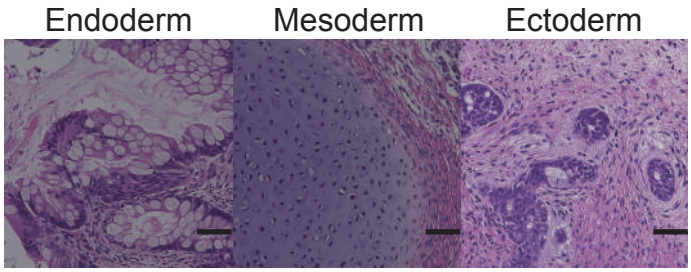
Supplemental Figure1

A



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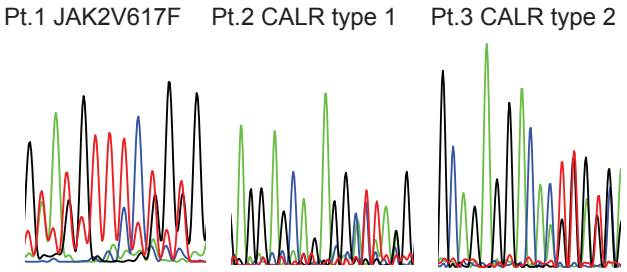

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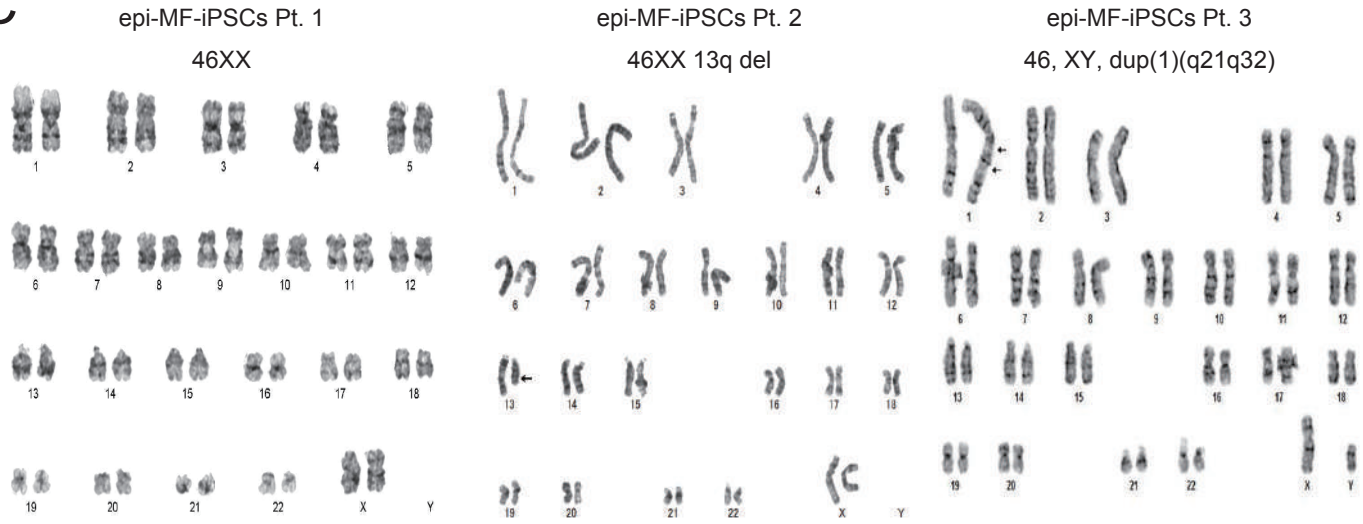
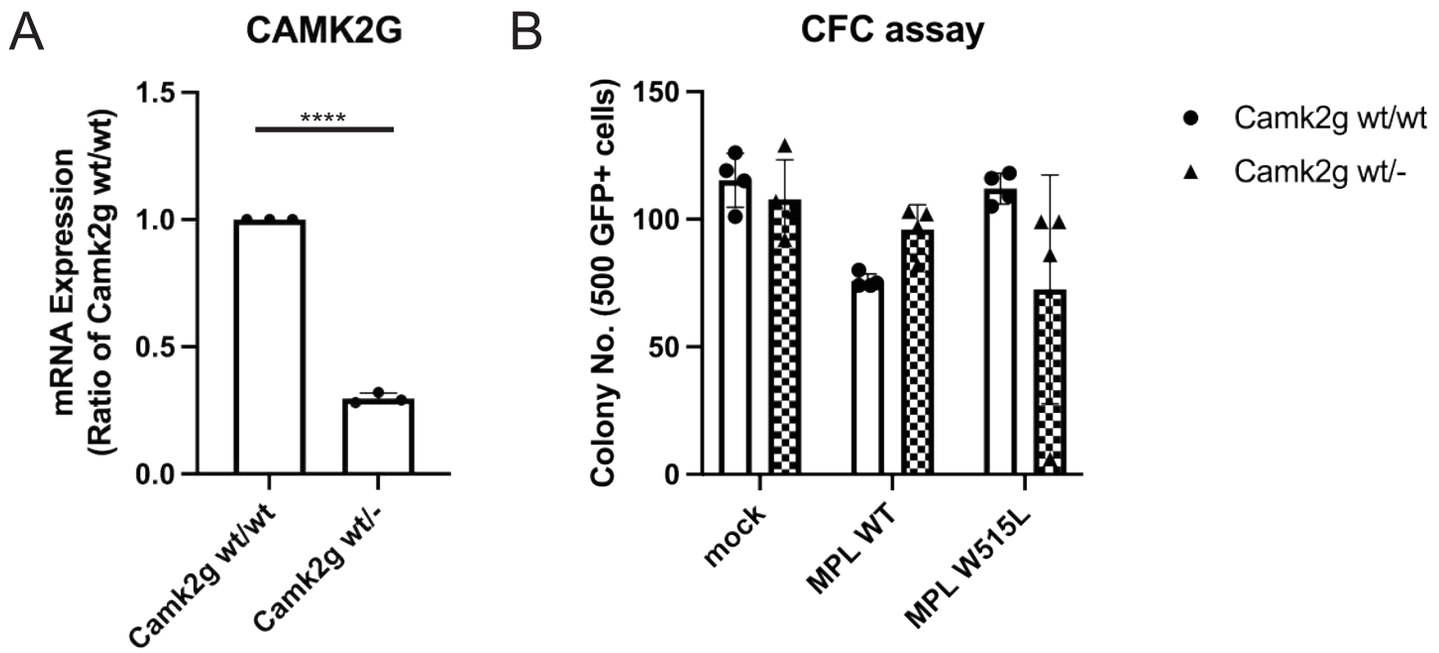
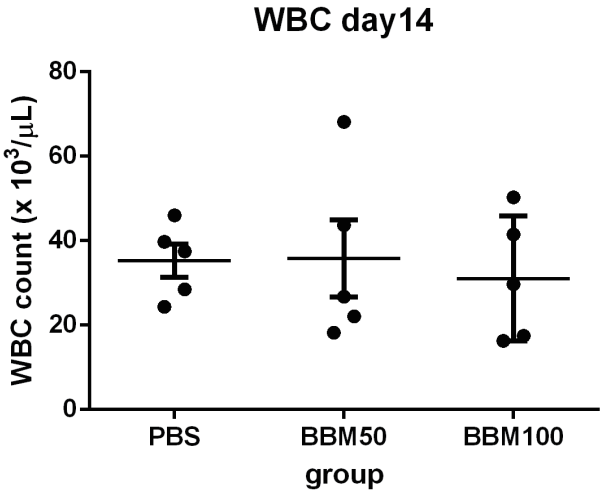


Supplemental Figure 2



Supplemental Figure 3

A



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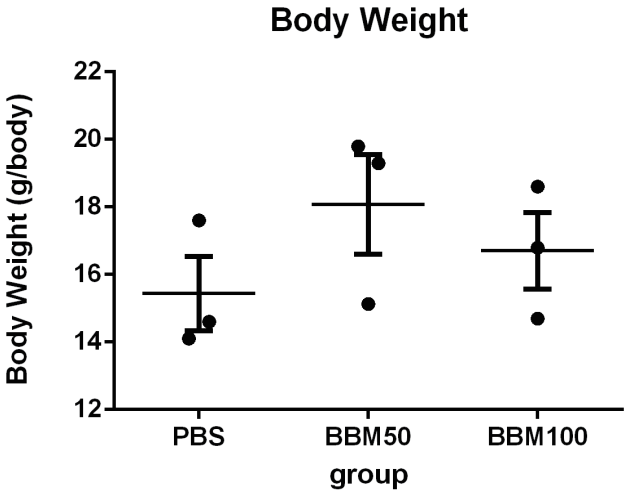

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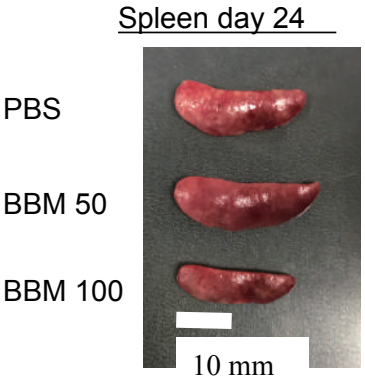
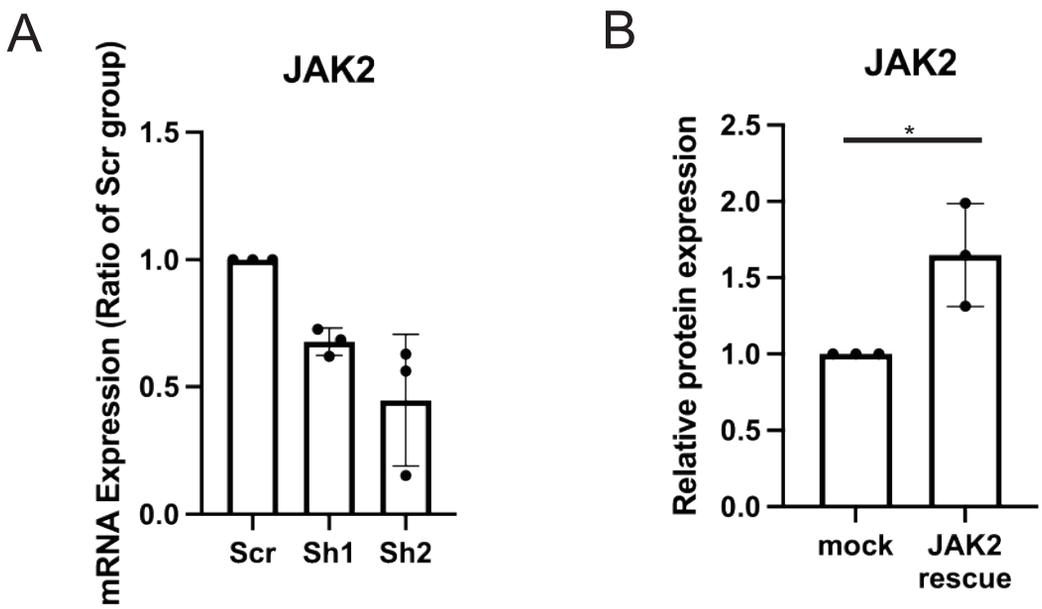


Supplemental Figure 4



SUPPLEMENTAL FIGURE LEGENDS

Supplemental Figure 1. Characteristics of MF-iPSCs

(A) histologic analyses of teratoma from MF-iPSCs are shown. Intestinal epithelium (endoderm), cartilage (mesoderm), and neurons (ectoderm) were formed. Scale bar, 500 μm

(B) Established MF-iPSCs were checked for having the same driver mutations as parental cells by sequence.

(C) Karyotypes of MF-iPSCs made with episomal vectors is shown.

Supplemental Figure 2. Characteristics of the Camk2g knockout mice and the result of the CFC assay

(A) Relative expression of CAMK2G measured by qPCR in Camk2g wt/wt or wt/- mice. Results are means ± SD. N = 3, independent experiments.

(B) The result of the colony-forming cell capacity of c-kit+ cells of wild and Camk2g knockout mice overexpressing mock, wild-type MPL and MPL W515L. Results are means ± SD. N = 3, independent experiments.

Supplemental Figure 3. Characteristics of Efficacy of MF model mice treated with berbamine

(A) White blood cell (WBC) counts before treatment with berbamine on day14 are shown.

(B) Body weight of mice treated with PBS and berbamine on day24 is shown.

(C) Gross images of the spleen are shown.

Supplemental Figure 4. Quantification of JAK2 in knockdown cells and rescued cells by overexpression of wild-type JAK2.

(A) Relative expression of JAK2 measured by qPCR in 32D cells overexpressing MPL W515L and CAMk2G transduced with retroviruses carrying vectors with shRNAs or an empty vector. Results are means ± SD. N = 3, independent experiments.

(B) Quantification of protein of JAK2 in JAK2 knockdown cells after cells were transduced with empty or wild-type JAK2 vectors.

Supplemental table

Supplemental table 1
Patient characteristics of MF-iPSCs established with episomal vectors

	sex	age	disease status	source	gene mutation	karyotype
Patient1	F	55	post-PV MF	PB CD34+ cells	JAK2V617F	46XX
Patient2	F	31	primary MF	BM CD34+ cells	CALR type1	46XX 13q del
Patient3	M	53	post-ET MF	PB CD34+ cells	CALR type2	46, XY, dup(1)(q21q32)

Supplemental table 2
Antibodies used for flow cytometry

	Epitope	Clone	Fluorophore	Supplier
mouse	Gr-1	RB6-8C5	Biotin	BioLegend

	Mac-1	M1/70	Biotin	BioLegend
	B220	RA3-6B2	Biotin	BioLegend
	TER-119	TER-119	Biotin	BioLegend
	CD3ε	145-2C11	Biotin	BioLegend
	CD4	GK1.5	Biotin	BioLegend
	CD8a	53-6.7	Biotin	BioLegend
	CD127	A7R34	Biotin	BioLegend
	Sca-1	E13-161.7	APC-Cy7	BioLegend
	c-kit	2B8	PE-Cy7	BioLegend
human	CD34	581	PE-Cy7	Biolegend
		4H11	APC	eBioscience
	CD38	HIT2	FITC	Biolegend
	CD43	DFT1	PE	BECKMAN COULTER
	IgG isotype	MOPC-21	Alexa Fluor 647	Biolegend
	IgG isotype	679.1Mc7	PE	BECKMAN COULTER
others	AnnexinV		APC	BioLegend

Supplemental table 3
Primers used for qPCR

primer	sequence
Camk1a FW_1	ATTGCCGTCTTACACAAGAT
Camk1a RV_1	TTCTCCACAATTCGGTCAAA
Camk1a FW_2	CATCAAATGCATTGCCAAGA
Camk1a RV_2	TTTCTCCACAATTCGGTCAA
Camk1b FW_1	TACGTGGTGTGTGCTTGA
Camk1b RV_1	TTTCTTGGGAATGCACTTGA

Camk1b FW_2	CATTCGAGCGGGTTGG
Camk1b RV_2	CTCCCGGATCTCATAGACA
Camk1g FW_1	GTCTATCCAAGATGGAGCAG
Camk1g RV_1	CACTTCTGGAGCCACGTA
Camk1g FW_2	GTCTATCCAAGATGGAGCAG
Camk1g RV_2	ACTTCTGGAGCCACGTA
Camk1d FW_1	TCTGAAGTTGTTTTAGCCGA
Camk1d RV_1	CAGACACATTTCTAAGCACG
Camk1d FW_2	CGTGCTTAGAAATGTGTCTG
Camk1d RV_2	TGTGGAGATAGTATACGGCA
Camk2g FW4	CAGGAATATGCTGCAAAAAT
Camk2g RV4	CCCTTCTTCAGAAATACTGT
Camk3 FW_1	GACTTGGGAATTCTCCTTGG
Camk3 RV_1	GCTTTCTCCTCCGTAATATCT
Camk3 FW_2	TCTCCTTGGGGGAGTATTTC
Camk3 RV_2	TAATATCTGTTCAGTGGTCCC
Camk4 FW_1	CTCGGGCATCTCCGC
Camk4 RV_1	CCGTGACTTTGAGCATCT

Camk4	
FW_2	GCGGTCTCGGGCATC
Camk4	
RV_2	ACCGTGACTTTGAGCATCTT
JAK2	
FW	GATGGCGGTGTTAGACATGA
JAK2	
RV	TGCTGAATGAATCTGCGAAA

Supplemental table 4

List of compounds for screening

SCAD inhibitor kit1 ver3.1

Well	Category	Compound
1- A	blank	none (DMSO)
1- B	antitumor (thymidylate synthetase)	5-FU
1- C	antitumor (aminopeptidase B)	Bestatin
1- D	antitumor (DNA)	Bleomycin sulfate
1- E	antitumor (DNA)	Cisplatin
1- F	antitumor (DHFR)	Methotrexate
1- G	antitumor (DNA)	Mitomycin C
1- H	antitumor (tubulin)	Vinblastine sulfate
2- A	antitumor (tubulin)	Paclitaxel
2- B	antitumor (AR)	Flutamide
2- C	antitumor (DNA)	Daunorubicin, HCl
2- D	antitumor (DNA)	Doxorubicin, HCl
2- E	antitumor (ER)	Tamoxifen, citrate
2- F	antitumor (RNA)	Actinomycin D
2- G	antitumor (topo I)	Camptothecin
2- H	antitumor (topo I/II)	Aclarubicin
3- A	antitumor (topo II)	Etoposide (VP-16)
3- B	actin filament	Cytochalasin D
3- C	adenylcyclase	2',5'-dideoxyadenosine
3- D	AKT	AKT inhibitor
3- E	blank	none (DMSO)

3- F	Bcr-Abl	AG957
3- G	CAMKII	KN93
3- H	caspase	Z-VAD-FMK
4- A	CDC2	Kenpaullone
4- B	CDK2	Purvalanol A
4- C	CDK4	3-ATA
4- D	CDKs	Olomoucine
4- E	CKII	TBB
4- F	COX-1	Sulindac sulfide
4- G	COX-1	Valeryl salicylate
4- H	COX-2	NS-398
5- A	COX	Sodium salicylate
5- B	cyclicphosphodiesterase	Theophylline
5- C	DNA methyltransferase	Azacytidine
5- D	DNA polymerase	Aphidicolin
5- E	EGFR	AG1478
5- F	EGFR, topoII	Genistein
5- G	farnesyltransferase	Manumycin A
5- H	farnesyltransferase	FTI-276
6- A	Flk-1	SU1498
6- B	geranylgeranyltransferase I	GGTI-286
6- C	GR	Dexamethasone
6- D	GSK-3	GSK-3 inhibitor II
6- E	HDAC	Scriptaid
6- F	HDAC	Trichostatin A
6- G	HER2 (erbB2/neu), EGFR	AG825
6- H	protein synthesis	Cycloheximide
7- A	HMG-CoA reductase	Lovastatin
7- B	HSP90	Radicicol
7- C	HSP90	17-AAG
7- D	IGF-1R	AG1024
7- E	iNOS	1400W, HCl
7- F	iNOS	AMT, HCl
7- G	Jak-2	AG490
7- H	Jak-2	Cucurbitacin I

8- A	JNK	SP600125
8- B	lck (p56), TYK	Damnacanthal
8- C	MEK	PD 98059
8- D	MEK	U0126
8- E	methionine aminopeptidase	Fumagillin
8- F	MMP	GM 6001
8- G	NF-kB	N-Acetyl-L-cysteine
8- H	NOS	Aminoguanidine, HCl
9- A	NOS	L-NMMA
9- B	p38 (MAPK)	PD169316
9- C	p38 (MAPK)	SB 203580
9- D	p70 S6K	Rapamycin
9- E	PARP	NU1025
9- F	PARP-1	Benzamide
9- G	PC-PLC	D609
9- H	PDE	IBMX
10- A	PDE (cAMP)	Ro-20-1724
10- B	PDE (cGMP)	Zaprinast
10- C	PDGFR	AG1296
10- D	PI3K	LY294002
10- E	PI3K	Wortmannin
10- F	PKA	H-89, HCl
10- G	PKC	Bisindolymaleimide I, HCl
10- H	PKC, PKA	H-7
11- A	PKC, PKA, PKG, MLCK	Staurosporine
11- B	PLA2	cPLA2inhibitor
11- C	PLA2	OBAA
11- D	PP2A	Cantharidin
11- E	PP2A	Cytostatin
11- F	PP2B/cyclophilin	Cyclosporin A
11- G	PP2B/FKBP	FK-506
11- H	proteasome	MG-132
12- A	proteasome	Lactacystin
12- B	ribonucleotide reductase	Hydroxyurea
12- C	ROCK	HA1077

12- D	ROCK	Y27632
12- E	Src, Fyn, Lck	PP1 (analog)
12- F	blank	none (DMSO)
12- G	tubulin depolymerization	Nocodazole
12- H	tyr phosphatase (PTP)	Dephostatin

SCAD inhibitor kit2 ver1.4

Well	Category	Compound
1- A	blank	none (DMSO)
1- B	p53	Pifithrin-a (cyclic)
1- C	p53 activator	PRIMA-1
1- D	5α-reductase	Finasteride
1- E	aromatase	Aminoglutethimide
1- F	aromatase	Formestane
1- G	progesterone receptor	Mifepristone
1- H	acetyl-CoA carboxylase (ACC)	TOFA
2- A	aminopeptidase A	Amastatin
2- B	aminopeptidase M	Actinonin
2- C	F1-ATPase	Oligomycin
2- D	V-ATPase	Bafilomycin A1
2- E	Bcl-2	HA 14-1
2- F	Bcl-XL	BH3I-1
2- G	Burton's tyrosine kinase(BTK)	LFM-A13
2- H	Burton's tyrosine kinase(BTK)	Terreic acid
3- A	calpain	E-64d
3- B	calpain, cathepsin B, L	ALLN
3- C	cathepsin B	CA-074
3- D	cathepsin D	Pepstatin A
3- E	cathepsin G	Z-GLF-CMK
3- F	CCR2	RS 102895
3- G	CCR3	SB 328437
3- H	CXCR2	SB 225002
4- A	CXCR4	AMD3100 octahydrochloride
4- B	Cdc25	NSC95397
4- C	Cdc25A	SC-αασ9

4- D	Na channel	Amiloride
4- E	Na channel	Lidocaine
4- F	Na ionophore	Monensin
4- G	Na/K ATPase	Ouabain
4- H	Na/K/Mg ATPase	Sanguinarine
5- A	K channel	Glibenclamide
5- B	K channel	Dequalinium
5- C	K channel opener	Diazoxide
5- D	K ionophore	Valinomycin
5- E	K ionophore	Nigericin
5- F	Ca channel	Diltiazem
5- G	Ca channel	Nifedipine
5- H	Ca channel, MDR	Verapamil
6- A	MDR	PGP-4008
6- B	BCRP	Fumitremorgin C
6- C	Ca ionophore	A23187
6- D	Ca ionophore	Ionomycin
6- E	Ca-ATPase	Thapsigargin
6- F	Ca-ATPase	t-Butylhydroquinone (BHQ)
6- G	Cl channel	N-phenylanthranilic acid
6- H	Cl channel	DIDS
7- A	Chk 1	SB 218078
7- B	Chk 1, 2	Debromohymenialdisine (DBH)
7- C	mitochondrial complex I	Rotenone
7- D	mitochondrial complex III	Antimycin A1
7- E	CRM1	Leptomycin B*
7- F	DAG kinase	R59022
7- G	DAG kinase	Dioctanoylglycol
7- H	DAG lipase	RHC80267
8- A	DAG acyltransferase (DGAT)	Xanthohumol
8- B	fatty acid synthase (FAS)	C75
8- C	FAS	Cerulenin
8- D	glycosylation	Tunicamycin
8- E	glucosidase I, II	Deoxynojirimycin
8- F	a-mannosidase	Swainsonine

8- G	guanylate cyclase	LY 83583
8- H	guanylate cyclase	ODQ
9- A	HAT	Anacardic acid
9- B	HIF	Chetomin
9- C	HIF-1a hydroxylase	Dimethyloxalylglycine
9- D	kinesin Eg5	HR22C16
9- E	kinesin Eg5	Monastrol
9- F	lipoxygenase	Nordihydroguaiaretic acid (NDGA)
9- G	12, 15-lipoxygenase	ETYA
9- H	12-lipoxygenase	Baicalein
10- A	Mdm2	Nutlin-3
10- B	Mdm2	MDM2 inhibitor
10- C	monoamine oxidase	Phenelzine
10- D	monoamine oxdase B	Deprenyl
10- E	mitochondrial permeability transition pore (MPTP)	Decylubiquinone
10- F	MPTP	Ro 5-4864
10- G	MPTP opener	Lonidamine
10- H	myosin light chain kinase	ML-7
11- A	O6-methylguanine-DNA methyltransferase (MGMT)	Benzylguanine
11- B	ornithine decarboxylase (ODC)	DFMO
11- C	PKG	KT 5823
11- D	PKG	Rp-8-CPT-cGMPS
11- E	PPAR-a	MK 886
11- F	PPAR-a activator	Clofibrate
11- G	PPAR-g	BADGE
11- H	PPAR-g activator	Troglitazone
12- A	reverse transcriptase	AZT
12- B	reverse transcriptase	Nalidixic acid
12- C	RNA polymerase	a-Amanitin
12- D	telomerase	MST-312
12- E	telomerase	b-Rubromycin
12- F	TGF-b receptor	SB 431542
12- G	spermidine/spermine N1-acetyltransferase (SSAT) activator	N1,N12-Diethylspermine (BESpm)

12- H	sphingosine N-acyltransferase	Fumonisin B1