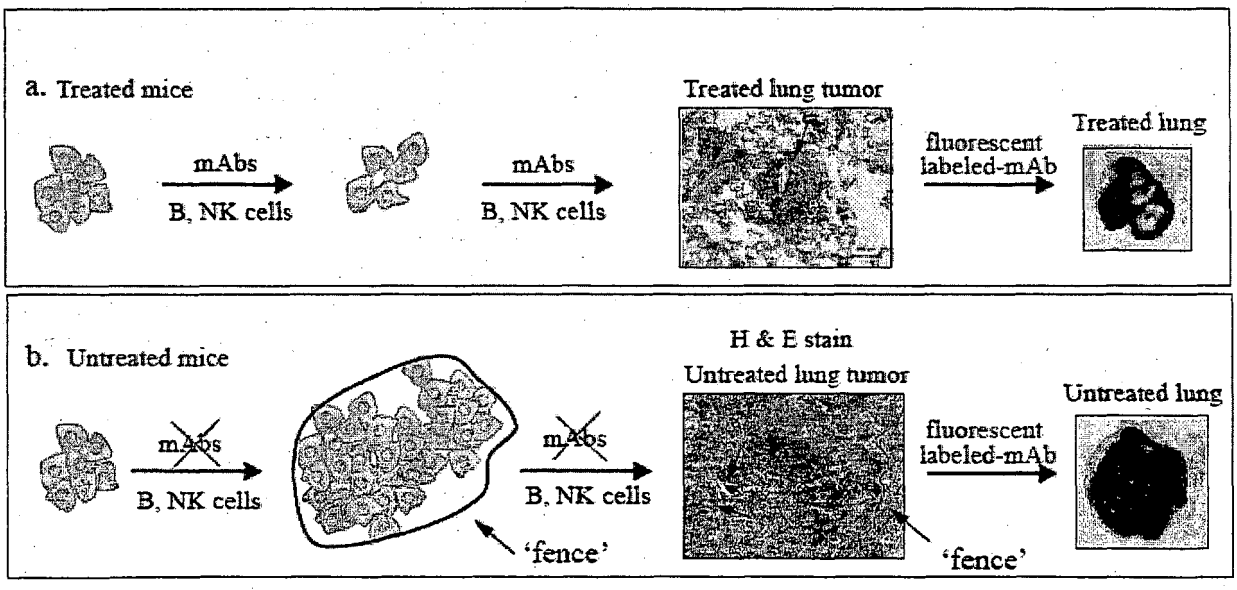
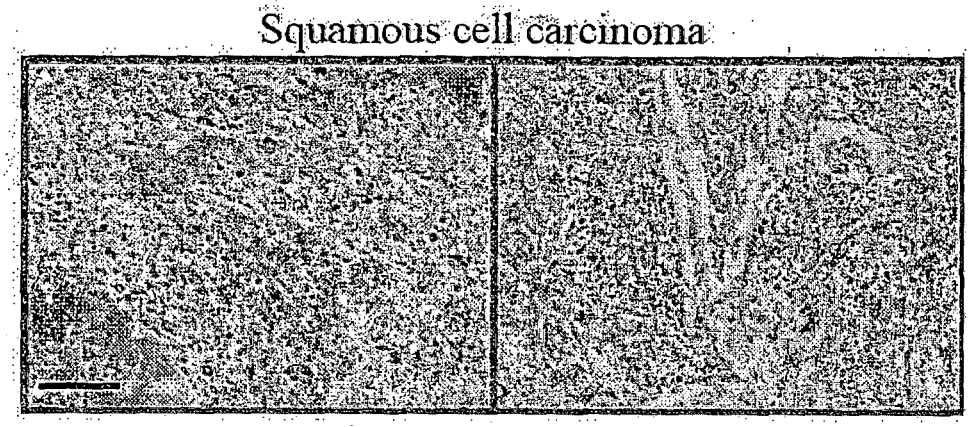
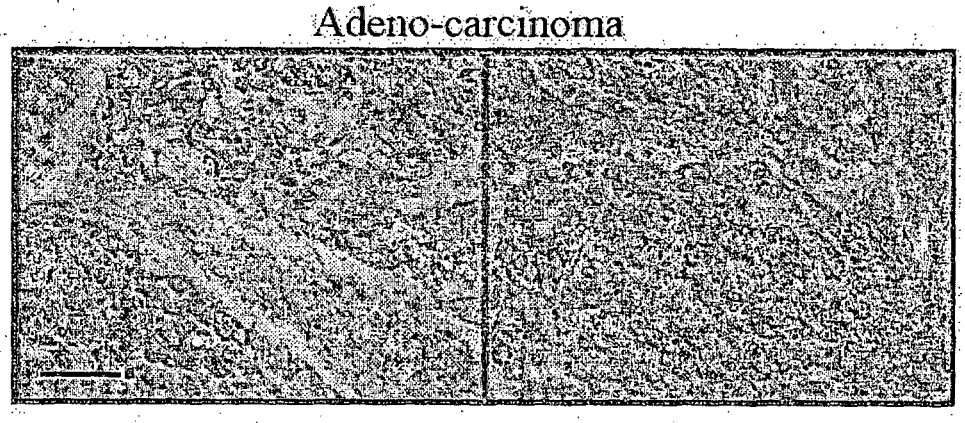


FIGURE 12

A



B



C

Summary of PRL-3 expression in human lung cancers

Subtypes of lung cancers	Squamous cell carcinoma	Adeno-carcinoma	Small cell carcinoma	Large cell carcinoma	Carcinoid	Normal lung
Total samples	74	68	12	5	4	8
PRL-3 positive samples	23	18	1	1	1	0
% of PRL-3 positive samples	31.1 %	26.4 %	8.3 %	1/5	1/4	0/8

FIGURE 12 (CONTINUED)

D PRL-3 overexpressed in 35 % of AML

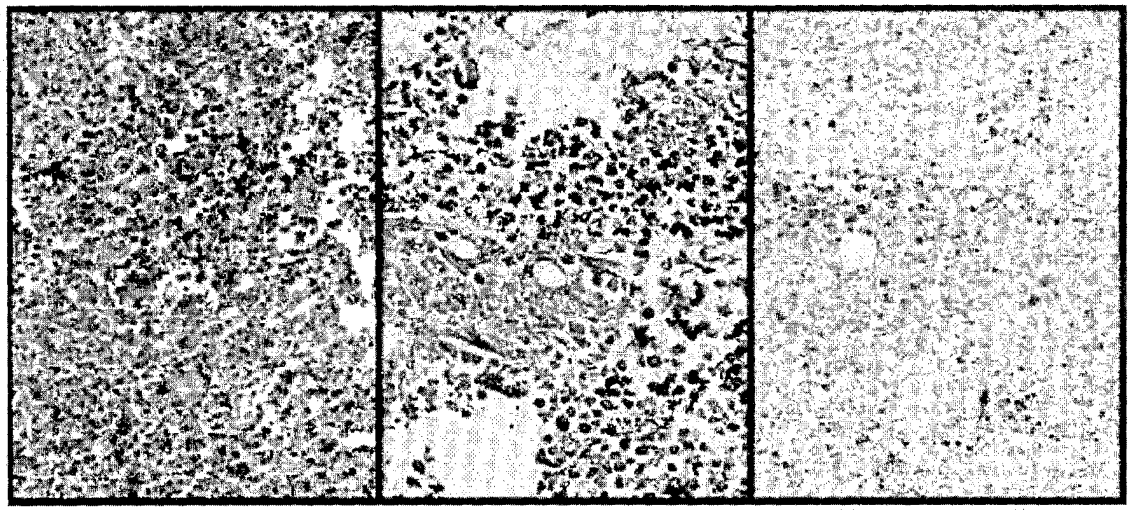


FIGURE 13

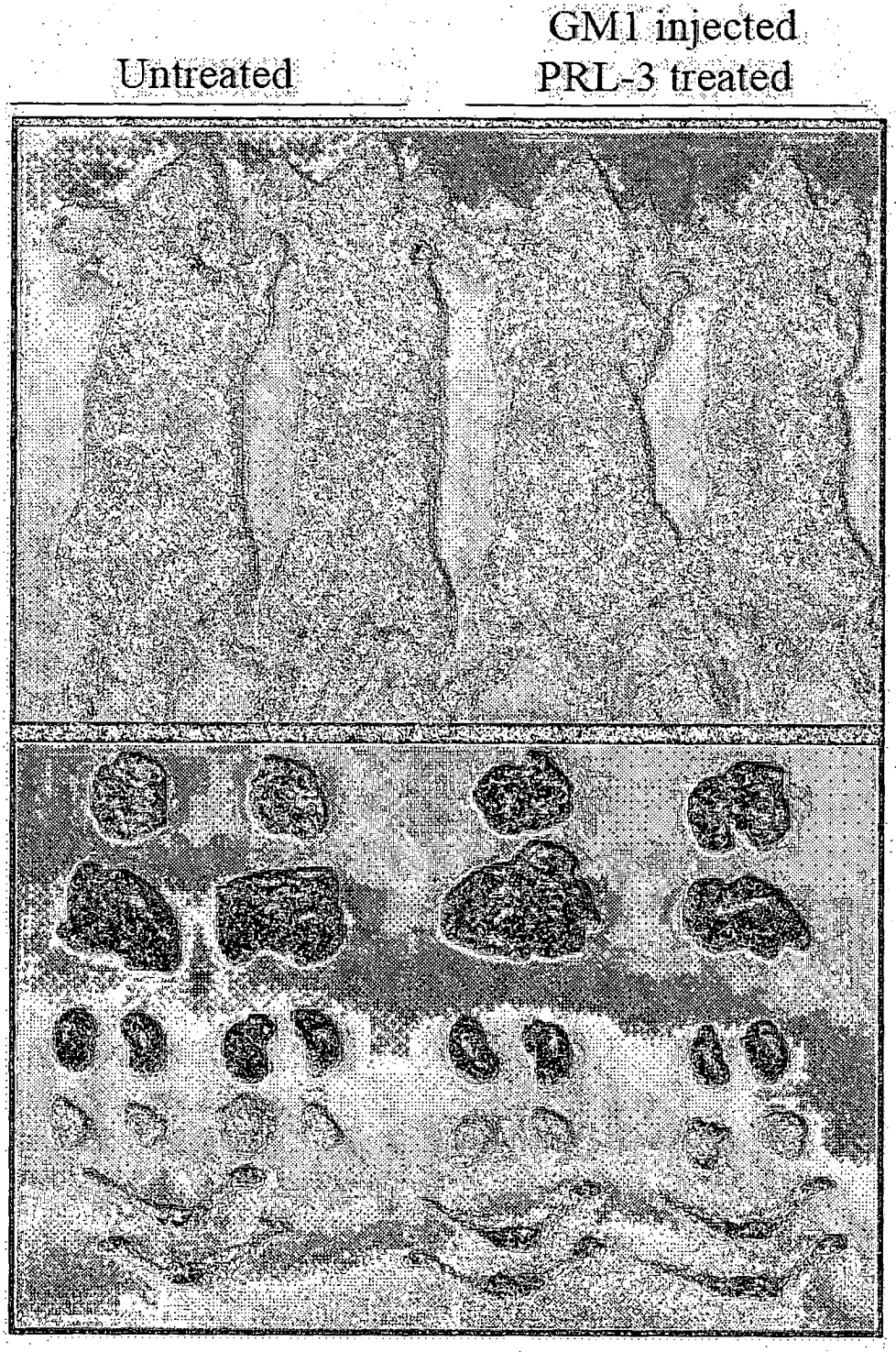


FIGURE 14

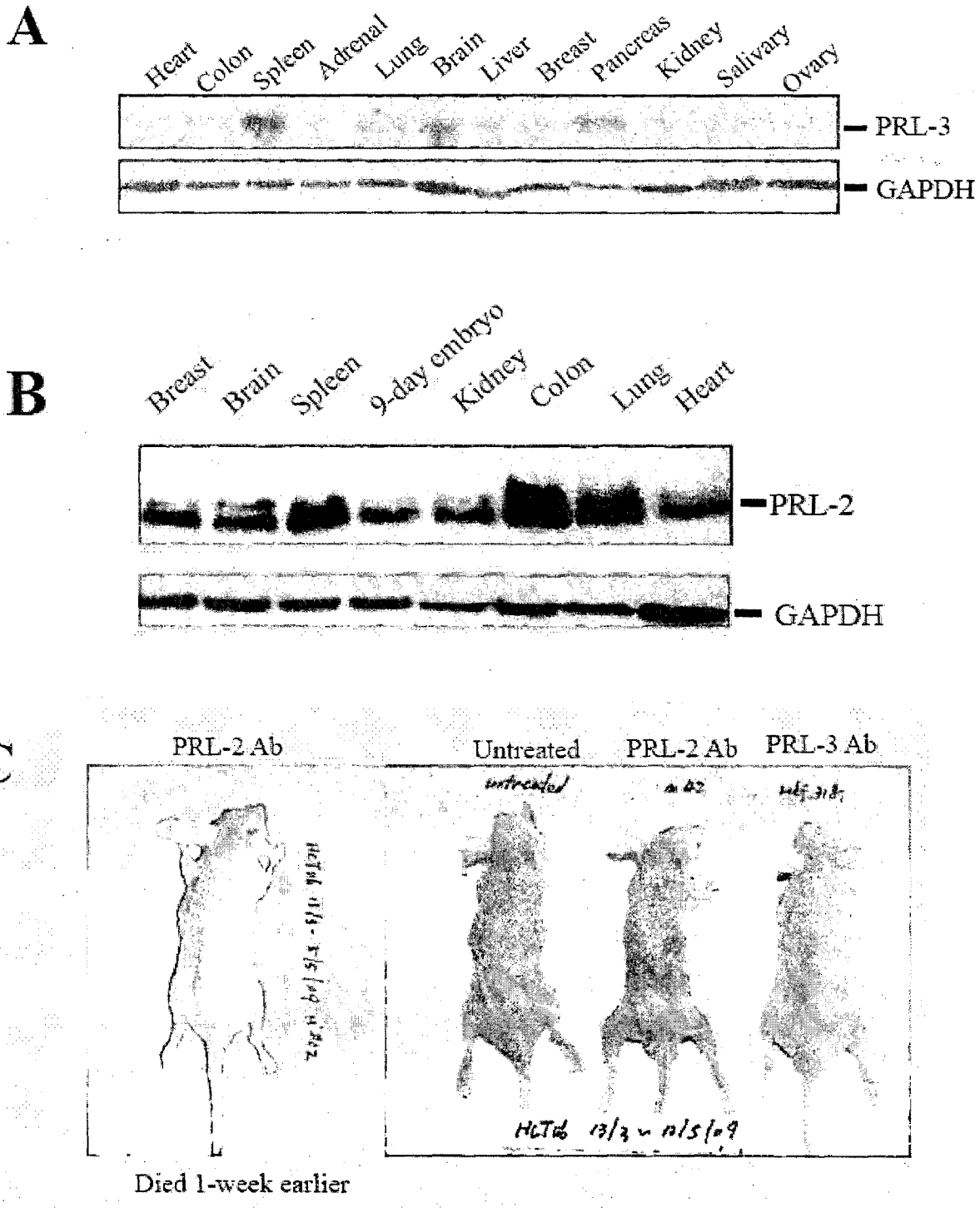

A
Heart
Colon
Spleen
Adrenal
Lung
Brain
Liver
Breast
Pancreas
Kidney
Salivary
Ovary
PRL-3
GAPDH
B
Breast
Brain
Spleen
9-day embryo
Kidney
Colon
Lung
Heart
PRL-2
GAPDH
C
PRL-2 Ab
Untreated
PRL-2 Ab
PRL-3 Ab
Died 1-week earlier

FIGURE 15

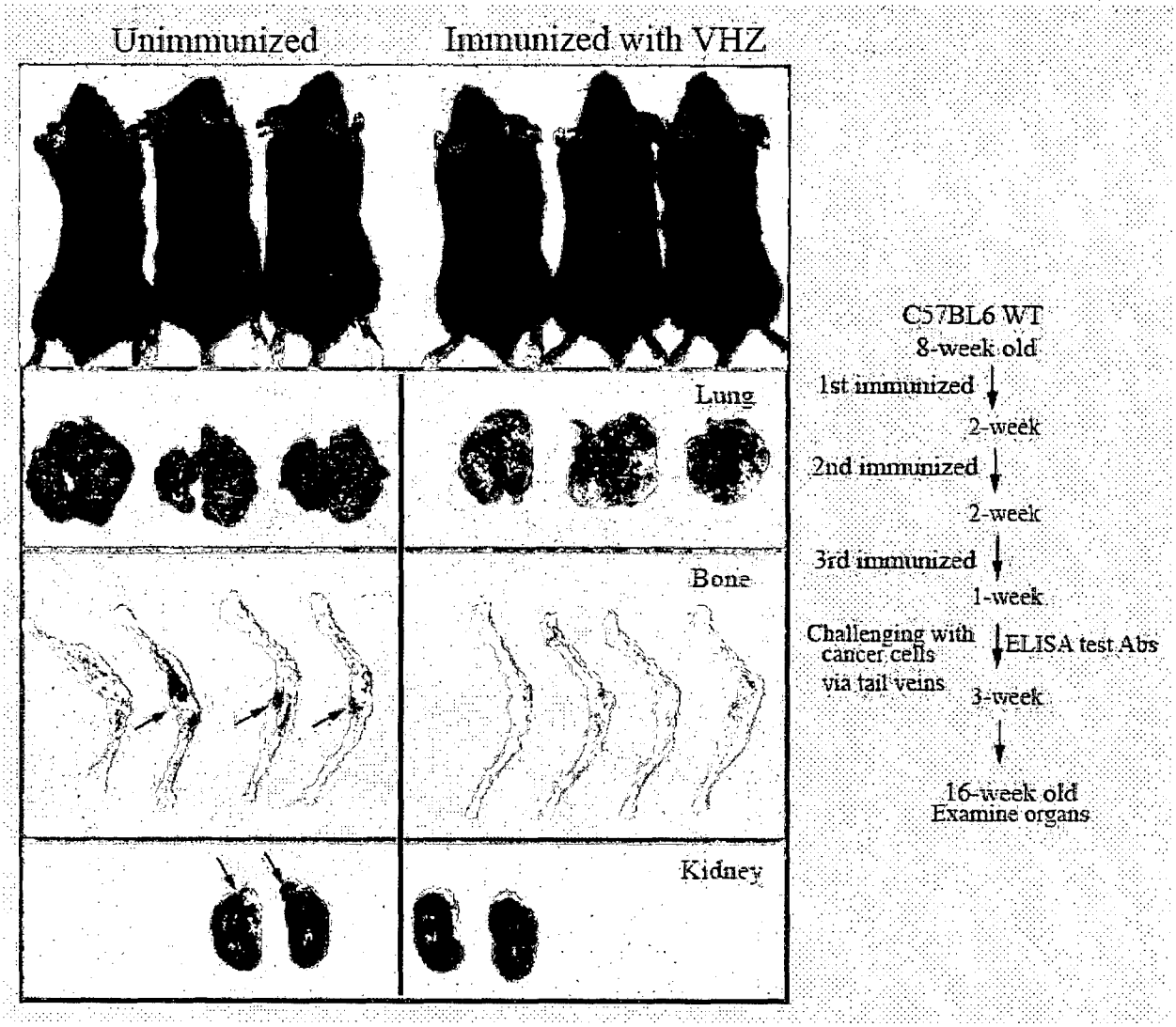

Unimmunized
Immunized with VHZ
Lung
Bone
Kidney
C57BL6 WT
8-week old
1st immunized
2-week
2nd immunized
2-week
3rd immunized
1-week
Challenging with cancer cells via tail veins
ELISA test Abs
3-week
16-week old
Examine organs

FIGURE 16

Her2 Target:

1. Her2 extracellular DNA sequences and peptide sequences:

ATCACAGGTCCCCTATACATCTCAGCATGGCCGGACAGCCTGCCTGACCTCAG
CGTCTTCCAGAACCTGCAAGTAATCCGGGGACGAATTCTGCACAATGGCGCCTA
CTCGCTGACCCTGCAAGGGCTGGGCATCAGCTGGCTGGGGCTGCGCTCACTG
AGGGAACTGGGCAGTGGACTGGCCCTCATC

ITGPLYISAWPDSLPDLSVFQNLQVIRGRILHNGAYSLTLQGLGISWLGLRSLRELGS
GLALI

2. Her 2 intracellular mid region DNA and peptide

ACCCACCAGAGTGATGTGTGGAGTTATGGTGTGACTGTGTGGGAGCTGATGAC
TTTTGGGGCCAAACCTTACGATGGGATCCCAGCCCGGGAGATCCCTGACCTGC
TGGAAAAGGGGGAGCGGCTGCCCCAGCCCCCCATCTGCACCATTGATGTCTAC
ATGATCATGGTCAAATGTTGGATG

THQSDVWSYGVTVWELMTFGAKPYDGIPAREIPDLLEKGERLPQPPICTIDVYMIMV
KCWM

3. Her2 intracellular C-Terminal

GAGAACCCCGAGTACTTGACACCCCAGGGAGGAGCTGCCCCTCAGCCCCACC
CTCCTCCTGCCTTCAGCCCAGCCTTCGACAACCTCTATTACTGGGACCGGGACC
CACCAGAGCGGGGGGCTCCACCCAGCACCTTCAAAGGGACACCTACGGCAGA
GAACCCAGAGTACCTGGGTCTGGACGTGCCAGTGTAA

ENPEYLTPQGGAAPQPHPPPAFSPAFDNLYYWDRDPPERGAPPSTFKGTPTAENP
EYLGLDVPV

4. Her2a intracellular peptide: VHHRHRSSSTRSGGGDLT

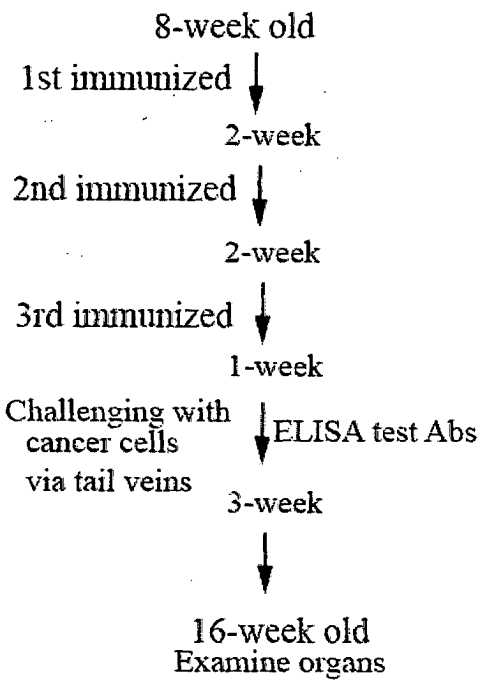
mT Target:

5. MMTV-PymT mT peptide sequence:

Cys-MDRVLSRADKERLLELLKLPRQLWGD

FIGURE 17

A


C57BL6 WT
8-week old
1st immunized
2-week
2nd immunized
2-week
3rd immunized
1-week
Challenging with cancer cells via tail veins
ELISA test Abs
3-week
16-week old
Examine organs

B

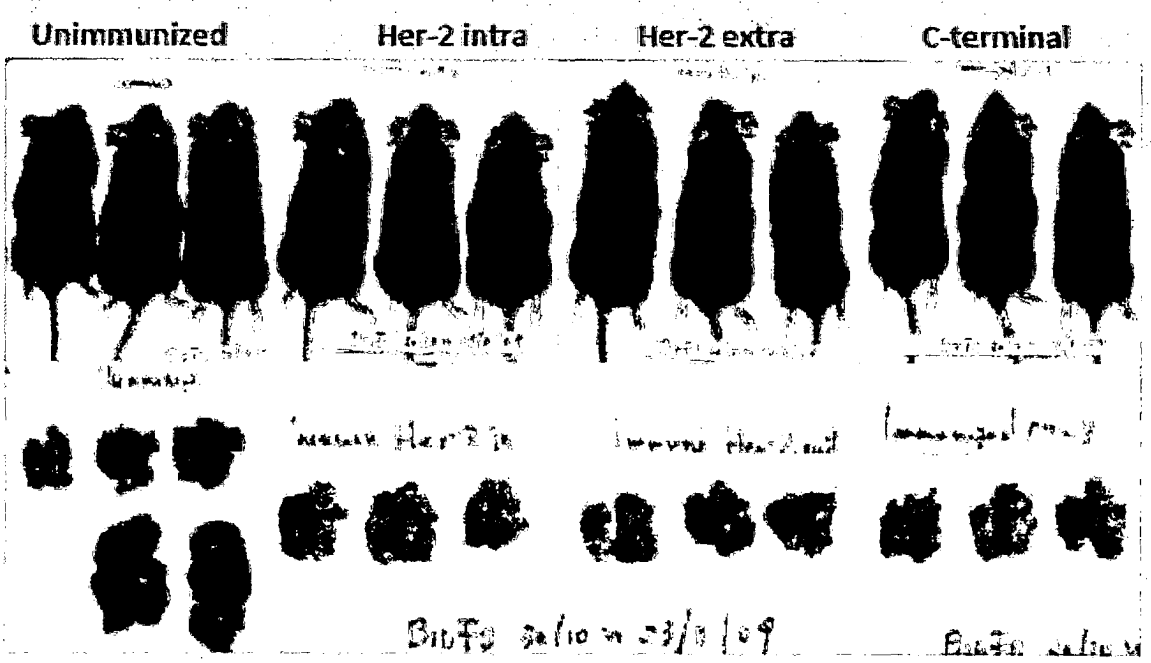
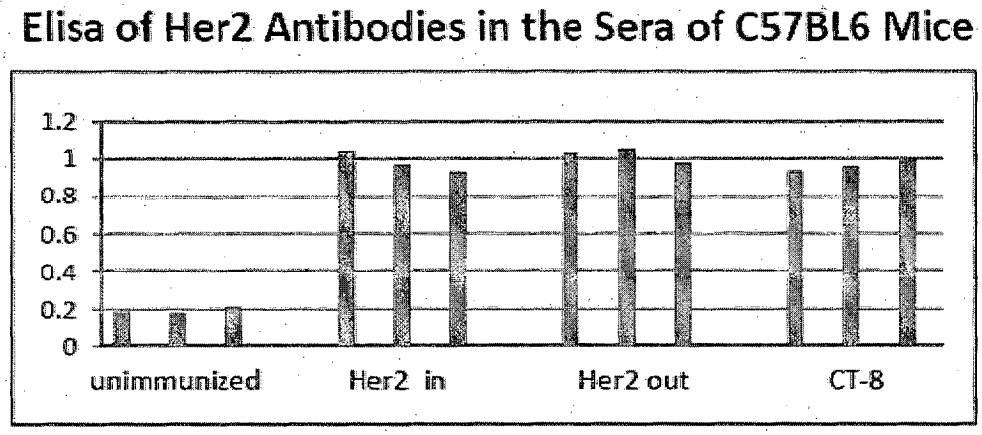

Unimmunized
Her-2 intra
Her-2 extra
C-terminal

FIGURE 17 (CONTINUED)

C



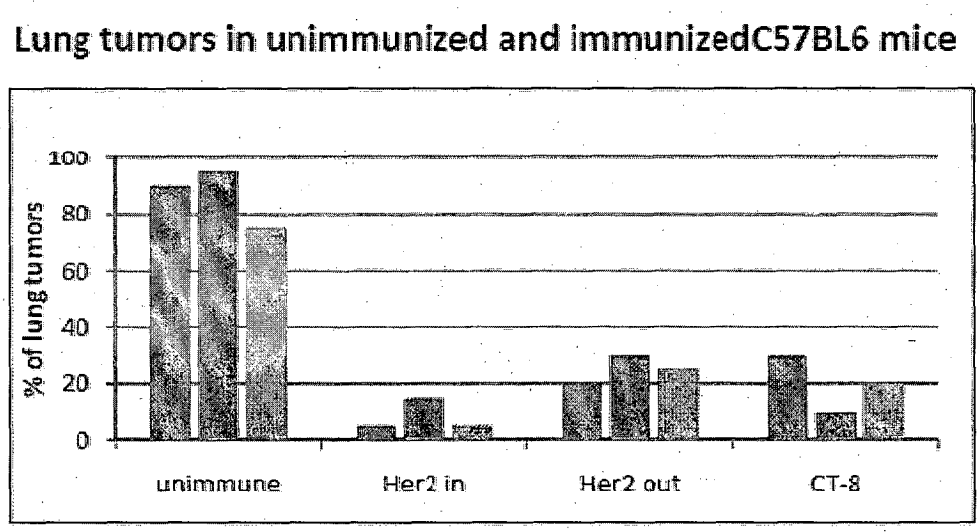
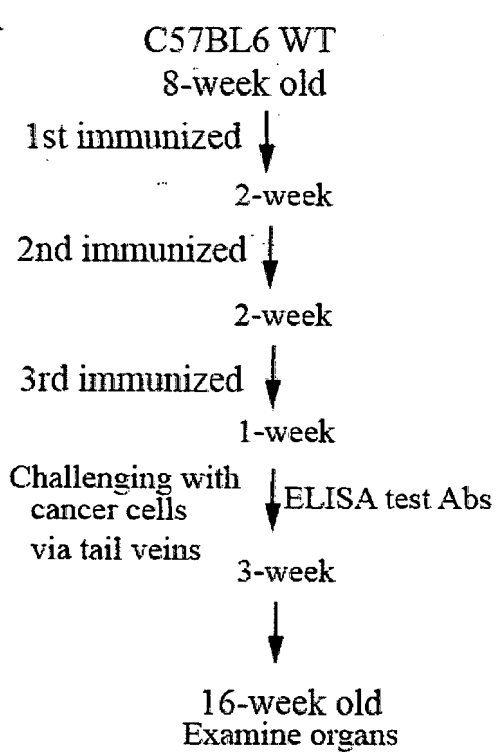


FIGURE 18

A


C57BL6 WT
8-week old
1st immunized
2-week
2nd immunized
2-week
3rd immunized
1-week
Challenging with cancer cells via tail veins
ELISA test Abs
3-week
16-week old
Examine organs

B

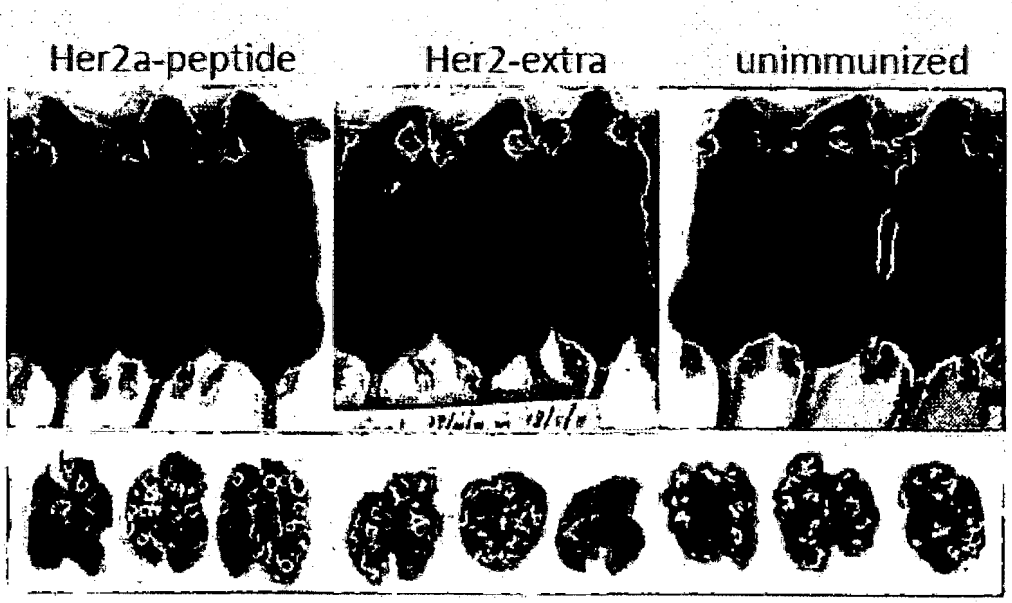
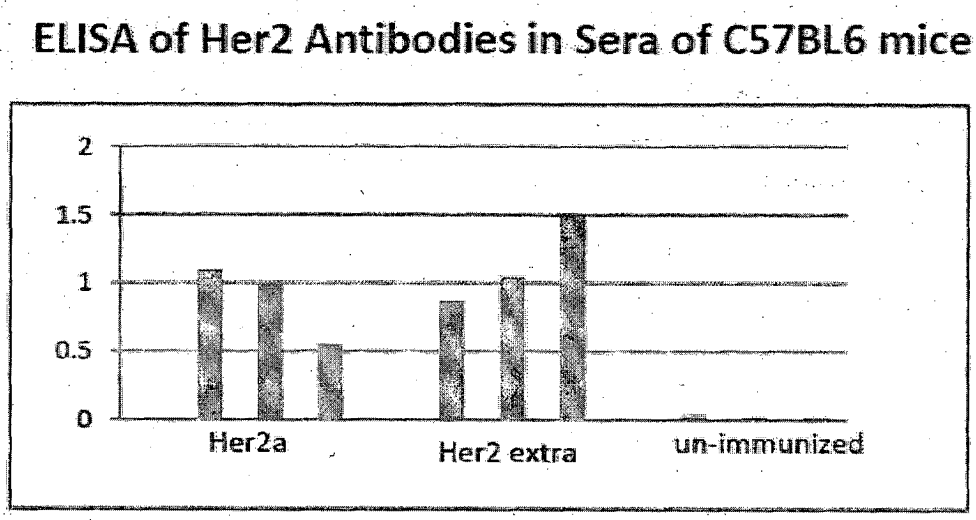

Her2a-peptide
Her2-extra
unimmunized

FIGURE 18 (CONTINUED)

C



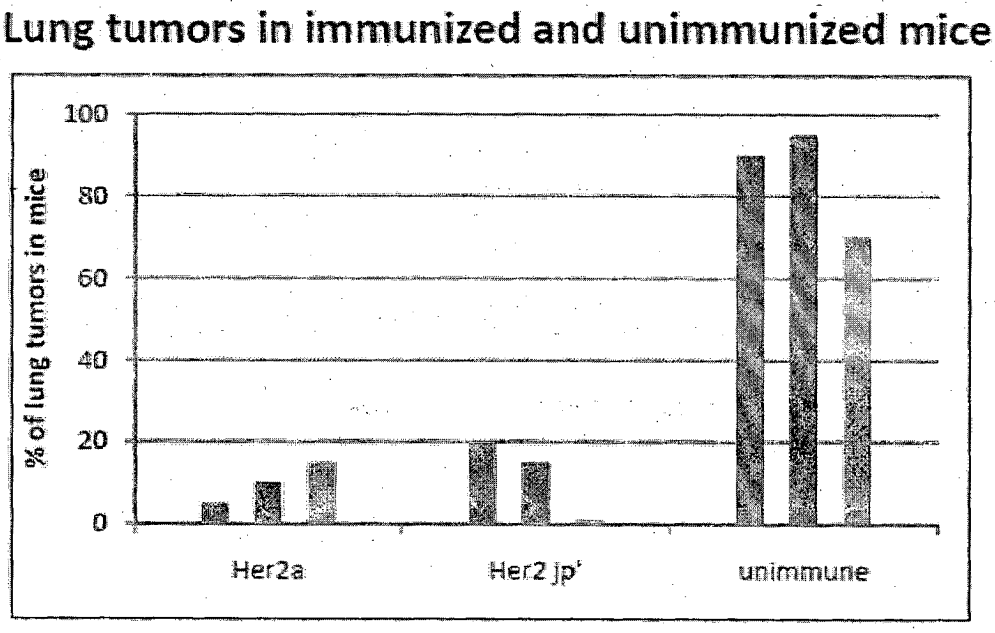
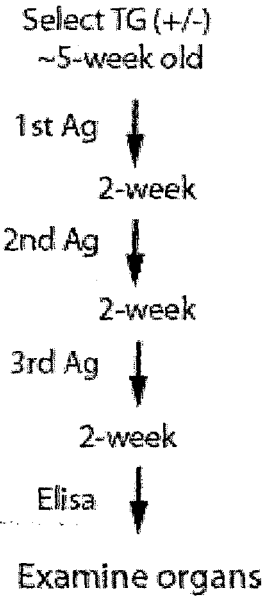


FIGURE 19

A


Select TG (+/-)
~5-week old
1st Ag
2-week
2nd Ag
2-week
3rd Ag
2-week
Elisa
Examine organs

B

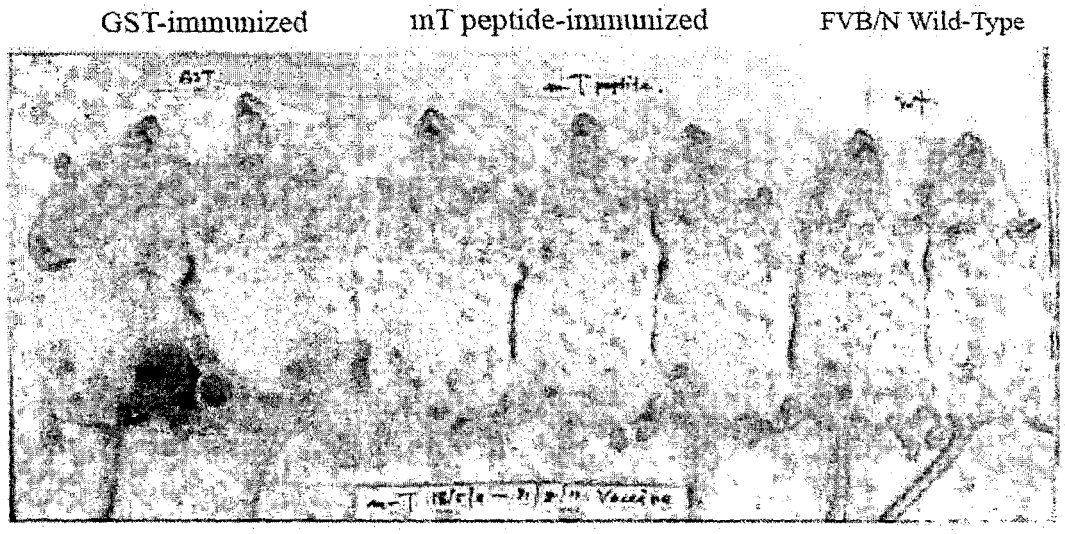
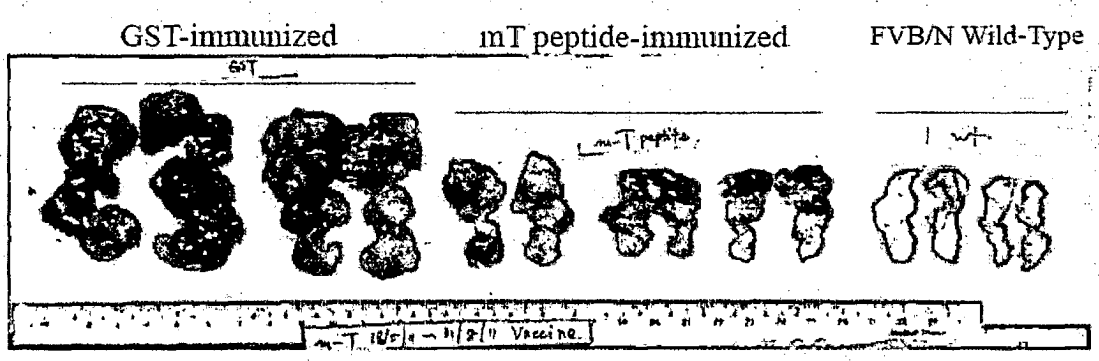

GST-immunized
mT peptide-immunized
FVB/N Wild-Type

FIGURE 19 (CONTINUED)

c



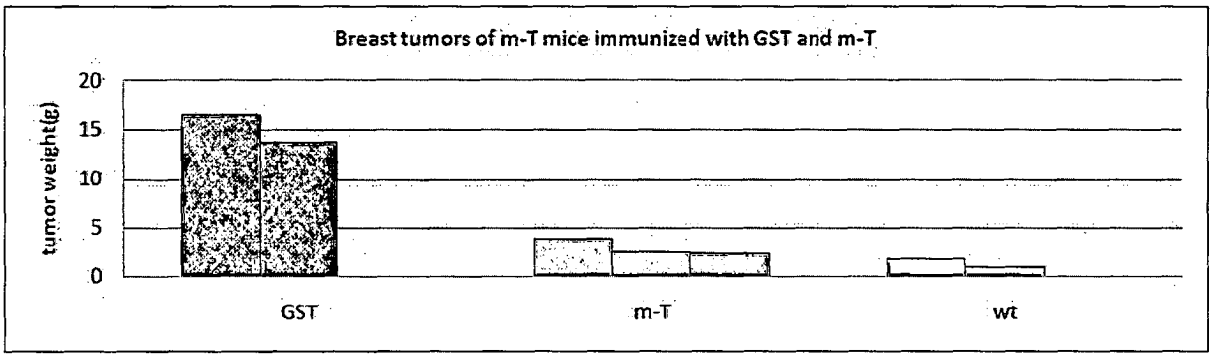


FIGURE 20

Targeting Estrogen Receptor with antibody and vaccination in PymT-transgenic mice model

Human ESR1 full protein sequence:

MTMTLHTKASGMALLHQIQGNELEPLNRPQLKIPLERPLGEVYLDSSKPAVYNYPEGAAYEFNAAAAANAQVY GQTGLPYGPGSEAAAFGSNGLGGFPPLNSVSPSPLMLLHPPPQLSPFLQPHGQQVPYYLENEPSGYTVREAGPP AFYRPNSDNRRQGGRERLASTNDKGSMAMESAKETRYCAVCNDYASGYHYGVWSCEGCKAFFKRSIQGHNDY MCPATNQCTIDKNRRKSCQACRLRKCYEVGMMKGGIRKDRRGGRMLKHKRQRDDGEGRGEVGSAGDMRAA NLWPSPLMIKRSKKNSLALSLTADQMVSALLDAEPPILYSEYDPTRPFSEASMMGLLTNLADRELVHMINWAKRV PGFVDLTLHDQVHLLECAWLEILMIGLVWRSMEHPGKLLFAPNLLLDRNQGKCVEGMVEIFDMLLATSSRFRMM NLQGEEFVCLKSIILLNSGVYTFLSSTLKSLEEKDHIHRVLDKITDTLIHLMAKAGLTLQQQHQRLAQLLLILSHIRHMS NKGMEHLYSMKCKNVVPLYDLLLEMLDAHRLHAPTSRGGASVEETDQSHLATAGSTSSHSLQKYYITGEAEGFPAT V

ER-red area:

Peptide: CGYTVREAGPPAFYRPNSDNRRQGGRE

Fragment:NRPQLKIPLERPLGEVYLDSSKPAVYNYPEGAAYEFNAAAAANAQVYGQTGLPYGPGSEAAAFGSNGL GGFPPLNSVSPSPLMLLHPPPQLSPFLQPHGQQVPYYLENEPSGYTVREAGPPAFYRPNSDNRRQGGRERLASTN DKGSMAMESAKETR

cDNA:aacggtccgcagctcaagatccccctggagcggccccttgggcgaggtgtacctggacagcagcaagcccgccgtgtacaactaccccg agggcgccgcctacgagttcaacgccgcggccgccgccaacgcgcaggtctacggtcagaccggcctcccctacggccccgggtctggaggctgc ggcgttcggctccaacggcctgggggtttccccccactcaacagcgtgtctccgagccgctgatgctactgcacccgccgccgcagctgtcgc ctttcctgcagcccacggccagcaggtgccctactacctggagaacgagcccagcggctacacggtgcgcgaggccggccgccggcattcta caggccaaattcagataatcgacgccagggtggcagagaaagattggccagtaccaatgacaagggaagtatggctatggaatctgccaagg agactcgc

ER-purple area:

Peptide: LKHKRQRDDGEGRGEVGSAGDMRAANLC

Fragment:GGIRKDRRGGRMLKHKRQRDDGEGRGEVGSAGDMRAANLWPSPLMIKRSKKNSLALSLTADQMVS ALL cDNA:

ggtgggatacgaaaagaccgaagaggaggaggagaatgttgaaacacaagcgccagagagatgatggggagggcaggggtgaagtgggggtct gctggagacatgagagctgccaacctttggccaagcccgctcatgatcaaacgctctaagaagaacagcctggccttgtccctgacggccgacc agatggtcagtgccttg

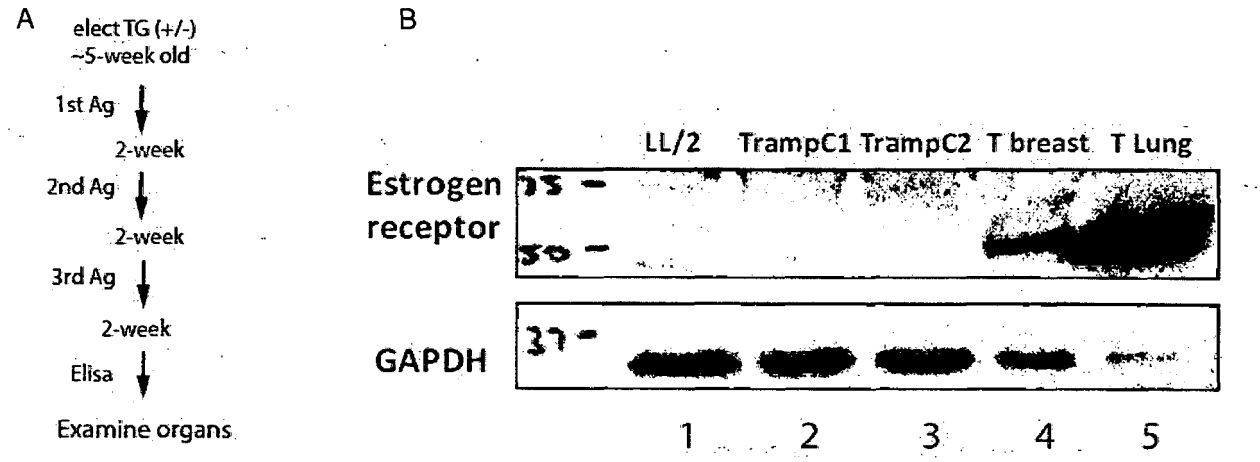
Targeting HBV-X protein with antibody and vaccination as liver cancer model in nude mice

HBV-X protein: maarlccqld ptrdvldlrp vgaesrgrpv sgplgdlpsp saspvptidr ahlslrglpvcafssagpca lrftsarnme ttvnthmilp kvlhkrtlgl pamstidlea yfkdclfkdweelgeeirlk vfvlggcrhk lvcspapcnf ftsa

HBV-X-peptide

FKDWEELGEEIRLKVFVLGGC (conserve sequence among the genotypes).

FIGURE 21


A
elect TG (+/-)
~5-week old
1st Ag
2-week
2nd Ag
2-week
3rd Ag
2-week
Elisa
Examine organs
B
LL/2
TrampC1
TrampC2
T breast
T Lung
Estrogen receptor
GAPDH
1
2
3
4
5

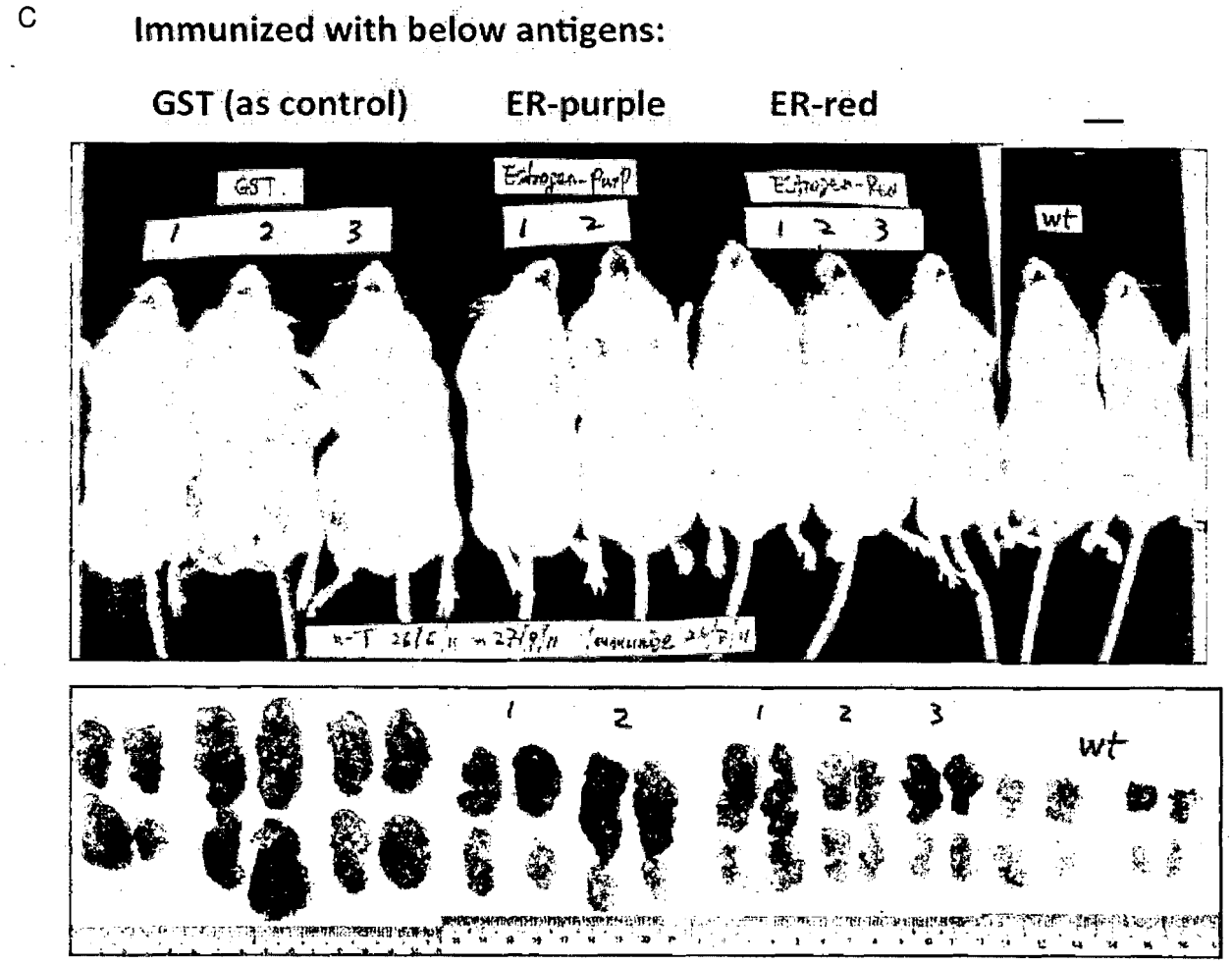

C
Immunized with below antigens:
GST (as control)
ER-purple
ER-red
GST
1 2 3
wt

FIGURE 21 (CONTINUED)

D

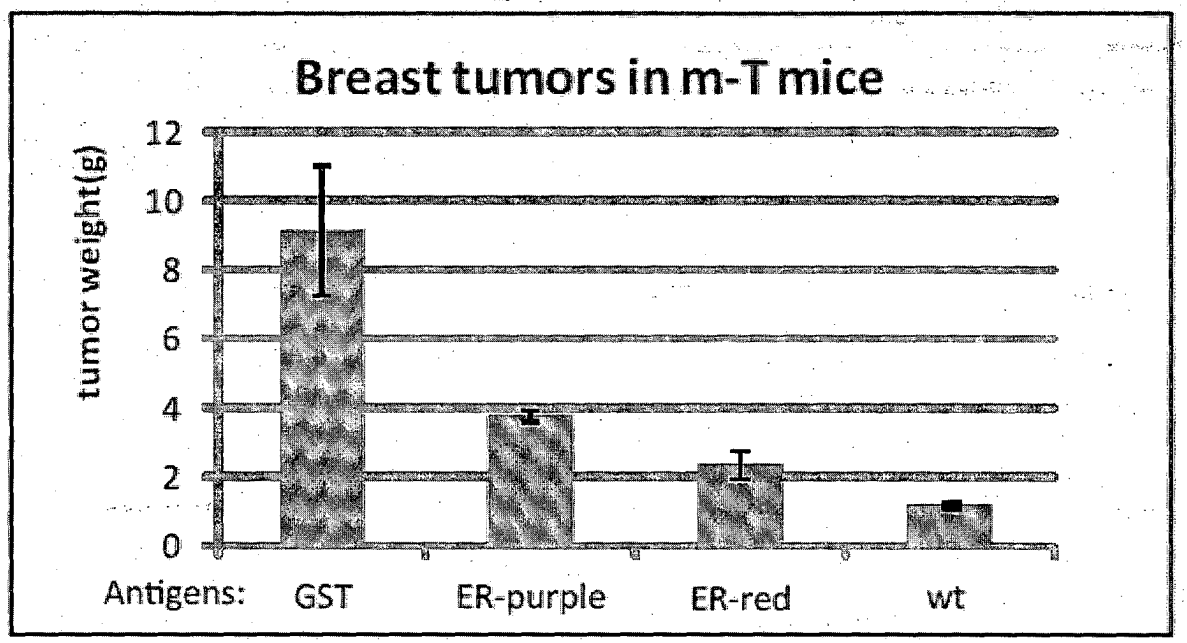


FIGURE 22

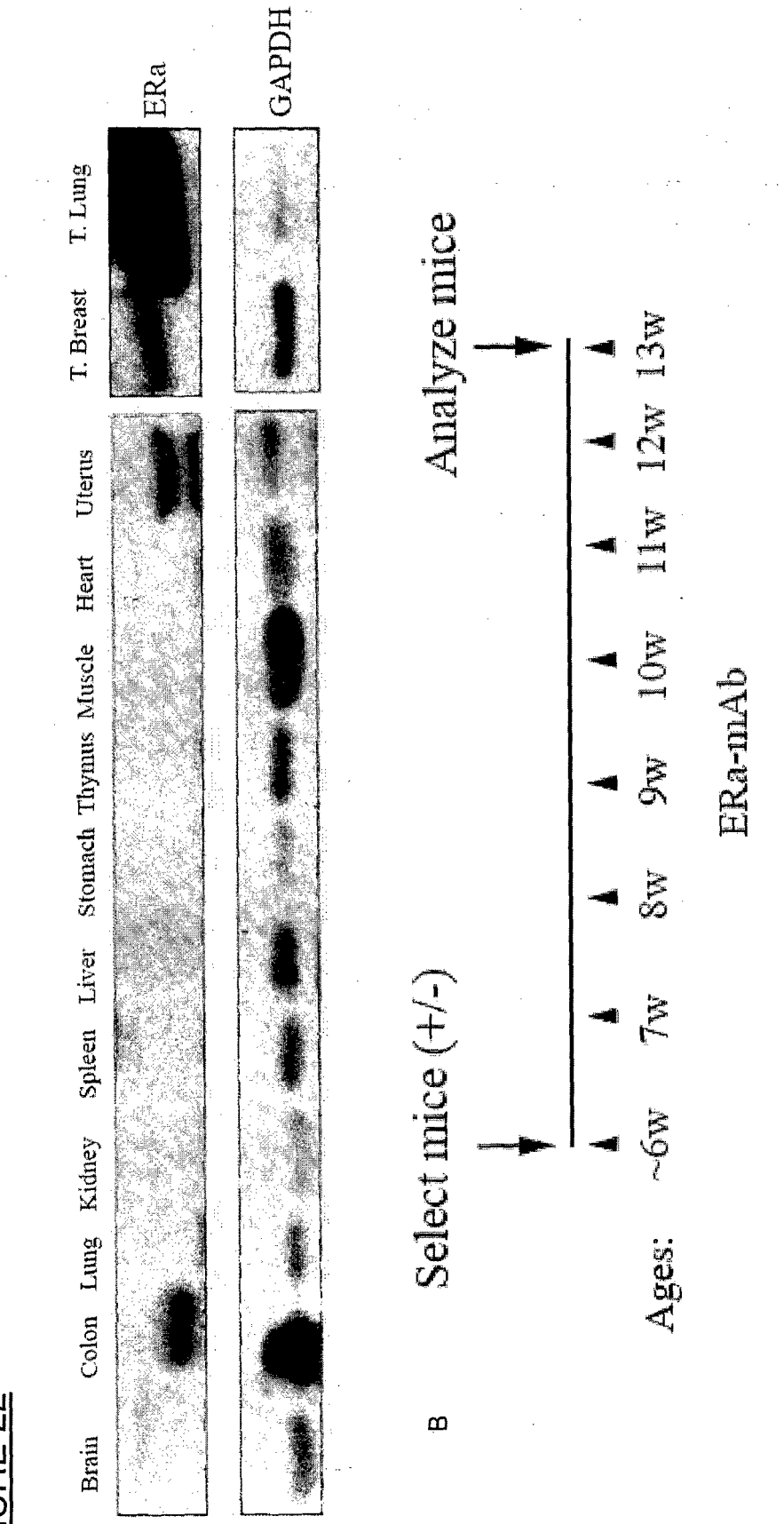
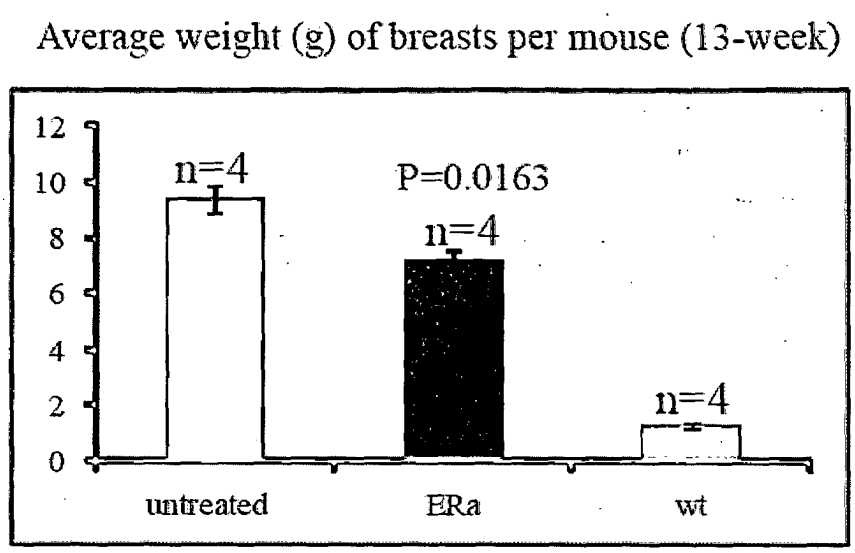

A
Brain
Colon
Lung
Kidney
Spleen
Liver
Stomach
Thymus
Muscle
Heart
Uterus
T. Breast
T. Lung
ERa
GAPDH
B
Select mice (+/-)
Analyze mice
Ages: ~6w 7w 8w 9w 10w 11w 12w 13w
ERa-mAb

FIGURE 22 (CONTINUED)

C



D

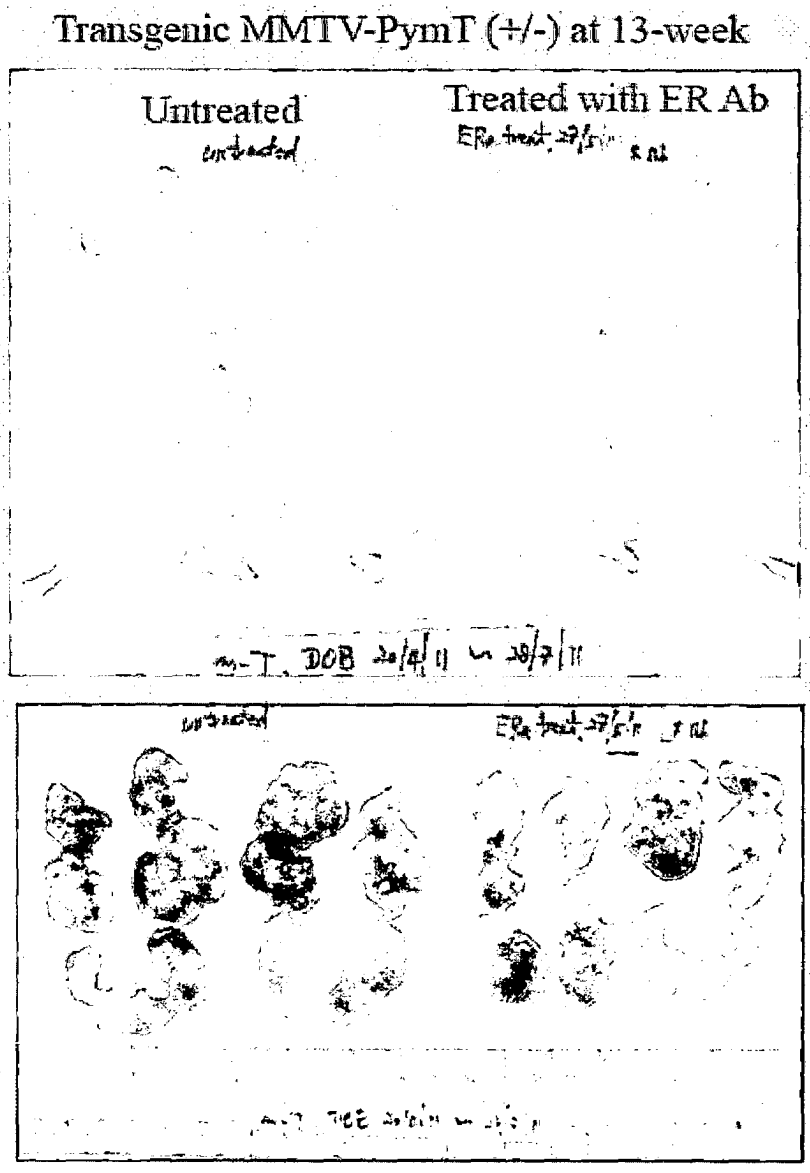


FIGURE 23

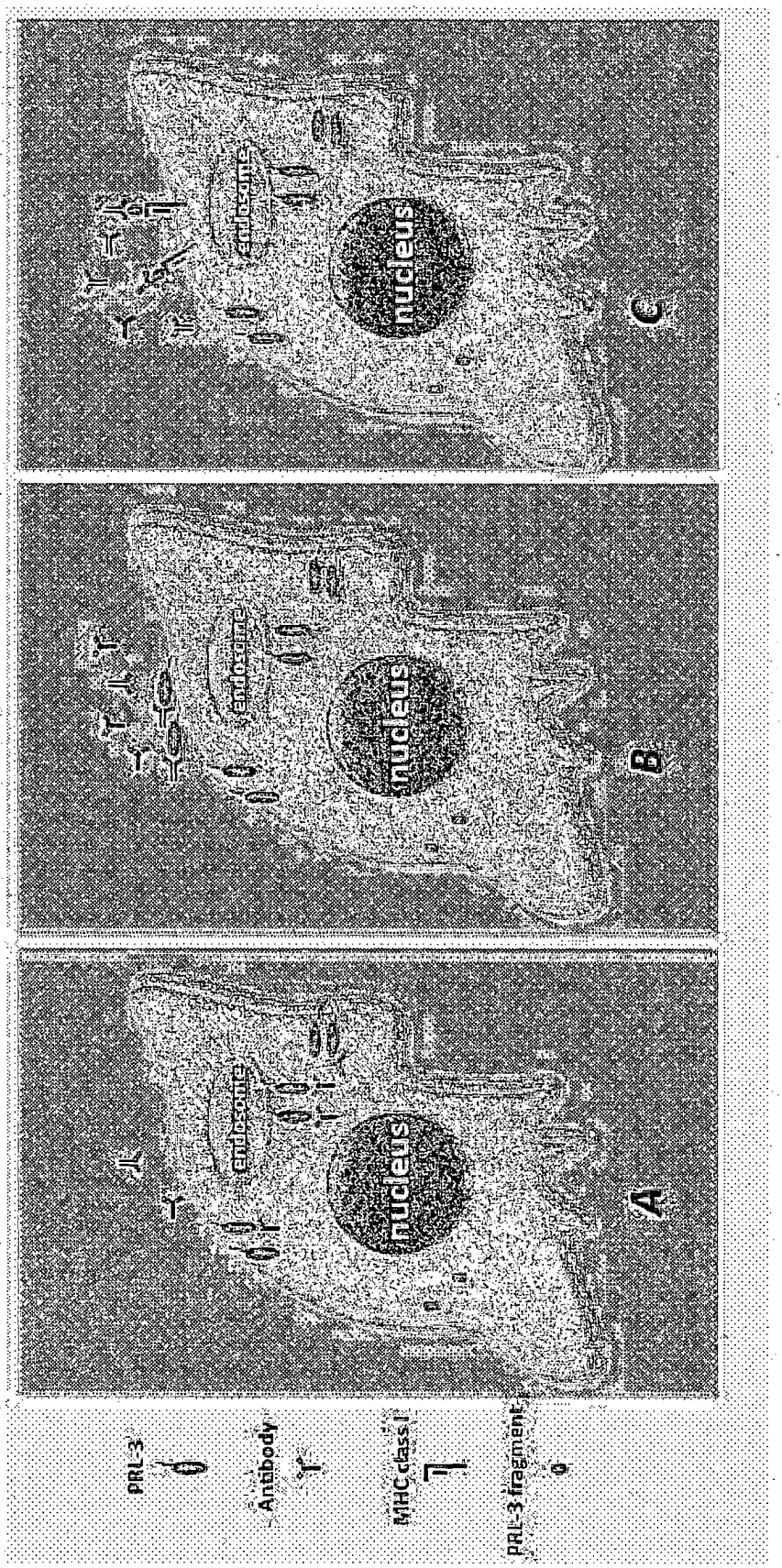

PRL-3
Antibody
MHC class I
PRL-3 fragment
nucleus
endosome
A
B
C

FIGURE 24

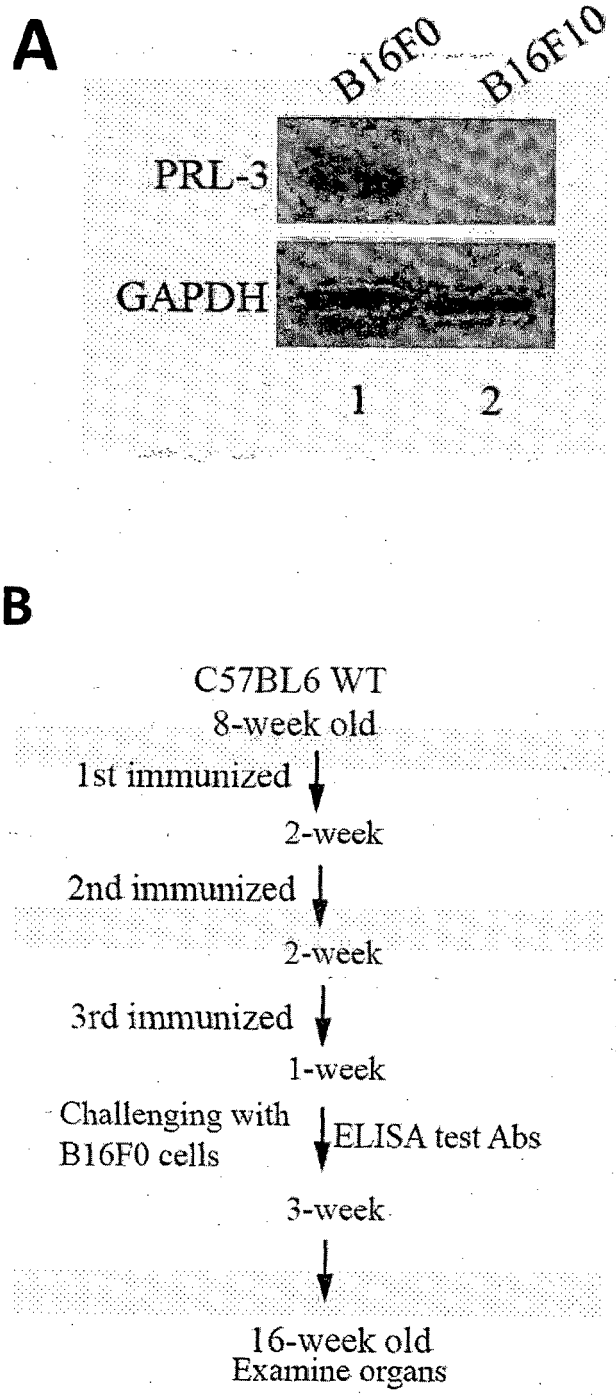
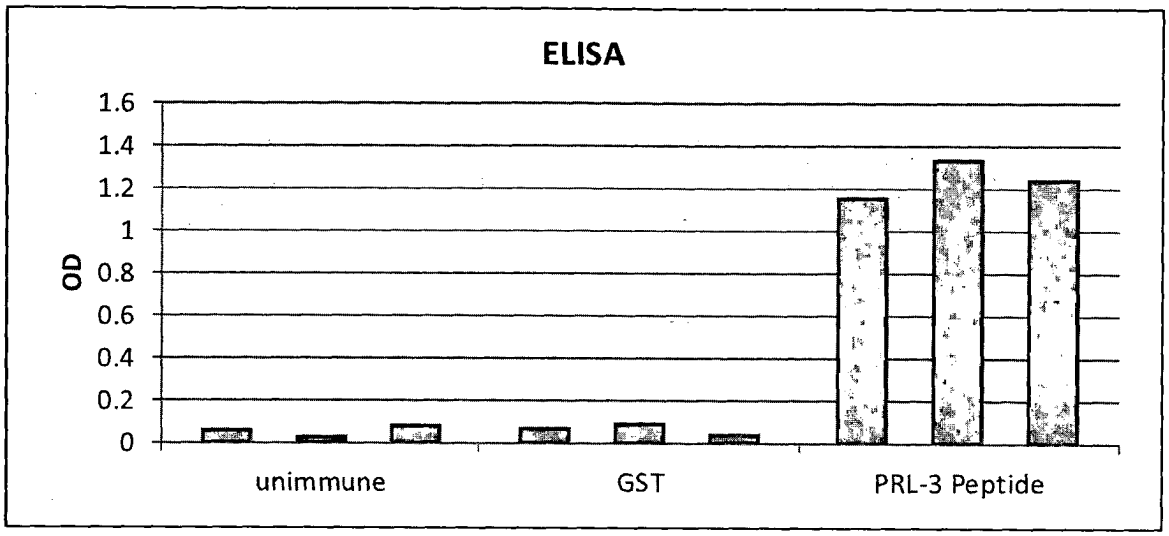

A
B16F0
B16F10
PRL-3
GAPDH
1
2
B
C57BL6 WT
8-week old
1st immunized
2-week
2nd immunized
2-week
3rd immunized
1-week
Challenging with B16F0 cells
ELISA test Abs
3-week
16-week old
Examine organs

FIGURE 24 (CONTINUED)

C



D

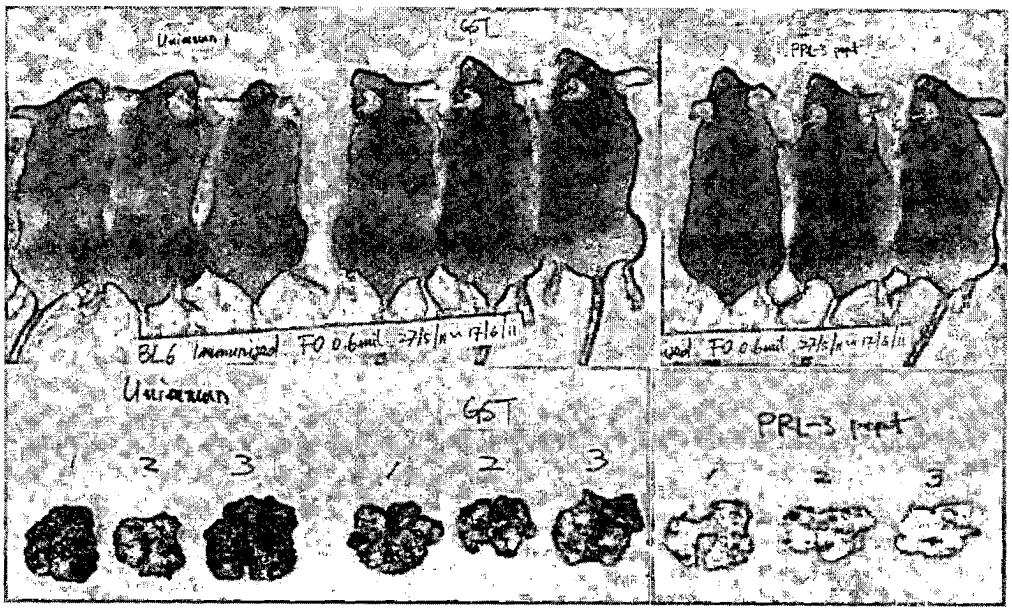
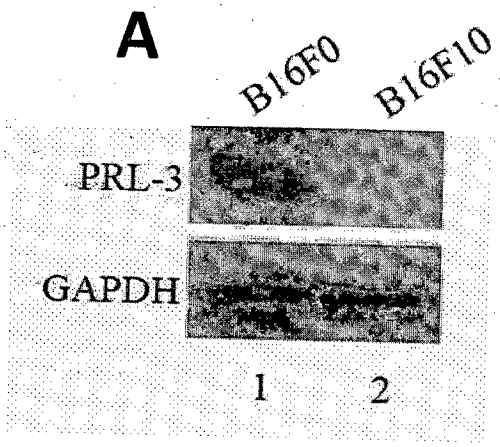


FIGURE 25


A
B16F0
B16F10
PRL-3
GAPDH
1
2

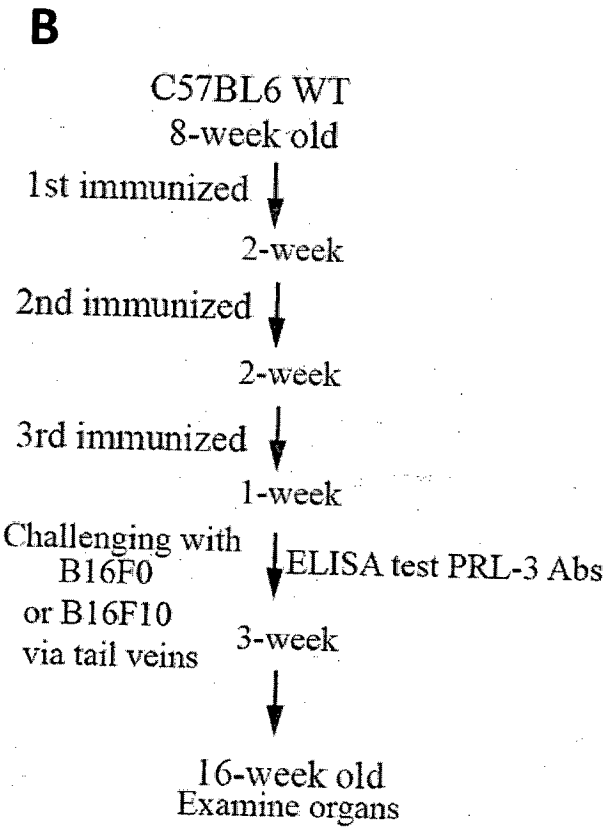
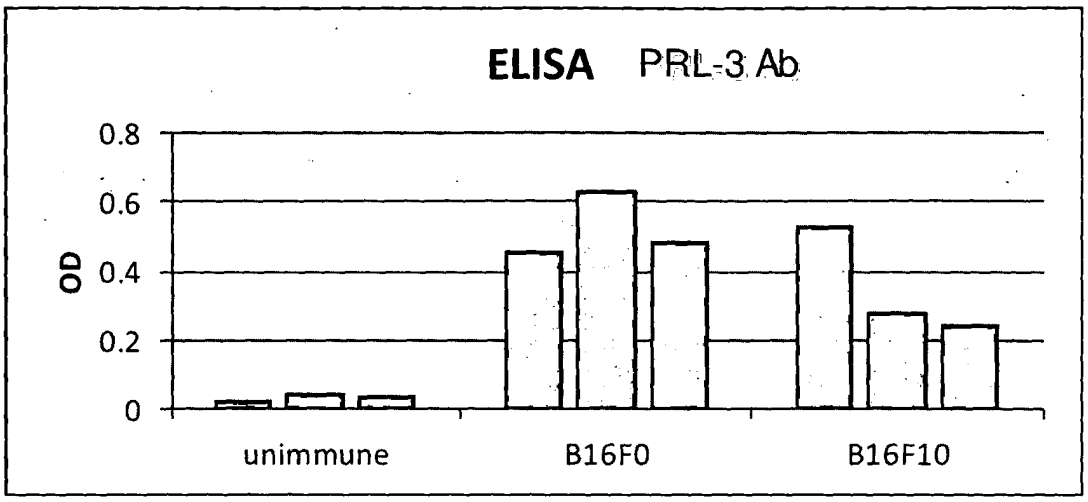

B
C57BL6 WT
8-week old
1st immunized
2-week
2nd immunized
2-week
3rd immunized
1-week
Challenging with B16F0 or B16F10 via tail veins
ELISA test PRL-3 Abs
3-week
16-week old
Examine organs

FIGURE 25 (CONTINUED)

C



D

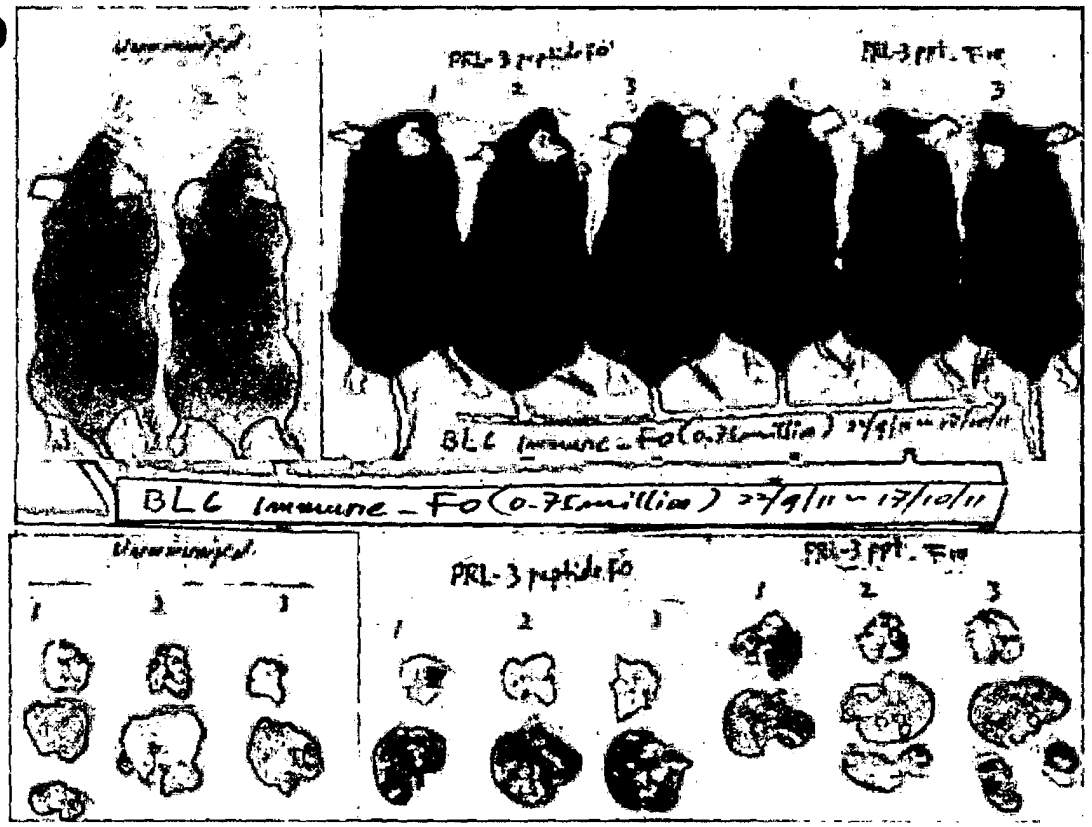
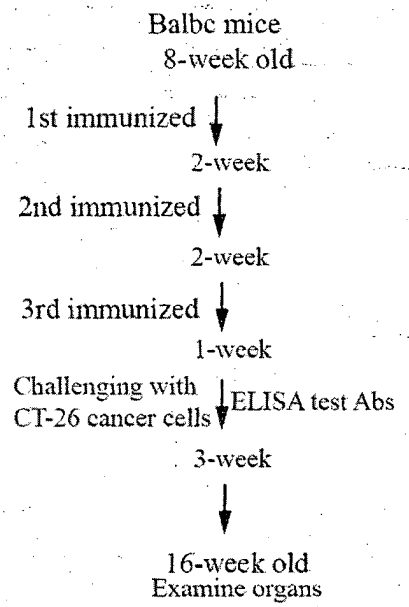


FIGURE 26

A


Balbc mice
8-week old
1st immunized
2-week
2nd immunized
2-week
3rd immunized
1-week
Challenging with
CT-26 cancer cells
ELISA test Abs
3-week
16-week old
Examine organs

B

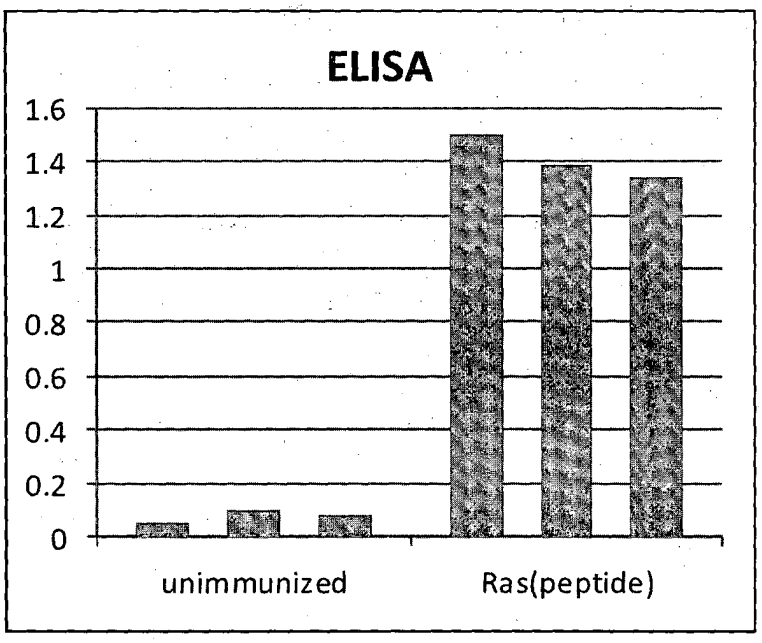

ELISA
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
unimmunized
Ras(peptide)

FIGURE 26 (CONTINUED)

C

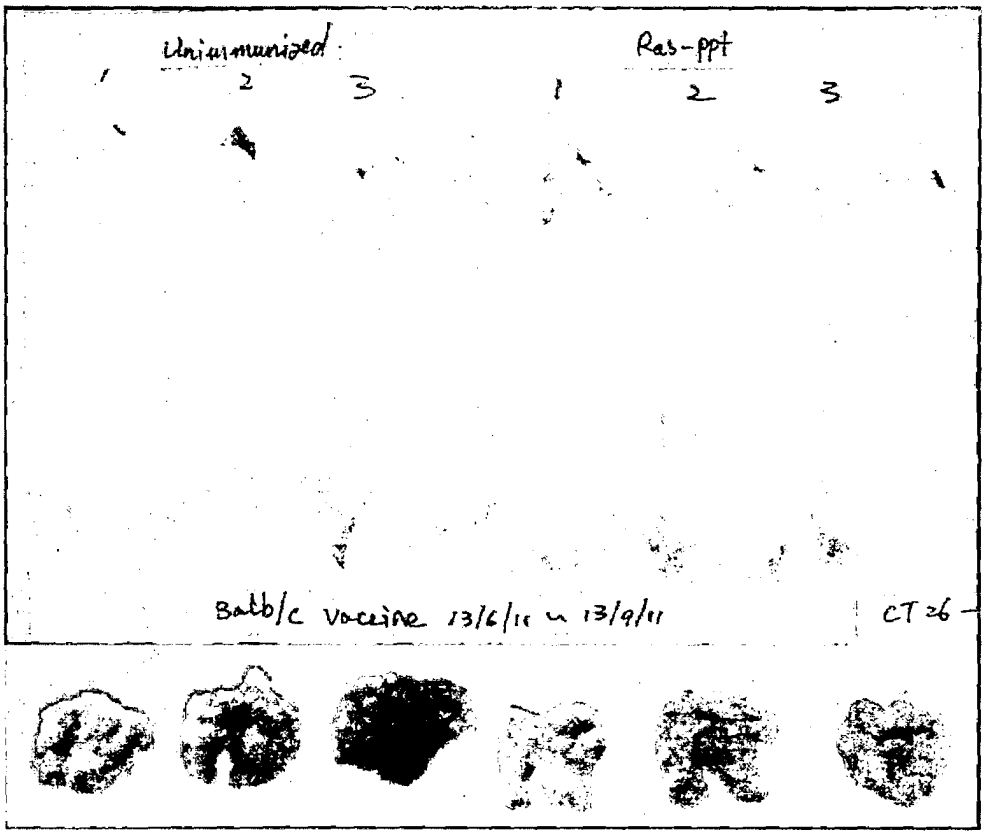


FIGURE 27

A

1. MTYKVVVGA**D**GVGKSATNH **(K-Ras-G12D)**
2. MTYKVVVGA**V**GVGKSATNH **(K-Ras-G12V)**
3. MTYKVVVGA**R**GVGKSATNH **(K-Ras-G12R)**
4. MTYKVVVGAG**R**VGKSATNH **(K-Ras-G13R)**
5. QHVKITDFG**R**AKLLGAEEKE **(EGFR-L858R)**
6. KIGDFGLAT**E**KSRWSGSHQ **(B-Raf-V600E)**
7. LTSTVQLI**M**QLMPFGC **(EGFR-T790M)**
8. KVKIPVAIK-----TSPKANKEI **(EGFR-E746-A750 del)**
9. KAISTRDPLS**K**ITEQEKDF **(PI3KCA-E542K)**
10. TRDPLSEIT**K**QEKDFLWSH **(PI3KCA-E545K)**
11. EYFMKQMNDA**R**HGGWTTKMD **(PI3KCA-H1047R)**
12. DSGIHSGAT**A**TAPSLSGKGN **(beta-catenin-T41A)**
13. HSGATTTAP**F**LSGKGNPEE **(beta-catenin-S45F)**
14. HSGATTTAP**P**LSGKGNPEE **(beta-catenin-S45P)**
15. SDQDLLRC**C**VLTSGIFETK **(GNAS-R201C)**
16. RSQGRIPVKW**T**AIESLFDH **(Ret-M918T)**
17. QKNEFISE**F**CGEIISQDEAD **(EZH2-Y646F)**
18. QKNEFISE**N**CGEIISQDEAD **(EZH2-Y646N)**
19. QKNEFISE**S**CGEIISQDEAD **(EZH2-Y646S)**
20. QKNEFISE**H**CGEIISQDEAD **(EZH2-Y646H)**
21. FRMVDVGG**L**RSERRKWIH **(GNA11/GNAQ-Q209L)**
22. FRMVDVGG**P**RSERRKWIH **(GNAQ-Q209P)**

FIGURE 27 (CONTINUED)

ALK (F1174L) ALK (R1275Q)	K-Ras (G12D) (LS-174T, COLO-678, GP5d, LS-513, SNU-C2B) K-Ras (G12V) (SW620, RCM-1, SK-CO-1) K-Ras (G12C) (SW1463, SW837) K-Ras (G13D) (HCT-116, HCT-15, T84) The majority of pancreatic and colon cancer
BRAF (V600E) (SK-MEL-1, 3, 5, 24 and 28, A375, A2058, HT-144, MDA-MB-435) The majority of skin cancer	EGFR (L858R) (NCI-H1975) EGFR (E746_A750del) (PC-14, NCI-H1650) EGFR (T790M) (NCI-H1975) The majority of lung cancer
PIK3CA (H1047R) (T47D, BT-20) PIK3CA (E545K) (MCF7, MDA-MB-361) PIK3CA (E542K) (CAL-51) 20% breast cancer has PI3K mutations, corresponding to basal/triple negative? Not.	HNF1A/TCF1 (W206C) HNF1A/TCF1 (W206L)
CTNNB1/beta-catenin (S45F) (LS-174T) CTNNB1/beta-catenin (S45P) (NCI-H295) CTNNB1/beta-catenin (T41A) (LXF-289, A427) 20% mutations in liver cancer	GNA11 (Q209L) GNAQ (Q209L) GNAQ (Q209P) Eye, uveal melanoma (together, GNA11 and GNAQ are mutated in over 50%)
IDH1 (R132C) (HT-1080) IDH1 (R132G) IDH1 (R132H) (mostly in glioma) IDH1 (R132L) IDH1 (R132S) Bone, Chondrosarcoma Glioma	IDH2 (R140Q) IDH2 (R172K) haematopoietic neoplasm
EZH2 (Y646F) EZH2 (Y646N) EZH2 (Y646H) EZH2 (Y646S)	PPP2R1A (R183W) PPP2R1A (R183Q) haematopoietic and lymphoid tissue
PTEN (R130G) PTEN (R130Q) PTEN (R130*)	STK11 (LKB1) mutations suggest a tumor suppressor in lung cancer
Endometrium carcinoma	Notch1 (releasing cytoplasmic domain) Lymphoid neoplasm
N-Ras (Q61R) (HT-1197, KMOE-2, SK-MEL-2) RET (M918T) Mostly in thyroid cancer	GNAS (R201C) Mostly in pituitary cancer
AKT1 (E17K)	MET (N375S)
FGFR3 (K650E) FGFR3 (K650M) FGFR3 (R248C) FGFR3 (S249C) FGFR3 (Y373C) FGFR3 (S371C) FGFR3 (G370C)	Mostly in skin cancer

FIGURE 28

ABL1	D276G
ABL1	E255K
ABL1	E255V
ABL1	E352G
ABL1	E355G
ABL1	E373G
ABL1	E459K
ABL1	F311L
ABL1	F317L
ABL1	F359A
ABL1	F359V
ABL1	F382L
ABL1	F486S
ABL1	G250E
ABL1	G321E
ABL1	H396P
ABL1	H396R
ABL1	L248V
ABL1	L387M
ABL1	M237I
ABL1	M244V
ABL1	M343T
ABL1	M351T
ABL1	Q252E
ABL1	Q252H
ABL1	Q252R
ABL1	R47G
ABL1	S417Y
ABL1	T315I
ABL1	T315N
ABL1	T389A
ABL1	V304G
ABL1	V371A
ABL1	V379I
ABL1	Y253F
ABL1	Y253H
ABL1	Y353H
ABL2	E63Q
ABL2	R483I
ALK	L560F
ALK	Y262Y
APC	S2621C
ATM	E848Q
ATM	L1794L
ATM	M1916I
ATM	P2842R
ATM	Q2441P
ATM	T2666A
ATM	T935I
BRAF	D587A
BRAF	D587E
BRAF	D594E
BRAF	D594G
BRAF	D594K
BRAF	D594V
BRAF	E586E
BRAF	E586K
BRAF	F468C
BRAF	F583F
BRAF	F595L
BRAF	F595S
BRAF	G464E
BRAF	G464R
BRAF	G464V
BRAF	G466A
BRAF	G466E
BRAF	G466R
BRAF	G466V
BRAF	G469A
BRAF	G469E
BRAF	G469R
BRAF	G469S
BRAF	G469V
BRAF	G596R
BRAF	G606E
BRAF	G615R
BRAF	H608R
BRAF	I463S
BRAF	I582M
BRAF	I592M
BRAF	I592V
BRAF	K439Q
BRAF	K439T
BRAF	K475M
BRAF	K601E
BRAF	K601N
BRAF	L584L
BRAF	L597L
BRAF	L597Q
BRAF	L597R
BRAF	L597S
BRAF	L597V
BRAF	L618S
BRAF	N581S
BRAF	Q456Q
BRAF	R444R
BRAF	R444W
BRAF	R462I
BRAF	S605F
BRAF	S605N
BRAF	S614P
BRAF	S616P
BRAF	T440P
BRAF	T599I
BRAF	V459L
BRAF	V600D
BRAF	V600E
BRAF	V600G
BRAF	V600K
BRAF	V600L
BRAF	V600M
BRAF	V600R
BRAF	W604G
CEBPA	A152A
CEBPA	H191H
CEBPA	H84L
CTNNB1	A13T
CTNNB1	A183S
CTNNB1	A183T
CTNNB1	A20A
CTNNB1	A20V
CTNNB1	A21T
CTNNB1	A39A
CTNNB1	A39G
CTNNB1	A39T
CTNNB1	A43P
CTNNB1	A43T
CTNNB1	A43V
CTNNB1	D11N
CTNNB1	D17H
CTNNB1	D32A
CTNNB1	D32G
CTNNB1	D32H
CTNNB1	D32N
CTNNB1	D32V
CTNNB1	D32Y
CTNNB1	D56N
CTNNB1	D58N
CTNNB1	D6G
CTNNB1	E53K
CTNNB1	E54K
CTNNB1	E58G
CTNNB1	E58K
CTNNB1	E65E
CTNNB1	E67K
CTNNB1	G245A
CTNNB1	G34E
CTNNB1	G34R
CTNNB1	G34V
CTNNB1	G38A
CTNNB1	G38D
CTNNB1	G48D
CTNNB1	G48V
CTNNB1	G50D
CTNNB1	H24Y
CTNNB1	H36P
CTNNB1	H36Y
CTNNB1	I199L
CTNNB1	I35I
CTNNB1	I35N
CTNNB1	I35S
CTNNB1	I35T
CTNNB1	K19D
CTNNB1	K49E
CTNNB1	K49R
CTNNB1	L31L
CTNNB1	L46L
CTNNB1	L46V
CTNNB1	M8I
CTNNB1	N287S
CTNNB1	P44L
CTNNB1	P44S
CTNNB1	P52L
CTNNB1	Q61R
CTNNB1	S23R
CTNNB1	S29A
CTNNB1	S29F
CTNNB1	S29P
CTNNB1	S33A
CTNNB1	S33C
CTNNB1	S33F
CTNNB1	S33L
CTNNB1	S33N
CTNNB1	S33P
CTNNB1	S33S
CTNNB1	S33Y
CTNNB1	S37A
CTNNB1	S37C
CTNNB1	S37F
CTNNB1	S37P
CTNNB1	S37T
CTNNB1	S37Y
CTNNB1	S46A
CTNNB1	S45C
CTNNB1	S45F
CTNNB1	S45P
CTNNB1	S45S
CTNNB1	S45T
CTNNB1	S45Y
CTNNB1	S47G
CTNNB1	S47N
CTNNB1	S47R
CTNNB1	S47T
CTNNB1	S60F
CTNNB1	T214T
CTNNB1	T40A
CTNNB1	T40I
CTNNB1	T40T
CTNNB1	T41A
CTNNB1	T41I
CTNNB1	T41N
CTNNB1	T41P
CTNNB1	T41S
CTNNB1	T41T
CTNNB1	T42A
CTNNB1	T42I
CTNNB1	T42R
CTNNB1	T76A
CTNNB1	V22A
CTNNB1	V57M
CTNNB1	W25L
CTNNB1	W66L
CTNNB1	Y30C
EGFR	A750P
EGFR	A839T
EGFR	A859I
EGFR	A864I
EGFR	D761N
EGFR	E709A
EGFR	E709G
EGFR	E709H
EGFR	E709K
EGFR	E709V
EGFR	E746K
EGFR	E746V
EGFR	E866K
EGFR	G719A
EGFR	G719C
EGFR	G719S
EGFR	G735S
EGFR	G779F
EGFR	G810S
EGFR	G873E
EGFR	H773L
EGFR	H773R
EGFR	H835L
EGFR	H850N
EGFR	I715S
EGFR	I853T
EGFR	K846R
EGFR	L688P
EGFR	L707L
EGFR	L718L
EGFR	L730F
EGFR	L792P
EGFR	L798F
EGFR	L833V
EGFR	L838V
EGFR	L858M
EGFR	L858R
EGFR	L961Q
EGFR	N826S
EGFR	P694L
EGFR	P694S
EGFR	P733L
EGFR	P753S
EGFR	P772P
EGFR	R776C
EGFR	S720F
EGFR	S752Y
EGFR	S768I
EGFR	S784F
EGFR	T725M
EGFR	T751I
EGFR	T790M
EGFR	I847I
EGFR	V742A
EGFR	V769L
EGFR	V769M
EGFR	V774M
EGFR	V815V
EGFR	V851A
EGFR	V851I
EGFR	Y727C
EGFR	Y764Y
ERBB2	E914K
ERBB2	G776S
ERBB2	L755P
ERBB2	N857S
FGFR1	P252T
FGFR1	S125L
FGFR2	D283N
FGFR2	R203C
FGFR2	R496I
FGFR2	S267P
FGFR2	W290C
FGFR3	A369A
FGFR3	A391E
FGFR3	E322K
FGFR3	F384L
FGFR3	G370C
FGFR3	G382D
FGFR3	I414I
FGFR3	K650E
FGFR3	K650M
FGFR3	K650Q
FGFR3	K650T
FGFR3	R248C
FGFR3	S249C
FGFR3	Y241C
FGFR3	Y373C
FLI3	A680V
FLI3	D835E
FLI3	D835H
FLI3	D835N
FLI3	D835V
FLI3	D835Y
FLI3	G64G
HRAS	A11A
HRAS	A18I
HRAS	A59T
HRAS	G12A
HRAS	G12C

FIGURE 28 (CONTINUED)

HRAS	G12D
HRAS	G12R
HRAS	G12S
HRAS	G12V
HRAS	G13C
HRAS	G13D
HRAS	G13G
HRAS	G13R
HRAS	G13S
HRAS	G13V
HRAS	K117E
HRAS	Q61E
HRAS	Q61H
HRAS	Q61K
HRAS	Q61L
HRAS	Q61P
HRAS	Q61Q
HRAS	Q61R
HRAS	S17G
JAK2	V617F
KIT	A829P
KIT	D52N
KIT	D572Y
KIT	D816F
KIT	D816H
KIT	D816N
KIT	D816V
KIT	D816Y
KIT	D820G
KIT	D820V
KIT	E554D
KIT	E554G
KIT	E561E
KIT	E561K
KIT	E839K
KIT	F584S
KIT	G51G
KIT	G565R
KIT	I798I
KIT	I805I
KIT	K550I
KIT	K550N
KIT	K550R
KIT	K558K
KIT	K558N
KIT	K642E
KIT	K818R
KIT	L576P
KIT	L799L
KIT	L862L
KIT	M541L
KIT	M552K
KIT	M552L
KIT	N564K
KIT	N566D
KIT	N566N
KIT	N822H
KIT	N822K
KIT	N822N
KIT	P551S
KIT	P551T
KIT	P577S
KIT	P585P
KIT	S590N
KIT	T574I
KIT	V497V
KIT	V530I
KIT	V559A
KIT	V559D
KIT	V559G
KIT	V559I
KIT	V560D
KIT	V560E
KIT	V560G
KIT	V560V
KIT	V569A
KIT	V825A
KIT	W557G
KIT	W557R
KIT	W557S
KIT	Y553N
KIT	Y553V
KIT	Y563C
KIT	Y568D
KIT	Y568Y
KRAS	A11P
KRAS	A11V
KRAS	A18D
KRAS	A18T
KRAS	A59E
KRAS	A59T
KRAS	D92Y
KRAS	E62D
KRAS	G12A
KRAS	G12C
KRAS	G12D
KRAS	G12E
KRAS	G12F
KRAS	G12G
KRAS	G12L
KRAS	G12N
KRAS	G12R
KRAS	G12S
KRAS	G12V
KRAS	G13A
KRAS	G13C
KRAS	G13D
KRAS	G13G
KRAS	G13I
KRAS	G13N
KRAS	G13R
KRAS	G13S
KRAS	G13V
KRAS	G15D
KRAS	G15S
KRAS	G60A
KRAS	H27L
KRAS	K5N
KRAS	L19F
KRAS	Q22K
KRAS	Q22Q
KRAS	Q22R
KRAS	Q61E
KRAS	Q61H
KRAS	Q61K
KRAS	Q61L
KRAS	Q61P
KRAS	Q61R
KRAS	S17G
KRAS	V8V
KRAS	V9V
MAP2K4	Q142L
MET	A1209G
MET	D1246H
MET	E168D
MET	G1137V
MET	H1112L
MET	H1112R
MET	H1112Y
MET	H1124D
MET	K1262R
MET	L1130L
MET	L1213V
MET	L229F
MET	M1149T
MET	M1268I
MET	M1268T
MET	N1118Y
MET	N375S
MET	R988C
MET	S283S
MET	T1010I
MET	T1191I
MET	V1290L
MET	Y1248C
MET	Y1248H
MET	Y1253D
MSH6	D390D
MSH6	D390N
MSH6	D575Y
MSH6	E1198A
MSH6	G141G
MSH6	P1087P
MSH6	R249R
MSH6	S315F
MSH6	V474A
MSH6	V480L
MSH6	V509A
MSH6	Y397C
NOTCH1	A1702P
NOTCH1	A2280V
NOTCH1	A2564D
NOTCH1	D1610V
NOTCH1	F1541L
NOTCH1	F1593S
NOTCH1	H2506Y
NOTCH1	I1681N
NOTCH1	L1575P
NOTCH1	L1586P
NOTCH1	L1594P
NOTCH1	L1601P
NOTCH1	L1679P
NOTCH1	P2413T
NOTCH1	R1589P
NOTCH1	R1609S
NOTCH1	R1628H
NOTCH1	T2467M
NOTCH1	V1677D
NRAS	A11T
NRAS	A18T
NRAS	A59T
NRAS	G12A
NRAS	G12C
NRAS	G12D
NRAS	G12G
NRAS	G12P
NRAS	G12R
NRAS	G12S
NRAS	G12V
NRAS	G12Y
NRAS	G13A
NRAS	G13C
NRAS	G13D
NRAS	G13G
NRAS	G13R
NRAS	G13S
NRAS	G13V
NRAS	G13Y
NRAS	Q61E
NRAS	Q61H
NRAS	Q61K
NRAS	Q61L
NRAS	Q61P
NRAS	Q61Q
NRAS	Q61R
NRAS	S65C
NRAS	Y64N
NTRK1	L213L
NTRK3	H677Y
NTRK3	R679Q
NTRK3	R721P
PDGFRA	D1071N
PDGFRA	D842I
PDGFRA	D842V
PDGFRA	D842Y
PDGFRA	D846Y
PDGFRA	F808L
PDGFRA	N870S
PDGFRA	I674I
PDGFRA	V561D
PDGFRB	I882I
PIK3CA	A1046A
PIK3CA	A1046V
PIK3CA	A1066V
PIK3CA	C378R
PIK3CA	C420R
PIK3CA	C901F
PIK3CA	D350H
PIK3CA	E1034G
PIK3CA	E110K
PIK3CA	E418K
PIK3CA	E453K
PIK3CA	E453Q
PIK3CA	E542G
PIK3CA	E542K
PIK3CA	E542V
PIK3CA	E545D
PIK3CA	E545G
PIK3CA	E545K
PIK3CA	F909L
PIK3CA	G1049R
PIK3CA	G1049S
PIK3CA	G106V
PIK3CA	G118D
PIK3CA	G122D
PIK3CA	H1047L
PIK3CA	H1047R
PIK3CA	H1047Y
PIK3CA	H1065Y
PIK3CA	H510H
PIK3CA	H701P
PIK3CA	K111N
PIK3CA	K733R
PIK3CA	M1043I
PIK3CA	M1043T
PIK3CA	M1043V
PIK3CA	N1044K
PIK3CA	N345K
PIK3CA	N345S
PIK3CA	P1011S
PIK3CA	P104R
PIK3CA	P124T
PIK3CA	P539R
PIK3CA	Q546E
PIK3CA	Q546K
PIK3CA	Q546P
PIK3CA	Q546R
PIK3CA	Q60K
PIK3CA	Q661K
PIK3CA	R108P
PIK3CA	R38C
PIK3CA	R38H
PIK3CA	R537R
PIK3CA	R88Q
PIK3CA	S1008P
PIK3CA	S405F
PIK3CA	T1025A
PIK3CA	T1025N
PIK3CA	T1025S
PIK3CA	Y1021C
PIK3CA	Y1021N
PTEN	A121E
PTEN	A121P
PTEN	A126P
PTEN	A126T
PTEN	A126V
PTEN	A137V
PTEN	A148T
PTEN	A151T
PTEN	A309A
PTEN	A34A
PTEN	A39T
PTEN	A3S
PTEN	A79T
PTEN	C105F
PTEN	C105G
PTEN	C105S
PTEN	C105Y
PTEN	C124S
PTEN	C124Y
PTEN	C136F
PTEN	C136R
PTEN	C211Y
PTEN	C304G
PTEN	C304S
PTEN	C71Y
PTEN	D107A
PTEN	D107Y
PTEN	D153D
PTEN	D153N
PTEN	D153Y
PTEN	D162H
PTEN	D19N
PTEN	D24E

FIGURE 28 (CONTINUED)

PTEN	D24G
PTEN	D24N
PTEN	D24Y
PTEN	D252D
PTEN	D252G
PTEN	D252Y
PTEN	D326G
PTEN	D331G
PTEN	D375N
PTEN	D52G
PTEN	D52N
PTEN	D68Y
PTEN	D92A
PTEN	D92G
PTEN	D92N
PTEN	D92V
PTEN	E150D
PTEN	E150G
PTEN	E150Q
PTEN	E242K
PTEN	E284K
PTEN	E288K
PTEN	E291K
PTEN	E307E
PTEN	E314K
PTEN	E73V
PTEN	E91A
PTEN	E91Q
PTEN	F154F
PTEN	F154L
PTEN	F241S
PTEN	F257L
PTEN	F341V
PTEN	F37S
PTEN	F56V
PTEN	F81C
PTEN	F90L
PTEN	F90S
PTEN	G127E
PTEN	G127V
PTEN	G129R
PTEN	G129V
PTEN	G132D
PTEN	G132S
PTEN	G132V
PTEN	G156R
PTEN	G165E
PTEN	G165R
PTEN	G20E
PTEN	G230R
PTEN	G251C
PTEN	G251V
PTEN	G36E
PTEN	G36R
PTEN	G36V
PTEN	G44D
PTEN	G44G
PTEN	H123Y
PTEN	H141Y
PTEN	H272R
PTEN	H272Y
PTEN	H397Y
PTEN	H61L
PTEN	H61P
PTEN	H61R
PTEN	H93D
PTEN	H93Q
PTEN	H93R
PTEN	H93Y
PTEN	I101I
PTEN	I101M
PTEN	I101N
PTEN	I101T
PTEN	I122S
PTEN	I135K
PTEN	I135M
PTEN	I135V
PTEN	I168F
PTEN	I253N
PTEN	I33S
PTEN	I5L
PTEN	I67K
PTEN	I67R
PTEN	K125E
PTEN	K128N
PTEN	K13E
PTEN	K13Q
PTEN	K144I
PTEN	K254E
PTEN	K342N
PTEN	K344R
PTEN	K62I
PTEN	K62R
PTEN	K66E
PTEN	K66N
PTEN	K66Q
PTEN	K6R
PTEN	K80E
PTEN	K80N
PTEN	L108R
PTEN	L112P
PTEN	L112V
PTEN	L139F
PTEN	L146V
PTEN	L152V
PTEN	L162F
PTEN	L23F
PTEN	L345Q
PTEN	L42P
PTEN	L42R
PTEN	L57S
PTEN	L57W
PTEN	L70P
PTEN	M134L
PTEN	M205I
PTEN	M35R
PTEN	M35V
PTEN	N184I
PTEN	N31N
PTEN	N323K
PTEN	N48D
PTEN	N48I
PTEN	N82T
PTEN	N94I
PTEN	N94Y
PTEN	P169H
PTEN	P204S
PTEN	P204T
PTEN	P244S
PTEN	P246L
PTEN	P339L
PTEN	P38S
PTEN	P95L
PTEN	P95S
PTEN	P96L
PTEN	P96Q
PTEN	P96S
PTEN	Q149R
PTEN	Q171E
PTEN	Q171H
PTEN	Q171P
PTEN	Q17P
PTEN	R130G
PTEN	R130L
PTEN	R130P
PTEN	R130Q
PTEN	R130R
PTEN	R142Q
PTEN	R142W
PTEN	R14G
PTEN	R159S
PTEN	R15I
PTEN	R15K
PTEN	R15S
PTEN	R173C
PTEN	R173H
PTEN	R173R
PTEN	R233R
PTEN	R234W
PTEN	R308C
PTEN	R335R
PTEN	R55G
PTEN	R84G
PTEN	S10N
PTEN	S113R
PTEN	S170G
PTEN	S170I
PTEN	S170N
PTEN	S179I
PTEN	S227F
PTEN	S338I
PTEN	S59P
PTEN	T131I
PTEN	T131N
PTEN	T160I
PTEN	T167A
PTEN	T167P
PTEN	T26P
PTEN	T348I
PTEN	T382S
PTEN	T401I
PTEN	T78A
PTEN	T78I
PTEN	V119D
PTEN	V133I
PTEN	V166L
PTEN	V216M
PTEN	V217A
PTEN	V217I
PTEN	V222A
PTEN	V255A
PTEN	V366I
PTEN	V369G
PTEN	V45V
PTEN	V53G
PTEN	V54L
PTEN	W111R
PTEN	W274G
PTEN	Y138C
PTEN	Y155C
PTEN	Y155H
PTEN	Y155N
PTEN	Y16C
PTEN	Y174N
PTEN	Y188S
PTEN	Y225C
PTEN	Y27C
PTEN	Y27N
PTEN	Y27S
PTEN	Y336F
PTEN	Y65C
PTEN	Y65D
PTEN	Y65N
PTEN	Y68H
PTEN	Y76Y
PTEN	Y88C
PTEN	Y88S
PTPN11	A16A
PTPN11	A72D
PTPN11	A72T
PTPN11	A72V
PTPN11	D61N
PTPN11	D61V
PTPN11	D61Y
PTPN11	E139D
PTPN11	E69K
PTPN11	E69V
PTPN11	E76A
PTPN11	E76G
PTPN11	E76K
PTPN11	E76Q
PTPN11	E76V
PTPN11	F71K
PTPN11	F71L
PTPN11	G503A
PTPN11	G503E
PTPN11	G503V
PTPN11	G60A
PTPN11	G60R
PTPN11	G60V
PTPN11	N58S
PTPN11	N58Y
PTPN11	P491L
PTPN11	P491S
PTPN11	Q510K
PTPN11	R138Q
PTPN11	R289G
PTPN11	S502L
PTPN11	S502P
PTPN11	T507K
PTPN11	I73I
PTPN11	W45L
PTPN11	Y63C
RB1	A14A
RB1	C706F
RB1	D718N
RB1	F839F
RB1	H673P
RB1	I1126S
RB1	I138S
RB1	K122K
RB1	L168S
RB1	L689P
RB1	M208V
RB1	M704V
RB1	N328H
RB1	Q444H
RB1	R621S
RB1	R661W
RB1	R798W
RB1	S187I
RB1	S474N
RB1	S612P
RB1	S794I
RB1	V754G
RET	A664D
RET	A876V
RET	A883F
RET	A883P
RET	A913V
RET	C609Y
RET	C618Y
RET	C630R
RET	C634A
RET	C634R
RET	C634T
RET	C634W
RET	C634Y
RET	D631G
RET	D825H
RET	E884K
RET	E901K
RET	G748C
RET	M918T
RET	P766S
RET	R348R
RET	R908K
RET	V778V
ROS1	Q865H
SMARCB1	A203T
SMARCB1	N152D
SMARCB1	P173S
SMARCB1	P48S
SMARCB1	R127G
SMARCB1	R341L
SMARCB1	R374Q
SMARCB1	R377H
SMARCB1	S284L
SMARCB1	S299S
SMARCB1	S49X
SMARCB1	T372I
SMO	A324T
SMO	A401A
SMO	A652V
SMO	A68V
SMO	L514F
SMO	P755P
SMO	R199W
SMO	R484W
SMO	R562Q
SMO	S533N
SMO	I349I
SMO	T640A
SMO	V404M

FIGURE 28 (CONTINUED)

SMO	W535L
SUFU	F197F
SUFU	P187L
TEC	R563K
IIF1	I403N
TP53	A159V
TP53	A161D
TP53	C124R
TP53	C135F
TP53	C135R
TP53	C176F
TP53	C176Y
TP53	C238Y
TP53	C242F
TP53	C242R
TP53	C242S
TP53	C242W
TP53	C275F
TP53	C275G
TP53	C275Y
TP53	D281G
TP53	D281Y
TP53	E11Q
TP53	E258K
TP53	E285K
TP53	E286K
TP53	F113C
TP53	F113S
TP53	G244A
TP53	G244C
TP53	G244D
TP53	G244S
TP53	G245C
TP53	G245S
TP53	G245V
TP53	G262V
TP53	G266E
TP53	G266V
TP53	G334V
TP53	G389W
TP53	H179Q
TP53	H179R
TP53	H193L
TP53	H193R
TP53	I162N
TP53	I195T
TP53	I232N
TP53	I251N
TP53	I251T
TP53	I254D
TP53	I255S
TP53	I255T
TP53	K132E
TP53	K132Q
TP53	K132R
TP53	K320N
TP53	L130V
TP53	L145R
TP53	L194F
TP53	L264R
TP53	L265P
TP53	M133K
TP53	N237I
TP53	M246I
TP53	N239D
TP53	N268I
TP53	P151S
TP53	P152L
TP53	P177T
TP53	P250L
TP53	P278A
TP53	P278L
TP53	P278R
TP53	P278S
TP53	P309S
TP53	Q16L
TP53	R110L
TP53	R110P
TP53	R156P
TP53	R158H
TP53	R158L
TP53	R175H
TP53	R175L
TP53	R213Q
TP53	R248L
TP53	R248Q
TP53	R248W
TP53	R249G
TP53	R249S
TP53	R267L
TP53	R267P
TP53	R267W
TP53	R273C
TP53	R273H
TP53	R273L
TP53	R280G
TP53	R280K
TP53	R280T
TP53	R282W
TP53	R283C
TP53	R283H
TP53	R283P
TP53	R337C
TP53	R337L
TP53	R379C
TP53	S241C
TP53	S241F
TP53	S241Y
TP53	V143A
TP53	V157F
TP53	V216L
TP53	V216M
TP53	V272M
TP53	V274F
TP53	Y126C
TP53	Y163C
TP53	Y220C
TP53	Y220D
TP53	Y236C
TRIM33	E811K