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(54) Title: KITS FOR IDENTIFICATION OF EXPOSURE TO PHENANTHRENE AND THE METHOD OF IDENTIFICATION OF EXPOSURE TO PHENANTHRENE

(57) Abstract:



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【DESCRIPTION】**【Invention Title】**

KITS FOR IDENTIFICATION OF EXPOSURE TO PHENANTHRENE
AND THE METHOD OF IDENTIFICATION OF EXPOSURE TO
5 PHENANTHRENE

【Technical Field】

The present invention relates to a kit for
identification of exposure to phenanthrene and a method for
10 identification of exposure to phenanthrene, more precisely,
a kit for identification of exposure to phenanthrene using
a gene up-regulated or down-regulated by phenanthrene, one
of polycyclic aromatic hydrocarbons, and a method for
identification of exposure to phenanthrene using the same.

15

【Background Art】

Phenanthrene, one of polycyclic aromatic hydrocarbons,
is a glossy, colorless blue fluorescent platy crystal,
which has a structure of fused ring composed of three
20 benzene rings. Phenanthrene is an isomer of anthracene.
It was first found in coal tar by R. Fittig of Germany in
1872. It is largely included in anthracene oil extracted
from coal tar and is separated by precise distillation.
When phenanthrene is oxidized by chromic acid,
25 phenanthraquinone is generated. When it is reduced,

hydrogenated compounds are generated in each stage. Phenanthrene is a synthetic raw material for dyes, plastics, insecticides and medical supplies, but it is not commercially produced or used but produced for the purpose of organic matter synthesis or studies in the field of chemistry. To measure exposure to phenanthrene in the environment, major facilities expected to discharge phenanthrene by the research of distribution of aromatic hydrocarbons (PAHs) of industrial stack gas are selected and examined. As a result, 1.2 ppb of phenanthrene was detected in cupola and some phenanthrene was also detected in boiler (The Report of National Institute of Environmental Research, Korea 1996). PAH concentration in the air of domestic cities was also investigated. As a result, 0.31 ng/m³ of PAH was detected in residential area of Seoul and 0.36 ng/m³ of PAH was detected in Taepyeong-dong, Daejeon (Ministry of Environment, 1997). In overseas studies, PAH concentration in the air in New York, USA, was confirmed to be 0.4 ng/m³ (1974), PAH concentration in Osaka, Japan was 100 ng/m³ (1977-4978), and PAH concentration in Paris, France was 28 ng/m³ (1981-1982) (Edoardo, *The Science of the Total Environment*, 116:119~135, 1992).

Phenanthrene is converted into phenanthrene-9,10-oxide and phenanthrene-1,2-diol-3,4-epoxide by epoxidation.

Phenanthrene is sensitive to skin and harmful to human since it causes dermatitis, bronchitis, cough, dyspnea, bronchial tumor and renal tumor in human. According to the classification of carcinogenicity made by International Agency for Research on Cancer (IARC), UN, it belongs to Group 3, indicating it is classified as a non-carcinogenic substance in human (there is insufficient evidence of carcinogenicity in humans).

There have been a few studies reporting carcinogenicity of polycyclic aromatic hydrocarbons and gene expression changes thereby, but most of them are limited to the representative polycyclic aromatic hydrocarbon, benzo[a]pyrene. Even if phenanthrene has carcinogenicity in human, there are not enough data to evaluate risk in human and methods for screening exposure to phenanthrene are limited to a couple of classical methods such as GC-MS (Gas Chromatography-Mass Spectrometer) or HPLC (High Performance Liquid Chromatography). GC-MS or HPLC facilitates quantification. However, to do so, proper conditions for analysis have to be determined and high price equipments are necessary. Therefore, it is an urgent and important request to establish and utilize molecular index for screening toxicity in human by evaluating risk quick enough using fast and easy screening methods such as real-time RT-PCR

(reverse transcript polymerase chain reaction) using primers or DNA micro-array chip to take measure and control exposure to phenanthrene.

5 Diverse genome nucleotide sequencing projects including 6 mammals and 292 microorganisms have been completed and reported to NCBI (National Center for Biotechnology Information). Based on a huge amount of data obtained thereby, studies on genome-wide expression
10 have been actively undergoing to examine functions of genes. DNA microarray enables the analysis of expressions of thousands of genes at a time (Schena, M., et al., *Proc. Natl. Acad. Sci. USA* 93:10614-10619, 1996).

15 Microarray is prepared by integrating cDNA (complementary DNA) or 20-25 base pair long oligonucleotides on a glass plate. cDNA microarray is produced in laboratories at schools or companies including Agilent, Genomic Solutions, etc, by mechanically fixing
20 cDNA collections on a chip or via ink jetting (Sellheyer K. et. al., *J. Am. Acad. Dermatol.* 51:681-692, 2004). Oligonucleotide microarray is prepared by direct synthesis on a chip using photolithography by Affymetrix Co. Agilent Co., etc. also produce oligonucleotide microarray by fixing
25 synthetic oligonucleotides on a chip (Sellheyer, K. et.

al., *J. Am. Acad. Dermatol.* 51:681-692, 2004).

To analyze gene expression, RNA is extracted from a sample such as tissues and hybridized with oligonucleotide on DNA microarray. The obtained RNA is labeled with
5 fluorescence or isotope and then converted into cDNA. According to oligo-microarray, control and experimental groups are labeled with different fluorescences (for example, Cy3 and Cy5) and hybridized on a same chip, followed by optical image scanning to measure the strength
10 of fluorescence. Gene expression is determined by the ratio of fluorescence strength between the two (Somasundaram, K. et al., *Genomics Proteomics* 1:1-10, 2002).

By integrating with high-tech-toxicogenomics based on
15 recent DNA microarray techniques, it is now possible to analyze gene expression pattern or quantify gene expression in specific tissues or cells vulnerable by medicines and newly developed drugs or any other chemicals including representative environmental pollutants. Therefore, by
20 investigating the expression pattern of a specific gene in a specific cell, side effects of a drug and genes causing harmful action in relation to environmental pollutants can be predicted, by which mechanisms of molecules involved in harmful action of pollutants and mechanisms of effect and
25 side-effect of a drug can be better understood,

facilitating screening and identification of a material causing side effects or toxicity.

The present inventors applied phenanthrene expression
5 profiles in human liver cancer cell line HepG2 using oligo-
microarray on which 44,000 human genes are integrated to
screen genes up-regulated or down-regulated by phenanthrene.
And the present inventors further investigated the
expression patterns of such genes by real-time RT-PCR. At
10 last the present inventors completed this invention by
providing a kit for identification of exposure to
phenanthrene using the said gene up-regulated or down-
regulated specifically by phenanthrene as a biomarker and a
method for identification of exposure to phenanthrene.

15
【Disclosure】

【Technical Problem】

It is an object of the present invention to provide a
kit for identification of exposure to phenanthrene using a
20 gene up-regulated or down-regulated specifically by
phenanthrene and a method for identification of exposure to
phenanthrene using the said gene.

【Technical Solution】

25 To achieve the above object, the present invention

provides a kit for identification of exposure to phenanthrene comprising oligonucleotide containing total length or a part of a gene up-regulated or down-regulated by phenanthrene or its complementary oligonucleotide.

5 The present invention also provides a kit for identification of exposure to phenanthrene containing a primer set capable of amplifying the said gene.

 The present invention further provides a method for identification of exposure to phenanthrene using the said
10 gene.

 Hereinafter, the present invention is described in detail.

15 The present invention provides a kit for identification of exposure to phenanthrene comprising oligonucleotide containing total length or a part of a gene selected from the group consisting of the following genes or its complementary oligonucleotide:

20 GeneBank accession No: NM_004420(DUSP8, Dual specificity phosphatase 8), GeneBank accession No: L11329(DUSP2, Dual specificity phosphatase 2), GeneBank accession No: BC094766(PKN1, Protein kinase N1), GeneBank accession No: AY247738(TRIB3, Tribbles homolog
25 3(Drosophila)), GeneBank accession No: AK129595(GADD45B,

Growth arrest and DNA-damage-inducible, beta), GeneBank accession No: AB208849(SHC1, SHC(Src homology 2 domain containing) transforming protein 1), GeneBank accession No: X02812(TGFB1, Transforming growth factor, beta 1(Camurati-Engelmann disease)), GeneBank accession No: NM_198951(TGM2, Transglutaminase 2(C polypeptide, protein-glutamine-gamma-glutamyltransferase)), GeneBank accession No: NM_147780(CTSB, Cathepsin B), GeneBank accession No: NM_078467(CDKN1A, Cyclin-dependent kinase inhibitor 1A(p21, Cip1)), GeneBank accession No: NM_033027(AXUD1, AXIN1 up-regulated 1), GeneBank accession No: NM_032797(AMID, Apoptosis-inducing factor(AIF)-like mitochondrion-associated inducer of death), GeneBank accession No: NM_021960(MCL1, Myeloid cell leukemia sequence 1(BCL2-related)), GeneBank accession No: NM_016639(TNFRSF12A, Tumor necrosis factor receptor superfamily, member 12A), GeneBank accession No: NM_016222(DDX41, DEAD(Asp-Glu-Ala-Asp) box polypeptide 41), GeneBank accession No: NM_013246(CLC, Cardiotrophin-like cytokine factor 1), GeneBank accession No: NM_004401(DFFA, DNA fragmentation factor, 45kDa, alpha polypeptide), GeneBank accession No: NM_004281(BAG3, BCL2-associated athanogene 3), GeneBank accession No: NM_003897(IER3, Immediate early response 3), GeneBank accession No: NM_003806(HRK, Harakiri, BCL2 interacting protein(contains only BH3 domain)), GeneBank

accession No: NM_003639(IKBKG, Inhibitor of kappa light polypeptide gene enhancer in B-cells, kinase gamma), GeneBank accession No: NM_003311(PHLDA2, Pleckstrin homology-like domain, family A, member 2), GeneBank
5 accession No: NM_002737(PRKCA, Protein kinase C, alpha), GeneBank accession No: NM_002648(PIM1, Pim-1 oncogene), GeneBank accession No: NM_002507(NGFR, Nerve growth factor receptor(TNFR superfamily, member 16)), GeneBank accession
10 No: NM_002305(LGALS1, Lectin, galactoside-binding, soluble, 1(galectin 1)), GeneBank accession No: NM_001013398(IGFBP3, Insulin-like growth factor binding protein 3), GeneBank accession No: BX640923(MDM4, Mdm4, transformed 3T3 cell double minute 4, p53 binding protein(mouse)), GeneBank
15 accession No: BX537586(STK17A, Serine/threonine kinase 17a(apoptosis-inducing)), GeneBank accession No: BG284742(P8, P8 protein(candidate of metastasis 1)), GeneBank accession No: BE903247(PDCD6IP, Programmed cell death 6 interacting protein), GeneBank accession No: BC027949(P2RX1, Purinergic receptor P2X, ligand-gated ion
20 channel, 1), GeneBank accession No: BC006365(PSEN2, Presenilin 2(Alzheimer disease 4)), GeneBank accession No: AY869712(PPP1R13L, Protein phosphatase 1, regulatory(inhibitor) subunit 13 like), GeneBank accession No: AY028896(CARD10, Caspase recruitment domain family,
25 member 10), GeneBank accession No: AK122614(PPARD,

Peroxisome proliferative activated receptor, delta),
GeneBank accession No: AK092872(ERCC2, Excision repair
cross-complementing rodent repair deficiency,
complementation group 2(xeroderma pigmentosum D)), GeneBank
5 accession No: AK092808(RRAGC, Ras-related GTP binding C),
GeneBank accession No: AJ001898(GDNF, Glial cell derived
neurotrophic factor), GeneBank accession No:
AF220656(PHLDA1, Pleckstrin homology-like domain, family A,
member 1), GeneBank accession No: AF055634(UNC5C, Unc-5
10 homolog C(C. elegans)), GeneBank accession No:
AB209485(VEGF, Vascular endothelial growth factor),
GeneBank accession No: AB096256(UNC5B, Unc-5 homolog B(C.
elegans)), GeneBank accession No: AB007960(SH3GLB1, SH3-
domain GRB2-like endophilin B1), GeneBank accession No:
15 X06374(PDGFA, Platelet-derived growth factor alpha
polypeptide), GeneBank accession No: S62138(DDIT3, DNA-
damage-inducible transcript 3), GeneBank accession No:
NM_078487(CDKN2B, Cyclin-dependent kinase inhibitor 2B(p15,
inhibits CDK4)), GeneBank accession No: NM_012127(CIZ1,
20 CDKN1A interacting zinc finger protein 1), GeneBank
accession No: NM_005883(APC2, Adenomatosis polyposis coli
2), GeneBank accession No: NM_004196(CDKL1, Cyclin-
dependent kinase-like 1(CDC2-related kinase)), GeneBank
accession No: NM_003236(TGFA, Transforming growth factor,
25 alpha), GeneBank accession No: NM_001261(CDK9, Cyclin-

dependent kinase 9(CDC2-related kinase)), GeneBank
accession No: NM_001007271(DUSP13, Dual specificity
phosphatase 13), GeneBank accession No: CR749511(PARC, P53-
associated parkin-like cytoplasmic protein), GeneBank
5 accession No: CR623038(ID2, Inhibitor of DNA binding 2,
dominant negative helix-loop-helix protein), GeneBank
accession No: CR618371(EGFR, Epidermal growth factor
receptor(erythroblastic leukemia viral(v-erb-b) oncogene
homolog, avian)), GeneBank accession No: BF965144(IFITM1,
10 Interferon induced transmembrane protein 1(9-27)), GeneBank
accession No: AK127679(DUSP1, Dual specificity phosphatase
1), GeneBank accession No: AK096276(CCND3, Cyclin D3),
GeneBank accession No: AB209586(MAPK13, Mitogen-activated
protein kinase 13), GeneBank accession No: AB209465(PCTK1,
15 PCTAIRE protein kinase 1), GeneBank accession No:
Z19588(SKIL, SKI-like), GeneBank accession No:
NM_020429(SMURF1, SMAD specific E3 ubiquitin protein ligase
1), GeneBank accession No: NM_014767(SPOCK2,
Sparc/osteonectin, cwcvc and kazal-like domains
20 proteoglycan(testican) 2), GeneBank accession No:
NM_005979(S100A13, S100 calcium binding protein A13),
GeneBank accession No: NM_005187(CBFA2T3, Core-binding
factor, runt domain, alpha subunit 2; translocated to, 3),
GeneBank accession No: NM_004364(CEBPA, CCAAT/enhancer
25 binding protein(C/EBP), alpha), GeneBank accession No:

NM_001769(CD9, CD9 antigen(p24)), GeneBank accession No:
 NM_001718(BMP6, Bone morphogenetic protein 6), GeneBank
 accession No: NM_000641(IL11, Interleukin 11), GeneBank
 accession No: BX647459(SERPINE2, Serpin peptidase inhibitor,
 5 clade E(nexin, plasminogen activator inhibitor type 1),
 member 2), GeneBank accession No: BQ066037(RPS19, Ribosomal
 protein S19), GeneBank accession No: BE791300(EDF1,
 Endothelial differentiation-related factor 1), GeneBank
 accession No: BC038504(SNF1LK, SNF1-like kinase), GeneBank
 10 accession No: AL832287(ZAP70, Zeta-chain(TCR) associated
 protein kinase 70kDa), GeneBank accession No:
 AK125742(PCGF1, Polycomb group ring finger 1), GeneBank
 accession No: AK124709(NDRG1, N-myc downstream regulated
 gene 1), GeneBank accession No: AB011157(PTDSR,
 15 Phosphatidylserine receptor), GeneBank accession No:
 NM_013255(MKLN1, Muskelein 1, intracellular mediator
 containing kelch motifs), GeneBank accession No:
 NM_006572(GNA13, Guanine nucleotide binding protein(G
 protein), alpha 13), GeneBank accession No: NM_002211(ITGB1,
 20 Integrin, beta 1(fibronectin receptor, beta polypeptide,
 antigen CD29 includes MDF2, MSK12)), GeneBank accession No:
 CR601067(PLAUR, Plasminogen activator, urokinase receptor),
 GeneBank accession No: BC050456(THBS4, Thrombospondin 4),
 GeneBank accession No: AK027389(CXCL16, Chemokine(C-X-C
 25 motif) ligand 16), GeneBank accession No: AJ132099(VNN1,

Vanin 1), GeneBank accession No: XM_371354(FLJ10157,
 Hypothetical protein FLJ10157), GeneBank accession No:
 XM_208313(TPM3, Similar to tropomyosin 4), GeneBank
 accession No: XM_208270(ACR, Acrosin-like protease),
 5 GeneBank accession No: NM_203353(PDLIM7, PDZ and LIM domain
 7(enigma)), GeneBank accession No: NM_201382(PLEC1, Plectin
 1, intermediate filament binding protein 500kDa), GeneBank
 accession No: NM_182961(SYNE1, Spectrin repeat containing,
 nuclear envelope 1), GeneBank accession No: NM_181826(NF2,
 10 Neurofibromin 2(bilateral acoustic neuroma)), GeneBank
 accession No: NM_172069(PLEKHH2, Pleckstrin homology domain
 containing, family H(with MyTH4 domain) member 2), GeneBank
 accession No: NM_022648(TNS, Tensin 1), GeneBank accession
 No: NM_017556(FBLP-1, Filamin binding LIM protein 1),
 15 GeneBank accession No: NM_016081(KIAA0992, Palladin,
 cytoskeletal associated protein), GeneBank accession No:
 NM_006617(NES, Nestin), GeneBank accession No:
 NM_006262(PRPH, Peripherin), GeneBank accession No:
 NM_005100(AKAP12, A kinase(PRKA) anchor protein(gravin) 12),
 20 GeneBank accession No: NM_004368(CNN2, Calponin 2),
 GeneBank accession No: NM_003388(CYLN2, Cytoplasmic linker
 2), GeneBank accession No: NM_003370(VASP, Vasodilator-
 stimulated phosphoprotein), GeneBank accession No:
 NM_003128(SPTBN1, Spectrin, beta, non-erythrocytic 1),
 25 GeneBank accession No: NM_002705(PPL, Periplakin), GeneBank

accession No: NM_002475(MLC1SA, Myosin light chain 1 slow
 a), GeneBank accession No: NM_002018(FLII, Flightless I
 homolog(Drosophila)), GeneBank accession No: NM_001465(FYB,
 FYN binding protein(FYB-120/130)), GeneBank accession No:
 5 NM_001069(TUBB2, Tubulin, beta 2A), GeneBank accession No:
 CR625172(MGC8685, Tubulin, beta 2B), GeneBank accession No:
 CR616919(KRT18, Keratin 18), GeneBank accession No:
 CR606241(ACTG1, Actin, gamma 1), GeneBank accession No:
 CB240572(MYH11, Myosin, heavy polypeptide 11, smooth
 10 muscle), GeneBank accession No: BX648253(PTPN3, Protein
 tyrosine phosphatase, non-receptor type 3), GeneBank
 accession No: BX648190(WDR1, WD repeat domain 1), GeneBank
 accession No: BX641076(ACTN1, Actinin, alpha 1), GeneBank
 accession No: BX537978(EPB41L1, Erythrocyte membrane
 15 protein band 4.1-like 1), GeneBank accession No:
 BG121847(NUDC, Nuclear distribution gene C homolog(A.
 nidulans)), GeneBank accession No: BC068013(MYO1C, Myosin
 IC), GeneBank accession No: BC065499(MAST2, Microtubule
 associated serine/threonine kinase 2), GeneBank accession
 20 No: BC051890(TUBG2, Tubulin, gamma 2), GeneBank accession
 No: BC041874(MAP1LC3B, Microtubule-associated protein 1
 light chain 3 beta), GeneBank accession No: BC012597(ACTA1,
 Actin, alpha 1, skeletal muscle), GeneBank accession No:
 AY484427(KIF17, Kinesin family member 17), GeneBank
 25 accession No: AK130546(STOML2, Stomatin(EPB72)-like 2),

GeneBank accession No: AK124711(CORO2B, Coronin, actin binding protein, 2B), GeneBank accession No: AK123974(MYL5, Myosin, light polypeptide 5, regulatory), GeneBank accession No: AK092792(LOC389833, Similar to hypothetical protein MGC27019), GeneBank accession No: AK026518(MYOHD1, Myosin head domain containing 1), GeneBank accession No: AK024500(NICAL, Microtubule associated monooxygenase, calponin and LIM domain containing 1), GeneBank accession No: AF085886(FLJ46675, Ribosomal protein L29 pseudogene 2),
5 GeneBank accession No: AB209997(MYO9B, Myosin IXB), GeneBank accession No: Y12692(WNT11, Wingless-type MMTV integration site family, member 11), GeneBank accession No: Y11307(CYR61, Cysteine-rich, angiogenic inducer, 61), GeneBank accession No: X17033(ITGA2, Integrin, alpha
10 2(CD49B, alpha 2 subunit of VLA-2 receptor)), GeneBank accession No: U41763(CLTCL1, Clathrin, heavy polypeptide-like 1), GeneBank accession No: NM_153609(TMPRSS6, Transmembrane protease, serine 6), GeneBank accession No: NM_031483(ITCH, Itchy homolog E3 ubiquitin protein
15 ligase(mouse)), GeneBank accession No: NM_024342(GRLF1, Glucocorticoid receptor DNA binding factor 1), GeneBank accession No: NM_017555(EGLN2, Egl nine homolog 2(C. elegans)), GeneBank accession No: NM_016569(TBX3, T-box
20 3(ulnar mammary syndrome)), GeneBank accession No: NM_004148(NINJ1, Ninjurin 1), GeneBank accession No:

NM_003377(VEGFB, Vascular endothelial growth factor B),
 GeneBank accession No: NM_001983(ERCC1, Excision repair
 cross-complementing rodent repair deficiency,
 complementation group 1(includes overlapping antisense
 5 sequence)), GeneBank accession No: NM_001552(IGFBP4,
 Insulin-like growth factor binding protein 4), GeneBank
 accession No: NM_001430(EPAS1, Endothelial PAS domain
 protein 1), GeneBank accession No: NM_001300(KLF6, Kruppel-
 like factor 6), GeneBank accession No: NM_001012661(SLC3A2,
 10 Solute carrier family 3(activators of dibasic and neutral
 amino acid transport), member 2), GeneBank accession No:
 NM_000596(IGFBP1, Insulin-like growth factor binding
 protein 1), GeneBank accession No: NM_000474(TWIST1, Twist
 homolog 1(acrocephalosyndactyly 3; Saethre-Chotzen
 15 syndrome)(Drosophila)), GeneBank accession No:
 BX649103(ChGn, Chondroitin beta1,4 N-
 acetylgalactosaminyltransferase), GeneBank accession No:
 BM913048(TIMPI, TIMP metalloproteinase inhibitor 1),
 GeneBank accession No: BM904612(S100A6, S100 calcium
 20 binding protein A6(calycyclin)), GeneBank accession No:
 BM556279(EMP3, Epithelial membrane protein 3), GeneBank
 accession No: BC015041(VAT1, Family with sequence
 similarity 82, member C), GeneBank accession No:
 AY258066(OKL38, Pregnancy-induced growth inhibitor),
 25 GeneBank accession No: AK126729(NDRG4, NDRG family member

4), GeneBank accession No: AK090459(NFE2L1, Nuclear factor(erythroid-derived 2)-like 1), GeneBank accession No: AK074163(ROBO4, Roundabout homolog 4, magic roundabout(Drosophila)), GeneBank accession No: 5 AK024680(FLJ21027 fis, CDNA: FLJ21027 fis, clone CAE07110), GeneBank accession No: AF176422(HEY1, Hairy/enhancer-of-split related with YRPW motif 1), GeneBank accession No: AF003837(JAG1, Jagged 1(Alagille syndrome)), GeneBank accession No: AB209322(SEMA3B, Sema domain, immunoglobulin 10 domain(Ig), short basic domain, secreted,(semaphorin) 3B), GeneBank accession No: AB011150(NRXN1, Neurexin 1), GeneBank accession No: NM_201589(MAFA, V-maf musculoaponeurotic fibrosarcoma oncogene homolog A(avian)), GeneBank accession No: NM_052999(CKLFSF1, CKLF-like MARVEL 15 transmembrane domain containing 1), GeneBank accession No: NM_006644(HSPH1, Heat shock 105kDa/110kDa protein 1), GeneBank accession No: NM_005438(FOSL1, FOS-like antigen 1), GeneBank accession No: NM_004996(ABCC1, ATP-binding cassette, sub-family C(CFTR/MRP), member 1), GeneBank 20 accession No: NM_002658(PLAU, Plasminogen activator, urokinase), GeneBank accession No: NM_001353(AKR1C1, Aldo-keto reductase family 1, member C1(dihydrodiol dehydrogenase 1; 20-alpha(3-alpha)-hydroxysteroid dehydrogenase)), GeneBank accession No: H18681(C20orf139, 25 Sulfiredoxin 1 homolog(S. cerevisiae)), GeneBank accession

No: DR004094(HAMP, Hepsidin antimicrobial peptide),
GeneBank accession No: BC082272(KCNMB3, Potassium large
conductance calcium-activated channel, subfamily M beta
member 3), GeneBank accession No: BC040494(DNAJB2,
5 DnaJ(Hsp40) homolog, subfamily B, member 2), GeneBank
accession No: BC018064(ATF6, Activating transcription
factor 6), GeneBank accession No: BC006523(SGK2,
Serum/glucocorticoid regulated kinase 2), GeneBank
accession No: AK090482(CXCL12, Chemokine(C-X-C motif)
10 ligand 12(stromal cell-derived factor 1)), GeneBank
accession No: AF219946(TULP4, Tubby like protein 4),
GeneBank accession No: AB209112(SLC2A8, Solute carrier
family 2,(facilitated glucose transporter) member 8),
GeneBank accession No: NM_005242(F2RL1, Coagulation factor
15 II(thrombin) receptor-like 1), GeneBank accession No:
NM_001002029(C4A, Complement component 4B, telomeric),
GeneBank accession No: NM_000539(RHO, Rhodopsin(opsin 2,
rod pigment)(retinitis pigmentosa 4, autosomal dominant)),
GeneBank accession No: BX649164(PAI, serpin peptidase
20 inhibitor, clade E(nexin, plasminogen activator inhibitor
type 1), member 1), GeneBank accession No: BM918324(LY96,
Lymphocyte antigen 96), GeneBank accession No:
AB209647(NCF2, Neutrophil cytosolic factor 2(65kDa, chronic
granulomatous disease, autosomal 2)), GeneBank accession
25 No: NM_152221(CSNK1E, Casein kinase 1, epsilon), GeneBank

accession No: NM_017999(RNF31, Ring finger protein 31),
GeneBank accession No: NM_016819(OGG1, 8-oxoguanine DNA
glycosylase), GeneBank accession No: NM_016816(OAS1, 2',5'-
oligoadenylate synthetase 1, 40/46kDa), GeneBank accession
5 No: NM_012235(SCAP, SREBP cleavage-activating protein),
GeneBank accession No: NM_006384(CIB1, Calcium and integrin
binding 1(calmyrin)), GeneBank accession No: NM_001779(CD58,
CD58 antigen,(lymphocyte function-associated antigen 3)),
GeneBank accession No: CB055213(ICOSLG, Inducible T-cell
10 co-stimulator ligand), GeneBank accession No:
BX641029(MASP1, Mannan-binding lectin serine peptidase
1(C4/C2 activating component of Ra-reactive factor)),
GeneBank accession No: BQ053419(BATF, Basic leucine zipper
transcription factor, ATF-like), GeneBank accession No:
15 BC039299(STIP1, Stress-induced-phosphoprotein
1(Hsp70/Hsp90-organizing protein)), GeneBank accession No:
AY055760(DAF, Decay accelerating factor for complement(CD55,
Cromer blood group system)), GeneBank accession No:
AK130188(FGR, Gardner-Rasheed feline sarcoma viral(v-fgr)
20 oncogene homolog), GeneBank accession No: AK095326(MUS81,
MUS81 endonuclease homolog(yeast)), GeneBank accession No:
NM_017670(OTUB1, OTU domain, ubiquitin aldehyde binding 1),
GeneBank accession No: NM_003004(SECTM1, Secreted and
transmembrane 1), GeneBank accession No: NM_002309(LIF,
25 Hypothetical protein MGC20647), GeneBank accession No:

NM_001421(ELF4, E74-like factor 4(ets domain transcription factor)), GeneBank accession No: NM_000418(IL4R, Interleukin 4 receptor), GeneBank accession No: BI909222(FCER1G, Fc fragment of IgE, high affinity I, receptor for; gamma polypeptide), GeneBank accession No: BF569086(NK4, Interleukin 32), GeneBank accession No: BC014470(AZGP1, Alpha-2-glycoprotein 1, zinc), GeneBank accession No: BC020744(AKR1C4, Aldo-keto reductase family 1, member C4(chlordecone reductase; 3-alpha hydroxysteroid dehydrogenase, type I; dihydrodiol), dehydrogenase 4), GeneBank accession No: BQ939577(AKR1C3, Aldo-keto reductase family 1, member C3(3-alpha hydroxysteroid dehydrogenase, type II)), GeneBank accession No: NM_000499(CYP1A1, Cytochrome P450, family 1, subfamily A, polypeptide 1), GeneBank accession No: NM_030622(CYP2S1, Cytochrome P450, family 2, subfamily S, polypeptide 1), GeneBank accession No: NM_184041(ALDOA, Aldolase A, fructose-bisphosphate), GeneBank accession No: NM_024307(MGC4171, Hypothetical protein LOC283901), GeneBank accession No: NM_005336(HDLBP, High density lipoprotein binding protein(vigilin)), GeneBank accession No: NM_002627(PFKP, Phosphofructokinase, platelet), GeneBank accession No: BX648281(LDLR, Low density lipoprotein receptor(familial hypercholesterolemia)), GeneBank accession No: BC069201(FLJ22761, Hexokinase domain containing 1),

GeneBank accession No: BC030207(NR0B2, Nuclear receptor subfamily 0, group B, member 2), GeneBank accession No: AL833069(KIAA1434, Hypothetical protein KIAA1434), GeneBank accession No: AK124656(ENO2, Enolase 2(gamma, neuronal)),
5 GeneBank accession No: AK094474(RHOC, Ras homolog gene family, member C), GeneBank accession No: AK093461(ISYNA1, Myo-inositol 1-phosphate synthase A1), GeneBank accession No: AB053232(GAL3ST3, Galactose-3-O-sulfotransferase 3), GeneBank accession No: AB045292(TMEN8, Transmembrane
10 protein 8(five membrane-spanning domains)), GeneBank accession No: NM_004753(DHRS3, Dehydrogenase/reductase(SDR family) member 3), GeneBank accession No: NM_002900(RBP3, Retinol binding protein 3, interstitial), GeneBank accession No: NM_001995(ACSL1, Acyl-CoA synthetase long-chain family member 1), GeneBank accession No: NM_000018(ACADVL, Acyl-Coenzyme A dehydrogenase, very long chain), GeneBank accession No: BC094756(CRA, Myotubularin related protein 11), GeneBank accession No: BC050553(NTE, Neuropathy target esterase), GeneBank accession No: BC033110(HSD17B1, Hydroxysteroid(17-beta) dehydrogenase 1),
20 GeneBank accession No: AY268890(TPP1, Tripeptidyl peptidase I), GeneBank accession No: AK172798(CPT1A, Carnitine palmitoyltransferase 1A(liver)), GeneBank accession No: AK096809(CYP4F8, Cytochrome P450, family 4, subfamily F, polypeptide 8),
25 GeneBank accession No: AK000600(SIAT7D,

ST6(alpha-N-acetyl-neuraminy1-2,3-beta- galactosyl-1,3)-N-
 acetylgalactosaminide alpha-2,6-sialyltransferase 4),
 GeneBank accession No: AB002454(CYP4F3, Cytochrome P450,
 family 4, subfamily F, polypeptide 3), GeneBank accession
 5 No: Z29093(DDR1, Discoidin domain receptor family, member
 1), GeneBank accession No: Z25424(MKNK2, MAP kinase
 interacting serine/threonine kinase 2), GeneBank accession
 No: XM_291277(DKFZp761P0423, Hypothetical protein
 DKFZp761P0423), GeneBank accession No: XM_038150(MAST3,
 10 Microtubule associated serine/threonine kinase 3), GeneBank
 accession No: U88357(ERBB3, V-erb-b2 erythroblastic
 leukemia viral oncogene homolog 3(avian)), GeneBank
 accession No: NM_025195(TRIB1, Tribbles homolog
 1(Drosophila)), GeneBank accession No: NM_020639(RIPK4,
 15 Receptor-interacting serine-threonine kinase 4), GeneBank
 accession No: NM_014172(PHPT1, Phosphohistidine phosphatase
 1), GeneBank accession No: NM_006254(PRKCD, Protein kinase
 C, delta), GeneBank accession No: NM_005415(SLC20A1, Solute
 carrier family 20(phosphate transporter), member 1),
 20 GeneBank accession No: NM_005026(PIK3CD, Phosphoinositide-
 3-kinase, catalytic, delta polypeptide), GeneBank accession
 No: NM_004431(EPHA2, EPH receptor A2), GeneBank accession
 No: NM_004419(DUSP5, Dual specificity phosphatase 5),
 GeneBank accession No: NM_004327(BCR, Breakpoint cluster
 25 region), GeneBank accession No: NM_004231(ATP6V1F, ATPase,

H⁺ transporting, lysosomal 14kDa, V1 subunit F), GeneBank accession No: NM_004090(DUSP3, Dual specificity phosphatase 3(vaccinia virus phosphatase VH1-related)), GeneBank accession No: NM_002843(PTPRJ, Protein tyrosine phosphatase, receptor type, J), GeneBank accession No: NM_002496(NDUFS8, NADH dehydrogenase(ubiquinone) Fe-S protein 8, 23kDa(NADH-coenzyme Q reductase)), GeneBank accession No: NM_001001852(PIM3, Pim-3 oncogene), GeneBank accession No: L76191(IRAK1, Interleukin-1 receptor-associated kinase 1), GeneBank accession No: D15049(PTPRH, Protein tyrosine phosphatase, receptor type, H), GeneBank accession No: BC065207(ATP6V0D2, ATPase, H⁺ transporting, lysosomal 38kDa, V0 subunit d isoform 2), GeneBank accession No: BC035578(STK24, Serine/threonine kinase 24(STE20 homolog, yeast)), GeneBank accession No: BC028724(DUSP18, Dual specificity phosphatase 18), GeneBank accession No: AL117482(ULK3, Unc-51-like kinase 3(C. elegans)), GeneBank accession No: AK126879(PCTK3, PCTAIRE protein kinase 3), GeneBank accession No: AB209416(ILK, Integrin-linked kinase-2), GeneBank accession No: NM_000782(CYP24A1, Cytochrome P450, family 24, subfamily A, polypeptide 1), GeneBank accession No: CR597101(ZFP36, Zinc finger protein 36, C3H type, homolog(mouse)), GeneBank accession No: CR936799(FHL2, Four and a half LIM domains 2), GeneBank accession No: M24898(NR1D1, Nuclear receptor subfamily 1,

group D, member 1), GeneBank accession No: AF132818(KLF5, Kruppel-like factor 5(intestinal)), GeneBank accession No: AK055337(ZNF213, Zinc finger protein 213), GeneBank accession No: BC008834(PHF1, PHD finger protein 1),
5 GeneBank accession No: AK126918(GLIS2, GLIS family zinc finger 2), GeneBank accession No: BC042692(CTL2, Solute carrier family 44, member 2), GeneBank accession No: NM_002224(ITPR3, Inositol 1,4,5-triphosphate receptor, type 3), GeneBank accession No: AK095363(AQP3, Aquaporin 3),
10 GeneBank accession No: NM_174953(ATP2A3, ATPase, Ca++ transporting, ubiquitous), GeneBank accession No: BC042390(VTI1B, Vesicle transport through interaction with t-SNAREs homolog 1B(yeast)), GeneBank accession No: NM_016113(TRPV2, Transient receptor potential cation
15 channel, subfamily V, member 2), GeneBank accession No: BM926478(RBP1, Retinol binding protein 1, cellular), GeneBank accession No: NM_000069(CACNA1S, Calcium channel, voltage-dependent, L type, alpha 1S subunit), GeneBank accession No: AK002107(RAB3B, RAB3B, member RAS oncogene
20 family), GeneBank accession No: NM_013321(SNX8, Sorting nexin 8), GeneBank accession No: AK125026(SLC6A12, Solute carrier family 6(neurotransmitter transporter, betaine/GABA), member 12), GeneBank accession No: NM_005843(STAM2, Signal transducing adaptor molecule(SH3
25 domain and ITAM motif) 2), GeneBank accession No:

AK092512(SLC16A5, Solute carrier family 16(monocarboxylic acid transporters), member 5), GeneBank accession No: U49248(ABCC2, ATP-binding cassette, sub-family C(CFTR/MRP), member 2), GeneBank accession No: AK172792(SCNN1A, Sodium channel, nonvoltage-gated 1 alpha), GeneBank accession No: 5 BC044656(CASC3, Cancer susceptibility candidate 3), GeneBank accession No: NM_203403(C9orf150, Chromosome 9 open reading frame 150), GeneBank accession No: NM_080388(S100A16, S100 calcium binding protein A16), 10 GeneBank accession No: NM_031286(SH3BGRL3, SH3 domain binding glutamic acid-rich protein like 3), GeneBank accession No: NM_022153(PP2135, Chromosome 10 open reading frame 54), GeneBank accession No: NM_004864(GDF15, Growth differentiation factor 15), GeneBank accession No: 15 NM_003330(TXNRD1, Thioredoxin reductase 1), GeneBank accession No: NM_001013632(LOC343521, Similar to hypothetical protein 4833401D15), GeneBank accession No: BX537968(LOC51149, Hypothetical LOC51149), GeneBank accession No: BU945318(MT2A, Hypothetical gene supported by 20 X97260; BC070289), GeneBank accession No: BQ683841(S100A11, S100 calcium binding protein A11(calgizzarin)), GeneBank accession No: BQ276852(TMSB10, Thymosin, beta 10), GeneBank accession No: AK126182(KIAA1949, KIAA1949), GeneBank accession No: AK124751(CAPN2, Calpain 2,(m/II) large 25 subunit), GeneBank accession No: AK095079(RGC32, Response

gene to complement 32), GeneBank accession No:
AB075871(FLJ42654, Golgi transport 1 homolog A(*S.*
cerevisiae)), GeneBank accession No: AK125150(MAPK8,
Mitogen-activated protein kinase 8), GeneBank accession No:
5 NM_002758(MAP2K6, Mitogen-activated protein kinase kinase
6), GeneBank accession No: NM_004612(TGFBR1, Transforming
growth factor, beta receptor I(activin A receptor type II-
like kinase, 53kDa)), GeneBank accession No:
NM_145686(MAP4K4, Mitogen-activated protein kinase kinase
10 kinase kinase 4), GeneBank accession No: XM_042066(MAP3K1,
Mitogen-activated protein kinase kinase kinase 1), GeneBank
accession No: AB011123(TNIK, TRAF2 and NCK interacting
kinase), GeneBank accession No: AB209031(C5, Complement
component 5), GeneBank accession No: NM_022740(HIPK2,
15 Homeodomain interacting protein kinase 2), GeneBank
accession No: NM_148957(TNFRSF19, Tumor necrosis factor
receptor superfamily, member 19), GeneBank accession No:
AB208909(ITGB2, Integrin, beta 2(antigen CD18(p95),
lymphocyte function-associated antigen 1; macrophage
20 antigen 1(mac-1) beta subunit)), GeneBank accession No:
AB209211(TIA1, TIA1 cytotoxic granule-associated RNA
binding protein), GeneBank accession No: AB209613(DNASE1L3,
Deoxyribonuclease I-like 3), GeneBank accession No:
AK122825(HMGB1, High-mobility group box 1), GeneBank
25 accession No: AK127326(PHF17, PHD finger protein 17),

GeneBank accession No: AK223503(CASP1, Caspase 1, apoptosis-related cysteine peptidase(interleukin 1, beta, convertase)), GeneBank accession No: BC013326(GAS2, Growth arrest-specific 2), GeneBank accession No: BC047698(IL7, Interleukin 7), GeneBank accession No: D79987(ESPL1, Extra spindle poles like 1(*S. cerevisiae*)), GeneBank accession No: NM_000893(KNG1, Kininogen 1), GeneBank accession No: NM_001012271(BIRC5, Effector cell peptidase receptor 1), GeneBank accession No: NM_004938(DAPK1, Death-associated protein kinase 1), GeneBank accession No: NM_005879(TRIP, TRAF interacting protein), GeneBank accession No: NM_014739(BCLAF1, BCL2-associated transcription factor 1), GeneBank accession No: NM_018947(CYCS, Cytochrome c, somatic), GeneBank accession No: AB033337(MPHOSPH1, M-phase phosphoprotein 1), GeneBank accession No: AB209179(PLK1, Polo-like kinase 1(*Drosophila*)), GeneBank accession No: AB209337(CDC7, CDC7 cell division cycle 7(*S. cerevisiae*)), GeneBank accession No: AF053305(BUB1, BUB1 budding uninhibited by benzimidazoles 1 homolog(yeast)), GeneBank accession No: AF053306(BUB1B, BUB1 budding uninhibited by benzimidazoles 1 homolog beta(yeast)), GeneBank accession No: AF345347(SPAG5, Sperm associated antigen 5), GeneBank accession No: AK092638(CCNG2, Cyclin G2), GeneBank accession No: AK222819(NUSAP1, Nucleolar and spindle associated protein 1), GeneBank accession No:

AL833191(SMC2L1, SMC2 structural maintenance of chromosomes
 2-like 1(yeast)), GeneBank accession No: AY257469(CIT,
 Citron(rho-interacting, serine/threonine kinase 21)),
 GeneBank accession No: AY367065(ASPM, Asp(abnormal
 5 spindle)-like, microcephaly associated(Drosophila)),
 GeneBank accession No: BC011000(CDCA5, Cell division cycle
 associated 5), GeneBank accession No: BC032677(UBE2C,
 Ubiquitin-conjugating enzyme E2C), GeneBank accession No:
 BC043502(NEK2, NIMA(never in mitosis gene a)-related kinase
 10 2), GeneBank accession No: BU675073(PTTG1, Pituitary tumor-
 transforming 1), GeneBank accession No: BX647885(STMN1,
 Stathmin 1/oncoprotein 18), GeneBank accession No:
 CR592757(BRRN1, Barren homolog 1(Drosophila)), GeneBank
 accession No: CR597075(MAPRE2, Microtubule-associated
 15 protein, RP/EB family, member 2), GeneBank accession No:
 CR604810(CCNA2, Cyclin A2), GeneBank accession No:
 CR933728(CDC2, Cell division cycle 2, G1 to S and G2 to M),
 GeneBank accession No: NM_000919(PAM, Peptidylglycine
 alpha-amidating monooxygenase), GeneBank accession No:
 20 NM_001790(CDC25C, Cell division cycle 25C), GeneBank
 accession No: NM_001798(CDK2, Cyclin-dependent kinase 2),
 GeneBank accession No: NM_001813(CENPE, Centromere protein
 E, 312kDa), GeneBank accession No: NM_003318(TTK, TTK
 protein kinase), GeneBank accession No: NM_003981(PRC1,
 25 Protein regulator of cytokinesis 1), GeneBank accession No:

NM_004523(KIF11, Kinesin family member 11), GeneBank
accession No: NM_004701(CCNB2, Cyclin B2), GeneBank
accession No: NM_005983(SKP2, S-phase kinase-associated
protein 2(p45)), GeneBank accession No: NM_006101(KNTC2,
5 Kinetochore associated 2), GeneBank accession No:
NM_006845(KIF2C, Kinesin family member 2C), GeneBank
accession No: NM_007375(TARDBP, TAR DNA binding protein),
GeneBank accession No: NM_012112(TPX2, TPX2, microtubule-
associated, homolog(Xenopus laevis)), GeneBank accession
10 No: NM_014750(DLG7, Discs, large homolog 7(Drosophila)),
GeneBank accession No: NM_015097(CLASP2, Cytoplasmic linker
associated protein 2), GeneBank accession No:
NM_016343(CENPF, Centromere protein F, 350/400ka(mitosis)),
GeneBank accession No: NM_016426(GTSE1, G-2 and S-phase
15 expressed 1), GeneBank accession No: NM_018492(PBK, PDZ
binding kinase), GeneBank accession No: NM_018685(ANLN,
Anillin, actin binding protein(scrap homolog, Drosophila)),
GeneBank accession No: NM_020242(KNSL7, Kinesin family
member 15), GeneBank accession No: NM_031966(CCNB1, Cyclin
20 B1), GeneBank accession No: NM_138555(KIF23, Kinesin family
member 23), GeneBank accession No: U65410(MAD2L1, MAD2
mitotic arrest deficient-like 1(yeast)), GeneBank accession
No: AB020656(CYLD, Cyldromatosis(turban tumor syndrome)),
GeneBank accession No: AF033122(SESN1, Sestrin 1), GeneBank
25 accession No: AK074377(UHRF1, Chromosome 19 open reading

frame 31), GeneBank accession No: AK091170(CDKN2C, Cyclin-
 dependent kinase inhibitor 2C(p18, inhibits CDK4)),
 GeneBank accession No: AK094323(NFYC, Nuclear transcription
 factor Y, gamma), GeneBank accession No: AY366508(LOH11CR2A,
 5 Loss of heterozygosity, 11, chromosomal region 2, gene A),
 GeneBank accession No: BC033086(TCF19, Transcription factor
 19(SC1)), GeneBank accession No: BC040303(PTP4A1, Protein
 tyrosine phosphatase type IVA, member 1), GeneBank
 accession No: BC040991(TFDP2, Transcription factor Dp-2(E2F
 10 dimerization partner 2)), GeneBank accession No:
 BC092412(SGOL2, Shugoshin-like 2(S. pombe)), GeneBank
 accession No: BQ278454(CKS1B, CDC28 protein kinase
 regulatory subunit 1B), GeneBank accession No:
 BX649128(SES3, Sestrin 3), GeneBank accession No:
 15 CD049340(AURKB, Aurora kinase B), GeneBank accession No:
 M89914(NF1, Neurofibromin 1(neurofibromatosis, von
 Recklinghausen disease, Watson disease)), GeneBank
 accession No: NM_001005414(ZWINT, ZW10 interactor
 antisense), GeneBank accession No: NM_001008491(Sep 2,
 20 Septin 2), GeneBank accession No: NM_001274(CHEK1, CHK1
 checkpoint homolog(S. pombe)), GeneBank accession No:
 NM_002105(H2AFX, H2A histone family, member X), GeneBank
 accession No: NM_002388(MCM3, MCM3 minichromosome
 maintenance deficient 3(S. cerevisiae)), GeneBank accession
 25 No: NM_002417(MKI67, Antigen identified by monoclonal

antibody Ki-67), GeneBank accession No: NM_002875(RAD51, RAD51 homolog(RecA homolog, E. coli)(S. cerevisiae)), GeneBank accession No: NM_003884(PCAF, P300/CBP-associated factor), GeneBank accession No: NM_004526(MCM2, MCM2

5 minichromosome maintenance deficient 2, mitotin(S. cerevisiae)), GeneBank accession No: NM_004847(AIF1, Allograft inflammatory factor 1), GeneBank accession No: NM_005915(MCM6, MCM6 minichromosome maintenance deficient 6(MIS5 homolog, S. pombe)(S. cerevisiae)), GeneBank

10 accession No: NM_012090(MACF1, Microtubule-actin crosslinking factor 1), GeneBank accession No: NM_012415(RAD54B, RAD54 homolog B(S. cerevisiae)), GeneBank accession No: NM_014264(PLK4, Polo-like kinase 4(Drosophila)), GeneBank accession No: NM_015714(G0S2,

15 G0/G1switch 2), GeneBank accession No: NM_024680(FLJ23311, E2F transcription factor 8), GeneBank accession No: XM_034274(MYBL1, V-myb myeloblastosis viral oncogene homolog(avian)-like 1), GeneBank accession No: AK001720(FLJ10858, Nei endonuclease VIII-like 3(E. coli)),

20 GeneBank accession No: AY032677(POLQ, Polymerase(DNA directed), theta), GeneBank accession No: BC034480(BLM, Bloom syndrome), GeneBank accession No: BC073161(RAD51C, RAD51 homolog C(S. cerevisiae)), GeneBank accession No: CR600021(HMGB2, High-mobility group box 2), GeneBank

25 accession No: CR625391(RAD51AP1, RAD51 associated protein

1), GeneBank accession No: CR936783(FLJ40869, Hypothetical protein LOC284952), GeneBank accession No: DQ140356(KIAA1596, Fanconi anemia, complementation group M), GeneBank accession No: NM_001067(TOP2A, Topoisomerase(DNA II alpha 170kDa), GeneBank accession No: NM_001618(PARP1, Poly(ADP-ribose) polymerase family, member 1), GeneBank accession No: NM_003362(UNG, Uracil-DNA glycosylase), GeneBank accession No: NM_006904(PRKDC, Protein kinase, DNA-activated, catalytic polypeptide), GeneBank accession No: NM_130398(EXO1, Exonuclease 1), GeneBank accession No: AB020807(TLR6, Toll-like receptor 6), GeneBank accession No: AB032980(DCDC2, Doublecortin domain containing 2), GeneBank accession No: AB209866(TFPI, Tissue factor pathway inhibitor(lipoprotein-associated coagulation inhibitor)), GeneBank accession No: AK057015(HSPA4, Heat shock 70kDa protein 4), GeneBank accession No: AK095515(IFIT1, Interferon-induced protein with tetratricopeptide repeats 1), GeneBank accession No: AK122686(IF, I factor(complement)), GeneBank accession No: AK123010(RRM2, Ribonucleotide reductase M2 polypeptide), GeneBank accession No: BC035582(TRIM22, Tripartite motif-containing 22), GeneBank accession No: BX537894(LOC493869, Similar to RIKEN cDNA 2310016C16), GeneBank accession No: M14338(PROS1, Protein S(alpha)), GeneBank accession No: NM_000821(GGCX, Gamma-glutamyl carboxylase), GeneBank accession No:

NM_000963(PTGS2, Prostaglandin-endoperoxide synthase
 2(prostaglandin G/H synthase and cyclooxygenase)), GeneBank
 accession No: NM_001001547(CD36, CD36 antigen(collagen type
 I receptor, thrombospondin receptor)), GeneBank accession
 5 No: NM_001512(GSTA4, Glutathione S-transferase A4),
 GeneBank accession No: NM_001629(ALOX5AP, Arachidonate 5-
 lipoyxygenase-activating protein), GeneBank accession No:
 NM_001752(CAT, Catalase), GeneBank accession No:
 NM_001837(CCR3, Chemokine(C-C motif) receptor 3), GeneBank
 10 accession No: NM_001979(EPHX2, Epoxide hydrolase 2,
 cytoplasmic), GeneBank accession No: NM_001994(F13B,
 Coagulation factor XIII, B polypeptide), GeneBank accession
 No: NM_002182(IL1RAP, Interleukin 1 receptor accessory
 protein), GeneBank accession No: NM_006120(HLA-DMA, Major
 15 histocompatibility complex, class II, DM alpha), GeneBank
 accession No: NM_173216(SIAT1, ST6 beta-galactosamide
 alpha-2,6-sialyltransferase 1), GeneBank accession No:
 NM_202002(FOXM1, Forkhead box M1), GeneBank accession No:
 AB163917(LRAP, Leukocyte-derived arginine aminopeptidase),
 20 GeneBank accession No: BC027881(AFP, Alpha-fetoprotein),
 GeneBank accession No: NM_015915(SPG3A, Spastic paraplegia
 3A(autosomal dominant)), GeneBank accession No:
 NM_000671(ADH5, Alcohol dehydrogenase 5(class III), chi
 polypeptide), GeneBank accession No: J05428(UGT2B7, UDP
 25 glucuronosyltransferase 2 family, polypeptide B7), GeneBank

accession No: NM_000672(ADH6, Alcohol dehydrogenase 6(class
 V)), GeneBank accession No: M15943(ADH4, Alcohol
 dehydrogenase 4(class II), pi polypeptide), GeneBank
 accession No: AK223395(FBP1, Fructose-1,6-bisphosphatase 1),
 5 GeneBank accession No: NM_000151(G6PC, Glucose-6-
 phosphatase, catalytic(glycogen storage disease type I, von
 Gierke disease)), GeneBank accession No: XM_113962(KIAA0650,
 Structural maintenance of chromosomes flexible hinge domain
 containing 1), GeneBank accession No: AB020644(ACSL6, Acyl-
 10 CoA synthetase long-chain family member 6), GeneBank
 accession No: AB209907(PLD1, Phospholipase D1,
 phophatidylcholine-specific), GeneBank accession No:
 AF285167(ABCA1, ATP-binding cassette, sub-family A(ABC1),
 member 1), GeneBank accession No: AF297872(TRERF1,
 15 Transcriptional regulating factor 1), GeneBank accession
 No: AF303134(ALDH8A1, Aldehyde dehydrogenase 8 family,
 member A1), GeneBank accession No: AF339053(PLA2G12B,
 Phospholipase A2, group XIIB), GeneBank accession No:
 AK096018(HADHSC, L-3-hydroxyacyl-Coenzyme A dehydrogenase,
 20 short chain), GeneBank accession No: AK124635(PCSK9,
 Proprotein convertase subtilisin/kexin type 9), GeneBank
 accession No: AK127346(SIAT9, ST3 beta-galactoside alpha-
 2,3-sialyltransferase 5), GeneBank accession No:
 AL359559(AGPS, Alkylglycerone phosphate synthase), GeneBank
 25 accession No: AY691170(PLCL3, Phospholipase C-like 3),

GeneBank accession No: BG567934(APOM, Apolipoprotein M),
 GeneBank accession No: BX538214(C6orf167, Chromosome 6 open
 reading frame 167), GeneBank accession No: BX640945(FADS2,
 Fatty acid desaturase 2), GeneBank accession No:
 5 BX648473(PIGK, Phosphatidylinositol glycan, class K),
 GeneBank accession No: BX648557(HSD17B2, Hydroxysteroid(17-
 beta) dehydrogenase 2), GeneBank accession No:
 CR749601(ETNK1, Death-associated protein kinase 3),
 GeneBank accession No: NM_000859(HMGCR, 3-hydroxy-3-
 10 methylglutaryl-Coenzyme A reductase), GeneBank accession
 No: NM_001443(FABP1, Fatty acid binding protein 1, liver),
 GeneBank accession No: NM_002130(HMGCS1, 3-hydroxy-3-
 methylglutaryl-Coenzyme A synthase 1(soluble)), GeneBank
 accession No: NM_003725(RODH, Hydroxysteroid(17-beta)
 15 dehydrogenase 6), GeneBank accession No: NM_004845(PCYT1B,
 Phosphate cytidylyltransferase 1, choline, beta), GeneBank
 accession No: NM_014762(DHCR24, 24-dehydrocholesterol
 reductase), GeneBank accession No: NM_020139(DHRS6,
 Dehydrogenase/reductase(SDR family) member 6), GeneBank
 20 accession No: NM_020918(GPAM, Glycerol-3-phosphate
 acyltransferase, mitochondrial), GeneBank accession No:
 NM_032523(OSBPL6, Oxysterol binding protein-like 6),
 GeneBank accession No: NM_033505(SELI, Selenoprotein I),
 GeneBank accession No: Z28339(AKR1D1, Aldo-keto reductase
 25 family 1, member D1(delta 4-3-ketosteroid-5-beta-

reductase)), GeneBank accession No: AK024899(ENPP3,
 Ectonucleotide pyrophosphatase/phosphodiesterase 3),
 GeneBank accession No: AK025546(PTPN4, Protein tyrosine
 phosphatase, non-receptor type 4(megakaryocyte)), GeneBank
 5 accession No: AK124910(ENPP2, Ectonucleotide
 pyrophosphatase/phosphodiesterase 2(autotaxin)), GeneBank
 accession No: BC035116(FLJ35059 fis, CDNA FLJ30761 fis,
 clone FEBRA2000538), GeneBank accession No: BC050565(PASK,
 PAS domain containing serine/threonine kinase), GeneBank
 10 accession No: L13436(NPR2, Natriuretic peptide receptor
 B/guanylate cyclase B(atrionatriuretic peptide receptor B)),
 GeneBank accession No: NM_001005862(ERBB2, V-erb-b2
 erythroblastic leukemia viral oncogene homolog 2,
 neuro/glioblastoma derived oncogene homolog(avian)),
 15 GeneBank accession No: NM_005012(ROR1, Receptor tyrosine
 kinase-like orphan receptor 1), GeneBank accession No:
 NM_006035(CDC42BPB, CDC42 binding protein kinase beta(DMPK-
 like)), GeneBank accession No: NM_014791(MELK, Maternal
 embryonic leucine zipper kinase), GeneBank accession No:
 20 NM_023028(FGFR2, Fibroblast growth factor receptor
 2(bacteria-expressed kinase, keratinocyte growth factor
 receptor, craniofacial dysostosis 1, Crouzon syndrome,
 Pfeiffer syndrome, Jackson-Weiss syndrome)), GeneBank
 accession No: NM_080836(STK35, Serine/threonine kinase 35),
 25 GeneBank accession No: AF419331(FUSIP1, FUS interacting

protein(serine/arginine-rich) 1), GeneBank accession No:
 AK091927(SFRS3, Splicing factor, arginine/serine-rich 3),
 GeneBank accession No: BC010266(HNRNPA1, Heterogeneous
 nuclear ribonucleoprotein A1), GeneBank accession No:
 5 BC012360(CTAGE5, CTAGE family, member 5), GeneBank
 accession No: BC036046(PLRG1, Pleiotropic regulator 1(PRL1
 homolog, Arabidopsis)), GeneBank accession No:
 BC065384(PCF11, PCF11, cleavage and polyadenylation factor
 subunit, homolog(S. cerevisiae)), GeneBank accession No:
 10 BX537360(CPSF5, Nudix(nucleoside diphosphate linked moiety
 X)-type motif 21), GeneBank accession No: BX537494(HNRPA2B1,
 Heterogeneous nuclear ribonucleoprotein A2/B1), GeneBank
 accession No: BX647784(HNRPR, Heterogeneous nuclear
 ribonucleoprotein R), GeneBank accession No: CA455267(PPIH,
 15 Peptidyl prolyl isomerase H(cyclophilin H)), GeneBank
 accession No: CR596214(HNRPA0, Heterogeneous nuclear
 ribonucleoprotein A0), GeneBank accession No:
 NM_001326(CSTF3, Hypothetical protein LOC283267), GeneBank
 accession No: NM_004640(BAT1, HLA-B associated transcript
 20 1), GeneBank accession No: NM_005463(HNRPDL, Heterogeneous
 nuclear ribonucleoprotein D-like), GeneBank accession No:
 NM_006924(SFRS1, Splicing factor, arginine/serine-rich
 1(splicing factor 2, alternate splicing factor)), GeneBank
 accession No: NM_012426(SF3B3, Splicing factor 3b, subunit
 25 3, 130kDa), GeneBank accession No: NM_018048(FLJ10292,

Mago-nashi homolog), GeneBank accession No:
 NM_030919(C20orf129, Chromosome 20 open reading frame 129),
 GeneBank accession No: NM_031370(HNRPD, Heterogeneous
 nuclear ribonucleoprotein D(AU-rich element RNA binding
 5 protein 1, 37kDa)), GeneBank accession No: NM_138933(ACF,
 Apobec-1 complementation factor), GeneBank accession No:
 AB193259(ACE2, Angiotensin I converting enzyme(peptidyl-
 dipeptidase A) 2), GeneBank accession No: BX648769(EWSR1,
 Ewing sarcoma breakpoint region 1), GeneBank accession No:
 10 AB023154(DTX4, Deltex 4 homolog(Drosophila)), GeneBank
 accession No: AL543755(VAV3, Vav 3 oncogene), GeneBank
 accession No: M75106(CPB2, Carboxypeptidase B2(plasma,
 carboxypeptidase U)), GeneBank accession No:
 NM_021045(ZNF248, Zinc finger protein 248), GeneBank
 15 accession No: AB209194(B4GALT6, UDP-Gal:betaGlcNAc beta
 1,4- galactosyltransferase, polypeptide 6), GeneBank
 accession No: AF279145(ANTXR1, Anthrax toxin receptor 1),
 GeneBank accession No: NM_025074(FRAS1, Fraser syndrome 1),
 GeneBank accession No: AK025790(KIF20A, Kinesin family
 20 member 20A), GeneBank accession No: NM_006152(LRMP,
 Lymphoid-restricted membrane protein), GeneBank accession
 No: NM_000340(SLC2A2, Solute carrier family 2(facilitated
 glucose transporter), member 2), GeneBank accession No:
 AF071592(KIF4A, Kinesin family member 4A), GeneBank
 25 accession No: NM_013277(RACGAP1, Rac GTPase activating

protein 1), GeneBank accession No: AY043484(SCN1A, Sodium channel, voltage-gated, type I, alpha), GeneBank accession No: AY791349(KIF18A, Kinesin family member 18A), GeneBank accession No: NM_018018(SLC38A4, Solute carrier family 38, member 4), GeneBank accession No: AK094603(FLJ37284 fis, unnamed protein product; Homo sapiens cDNA FLJ37284 fis, clone BRAMY2013590.), GeneBank accession No: NM_021069(ARGBP2, Sorbin and SH3 domain containing 2), GeneBank accession No: NM_001005747(CACNB4, Calcium channel, voltage-dependent, beta 4 subunit), GeneBank accession No: AJ496568(SLC25A12, Solute carrier family 25(mitochondrial carrier, Aralar), member 12), GeneBank accession No: NM_030641(APOL6, Apolipoprotein L, 6), GeneBank accession No: NM_173512(FLJ39822, Hypothetical protein FLJ39822), GeneBank accession No: NM_000037(ANK1, Ankyrin 1, erythrocytic), GeneBank accession No: NM_001011554(SLC13A3, Solute carrier family 13(sodium-dependent dicarboxylate transporter), member 3), GeneBank accession No: AB091343(C10orf3, Centrosomal protein 55kDa), GeneBank accession No: AK000643(ASB9, Ankyrin repeat and SOCS box-containing 9), GeneBank accession No: AK055221(FBX05, F-box protein 5), GeneBank accession No: AK075271(SPTLC2L, Serine palmitoyltransferase, long chain base subunit 2-like(aminotransferase 2)), GeneBank accession No: AK122685(GLUD1, Glutamate dehydrogenase 1), GeneBank

accession No: AK127098(FLJ10706, Chromosome 1 open reading
 frame 112), GeneBank accession No: AL133031(MLR1,
 Transcription factor MLR1), GeneBank accession No:
 AY007723(MAL2, Mal, T-cell differentiation protein 2),
 5 GeneBank accession No: BC022255(Spc25, Spindle pole body
 component 25 homolog(*S. cerevisiae*)), GeneBank accession
 No: BC041882(ATF7IP2, Activating transcription factor 7
 interacting protein 2), GeneBank accession No:
 BC052951(LMNB1, Lamin B1), GeneBank accession No:
 10 BC098313(FLJ20641, Hypothetical protein FLJ20641), GeneBank
 accession No: NM_001809(CENPA, Centromere protein A, 17kDa),
 GeneBank accession No: NM_145061(C13orf3, Chromosome 13
 open reading frame 3), GeneBank accession No:
 XM_372695(LOC390859, PREDICTED: Homo sapiens similar to
 15 Chain A, Crystal Structure Of The R463a Mutant Of Human
 Glutamate Dehydrogenase(LOC390859), mRNA).

Among the above genes, those up-regulated by the
 20 exposure to phenanthrene are as follows:

GeneBank accession No: NM_004420(DUSP8, Dual
 specificity phosphatase 8), GeneBank accession No:
 L11329(DUSP2, Dual specificity phosphatase 2), GeneBank
 accession No: BC094766(PKN1, Protein kinase N1), GeneBank
 25 accession No: AY247738(TRIB3, Tribbles homolog

3(Drosophila)), GeneBank accession No: AK129595(GADD45B, Growth arrest and DNA-damage-inducible, beta), GeneBank accession No: AB208849(SHC1, SHC(Src homology 2 domain containing) transforming protein 1), GeneBank accession No:

5 X02812(TGFB1, Transforming growth factor, beta 1(Camurati-Engelmann disease)), GeneBank accession No: NM_198951(TGM2, Transglutaminase 2(C polypeptide, protein-glutamine-gamma-glutamyltransferase)), GeneBank accession No: NM_147780(CTSB, Cathepsin B), GeneBank accession No:

10 NM_078467(CDKN1A, Cyclin-dependent kinase inhibitor 1A(p21, Cip1)), GeneBank accession No: NM_033027(AXUD1, AXIN1 up-regulated 1), GeneBank accession No: NM_032797(AMID, Apoptosis-inducing factor(AIF)-like mitochondrion-associated inducer of death), GeneBank accession No:

15 NM_021960(MCL1, Myeloid cell leukemia sequence 1(BCL2-related)), GeneBank accession No: NM_016639(TNFRSF12A, Tumor necrosis factor receptor superfamily, member 12A), GeneBank accession No: NM_016222(DDX41, DEAD(Asp-Glu-Ala-Asp) box polypeptide 41), GeneBank accession No:

20 NM_013246(CLC, Cardiotrophin-like cytokine factor 1), GeneBank accession No: NM_004401(DFFA, DNA fragmentation factor, 45kDa, alpha polypeptide), GeneBank accession No: NM_004281(BAG3, BCL2-associated athanogene 3), GeneBank accession No: NM_003897(IER3, Immediate early response 3),

25 GeneBank accession No: NM_003806(HRK, Harakiri, BCL2

interacting protein(contains only BH3 domain)), GeneBank
accession No: NM_003639(IKBKG, Inhibitor of kappa light
polypeptide gene enhancer in B-cells, kinase gamma),
GeneBank accession No: NM_003311(PHLDA2, Pleckstrin
5 homology-like domain, family A, member 2), GeneBank
accession No: NM_002737(PRKCA, Protein kinase C, alpha),
GeneBank accession No: NM_002648(PIM1, Pim-1 oncogene),
GeneBank accession No: NM_002507(NGFR, Nerve growth factor
receptor(TNFR superfamily, member 16)), GeneBank accession
10 No: NM_002305(LGALS1, Lectin, galactoside-binding, soluble,
1(galectin 1)), GeneBank accession No: NM_001013398(IGFBP3,
Insulin-like growth factor binding protein 3), GeneBank
accession No: BX640923(MDM4, Mdm4, transformed 3T3 cell
double minute 4, p53 binding protein(mouse)), GeneBank
15 accession No: BX537586(STK17A, Serine/threonine kinase
17a(apoptosis-inducing)), GeneBank accession No:
BG284742(P8, P8 protein(candidate of metastasis 1)),
GeneBank accession No: BE903247(PDCD6IP, Programmed cell
death 6 interacting protein), GeneBank accession No:
20 BC027949(P2RX1, Purinergic receptor P2X, ligand-gated ion
channel, 1), GeneBank accession No: BC006365(PSEN2,
Presenilin 2(Alzheimer disease 4)), GeneBank accession No:
AY869712(PPP1R13L, Protein phosphatase 1,
regulatory(inhibitor) subunit 13 like), GeneBank accession
25 No: AY028896(CARD10, Caspase recruitment domain family,

member 10), GeneBank accession No: AK122614(PPARD, Peroxisome proliferative activated receptor, delta), GeneBank accession No: AK092872(ERCC2, Excision repair cross-complementing rodent repair deficiency, complementation group 2(xeroderma pigmentosum D)), GeneBank accession No: AK092808(RRAGC, Ras-related GTP binding C), GeneBank accession No: AJ001898(GDNF, Glial cell derived neurotrophic factor), GeneBank accession No: AF220656(PHLDA1, Pleckstrin homology-like domain, family A, member 1), GeneBank accession No: AF055634(UNC5C, Unc-5 homolog C(C. elegans)), GeneBank accession No: AB209485(VEGF, Vascular endothelial growth factor), GeneBank accession No: AB096256(UNC5B, Unc-5 homolog B(C. elegans)), GeneBank accession No: AB007960(SH3GLB1, SH3-domain GRB2-like endophilin B1), GeneBank accession No: X06374(PDGFA, Platelet-derived growth factor alpha polypeptide), GeneBank accession No: S62138(DDIT3, DNA-damage-inducible transcript 3), GeneBank accession No: NM_078487(CDKN2B, Cyclin-dependent kinase inhibitor 2B(p15, inhibits CDK4)), GeneBank accession No: NM_012127(CI21, CDKN1A interacting zinc finger protein 1), GeneBank accession No: NM_005883(APC2, Adenomatosis polyposis coli 2), GeneBank accession No: NM_004196(CDKL1, Cyclin-dependent kinase-like 1(CDC2-related kinase)), GeneBank accession No: NM_003236(TGFA, Transforming growth factor,

alpha), GeneBank accession No: NM_001261(CDK9, Cyclin-dependent kinase 9(CDC2-related kinase)), GeneBank accession No: NM_001007271(DUSP13, Dual specificity phosphatase 13), GeneBank accession No: CR749511(PARC, P53-associated parkin-like cytoplasmic protein), GeneBank accession No: CR623038(ID2, Inhibitor of DNA binding 2, dominant negative helix-loop-helix protein), GeneBank accession No: CR618371(EGFR, Epidermal growth factor receptor(erythroblastic leukemia viral(v-erb-b) oncogene homolog, avian)), GeneBank accession No: BF965144(IFITM1, Interferon induced transmembrane protein 1(9-27)), GeneBank accession No: AK127679(DUSP1, Dual specificity phosphatase 1), GeneBank accession No: AK096276(CCND3, Cyclin D3), GeneBank accession No: AB209586(MAPK13, Mitogen-activated protein kinase 13), GeneBank accession No: AB209465(PCTK1, PCTAIRE protein kinase 1), GeneBank accession No: Z19588(SKIL, SKI-like), GeneBank accession No: NM_020429(SMURF1, SMAD specific E3 ubiquitin protein ligase 1), GeneBank accession No: NM_014767(SPOCK2, Sparc/osteonectin, cwcvc and kazal-like domains proteoglycan(testican) 2), GeneBank accession No: NM_005979(S100A13, S100 calcium binding protein A13), GeneBank accession No: NM_005187(CBFA2T3, Core-binding factor, runt domain, alpha subunit 2; translocated to, 3), GeneBank accession No: NM_004364(CEBPA, CCAAT/enhancer

binding protein(C/EBP), alpha), GeneBank accession No:
NM_001769(CD9, CD9 antigen(p24)), GeneBank accession No:
NM_001718(BMP6, Bone morphogenetic protein 6), GeneBank
accession No: NM_000641(IL11, Interleukin 11), GeneBank
5 accession No: BX647459(SERPINE2, Serpin peptidase inhibitor,
clade E(nexin, plasminogen activator inhibitor type 1),
member 2), GeneBank accession No: BQ066037(RPS19, Ribosomal
protein S19), GeneBank accession No: BE791300(EDF1,
Endothelial differentiation-related factor 1), GeneBank
10 accession No: BC038504(SNF1LK, SNF1-like kinase), GeneBank
accession No: AL832287(ZAP70, Zeta-chain(TCR) associated
protein kinase 70kDa), GeneBank accession No:
AK125742(PCGF1, Polycomb group ring finger 1), GeneBank
accession No: AK124709(NDRG1, N-myc downstream regulated
15 gene 1), GeneBank accession No: AB011157(PTDSR,
Phosphatidylserine receptor), GeneBank accession No:
NM_013255(MKLN1, Muskelein 1, intracellular mediator
containing kelch motifs), GeneBank accession No:
NM_006572(GNA13, Guanine nucleotide binding protein(G
20 protein), alpha 13), GeneBank accession No: NM_002211(ITGB1,
Integrin, beta 1(fibronectin receptor, beta polypeptide,
antigen CD29 includes MDF2, MSK12)), GeneBank accession No:
CR601067(PLAUR, Plasminogen activator, urokinase receptor),
GeneBank accession No: BC050456(THBS4, Thrombospondin 4),
25 GeneBank accession No: AK027389(CXCL16, Chemokine(C-X-C

motif) ligand 16), GeneBank accession No: AJ132099(VNN1,
 Vanin 1), GeneBank accession No: XM_371354(FLJ10157,
 Hypothetical protein FLJ10157), GeneBank accession No:
 XM_208313(TPM3, Similar to tropomyosin 4), GeneBank
 5 accession No: XM_208270(ACR, Acrosin-like protease),
 GeneBank accession No: NM_203353(PDLIM7, PDZ and LIM domain
 7(enigma)), GeneBank accession No: NM_201382(PLEC1, Plectin
 1, intermediate filament binding protein 500kDa), GeneBank
 accession No: NM_182961(SYNE1, Spectrin repeat containing,
 10 nuclear envelope 1), GeneBank accession No: NM_181826(NF2,
 Neurofibromin 2(bilateral acoustic neuroma)), GeneBank
 accession No: NM_172069(PLEKHH2, Pleckstrin homology domain
 containing, family H(with MyTH4 domain) member 2), GeneBank
 accession No: NM_022648(TNS, Tensin 1), GeneBank accession
 15 No: NM_017556(FBLP-1, Filamin binding LIM protein 1),
 GeneBank accession No: NM_016081(KIAA0992, Palladin,
 cytoskeletal associated protein), GeneBank accession No:
 NM_006617(NES, Nestin), GeneBank accession No:
 NM_006262(PRPH, Peripherin), GeneBank accession No:
 20 NM_005100(AKAP12, A kinase(PRKA) anchor protein(gravin) 12),
 GeneBank accession No: NM_004368(CNN2, Calponin 2),
 GeneBank accession No: NM_003388(CYLN2, Cytoplasmic linker
 2), GeneBank accession No: NM_003370(VASP, Vasodilator-
 stimulated phosphoprotein), GeneBank accession No:
 25 NM_003128(SPTBN1, Spectrin, beta, non-erythrocytic 1),

GeneBank accession No: NM_002705(PPL, Periplakin), GeneBank
 accession No: NM_002475(MLC1SA, Myosin light chain 1 slow
 a), GeneBank accession No: NM_002018(FLII, Flightless I
 homolog(Drosophila)), GeneBank accession No: NM_001465(FYB,
 5 FYN binding protein(FYB-120/130)), GeneBank accession No:
 NM_001069(TUBB2, Tubulin, beta 2A), GeneBank accession No:
 CR625172(MGC8685, Tubulin, beta 2B), GeneBank accession No:
 CR616919(KRT18, Keratin 18), GeneBank accession No:
 CR606241(ACTG1, Actin, gamma 1), GeneBank accession No:
 10 CB240572(MYH11, Myosin, heavy polypeptide 11, smooth
 muscle), GeneBank accession No: BX648253(PTPN3, Protein
 tyrosine phosphatase, non-receptor type 3), GeneBank
 accession No: BX648190(WDR1, WD repeat domain 1), GeneBank
 accession No: BX641076(ACTN1, Actinin, alpha 1), GeneBank
 15 accession No: BX537978(EPB41L1, Erythrocyte membrane
 protein band 4.1-like 1), GeneBank accession No:
 BG121847(NUDC, Nuclear distribution gene C homolog(A.
 nidulans)), GeneBank accession No: BC068013(MYO1C, Myosin
 IC), GeneBank accession No: BC065499(MAST2, Microtubule
 20 associated serine/threonine kinase 2), GeneBank accession
 No: BC051890(TUBG2, Tubulin, gamma 2), GeneBank accession
 No: BC041874(MAP1LC3B, Microtubule-associated protein 1
 light chain 3 beta), GeneBank accession No: BC012597(ACTA1,
 Actin, alpha 1, skeletal muscle), GeneBank accession No:
 25 AY484427(KIF17, Kinesin family member 17), GeneBank

accession No: AK130546(STOML2, Stomatin(EPB72)-like 2),
 GeneBank accession No: AK124711(CORO2B, Coronin, actin
 binding protein, 2B), GeneBank accession No: AK123974(MYL5,
 Myosin, light polypeptide 5, regulatory), GeneBank
 5 accession No: AK092792(LOC389833, Similar to hypothetical
 protein MGC27019), GeneBank accession No: AK026518(MYOHD1,
 Myosin head domain containing 1), GeneBank accession No:
 AK024500(NICAL, Microtubule associated monooxygenase,
 calponin and LIM domain containing 1), GeneBank accession
 10 No: AF085886(FLJ46675, Ribosomal protein L29 pseudogene 2),
 GeneBank accession No: AB209997(MYO9B, Myosin IXB),
 GeneBank accession No: Y12692(WNT11, Wingless-type MMTV
 integration site family, member 11), GeneBank accession No:
 Y11307(CYR61, Cysteine-rich, angiogenic inducer, 61),
 15 GeneBank accession No: X17033(ITGA2, Integrin, alpha
 2(CD49B, alpha 2 subunit of VLA-2 receptor)), GeneBank
 accession No: U41763(CLTCL1, Clathrin, heavy polypeptide-
 like 1), GeneBank accession No: NM_153609(TMPRSS6,
 Transmembrane protease, serine 6), GeneBank accession No:
 20 NM_031483(ITCH, Itchy homolog E3 ubiquitin protein
 ligase(mouse)), GeneBank accession No: NM_024342(GRLF1,
 Glucocorticoid receptor DNA binding factor 1), GeneBank
 accession No: NM_017555(EGLN2, Egl nine homolog 2(C.
 elegans)), GeneBank accession No: NM_016569(TBX3, T-box
 25 3(ulnar mammary syndrome)), GeneBank accession No:

NM_004148(NINJ1, Ninjurin 1), GeneBank accession No:
 NM_003377(VEGFB, Vascular endothelial growth factor B),
 GeneBank accession No: NM_001983(ERCC1, Excision repair
 cross-complementing rodent repair deficiency,
 5 complementation group 1(includes overlapping antisense
 sequence)), GeneBank accession No: NM_001552(IGFBP4,
 Insulin-like growth factor binding protein 4), GeneBank
 accession No: NM_001430(EPAS1, Endothelial PAS domain
 protein 1), GeneBank accession No: NM_001300(KLF6, Kruppel-
 10 like factor 6), GeneBank accession No: NM_001012661(SLC3A2,
 Solute carrier family 3(activators of dibasic and neutral
 amino acid transport), member 2), GeneBank accession No:
 NM_000596(IGFBP1, Insulin-like growth factor binding
 protein 1), GeneBank accession No: NM_000474(TWIST1, Twist
 15 homolog 1(acrocephalosyndactyly 3; Saethre-Chotzen
 syndrome)(Drosophila)), GeneBank accession No:
 BX649103(ChGn, Chondroitin beta1,4 N-
 acetylgalactosaminyltransferase), GeneBank accession No:
 BM913048(TIMP1, TIMP metalloproteinase inhibitor 1),
 20 GeneBank accession No: BM904612(S100A6, S100 calcium
 binding protein A6(calcyclin)), GeneBank accession No:
 BM556279(EMP3, Epithelial membrane protein 3), GeneBank
 accession No: BC015041(VAT1, Family with sequence
 similarity 82, member C), GeneBank accession No:
 25 AY258066(OKL38, Pregnancy-induced growth inhibitor),

GeneBank accession No: AK126729(NDRG4, NDRG family member 4), GeneBank accession No: AK090459(NFE2L1, Nuclear factor(erythroid-derived 2)-like 1), GeneBank accession No: AK074163(ROBO4, Roundabout homolog 4, magic roundabout(Drosophila)), GeneBank accession No: AK024680(FLJ21027 fis, CDNA: FLJ21027 fis, clone CAE07110), GeneBank accession No: AF176422(HEY1, Hairy/enhancer-of-split related with YRPW motif 1), GeneBank accession No: AF003837(JAG1, Jagged 1(Alagille syndrome)), GeneBank accession No: AB209322(SEMA3B, Sema domain, immunoglobulin domain(Ig), short basic domain, secreted,(semaphorin) 3B), GeneBank accession No: AB011150(NRXN1, Neurexin 1), GeneBank accession No: NM_201589(MAFA, V-maf musculoaponeurotic fibrosarcoma oncogene homolog A(avian)), GeneBank accession No: NM_052999(CKLFSF1, CKLF-like MARVEL transmembrane domain containing 1), GeneBank accession No: NM_006644(HSPH1, Heat shock 105kDa/110kDa protein 1), GeneBank accession No: NM_005438(FOSL1, FOS-like antigen 1), GeneBank accession No: NM_004996(ABCC1, ATP-binding cassette, sub-family C(CFTR/MRP), member 1), GeneBank accession No: NM_002658(PLAU, Plasminogen activator, urokinase), GeneBank accession No: NM_001353(AKR1C1, Aldo-keto reductase family 1, member C1(dihydrodiol dehydrogenase 1; 20-alpha(3-alpha)-hydroxysteroid dehydrogenase)), GeneBank accession No: H18681(C20orf139,

Sulfiredoxin 1 homolog(*S. cerevisiae*)), GeneBank accession
 No: DR004094(HAMP, Hecidin antimicrobial peptide),
 GeneBank accession No: BC082272(KCNMB3, Potassium large
 conductance calcium-activated channel, subfamily M beta
 5 member 3), GeneBank accession No: BC040494(DNAJB2,
 DnaJ(Hsp40) homolog, subfamily B, member 2), GeneBank
 accession No: BC018064(ATF6, Activating transcription
 factor 6), GeneBank accession No: BC006523(SGK2,
 Serum/glucocorticoid regulated kinase 2), GeneBank
 10 accession No: AK090482(CXCL12, Chemokine(C-X-C motif)
 ligand 12(stromal cell-derived factor 1)), GeneBank
 accession No: AF219946(TULP4, Tubby like protein 4),
 GeneBank accession No: AB209112(SLC2A8, Solute carrier
 family 2,(facilitated glucose transporter) member 8),
 15 GeneBank accession No: NM_005242(F2RL1, Coagulation factor
 II(thrombin) receptor-like 1), GeneBank accession No:
 NM_001002029(C4A, Complement component 4B, telomeric),
 GeneBank accession No: NM_000539(RHO, Rhodopsin(opsin 2,
 rod pigment)(retinitis pigmentosa 4, autosomal dominant)),
 20 GeneBank accession No: BX649164(PAI, serpin peptidase
 inhibitor, clade E(nexin, plasminogen activator inhibitor
 type 1), member 1), GeneBank accession No: BM918324(LY96,
 Lymphocyte antigen 96), GeneBank accession No:
 AB209647(NCF2, Neutrophil cytosolic factor 2(65kDa, chronic
 25 granulomatous disease, autosomal 2)), GeneBank accession

No: NM_152221(CSNK1E, Casein kinase 1, epsilon), GeneBank
 accession No: NM_017999(RNF31, Ring finger protein 31),
 GeneBank accession No: NM_016819(OGG1, 8-oxoguanine DNA
 glycosylase), GeneBank accession No: NM_016816(OAS1, 2',5'-
 5 oligoadenylate synthetase 1, 40/46kDa), GeneBank accession
 No: NM_012235(SCAP, SREBP cleavage-activating protein),
 GeneBank accession No: NM_006384(CIB1, Calcium and integrin
 binding 1(calmyrin)), GeneBank accession No: NM_001779(CD58,
 CD58 antigen,(lymphocyte function-associated antigen 3)),
 10 GeneBank accession No: CB055213(ICOSLG, Inducible T-cell
 co-stimulator ligand), GeneBank accession No:
 BX641029(MASP1, Mannan-binding lectin serine peptidase
 1(C4/C2 activating component of Ra-reactive factor)),
 GeneBank accession No: BQ053419(BATF, Basic leucine zipper
 15 transcription factor, ATF-like), GeneBank accession No:
 BC039299(STIP1, Stress-induced-phosphoprotein
 1(Hsp70/Hsp90-organizing protein)), GeneBank accession No:
 AY055760(DAF, Decay accelerating factor for complement(CD55,
 Cromer blood group system)), GeneBank accession No:
 20 AK130188(FGR, Gardner-Rasheed feline sarcoma viral(v-fgr)
 oncogene homolog), GeneBank accession No: AK095326(MUS81,
 MUS81 endonuclease homolog(yeast)), GeneBank accession No:
 NM_017670(OTUB1, OTU domain, ubiquitin aldehyde binding 1),
 GeneBank accession No: NM_003004(SECTM1, Secreted and
 25 transmembrane 1), GeneBank accession No: NM_002309(LIF,

Hypothetical protein MGC20647), GeneBank accession No:
 NM_001421(ELF4, E74-like factor 4(ets domain transcription
 factor)), GeneBank accession No: NM_000418(IL4R,
 Interleukin 4 receptor), GeneBank accession No:
 5 BI909222(FCER1G, Fc fragment of IgE, high affinity I,
 receptor for; gamma polypeptide), GeneBank accession No:
 BF569086(NK4, Interleukin 32), GeneBank accession No:
 BC014470(AZGP1, Alpha-2-glycoprotein 1, zinc), GeneBank
 accession No: BC020744(AKR1C4, Aldo-keto reductase family 1,
 10 member C4(chlordecone reductase; 3-alpha hydroxysteroid
 dehydrogenase, type I; dihydrodiol),dehydrogenase 4),
 GeneBank accession No: BQ939577(AKR1C3, Aldo-keto reductase
 family 1, member C3(3-alpha hydroxysteroid dehydrogenase,
 type II)), GeneBank accession No: NM_000499(CYP1A1,
 15 Cytochrome P450, family 1, subfamily A, polypeptide 1),
 GeneBank accession No: NM_030622(CYP2S1, Cytochrome P450,
 family 2, subfamily S, polypeptide 1), GeneBank accession
 No: NM_184041(ALDOA, Aldolase A, fructose-bisphosphate),
 GeneBank accession No: NM_024307(MGC4171, Hypothetical
 20 protein LOC283901), GeneBank accession No: NM_005336(HDLBP,
 High density lipoprotein binding protein(vigilin)),
 GeneBank accession No: NM_002627(PFKP, Phosphofructokinase,
 platelet), GeneBank accession No: BX648281(LDLR, Low
 density lipoprotein receptor(familial
 25 hypercholesterolemia)), GeneBank accession No:

BC069201(FLJ22761, Hexokinase domain containing 1),
 GeneBank accession No: BC030207(NR0B2, Nuclear receptor
 subfamily 0, group B, member 2), GeneBank accession No:
 AL833069(KIAA1434, Hypothetical protein KIAA1434), GeneBank
 5 accession No: AK124656(ENO2, Enolase 2(gamma, neuronal)),
 GeneBank accession No: AK094474(RHOC, Ras homolog gene
 family, member C), GeneBank accession No: AK093461(ISYNA1,
 Myo-inositol 1-phosphate synthase A1), GeneBank accession
 No: AB053232(GAL3ST3, Galactose-3-O-sulfotransferase 3),
 10 GeneBank accession No: AB045292(TMEM8, Transmembrane
 protein 8(five membrane-spanning domains)), GeneBank
 accession No: NM_004753(DHRS3, Dehydrogenase/reductase(SDR
 family) member 3), GeneBank accession No: NM_002900(RBP3,
 Retinol binding protein 3, interstitial), GeneBank
 15 accession No: NM_001995(ACSL1, Acyl-CoA synthetase long-
 chain family member 1), GeneBank accession No:
 NM_000018(ACADVL, Acyl-Coenzyme A dehydrogenase, very long
 chain), GeneBank accession No: BC094756(CRA, Myotubularin
 related protein 11), GeneBank accession No: BC050553(NTE,
 20 Neuropathy target esterase), GeneBank accession No:
 BC033110(HSD17B1, Hydroxysteroid(17-beta) dehydrogenase 1),
 GeneBank accession No: AY268890(TPP1, Tripeptidyl peptidase
 I), GeneBank accession No: AK172798(CPT1A, Carnitine
 palmitoyltransferase 1A(liver)), GeneBank accession No:
 25 AK096809(CYP4F8, Cytochrome P450, family 4, subfamily F,

polypeptide 8), GeneBank accession No: AK000600(SIAT7D,
ST6(alpha-N-acetyl-neuraminy1-2,3-beta- galactosyl-1,3)-N-
acetylgalactosaminide alpha-2,6-sialyltransferase 4),
GeneBank accession No: AB002454(CYP4F3, Cytochrome P450,
5 family 4, subfamily F, polypeptide 3), GeneBank accession
No: Z29093(DDR1, Discoidin domain receptor family, member
1), GeneBank accession No: Z25424(MKNK2, MAP kinase
interacting serine/threonine kinase 2), GeneBank accession
No: XM_291277(DKFZp761P0423, Hypothetical protein
10 DKFZp761P0423), GeneBank accession No: XM_038150(MAST3,
Microtubule associated serine/threonine kinase 3), GeneBank
accession No: U88357(ERBB3, V-erb-b2 erythroblastic
leukemia viral oncogene homolog 3(avian)), GeneBank
accession No: NM_025195(TRIB1, Tribbles homolog
15 1(Drosophila)), GeneBank accession No: NM_020639(RIPK4,
Receptor-interacting serine-threonine kinase 4), GeneBank
accession No: NM_014172(PHPT1, Phosphohistidine phosphatase
1), GeneBank accession No: NM_006254(PRKCD, Protein kinase
C, delta), GeneBank accession No: NM_005415(SLC20A1, Solute
20 carrier family 20(phosphate transporter), member 1),
GeneBank accession No: NM_005026(PIK3CD, Phosphoinositide-
3-kinase, catalytic, delta polypeptide), GeneBank accession
No: NM_004431(EPHA2, EPH receptor A2), GeneBank accession
No: NM_004419(DUSP5, Dual specificity phosphatase 5),
25 GeneBank accession No: NM_004327(BCR, Breakpoint cluster

region), GeneBank accession No: NM_004231(ATP6V1F, ATPase, H⁺ transporting, lysosomal 14kDa, V1 subunit F), GeneBank accession No: NM_004090(DUSP3, Dual specificity phosphatase 3(vaccinia virus phosphatase VH1-related)), GeneBank
5 accession No: NM_002843(PTPRJ, Protein tyrosine phosphatase, receptor type, J), GeneBank accession No: NM_002496(NDUFS8, NADH dehydrogenase(ubiquinone) Fe-S protein 8, 23kDa(NADH-coenzyme Q reductase)), GeneBank accession No: NM_001001852(PIM3, Pim-3 oncogene), GeneBank accession No:
10 L76191(IRAK1, Interleukin-1 receptor-associated kinase 1), GeneBank accession No: D15049(PTPRH, Protein tyrosine phosphatase, receptor type, H), GeneBank accession No: BC065207(ATP6V0D2, ATPase, H⁺ transporting, lysosomal 38kDa, V0 subunit d isoform 2), GeneBank accession No:
15 BC035578(STK24, Serine/threonine kinase 24(STE20 homolog, yeast)), GeneBank accession No: BC028724(DUSP18, Dual specificity phosphatase 18), GeneBank accession No: AL117482(ULK3, Unc-51-like kinase 3(C. elegans)), GeneBank accession No: AK126879(PCTK3, PCTAIRE protein kinase 3),
20 GeneBank accession No: AB209416(ILK, Integrin-linked kinase-2), GeneBank accession No: NM_000782(CYP24A1, Cytochrome P450, family 24, subfamily A, polypeptide 1), GeneBank accession No: CR597101(ZFP36, Zinc finger protein 36, C3H type, homolog(mouse)), GeneBank accession No:
25 CR936799(FHL2, Four and a half LIM domains 2), GeneBank

accession No: M24898(NR1D1, Nuclear receptor subfamily 1,
group D, member 1), GeneBank accession No: AF132818(KLF5,
Kruppel-like factor 5(intestinal)), GeneBank accession No:
AK055337(ZNF213, Zinc finger protein 213), GeneBank
5 accession No: BC008834(PHF1, PHD finger protein 1),
GeneBank accession No: AK126918(GLIS2, GLIS family zinc
finger 2), GeneBank accession No: BC042692(CTL2, Solute
carrier family 44, member 2), GeneBank accession No:
NM_002224(ITPR3, Inositol 1,4,5-triphosphate receptor, type
10 3), GeneBank accession No: AK095363(AQP3, Aquaporin 3),
GeneBank accession No: NM_174953(ATP2A3, ATPase, Ca++
transporting, ubiquitous), GeneBank accession No:
BC042390(VTI1B, Vesicle transport through interaction with
t-SNAREs homolog 1B(yeast)), GeneBank accession No:
15 NM_016113(TRPV2, Transient receptor potential cation
channel, subfamily V, member 2), GeneBank accession No:
BM926478(RBP1, Retinol binding protein 1, cellular),
GeneBank accession No: NM_000069(CACNA1S, Calcium channel,
voltage-dependent, L type, alpha 1S subunit), GeneBank
20 accession No: AK002107(RAB3B, RAB3B, member RAS oncogene
family), GeneBank accession No: NM_013321(SNX8, Sorting
nexin 8), GeneBank accession No: AK125026(SLC6A12, Solute
carrier family 6(neurotransmitter transporter,
betaine/GABA), member 12), GeneBank accession No:
25 NM_005843(STAM2, Signal transducing adaptor molecule(SH3

domain and ITAM motif) 2), GeneBank accession No: AK092512(SLC16A5, Solute carrier family 16(monocarboxylic acid transporters), member 5), GeneBank accession No: U49248(ABCC2, ATP-binding cassette, sub-family C(CFTR/MRP), member 2), GeneBank accession No: AK172792(SCNN1A, Sodium channel, nonvoltage-gated 1 alpha), GeneBank accession No: BC044656(CASC3, Cancer susceptibility candidate 3), GeneBank accession No: NM_203403(C9orf150, Chromosome 9 open reading frame 150), GeneBank accession No: NM_080388(S100A16, S100 calcium binding protein A16), GeneBank accession No: NM_031286(SH3BGRL3, SH3 domain binding glutamic acid-rich protein like 3), GeneBank accession No: NM_022153(PP2135, Chromosome 10 open reading frame 54), GeneBank accession No: NM_004864(GDF15, Growth differentiation factor 15), GeneBank accession No: NM_003330(TXNRD1, Thioredoxin reductase 1), GeneBank accession No: NM_001013632(LOC343521, Similar to hypothetical protein 4833401D15), GeneBank accession No: BX537968(LOC51149, Hypothetical LOC51149), GeneBank accession No: BU945318(MT2A, Hypothetical gene supported by X97260; BC070289), GeneBank accession No: BQ683841(S100A11, S100 calcium binding protein A11(calgizzarin)), GeneBank accession No: BQ276852(TMSB10, Thymosin, beta 10), GeneBank accession No: AK126182(KIAA1949, KIAA1949), GeneBank accession No: AK124751(CAPN2, Calpain 2,(m/II) large

subunit), GeneBank accession No: AK095079(RGC32, Response gene to complement 32), GeneBank accession No: AB075871(FLJ42654, Golgi transport 1 homolog A(*S. cerevisiae*)).

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Among the above genes, those down-regulated by the exposure to phenanthrene are as follows:

GeneBank accession No: AK125150(MAPK8, Mitogen-activated protein kinase 8), GeneBank accession No:
 10 NM_002758(MAP2K6, Mitogen-activated protein kinase kinase 6), GeneBank accession No: NM_004612(TGFB1, Transforming growth factor, beta receptor I(activin A receptor type II-like kinase, 53kDa)), GeneBank accession No:
 NM_145686(MAP4K4, Mitogen-activated protein kinase kinase
 15 kinase kinase 4), GeneBank accession No: XM_042066(MAP3K1, Mitogen-activated protein kinase kinase kinase 1), GeneBank accession No: AB011123(TNIK, TRAF2 and NCK interacting kinase), GeneBank accession No: AB209031(C5, Complement component 5), GeneBank accession No: NM_022740(HIPK2,
 20 Homeodomain interacting protein kinase 2), GeneBank accession No: NM_148957(TNFRSF19, Tumor necrosis factor receptor superfamily, member 19), GeneBank accession No: AB208909(ITGB2, Integrin, beta 2(antigen CD18(p95), lymphocyte function-associated antigen 1; macrophage
 25 antigen 1(mac-1) beta subunit)), GeneBank accession No:

AB209211(TIA1, TIA1 cytotoxic granule-associated RNA binding protein), GeneBank accession No: AB209613(DNASE1L3, Deoxyribonuclease I-like 3), GeneBank accession No: AK122825(HMGB1, High-mobility group box 1), GeneBank accession No: AK127326(PHF17, PHD finger protein 17),
5 GeneBank accession No: AK223503(CASP1, Caspase 1, apoptosis-related cysteine peptidase(interleukin 1, beta, convertase)), GeneBank accession No: BC013326(GAS2, Growth arrest-specific 2), GeneBank accession No: BC047698(IL7, Interleukin 7), GeneBank accession No: D79987(ESPL1, Extra spindle poles like 1(*S. cerevisiae*)), GeneBank accession No: NM_000893(KNG1, Kininogen 1), GeneBank accession No: NM_001012271(BIRC5, Effector cell peptidase receptor 1), GeneBank accession No: NM_004938(DAPK1, Death-associated protein kinase 1), GeneBank accession No: NM_005879(TRIP, TRAF interacting protein), GeneBank accession No: NM_014739(BCLAF1, BCL2-associated transcription factor 1), GeneBank accession No: NM_018947(CYCS, Cytochrome c, somatic), GeneBank accession No: AB033337(MPHOSPH1, M-phase phosphoprotein 1), GeneBank accession No: AB209179(PLK1, Polo-like kinase 1(*Drosophila*)), GeneBank accession No: AB209337(CDC7, CDC7 cell division cycle 7(*S. cerevisiae*)), GeneBank accession No: AF053305(BUB1, BUB1 budding uninhibited by benzimidazoles 1 homolog(yeast)), GeneBank accession No: AF053306(BUB1B, BUB1 budding uninhibited by

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benzimidazoles 1 homolog beta(yeast)), GeneBank accession
 No: AF345347(SPAG5, Sperm associated antigen 5), GeneBank
 accession No: AK092638(CCNG2, Cyclin G2), GeneBank
 accession No: AK222819(NUSAP1, Nucleolar and spindle
 5 associated protein 1), GeneBank accession No:
 AL833191(SMC2L1, SMC2 structural maintenance of chromosomes
 2-like 1(yeast)), GeneBank accession No: AY257469(CIT,
 Citron(rho-interacting, serine/threonine kinase 21)),
 GeneBank accession No: AY367065(ASPM, Asp(abnormal
 10 spindle)-like, microcephaly associated(Drosophila)),
 GeneBank accession No: BC011000(CDCA5, Cell division cycle
 associated 5), GeneBank accession No: BC032677(UBE2C,
 Ubiquitin-conjugating enzyme E2C), GeneBank accession No:
 BC043502(NEK2, NIMA(never in mitosis gene a)-related kinase
 15 2), GeneBank accession No: BU675073(PTTG1, Pituitary tumor-
 transforming 1), GeneBank accession No: BX647885(STMN1,
 Stathmin 1/oncoprotein 18), GeneBank accession No:
 CR592757(BRRN1, Barren homolog 1(Drosophila)), GeneBank
 accession No: CR597075(MAPRE2, Microtubule-associated
 20 protein, RP/EB family, member 2), GeneBank accession No:
 CR604810(CCNA2, Cyclin A2), GeneBank accession No:
 CR933728(CDC2, Cell division cycle 2, G1 to S and G2 to M),
 GeneBank accession No: NM_000919(PAM, Peptidylglycine
 alpha-amidating monooxygenase), GeneBank accession No:
 25 NM_001790(CDC25C, Cell division cycle 25C), GeneBank

accession No: NM_001798(CDK2, Cyclin-dependent kinase 2),
GeneBank accession No: NM_001813(CENPE, Centromere protein
E, 312kDa), GeneBank accession No: NM_003318(TTK, TTK
protein kinase), GeneBank accession No: NM_003981(PRC1,
5 Protein regulator of cytokinesis 1), GeneBank accession No:
NM_004523(KIF11, Kinesin family member 11), GeneBank
accession No: NM_004701(CCNB2, Cyclin B2), GeneBank
accession No: NM_005983(SKP2, S-phase kinase-associated
protein 2(p45)), GeneBank accession No: NM_006101(KNTC2,
10 Kinetochore associated 2), GeneBank accession No:
NM_006845(KIF2C, Kinesin family member 2C), GeneBank
accession No: NM_007375(TARDBP, TAR DNA binding protein),
GeneBank accession No: NM_012112(TPX2, TPX2, microtubule-
associated, homolog(Xenopus laevis)), GeneBank accession
15 No: NM_014750(DLG7, Discs, large homolog 7(Drosophila)),
GeneBank accession No: NM_015097(CLASP2, Cytoplasmic linker
associated protein 2), GeneBank accession No:
NM_016343(CENPF, Centromere protein F, 350/400ka(mitotin)),
GeneBank accession No: NM_016426(GTSE1, G-2 and S-phase
20 expressed 1), GeneBank accession No: NM_018492(PBK, PDZ
binding kinase), GeneBank accession No: NM_018685(ANLN,
Anillin, actin binding protein(scrapin homolog, Drosophila)),
GeneBank accession No: NM_020242(KNSL7, Kinesin family
member 15), GeneBank accession No: NM_031966(CCNB1, Cyclin
25 B1), GeneBank accession No: NM_138555(KIF23, Kinesin family

member 23), GeneBank accession No: U65410(MAD2L1, MAD2
 mitotic arrest deficient-like 1(yeast)), GeneBank accession
 No: AB020656(CYLD, Cyldromatosis(turban tumor syndrome)),
 GeneBank accession No: AF033122(SESNI, Sestrin 1), GeneBank
 5 accession No: AK074377(UHRF1, Chromosome 19 open reading
 frame 31), GeneBank accession No: AK091170(CDKN2C, Cyclin-
 dependent kinase inhibitor 2C(p18, inhibits CDK4)),
 GeneBank accession No: AK094323(NFYC, Nuclear transcription
 factor Y, gamma), GeneBank accession No: AY366508(LOH11CR2A,
 10 Loss of heterozygosity, 11, chromosomal region 2, gene A),
 GeneBank accession No: BC033086(TCF19, Transcription factor
 19(SC1)), GeneBank accession No: BC040303(PTP4A1, Protein
 tyrosine phosphatase type IVA, member 1), GeneBank
 accession No: BC040991(TFDP2, Transcription factor Dp-2(E2F
 15 dimerization partner 2)), GeneBank accession No:
 BC092412(SGOL2, Shugoshin-like 2(S. pombe)), GeneBank
 accession No: BQ278454(CKS1B, CDC28 protein kinase
 regulatory subunit 1B), GeneBank accession No:
 BX649128(SESNI, Sestrin 3), GeneBank accession No:
 20 CD049340(AURKB, Aurora kinase B), GeneBank accession No:
 M89914(NF1, Neurofibromin 1(neurofibromatosis, von
 Recklinghausen disease, Watson disease)), GeneBank
 accession No: NM_001005414(ZWINT, ZW10 interactor
 antisense), GeneBank accession No: NM_001008491(Sep 2,
 25 Septin 2), GeneBank accession No: NM_001274(CHEK1, CHK1

checkpoint homolog(*S. pombe*)), GeneBank accession No:
 NM_002105(H2AFX, H2A histone family, member X), GeneBank
 accession No: NM_002388(MCM3, MCM3 minichromosome
 maintenance deficient 3(*S. cerevisiae*)), GeneBank accession
 5 No: NM_002417(MKI67, Antigen identified by monoclonal
 antibody Ki-67), GeneBank accession No: NM_002875(RAD51,
 RAD51 homolog(RecA homolog, *E. coli*)(*S. cerevisiae*)),
 GeneBank accession No: NM_003884(PCAF, P300/CBP-associated
 factor), GeneBank accession No: NM_004526(MCM2, MCM2
 10 minichromosome maintenance deficient 2, mitotin(*S.*
cerevisiae)), GeneBank accession No: NM_004847(AIF1,
 Allograft inflammatory factor 1), GeneBank accession No:
 NM_005915(MCM6, MCM6 minichromosome maintenance deficient
 6(MIS5 homolog, *S. pombe*)(*S. cerevisiae*)), GeneBank
 15 accession No: NM_012090(MACF1, Microtubule-actin
 crosslinking factor 1), GeneBank accession No:
 NM_012415(RAD54B, RAD54 homolog B(*S. cerevisiae*)), GeneBank
 accession No: NM_014264(PLK4, Polo-like kinase
 4(*Drosophila*)), GeneBank accession No: NM_015714(G0S2,
 20 G0/G1switch 2), GeneBank accession No: NM_024680(FLJ23311,
 E2F transcription factor 8), GeneBank accession No:
 XM_034274(MYBL1, V-myb myeloblastosis viral oncogene
 homolog(avian)-like 1), GeneBank accession No:
 AK001720(FLJ10858, Nei endonuclease VIII-like 3(*E. coli*)),
 25 GeneBank accession No: AY032677(POLQ, Polymerase(DNA

directed), theta), GeneBank accession No: BC034480(BLM,
 Bloom syndrome), GeneBank accession No: BC073161(RAD51C,
 RAD51 homolog C(*S. cerevisiae*)), GeneBank accession No:
 CR600021(HMGB2, High-mobility group box 2), GeneBank
 5 accession No: CR625391(RAD51AP1, RAD51 associated protein
 1), GeneBank accession No: CR936783(FLJ40869, Hypothetical
 protein LOC284952), GeneBank accession No:
 DQ140356(KIAA1596, Fanconi anemia, complementation group M),
 GeneBank accession No: NM_001067(TOP2A, Topoisomerase(DNA)
 10 II alpha 170kDa), GeneBank accession No: NM_001618(PARP1,
 Poly(ADP-ribose) polymerase family, member 1), GeneBank
 accession No: NM_003362(UNG, Uracil-DNA glycosylase),
 GeneBank accession No: NM_006904(PRKDC, Protein kinase,
 DNA-activated, catalytic polypeptide), GeneBank accession
 15 No: NM_130398(EXO1, Exonuclease 1), GeneBank accession No:
 AB020807(TLR6, Toll-like receptor 6), GeneBank accession
 No: AB032980(DCDC2, Doublecortin domain containing 2),
 GeneBank accession No: AB209866(TFPI, Tissue factor pathway
 inhibitor(lipoprotein-associated coagulation inhibitor)),
 20 GeneBank accession No: AK057015(HSPA4, Heat shock 70kDa
 protein 4), GeneBank accession No: AK095515(IFIT1,
 Interferon-induced protein with tetratricopeptide repeats
 1), GeneBank accession No: AK122686(IF, I
 factor(complement)), GeneBank accession No: AK123010(RRM2,
 25 Ribonucleotide reductase M2 polypeptide), GeneBank

accession No: BC035582(TRIM22, Tripartite motif-containing
 22), GeneBank accession No: BX537894(LOC493869, Similar to
 RIKEN cDNA 2310016C16), GeneBank accession No: M14338(PROS1,
 Protein S(alpha)), GeneBank accession No: NM_000821(GGCX,
 5 Gamma-glutamyl carboxylase), GeneBank accession No:
 NM_000963(PTGS2, Prostaglandin-endoperoxide synthase
 2(prostaglandin G/H synthase and cyclooxygenase)), GeneBank
 accession No: NM_001001547(CD36, CD36 antigen(collagen type
 I receptor, thrombospondin receptor)), GeneBank accession
 10 No: NM_001512(GSTA4, Glutathione S-transferase A4),
 GeneBank accession No: NM_001629(ALOX5AP, Arachidonate 5-
 lipoxygenase-activating protein), GeneBank accession No:
 NM_001752(CAT, Catalase), GeneBank accession No:
 NM_001837(CCR3, Chemokine(C-C motif) receptor 3), GeneBank
 15 accession No: NM_001979(EPHX2, Epoxide hydrolase 2,
 cytoplasmic), GeneBank accession No: NM_001994(F13B,
 Coagulation factor XIII, B polypeptide), GeneBank accession
 No: NM_002182(IL1RAP, Interleukin 1 receptor accessory
 protein), GeneBank accession No: NM_006120(HLA-DMA, Major
 20 histocompatibility complex, class II, DM alpha), GeneBank
 accession No: NM_173216(SIAT1, ST6 beta-galactosamide
 alpha-2,6-sialyltransferase 1), GeneBank accession No:
 NM_202002(FOXM1, Forkhead box M1), GeneBank accession No:
 AB163917(LRAP, Leukocyte-derived arginine aminopeptidase),
 25 GeneBank accession No: BC027881(AFP, Alpha-fetoprotein),

GeneBank accession No: NM_015915(SPG3A, Spastic paraplegia 3A(autosomal dominant)), GeneBank accession No: NM_000671(ADH5, Alcohol dehydrogenase 5(class III), chi polypeptide), GeneBank accession No: J05428(UGT2B7, UDP
5 glucuronosyltransferase 2 family, polypeptide B7), GeneBank accession No: NM_000672(ADH6, Alcohol dehydrogenase 6(class V)), GeneBank accession No: M15943(ADH4, Alcohol dehydrogenase 4(class II), pi polypeptide), GeneBank accession No: AK223395(FBP1, Fructose-1,6-bisphosphatase 1),
10 GeneBank accession No: NM_000151(G6PC, Glucose-6-phosphatase, catalytic(glycogen storage disease type I, von Gierke disease)), GeneBank accession No: XM_113962(KIAA0650, Structural maintenance of chromosomes flexible hinge domain containing 1), GeneBank accession No: AB020644(ACSL6, Acyl-CoA synthetase long-chain family member 6), GeneBank
15 accession No: AB209907(PLD1, Phospholipase D1, phosphatidylcholine-specific), GeneBank accession No: AF285167(ABCA1, ATP-binding cassette, sub-family A(ABC1), member 1), GeneBank accession No: AF297872(TRERF1, Transcriptional regulating factor 1), GeneBank accession
20 No: AF303134(ALDH8A1, Aldehyde dehydrogenase 8 family, member A1), GeneBank accession No: AF339053(PLA2G12B, Phospholipase A2, group XIIB), GeneBank accession No: AK096018(HADHSC, L-3-hydroxyacyl-Coenzyme A dehydrogenase, short chain), GeneBank accession No: AK124635(PCSK9,

Proprotein convertase subtilisin/kexin type 9), GeneBank
 accession No: AK127346(SIAT9, ST3 beta-galactoside alpha-
 2,3-sialyltransferase 5), GeneBank accession No:
 AL359559(AGPS, Alkylglycerone phosphate synthase), GeneBank
 5 accession No: AY691170(PLCL3, Phospholipase C-like 3),
 GeneBank accession No: BG567934(APOM, Apolipoprotein M),
 GeneBank accession No: BX538214(C6orf167, Chromosome 6 open
 reading frame 167), GeneBank accession No: BX640945(FADS2,
 Fatty acid desaturase 2), GeneBank accession No:
 10 BX648473(PIGK, Phosphatidylinositol glycan, class K),
 GeneBank accession No: BX648557(HSD17B2, Hydroxysteroid(17-
 beta) dehydrogenase 2), GeneBank accession No:
 CR749601(ETNK1, Death-associated protein kinase 3),
 GeneBank accession No: NM_000859(HMGCR, 3-hydroxy-3-
 15 methylglutaryl-Coenzyme A reductase), GeneBank accession
 No: NM_001443(FABP1, Fatty acid binding protein 1, liver),
 GeneBank accession No: NM_002130(HMGCS1, 3-hydroxy-3-
 methylglutaryl-Coenzyme A synthase 1(soluble)), GeneBank
 accession No: NM_003725(RODH, Hydroxysteroid(17-beta)
 20 dehydrogenase 6), GeneBank accession No: NM_004845(PCYT1B,
 Phosphate cytidylyltransferase 1, choline, beta), GeneBank
 accession No: NM_014762(DHCR24, 24-dehydrocholesterol
 reductase), GeneBank accession No: NM_020139(DHRS6,
 Dehydrogenase/reductase(SDR family) member 6), GeneBank
 25 accession No: NM_020918(GPAM, Glycerol-3-phosphate

acyltransferase, mitochondrial), GeneBank accession No:
 NM_032523(OSBPL6, Oxysterol binding protein-like 6),
 GeneBank accession No: NM_033505(SELI, Selenoprotein I),
 GeneBank accession No: Z28339(AKR1D1, Aldo-keto reductase
 5 family 1, member D1(delta 4-3-ketosteroid-5-beta-
 reductase)), GeneBank accession No: AK024899(ENPP3,
 Ectonucleotide pyrophosphatase/ phosphodiesterase 3),
 GeneBank accession No: AK025546(PTPN4, Protein tyrosine
 phosphatase, non-receptor type 4(megakaryocyte)), GeneBank
 10 accession No: AK124910(ENPP2, Ectonucleotide
 pyrophosphatase/phosphodiesterase 2(autotaxin)), GeneBank
 accession No: BC035116(FLJ35059 fis, CDNA FLJ30761 fis,
 clone FEBRA2000538), GeneBank accession No: BC050565(PASK,
 PAS domain containing serine/threonine kinase), GeneBank
 15 accession No: L13436(NPR2, Natriuretic peptide receptor
 B/guanylate cyclase B(atrionatriuretic peptide receptor B)),
 GeneBank accession No: NM_001005862(ERBB2, V-erb-b2
 erythroblastic leukemia viral oncogene homolog 2,
 neuro/glioblastoma derived oncogene homolog(avian)),
 20 GeneBank accession No: NM_005012(ROR1, Receptor tyrosine
 kinase-like orphan receptor 1), GeneBank accession No:
 NM_006035(CDC42BPB, CDC42 binding protein kinase beta(DMPK-
 like)), GeneBank accession No: NM_014791(MELK, Maternal
 embryonic leucine zipper kinase), GeneBank accession No:
 25 NM_023028(FGFR2, Fibroblast growth factor receptor

2(bacteria-expressed kinase, keratinocyte growth factor
 receptor, craniofacial dysostosis 1, Crouzon syndrome,
 Pfeiffer syndrome, Jackson-Weiss syndrome)), GeneBank
 accession No: NM_080836(STK35, Serine/threonine kinase 35),
 5 GeneBank accession No: AF419331(FUSIP1, FUS interacting
 protein(serine/arginine-rich) 1), GeneBank accession No:
 AK091927(SFRS3, Splicing factor, arginine/serine-rich 3),
 GeneBank accession No: BC010266(HNRNPA1, Heterogeneous
 nuclear ribonucleoprotein A1), GeneBank accession No:
 10 BC012360(CTAGE5, CTAGE family, member 5), GeneBank
 accession No: BC036046(PLRG1, Pleiotropic regulator 1(PRL1
 homolog, Arabidopsis)), GeneBank accession No:
 BC065384(PCF11, PCF11, cleavage and polyadenylation factor
 subunit, homolog(*S. cerevisiae*)), GeneBank accession No:
 15 BX537360(CPSF5, Nudix(nucleoside diphosphate linked moiety
 X)-type motif 21), GeneBank accession No: BX537494(HNRPA2B1,
 Heterogeneous nuclear ribonucleoprotein A2/B1), GeneBank
 accession No: BX647784(HNRPR, Heterogeneous nuclear
 ribonucleoprotein R), GeneBank accession No: CA455267(PPIH,
 20 Peptidyl prolyl isomerase H(cyclophilin H)), GeneBank
 accession No: CR596214(HNRPA0, Heterogeneous nuclear
 ribonucleoprotein A0), GeneBank accession No:
 NM_001326(CSTF3, Hypothetical protein LOC283267), GeneBank
 accession No: NM_004640(BAT1, HLA-B associated transcript
 25 1), GeneBank accession No: NM_005463(HNRPDL, Heterogeneous

nuclear ribonucleoprotein D-like), GeneBank accession No: NM_006924(SFRS1, Splicing factor, arginine/serine-rich 1(splicing factor 2, alternate splicing factor)), GeneBank accession No: NM_012426(SF3B3, Splicing factor 3b, subunit 3, 130kDa), GeneBank accession No: NM_018048(FLJ10292, Mago-nashi homolog), GeneBank accession No: NM_030919(C20orf129, Chromosome 20 open reading frame 129), GeneBank accession No: NM_031370(HNRPD, Heterogeneous nuclear ribonucleoprotein D(AU-rich element RNA binding protein 1, 37kDa)), GeneBank accession No: NM_138933(ACF, Apobec-1 complementation factor), GeneBank accession No: AB193259(ACE2, Angiotensin I converting enzyme(peptidyl-dipeptidase A) 2), GeneBank accession No: BX648769(EWSR1, Ewing sarcoma breakpoint region 1), GeneBank accession No: AB023154(DTX4, Deltex 4 homolog(Drosophila)), GeneBank accession No: AL543755(VAV3, Vav 3 oncogene), GeneBank accession No: M75106(CPB2, Carboxypeptidase B2(plasma, carboxypeptidase U)), GeneBank accession No: NM_021045(ZNF248, Zinc finger protein 248), GeneBank accession No: AB209194(B4GALT6, UDP-Gal:betaGlcNAc beta 1,4- galactosyltransferase, polypeptide 6), GeneBank accession No: AF279145(ANTXR1, Anthrax toxin receptor 1), GeneBank accession No: NM_025074(FRAS1, Fraser syndrome 1), GeneBank accession No: AK025790(KIF20A, Kinesin family member 20A), GeneBank accession No: NM_006152(LRMP,

Lymphoid-restricted membrane protein), GeneBank accession
 No: NM_000340(SLC2A2, Solute carrier family 2(facilitated
 glucose transporter), member 2), GeneBank accession No:
 AF071592(KIF4A, Kinesin family member 4A), GeneBank
 5 accession No: NM_013277(RACGAP1, Rac GTPase activating
 protein 1), GeneBank accession No: AY043484(SCN1A, Sodium
 channel, voltage-gated, type I, alpha), GeneBank accession
 No: AY791349(KIF18A, Kinesin family member 18A), GeneBank
 accession No: NM_018018(SLC38A4, Solute carrier family 38,
 10 member 4), GeneBank accession No: AK094603(FLJ37284 fis,
 unnamed protein product; Homo sapiens cDNA FLJ37284 fis,
 clone BRAMY2013590.), GeneBank accession No:
 NM_021069(ARGBP2, Sorbin and SH3 domain containing 2),
 GeneBank accession No: NM_001005747(CACNB4, Calcium channel,
 15 voltage-dependent, beta 4 subunit), GeneBank accession No:
 AJ496568(SLC25A12, Solute carrier family 25(mitochondrial
 carrier, Aralar), member 12), GeneBank accession No:
 NM_030641(APOL6, Apolipoprotein L, 6), GeneBank accession
 No: NM_173512(FLJ39822, Hypothetical protein FLJ39822),
 20 GeneBank accession No: NM_000037(ANK1, Ankyrin 1,
 erythrocytic), GeneBank accession No: NM_001011554(SLC13A3,
 Solute carrier family 13(sodium-dependent dicarboxylate
 transporter), member 3), GeneBank accession No:
 AB091343(C10orf3, Centrosomal protein 55kDa), GeneBank
 25 accession No: AK000643(ASB9, Ankyrin repeat and SOCS box-

containing 9), GeneBank accession No: AK055221(FBXO5, F-box protein 5), GeneBank accession No: AK075271(SPTLC2L, Serine palmitoyltransferase, long chain base subunit 2-like(aminotransferase 2)), GeneBank accession No:

5 AK122685(GLUD1, Glutamate dehydrogenase 1), GeneBank accession No: AK127098(FLJ10706, Chromosome 1 open reading frame 112), GeneBank accession No: AL133031(MLR1, Transcription factor MLR1), GeneBank accession No: AY007723(MAL2, Mal, T-cell differentiation protein 2),

10 GeneBank accession No: BC022255(Spc25, Spindle pole body component 25 homolog(*S. cerevisiae*)), GeneBank accession No: BC041882(ATF7IP2, Activating transcription factor 7 interacting protein 2), GeneBank accession No: BC052951(LMNB1, Lamin B1), GeneBank accession No:

15 BC098313(FLJ20641, Hypothetical protein FLJ20641), GeneBank accession No: NM_001809(CENPA, Centromere protein A, 17kDa), GeneBank accession No: NM_145061(C13orf3, Chromosome 13 open reading frame 3), GeneBank accession No: XM_372695(LOC390859, PREDICTED: Homo sapiens similar to

20 Chain A, Crystal Structure Of The R463a Mutant Of Human Glutamate Dehydrogenase(LOC390859), mRNA).

The above genes are up-regulated or down-regulated at least double the average by phenanthrene, which are

25 composed of those genes involved in MAPKinase signaling

pathway, MAPKKK cascade, apoptosis, mitotic cell cycle, cell cycle, cell differentiation, cell motility, cytoskeleton, morphogenesis, response to DNA damage stimulus, response to chemical stimulus, response to external stimulus, response to stress, immune response, metabolism of xenobiotics by cytochrome p450, alcohol metabolism, lipid metabolism, phosphate metabolism, DNA metabolism, and metal binding or transport.

The present inventors treated phenanthrene to human liver cancer cell line (HepG2), followed by examination of cytotoxicity to identify the said genes. As a result, phenanthrene was confirmed to have cytotoxicity in human liver cancer cell line (see Figure 1), based on which concentration of phenanthrene was determined. Human liver cancer cell line was treated with phenanthrene by the concentration determined above, from which mRNA was extracted. During the synthesis of cDNA from the mRNA, the cDNA was labeled with Cy5. cDNA of the control group which was not treated with phenanthrene was labeled with Cy3. The labeled cDNA was hybridized with 44 k oligo-microarray chip (human whole genome microarray (Agilent, USA)) and then fluorescent image was scanned to analyze gene expression patterns (see Figure 2). When the ratio of Cy5 to Cy3 was at least 2.0, the gene was classified as up-

regulated. When the ratio of Cy5 to Cy3 was up to 0.5, the gene was classified as down-regulated. As a result, up-regulated genes took 0.69% (302 out of 44,000 genes) and down-regulated genes took 0.55% (244 out of 44,000 genes).

5 Genes which were down-regulated or up-regulated by phenanthrene were classified according to their functions, as genes respectively involved in MAPKinase signaling pathway, MAPKKK cascade, apoptosis, mitotic cell cycle, cell cycle, cell differentiation, cell motility,
10 cytoskeleton, morphogenesis, response to DNA damage stimulus, response to chemical stimulus, response to external stimulus, response to stress, immune response, metabolism of xenobiotics by cytochrome p450, alcohol metabolism, lipid metabolism, phosphate metabolism, DNA
15 metabolism, metal binding or transport, etc. (see Table 2 and Table 3). There has been no report saying that the genes are related with cytotoxicity in human liver cancer cells treated with phenanthrene.

The present inventors separated 19 up-regulated genes
20 and 9 down-regulated genes, with which real-time RT-PCR (reverse transcript polymerase chain reaction) was performed to examine gene expression patterns. As a result, gene expression patterns of those 19 up-regulated genes and 9 down-regulated genes were similar to those observed on
25 oligo-microarray chip (see Table 5). These genes were

GeneBank accession No: BM913048(TIMP metalloproteinase inhibitor 1), GeneBank accession No: BX649164(serpin peptidase inhibitor, clade E(nexin, plasminogen activator inhibitor type 1), member 1), GeneBank accession No:

5 NM_004864(Growth differentiation factor 15), GeneBank accession No: NM_000499(Cytochrome P450, family 1, subfamily A, polypeptide 1), GeneBank accession No: AK095363(Aquaporin 3), GeneBank accession No: NM_001013632(Similar to hypothetical protein 4833401D15),

10 GeneBank accession No: BC042390(Vesicle transport through interaction with t-SNAREs homolog 1B(yeast)), GeneBank accession No: BQ683841(S100 calcium binding protein A11(calgizzarin)), GeneBank accession No: NM_003897(Immediate early response 3), GeneBank accession

15 No: BM926478(Retinol binding protein 1, cellular), GeneBank accession No: BU945318(metallothionein 2A), GeneBank accession No: AK094474(Ras homolog gene family, member C), GeneBank accession No: Y11307(Cysteine-rich, angiogenic inducer, 61), GeneBank accession No: AY247738(Tribbles

20 homolog 3(Drosophila)), GeneBank accession No: Z25424(MAP kinase interacting serine/threonine kinase 2), GeneBank accession No: NM_001769(CD9 antigen(p24)), GeneBank accession No: Y12692(Wingless-type MMTV integration site family, member 11), GeneBank accession No:

25 X02812(Transforming growth factor, beta 1(Camurati-

Engelmann disease)), GeneBank accession No:
NM_000596(Insulin-like growth factor binding protein 1),
GeneBank accession No: NM_006101(Kinetochore associated 2),
GeneBank accession No: NM_003318(TTK protein kinase),
5 GeneBank accession No: NM_001067(Topoiso-merase(DNA) II
alpha 170kDa), GeneBank accession No: NM_018492(PDZ binding
kinase), GeneBank accession No: U65410(MAD2 mitotic arrest
deficient-like 1(yeast)), GeneBank accession No:
AK074377(Chromosome 19 open reading frame 31), GeneBank
10 accession No: CR600021(High-mobility group box 2), GeneBank
accession No: BC022255(Spindle pole body component 25
homolog(*S. cerevisiae*)), GeneBank accession No:
AB091343(Centrosomal protein 55kDa).

15 In the kit of the present invention, the
oligonucleotide containing total length or a part of the
gene or its complementary oligonucleotide contains 18-30
nucleic acids and more preferably 20-25 nucleic acids, but
not always limited thereto.

20 In the kit of the present invention, the
oligonucleotide containing total length or a part of the
gene or its complementary oligonucleotide can be included
on a DNA microarray chip.

25 The DNA microarray chip can be prepared by the
conventional method well known to those in the art. The

conventional method for preparing DNA microarray chip is as follows: micropipetting method using piezoelectric process to fix the screened biomarker as a probe DNA molecule on a DNA chip board; or a method using a pin type spotter, but
5 not always limited thereto. In a preferred embodiment of the present invention, the pin type spotter microarray was used. The board of DNA microarray chip is coated with one of active groups selected from the group consisting of amino-silane, poly-L-lysine and aldehyde, but not always
10 limited thereto. The said board can be selected from the group consisting of slide glass, plastic, metal, silicon, nylon membrane and nitrocellulose membrane, but not always limited thereto. In a preferred embodiment of the present invention, the slide glass coated with amino-silane was
15 used.

The present invention provides a kit for identification of exposure to phenanthrene which contains human liver cells additionally. The human liver cell herein is preferably HepG2, but not always limited thereto
20 and any cells and tissues originated from human liver or liver cancer can be used.

The kit of the present invention can additionally include a fluorescent material, and the fluorescent material herein is selected from the group consisting of
25 strepavidin-like phosphatase conjugate, chemifluorescence

and chemiluminescent, but not always limited thereto. In a preferred embodiment of the present invention, Cy3 and Cy5 were used.

5 The kit of the present invention can additionally include a reaction reagent. The reaction reagent herein is selected from the group consisting of hybridization buffer, reverse transcriptase for the synthesis of cDNA from mRNA, cNTPs and rNTP (pre-mixed or separated), marker reagent such as chemical inducer of fluorescent staining, and
10 washing buffer, but not always limited thereto and any reaction reagent necessary for hybridization on DNA microarray known to those in the art can be included.

The present invention also provides a kit for
15 identification of exposure to phenanthrene containing a primer set capable of amplifying the said gene.

The primer of the kit contains preferably at least two sets of forward primers and reverse primers selected from the group consisting of sequences represented by SEQ.
20 ID. NO: 1 - NO: 56, but not always limited thereto, and any primer set containing a forward primer and a reverse primer which is complementary to the said gene and capable of amplifying a biomarker gene and designed to produce 100 - 300 bp product can be used.

25

The present invention further provides a method for detecting the said gene for the identification of exposure to phenanthrene comprising the following steps:

1) comparing expressions of genes up- or down-regulated by phenanthrene in the experimental group somatic cells and the control group somatic cells; and

2) determining exposure to phenanthrene if the expression of the said gene of step 1) is significantly different from that of the control.

In this method, the somatic cell of step 1) is preferably human liver cancer cell line (HepG2), but not always limited thereto and any cells originated from human liver or liver cancer cells and tissues can be used.

In this method, the expression of the gene of step 1) can be measured at the level of mRNA or protein. The expression at mRNA level is measured preferably by oligonucleotide or polynucleotide microarray or RT-PCR. The expression at protein level is preferably measured by protein microarray or ELISA, but not always limited thereto.

The present invention also provides a method for detecting the said gene for the identification of exposure to phenanthrene, comprising the following steps:

1) extracting RNAs from the experimental group human somatic cells and the control group human somatic cells;

2) synthesizing cDNAs from the RNAs of the experimental group and the control group of step 1), and labeling the cDNAs with different fluorescent materials;

3) hybridizing the cDNAs labeled with different fluorescent materials in step 2) with DNA microarray containing oligonucleotide comprising total length or a part of the gene up- or down-regulated by the exposure to phenanthrene or its complementary oligonucleotide;

4) analyzing the DNA microarray reacted in step 3);

and

5) determining exposure to phenanthrene by comparing the expression of the gene between the experimental group and the control group, precisely if the gene expression of the experimental group is significantly changed by phenanthrene, compared with that of the control group, it is judged that the gene is exposed to phenanthrene.

In this method, the somatic cell of step 1) is preferably human liver cancer cell line (HepG2), but not always limited thereto and any cells originated from human liver or liver cancer cells and tissues can be used.

In this method, the florescent material of step 3) is preferably selected from the group consisting of Cy3, Cy5, FITC (poly L-lysine-fluorescein isothiocyanate), RITC (rhodamine-B-isothiocyanate) and rhodamine, but not always limited thereto and any fluorescent material well-known to

those in the art can be used.

In this method, the DNA microarray of step 5) is preferably whole human genome oligo microarray (Agilent, USA), but not always limited thereto and any microarray chip loaded with genes up- or down-regulated (see Table 2 and Table 3) can be used. It is more preferred to use the DNA microarray chip developed by the present inventors. The analysis method of step 5) preferably uses GenePix 4.1 software (Axon Instruments, USA), but not always limited thereto and any software known to those in the art can be used.

The present invention also provides a method for detecting the said gene for the identification of exposure to phenanthrene, comprising the following steps:

1) extracting RNAs from the experimental group human somatic cells and the control group human somatic cells;

2) performing real-time RT-PCR (reverse transcript polymerase chain reaction) with the RNAs of step 1) using a primer set capable of amplifying the gene up- or down-regulated by phenanthrene; and

3) determining exposure to phenanthrene by comparing gene expressions, precisely if the gene expression in the experimental group exposed to phenanthrene is significantly changed, compared with that of the control group, it is

judged that the gene is exposed to phenanthrene.

In this method, the somatic cell of step 1) is preferably human liver cancer cell line (HepG2), but not always limited thereto and any cells originated from human
5 liver or liver cancer cells and tissues can be used.

In this method, the primer of step 3) can be any primer that is capable of amplifying a biomarker and is complementary to the screened biomarker gene. In this invention, 28 sets of forward primers and reverse primers
10 represented by SEQ. ID. NO: 1 -NO: 56 are presented, but not always limited thereto.

【Advantageous Effect】

The kit for identification of exposure to
15 phenanthrene and a method for identification of exposure to phenanthrene of the present invention are useful for determining risk of phenanthrene and monitoring thereof using a gene specifically up- or down-regulated by phenanthrene as a biomarker, and also useful as a tool to
20 investigate toxicity caused by phenanthrene.

【Description of Drawings】

The application of the preferred embodiments of the present invention is best understood with reference to
25 the accompanying drawings, wherein:

Figure 1 is a diagram illustrating the cytotoxicity of phenanthrene in human liver cancer cell line.

Figure 2 is a diagram illustrating the gene expression pattern in human liver cancer cell line treated with phenanthrene which is analyzed by using microarray chip.

【Mode for Invention】

Practical and presently preferred embodiments of the present invention are illustrative as shown in the following Examples.

However, it will be appreciated that those skilled in the art, on consideration of this disclosure, may make modifications and improvements within the spirit and scope of the present invention.

Example 1: Cell culture and chemical treatment

<1-1> Cell culture

Human liver cancer cell line HepG2 (Korean Cell Line Bank) was cultured in 100 mm dish containing DMEM (Gibco-BRL, USA) supplemented with 10% FBS until it grew 80%. The present inventors selected phenanthrene, one of polycyclic aromatic hydrocarbons having carcinogenicity, and dissolved thereof in DMSO. The concentration of a vehicle was up to

0.1% in every experiment.

<1-2> Cytotoxicity test (MTT assay) and chemical treatment

5 MTT assay was performed with HepG2 according to the method of Mossman et al (*J. Immunol. Methods*, 65, 55-63, 1983). Cells were inoculated in 24-well plate at the concentration of 4×10^5 cells/well and treated with phenanthrene dissolved in DMSO in DMEM (Gibco-BRL, USA).
10 48 hours later, the cells were treated with MTT (3-(4,5-dimethylthiazol-2,5-diphenyltetra zolium bromide) at the concentration of 5 mg/ml, followed by culture in a tube at 37°C for 3 hours. The medium was discarded and formed formazan crystal was dissolved in 500 μ l of DMSO. The
15 solution was aliquoted in a 96-well plate and OD₅₄₀ was measured.

Cytotoxicity of phenanthrene in HepG2 was investigated. As a result, the test sample was educted at the concentration of 500 uM or up but cytotoxicity was not
20 observed. So, 500 uM, which was the highest concentration at which the test sample was not educted, was determined as the concentration for microarray (Figure 1).

Example 2: Microarray

25 <2-1> Extraction of target RNA and labeling with

fluorescent material

HepG2 cells were distributed in 100 mm dish at the concentration of 6×10^6 cells/ml, to which phenanthrene was treated at the concentration determined in Example <1-2> for 48 hours. Then, total RNA was extracted from the treated cells using trizol reagent (Invitrogen life technologies, USA) according to the manufacturer's instruction. The RNA was purified with RNeasy mini kit (Qiagen, USA). Genome DNA was eliminated by using RNase-free DNase set (Qiagen, USA) during the purification of RNA. Total RNA was quantified with spectrophotometer and the concentration was confirmed by Agilent 2100 Bioanalyzer (Agilent Technologies, USA) and agarose gel electrophoresis.

<2-2> Preparation of labeled cDNA

For oligo-microarray analysis, cDNA was synthesized with the total RNA of the phenanthrene treated group obtained in Example <2-1>. 30 μg of total RNA was mixed with 2 μg (1 $\mu\text{g}/\mu\text{l}$) of primer at 65°C for 10 minutes, followed by annealing in ice. Reagents were mixed as shown in Table 1 for reverse transcription of the annealed RNA.

Table 1

Composition	Volume (μl)
5X first strand buffer	6

dNTPs	0.6
0.1 M DDT	3
SuperScript II enzyme	3
Cy-3 or Cy-5 dUTP	2

The total RNA extracted from the control group HepG2 cell line was labeled with Cy3-dUTP (green) and the RNA extracted from the phenanthrene treated HepG2 cell line was labeled with Cy5-dUTP (red). Two samples were mixed and purified by Microcon YM-30 column (Millipore, USA).

<2-3> Hybridization

Hybridization and washing were performed according to GenoCheck's instruction. Hybridization was performed in a 62°C oven for 12 hours. 44 k Whole Human Genome Oligo Microarray (Agilent, USA) was used as a DNA microarray chip. After washing (washing with 2× SSC/0.1% SDS for 2 minutes, 1× SSC for 3 minutes and 0.2× SSC for 2 minutes), slide was dried by centrifugation at 800 rpm for 3 minutes.

<2-4> Obtainment of fluorescent image

Hybridization image on the slide was scanned by Genepix 4000B (Axon Instruments, USA). Non-hybridized gene was washed off the chip and fluorescent image was obtained by using laser fluorescence scanner. Green

fluorescent image indicates the activity of the gene expressed in the control group, while red fluorescent image indicates the activity of the gene expressed specifically in the experimental group. Yellow fluorescent image indicates there is no big difference in gene expression between the two groups (green + red). Those scanned images were analyzed by GenePix 4.1 software (Axon Instruments, USA) to investigate changes of gene expression. From the data obtained thereby, marker genes for phenanthrene were selected (Figure 2).

As a result, among 44,000 genes on the chip, those genes up-regulated by phenanthrene, making the ratio of Cy5 to Cy3 to be at least 2.0, took 0.69% (302 out of 44,000 genes) and those genes down-regulated took 0.55% (244 out of 44,000 genes).

Those genes up-regulated or down-regulated at least 2 fold by phenanthrene were classified according to functions. As a result, the genes were grouped into those involved in MAPKinase signal pathway, those involved in MAPKKK cascade, those involved in apoptosis, those involved in mitotic cell cycle, those involved in cell cycle, those involved in cell differentiation, those involved in cell motility, those involved in cytoskeleton, those involved in morphogenesis, those involved in response to DNA damage stimulus, those involved in response to chemical stimulus,

those involved in response to external stimulus, those involved in response to stress, those involved in immune response, those involved in metabolism of xenobiotics by cytochrome p450, those involved in alcohol metabolism, those involved in lipid metabolism, those involved in phosphate metabolism, those involved in DNA metabolism, and those involved in metal binding or transport (Table 2 and Table 3). There has been no report saying that phenanthrene causes cytotoxicity in human liver cancer cells.

Table 2**Genes up-regulated by phenanthrene**

Accession number	Gene name	Gene abbreviation	Ratio of intermediate value
(a) MAPKKK cascade			
NM_004420	DUSP8	Dual specificity phosphatase 8	2.27022762
L11329	DUSP2	Dual specificity phosphatase 2	2.521509104
BC094766	PKN1	Protein kinase N1	2.611916464
AY247738	TRIB3	Tribbles homolog 3 (Drosophila)	3.427077604
AK129595	GADD45B	Growth arrest and DNA-damage-inducible, beta	2.909002115
AB208849	SHC1	SHC (Src homology 2 domain containing) transforming protein 1	2.512464675
(b) Apoptosis			

X02812	TGFB1	Transforming growth factor, beta 1 (Camurati-Engelmann disease)	2.554984038
NM_198951	TGM2	Transglutaminase 2 (C polypeptide, protein-glutamine-gamma-glutamyltransferase)	2.425204553
NM_147780	CTSB	Cathepsin B	6.761908242
NM_078467	CDKN1A	Cyclin-dependent kinase inhibitor 1A (p21, Cip1)	3.526032425
NM_033027	AXUD1	AXIN1 up-regulated 1	2.066280072
NM_032797	AMID	Apoptosis-inducing factor (AIF)-like mitochondrion-associated inducer of death	2.95773602
NM_021960	MCL1	Myeloid cell leukemia sequence 1 (BCL2-related)	2.054026296
NM_016639	TNFRSF12A	Tumor necrosis factor receptor superfamily, member 12A	3.746215932
NM_016222	DDX41	DEAD (Asp-Glu-Ala-Asp) box polypeptide 41	2.205477132
NM_013246	CLC	Cardiotrophin-like cytokine factor 1	4.597526212
NM_004401	DFFA	DNA fragmentation factor, 45kDa, alpha polypeptide	2.190487127
NM_004281	BAG3	BCL2-associated athanogene 3	2.164884932
NM_003897	IER3	Immediate early response 3	4.950342184
NM_003806	HRK	Harakiri, BCL2 interacting protein (contains only BH3 domain)	2.177796496
NM_003639	IKBKG	Inhibitor of kappa light polypeptide gene enhancer in B-cells, kinase gamma	2.051623671
NM_003311	PHLDA2	Pleckstrin homology-like domain, family A, member 2	4.282799556
NM_002737	PRKCA	Protein kinase C, alpha	2.012857122
NM_00264	PIM1	Pim-1 oncogene	3.73778041

8			9
NM_002507	NGFR	Nerve growth factor receptor (TNFR superfamily, member 16)	2.482350728
NM_002305	LGALS1	Lectin, galactoside-binding, soluble, 1 (galectin 1)	4.245909804
NM_001013398	IGFBP3	Insulin-like growth factor binding protein 3	4.531730708
BX640923	MDM4	Mdm4, transformed 3T3 cell double minute 4, p53 binding protein (mouse)	2.164995807
BX537586	STK17A	Serine/threonine kinase 17a (apoptosis-inducing)	2.409247881
BG284742	P8	P8 protein (candidate of metastasis 1)	3.948814552
BE903247	PDCD6IP	Programmed cell death 6 interacting protein	2.353912724
BC027949	P2RX1	Purinergic receptor P2X, ligand-gated ion channel, 1	2.354820929
BC006365	PSEN2	Presenilin 2 (Alzheimer disease 4)	2.30373691
AY869712	PPP1R13L	Protein phosphatase 1, regulatory (inhibitor) subunit 13 like	2.23804243
AY028896	CARD10	Caspase recruitment domain family, member 10	2.056288566
AK122614	PPARD	Peroxisome proliferative activated receptor, delta	2.180466538
AK092872	ERCC2	Excision repair cross-complementing rodent repair deficiency, complementation group 2 (xeroderma pigmentosum D)	2.015784385
AK092808	RRAGC	Ras-related GTP binding C	2.200055389
AJ001898	GNDF	Glial cell derived neurotrophic factor	2.266726651
AF220656	PHLDA1	Pleckstrin homology-like domain, family A, member 1	2.913029067
AF055634	UNC5C	Unc-5 homolog C (C. elegans)	2.232102487
AB209485	VEGF	Vascular endothelial growth	2.58672964

		factor	7
AB096256	UNC5B	Unc-5 homolog B (C. elegans)	2.49471227 2
AB007960	SH3GLB1	SH3-domain GRB2-like endophilin B1	2.07385989 8
(c) Cell cycle			
X06374	PDGFA	Platelet-derived growth factor alpha polypeptide	3.64844905 8
S62138	DDIT3	DNA-damage-inducible transcript 3	3.15137244 1
NM_07848 7	CDKN2B	Cyclin-dependent kinase inhibitor 2B (p15, inhibits CDK4)	2.44641596 1
NM_01212 7	CIZ1	CDKN1A interacting zinc finger protein 1	2.11277914 3
NM_00588 3	APC2	Adenomatosis polyposis coli 2	2.02755475 6
NM_00419 6	CDKL1	Cyclin-dependent kinase-like 1 (CDC2-related kinase)	2.23567672 6
NM_00323 6	TGFA	Transforming growth factor, alpha	2.45484202 2
NM_00126 1	CDK9	Cyclin-dependent kinase 9 (CDC2-related kinase)	2.27463329 3
NM_00100 7271	DUSP13	Dual specificity phosphatase 13	3.14955999 6
CR749511	PARC	P53-associated parkin-like cytoplasmic protein	2.09487022 5
CR623038	ID2	Inhibitor of DNA binding 2, dominant negative helix-loop- helix protein	2.55029796 7
CR618371	EGFR	Epidermal growth factor receptor (erythroblastic leukemia viral (v-erb-b) oncogene homolog, avian)	2.49105131 6
BF965144	IFITM1	Interferon induced transmembrane protein 1 (9-27)	2.54327018 9
AK127679	DUSP1	Dual specificity phosphatase 1	3.91453886 2
AK096276	CCND3	Cyclin D3	2.85774271 7
AB209586	MAPK13	Mitogen-activated protein	2.90555485

		kinase 13	1
AB209465	PCTK1	PCTAIRE protein kinase 1	2.42577099
(d) Cell differentiation			
Z19588	SKIL	SKI-like	2.30959844 9
NM_02042 9	SMURF1	SMAD specific E3 ubiquitin protein ligase 1	2.37207844 9
NM_01476 7	SPOCK2	Sparc/osteonectin, cwcw and kazal-like domains proteoglycan (testican) 2	2.25703573 9
NM_00597 9	S100A13	S100 calcium binding protein A13	2.10995094 5
NM_00518 7	CBFA2T3	Core-binding factor, runt domain, alpha subunit 2; translocated to, 3	2.15863559 3
NM_00436 4	CEBPA	CCAAT/enhancer binding protein (C/EBP), alpha	2.49591064 1
NM_00176 9	CD9	CD9 antigen (p24)	3.09695458 7
NM_00171 8	BMP6	Bone morphogenetic protein 6	4.24983545 7
NM_00064 1	IL11	Interleukin 11	8.14151368 5
BX647459	SERPINE2	Serpin peptidase inhibitor, clade E (nexin, plasminogen activator inhibitor type 1), member 2	3.47113621 9
BQ066037	RPS19	Ribosomal protein S19	2.19400905 6
BE791300	EDF1	Endothelial differentiation- related factor 1	2.56260782 3
BC038504	SNF1LK	SNF1-like kinase	2.22818062 9
AL832287	ZAP70	Zeta-chain (TCR) associated protein kinase 70kDa	2.25453809 8
AK125742	PCGF1	Polycomb group ring finger 1	2.06220721 1
AK124709	NDRG1	N-myc downstream regulated gene 1	2.75750812 9
AB011157	PTDSR	Phosphatidylserine receptor	2.09664569

(e) Cell motility			
NM_013255	MKLN1	Muskelin 1, intracellular mediator containing kelch motifs	2.095388213
NM_006572	GNA13	Guanine nucleotide binding protein (G protein), alpha 13	2.586638776
NM_002211	ITGB1	Integrin, beta 1 (fibronectin receptor, beta polypeptide, antigen CD29 includes MDF2, MSK12)	2.037108612
CR601067	PLAUR	Plasminogen activator, urokinase receptor	2.622923731
BC050456	THBS4	Thrombospondin 4	4.173162214
AK027389	CXCL16	Chemokine (C-X-C motif) ligand 16	2.172103299
AJ132099	VNN1	Vanin 1	2.495809111
(f) Cytoskeleton			
XM_371354	FLJ10157	Hypothetical protein FLJ10157	3.585853829
XM_208313	TPM3	Similar to tropomyosin 4	2.031835381
XM_208270	ACR	Acrosin-like protease	2.236260141
NM_203353	PDLIM7	PDZ and LIM domain 7 (enigma)	4.413393311
NM_201382	PLEC1	Plectin 1, intermediate filament binding protein 500kDa	2.281171511
NM_182961	SYNE1	Spectrin repeat containing, nuclear envelope 1	3.139279289
NM_181826	NF2	Neurofibromin 2 (bilateral acoustic neuroma)	2.07772497
NM_172069	PLEKHH2	Pleckstrin homology domain containing, family H (with MyTH4 domain) member 2	2.056655736
NM_022648	TNS	Tensin 1	2.710366065
NM_017556	FBLP-1	Filamin binding LIM protein 1	6.033760457

NM_016081	KIAA0992	Palladin, cytoskeletal associated protein	2.883352333
NM_006617	NES	Nestin	13.84724765
NM_006262	PRPH	Peripherin	10.7669125
NM_005100	AKAP12	A kinase (PRKA) anchor protein (gravin) 12	4.230966504
NM_004368	CNN2	Calponin 2	2.419959379
NM_003388	CYLN2	Cytoplasmic linker 2	5.466743523
NM_003370	VASP	Vasodilator-stimulated phosphoprotein	2.470396656
NM_003128	SPTBN1	Spectrin, beta, non-erythrocytic 1	3.389586475
NM_002705	PPL	Periplakin	4.391168596
NM_002475	MLC1SA	Myosin light chain 1 slow a	2.045728107
NM_002018	FLII	Flightless I homolog (Drosophila)	2.923717161
NM_001465	FYB	FYN binding protein (FYB-120/130)	2.243075989
NM_001069	TUBB2	Tubulin, beta 2A	2.078002541
CR625172	MGC8685	Tubulin, beta 2B	2.022491047
CR616919	KRT18	Keratin 18	2.254726412
CR606241	ACTG1	Actin, gamma 1	4.329668087
CB240572	MYH11	Myosin, heavy polypeptide 11, smooth muscle	2.226688186
BX648253	PTPN3	Protein tyrosine phosphatase, non-receptor type 3	2.228540111
BX648190	WDR1	WD repeat domain 1	3.15399225
BX641076	ACTN1	Actinin, alpha 1	2.072263838
BX537978	EPB41L1	Erythrocyte membrane protein	2.347311111

		band 4.1-like 1	2
BG121847	NUDC	Nuclear distribution gene C homolog (A. nidulans)	2.810520113
BC068013	MYO1C	Myosin IC	2.077468702
BC065499	MAST2	Microtubule associated serine/threonine kinase 2	2.684272001
BC051890	TUBG2	Tubulin, gamma 2	2.064679402
BC041874	MAP1LC3B	Microtubule-associated protein 1 light chain 3 beta	2.030971208
BC012597	ACTA1	Actin, alpha 1, skeletal muscle	2.304539673
AY484427	KIF17	Kinesin family member 17	2.353016258
AK130546	STOML2	Stomatin (EPB72)-like 2	2.03643507
AK124711	CORO2B	Coronin, actin binding protein, 2B	3.293861898
AK123974	MYL5	Myosin, light polypeptide 5, regulatory	2.023013016
AK092792	LOC389833	Similar to hypothetical protein MGC27019	2.389366922
AK026518	MYOHD1	Myosin head domain containing 1	2.059851337
AK024500	NICAL	Microtubule associated monooxygenase, calponin and LIM domain containing 1	4.245993327
AF085886	FLJ46675	Ribosomal protein L29 pseudogene 2	2.603966059
AB209997	MYO9B	Myosin IXB	2.009959651
(g) Morphogenesis			
Y12692	WNT11	Wingless-type MMTV integration site family, member 11	3.084421035
Y11307	CYR61	Cysteine-rich, angiogenic inducer, 61	3.733165979
X17033	ITGA2	Integrin, alpha 2 (CD49B, alpha 2 subunit of VLA-2 receptor)	2.366215982
U41763	CLTCL1	Clathrin, heavy polypeptide-	2.04097343

		like 1	7
NM_153609	TMPRSS6	Transmembrane protease, serine 6	2.727002631
NM_031483	ITCH	Itchy homolog E3 ubiquitin protein ligase (mouse)	2.476782073
NM_024342	GRLF1	Glucocorticoid receptor DNA binding factor 1	2.420894178
NM_017555	EGLN2	Egl nine homolog 2 (C. elegans)	2.239028595
NM_016569	TBX3	T-box 3 (ulnar mammary syndrome)	2.291924172
NM_004148	NINJ1	Ninjurin 1	3.079151972
NM_003377	VEGFB	Vascular endothelial growth factor B	2.245728727
NM_001983	ERCC1	Excision repair cross-complementing rodent repair deficiency, complementation group 1 (includes overlapping antisense sequence)	2.044162332
NM_001552	IGFBP4	Insulin-like growth factor binding protein 4	2.024402634
NM_001430	EPAS1	Endothelial PAS domain protein 1	4.033078615
NM_001300	KLF6	Kruppel-like factor 6	3.506436022
NM_001012661	SLC3A2	Solute carrier family 3 (activators of dibasic and neutral amino acid transport), member 2	4.490498433
NM_000596	IGFBP1	Insulin-like growth factor binding protein 1	2.537989362
NM_000474	TWIST1	Twist homolog 1 (acrocephalosyndactyly 3; Saethre-Chotzen syndrome) (Drosophila)	2.868639316
BX649103	ChGn	Chondroitin beta1,4 N-acetylgalactosaminyltransferase	2.71666046
BM913048	TIMP1	TIMP metalloproteinase inhibitor 1	12.6273547

BM904612	S100A6	S100 calcium binding protein A6 (calcyclin)	4.459584806
BM556279	EMP3	Epithelial membrane protein 3	2.776375864
BC015041	VAT1	Family with sequence similarity 82, member C	2.828306176
AY258066	OKL38	Pregnancy-induced growth inhibitor	2.006590778
AK126729	NDRG4	NDRG family member 4	2.992338668
AK090459	NFE2L1	Nuclear factor (erythroid-derived 2)-like 1	2.067852387
AK074163	ROBO4	Roundabout homolog 4, magic roundabout (Drosophila)	2.253993016
AK024680	FLJ21027 fis	CDNA: FLJ21027 fis, clone CAE07110	3.277997184
AF176422	HEY1	Hairy/enhancer-of-split related with YRPW motif 1	6.385567161
AF003837	JAG1	Jagged 1 (Alagille syndrome)	3.357641161
AB209322	SEMA3B	Sema domain, immunoglobulin domain (Ig), short basic domain, secreted, (semaphorin) 3B	2.514207227
AB011150	NRXN1	Neurexin 1	2.651119398
(h) Response to chemical stimulus			
NM_201589	MAFA	V-maf musculoaponeurotic fibrosarcoma oncogene homolog A (avian)	2.289466133
NM_052999	CKLF1	CKLF-like MARVEL transmembrane domain containing 1	2.154500421
NM_006644	HSPH1	Heat shock 105kDa/110kDa protein 1	2.052814832
NM_005438	FOSL1	FOS-like antigen 1	4.369479447
NM_004996	ABCC1	ATP-binding cassette, sub-family C (CFTR/MRP), member 1	2.496546667
NM_002658	PLAU	Plasminogen activator, urokinase	3.118938277

NM_001353	AKR1C1	Aldo-keto reductase family 1, member C1 (dihydrodiol dehydrogenase 1; 20-alpha (3-alpha)-hydroxysteroid dehydrogenase)	4.189449913
H18681	C20orf139	Sulfiredoxin 1 homolog (S. cerevisiae)	3.459820496
DR004094	HAMP	Hepcidin antimicrobial peptide	8.454862939
BC082272	KCNMB3	Potassium large conductance calcium-activated channel, subfamily M beta member 3	5.908505574
BC040494	DNAJB2	DnaJ (Hsp40) homolog, subfamily B, member 2	3.118589339
BC018064	ATF6	Activating transcription factor 6	2.200518512
BC006523	SGK2	Serum/glucocorticoid regulated kinase 2	2.324097135
AK090482	CXCL12	Chemokine (C-X-C motif) ligand 12 (stromal cell-derived factor 1)	2.095056818
AF219946	TULP4	Tubby like protein 4	2.152711359
AB209112	SLC2A8	Solute carrier family 2, (facilitated glucose transporter) member 8	2.096424216
(i) Response to external stimulus			
NM_005242	F2RL1	Coagulation factor II (thrombin) receptor-like 1	2.472382781
NM_001002029	C4A	Complement component 4B, telomeric	2.443397995
NM_000539	RHO	Rhodopsin (opsin 2, rod pigment) (retinitis pigmentosa 4, autosomal dominant)	3.513455205
BX649164	PAI	serpin peptidase inhibitor, clade E (nexin, plasminogen activator inhibitor type 1), member 1	12.37514297
BM918324	LY96	Lymphocyte antigen 96	2.167248213

AB209647	NCF2	Neutrophil cytosolic factor 2 (65kDa, chronic granulomatous disease, autosomal 2)	12.87547312
(j) Response to stress			
NM_152221	CSNK1E	Casein kinase 1, epsilon	2.178753696
NM_017999	RNF31	Ring finger protein 31	2.570292632
NM_016819	OGG1	8-oxoguanine DNA glycosylase	2.533863905
NM_016816	OAS1	2',5'-oligoadenylate synthetase 1, 40/46kDa	3.501233276
NM_012235	SCAP	SREBP cleavage-activating protein	2.060092593
NM_006384	CIB1	Calcium and integrin binding 1 (calmyrin)	2.25718134
NM_001779	CD58	CD58 antigen, (lymphocyte function-associated antigen 3)	2.034681567
CB055213	ICOSLG	Inducible T-cell co-stimulator ligand	2.619181365
BX641029	MASP1	Mannan-binding lectin serine peptidase 1 (C4/C2 activating component of Ra-reactive factor)	2.025636667
BQ053419	BATF	Basic leucine zipper transcription factor, ATF-like	2.554587227
BC039299	STIP1	Stress-induced-phosphoprotein 1 (Hsp70/Hsp90-organizing protein)	2.76836206
AY055760	DAF	Decay accelerating factor for complement (CD55, Cromer blood group system)	2.031359498
AK130188	FGR	Gardner-Rasheed feline sarcoma viral (v-fgr) oncogene homolog	2.136850952
AK095326	MUS81	MUS81 endonuclease homolog (yeast)	2.238016633
(k) Immune response			
NM_017670	OTUB1	OTU domain, ubiquitin aldehyde binding 1	2.032834107
NM_003004	SECTM1	Secreted and transmembrane 1	2.491208324

NM_002309	LIF	Hypothetical protein MGC20647	3.230632598
NM_001421	ELF4	E74-like factor 4 (ets domain transcription factor)	3.478175442
NM_000418	IL4R	Interleukin 4 receptor	2.422846596
BI909222	FCER1G	Fc fragment of IgE, high affinity I, receptor for; gamma polypeptide	2.289239011
BF569086	NK4	Interleukin 32	3.196970924
BC014470	AZGP1	Alpha-2-glycoprotein 1, zinc	2.206481506
(l) Metabolism of xenobiotics by cytochrome p450			
BC020744	AKR1C4	Aldo-keto reductase family 1, member C4 (chlordecone reductase; 3-alpha hydroxysteroid dehydrogenase, type I; dihydrodiol dehydrogenase 4)	4.026497244
BQ939577	AKR1C3	Aldo-keto reductase family 1, member C3 (3-alpha hydroxysteroid dehydrogenase, type II)	3.534961959
NM_000499	CYP1A1	Cytochrome P450, family 1, subfamily A, polypeptide 1	7.800377521
NM_030622	CYP2S1	Cytochrome P450, family 2, subfamily S, polypeptide 1	9.165266222
(m) Alcohol metabolism			
NM_184041	ALDOA	Aldolase A, fructose-bisphosphate	2.484342488
NM_024307	MGC4171	Hypothetical protein LOC283901	2.180571996
NM_005336	HDLBP	High density lipoprotein binding protein (vigilin)	2.05207069
NM_002627	PFKP	Phosphofructokinase, platelet	2.236435695
BX648281	LDLR	Low density lipoprotein receptor (familial hypercholesterolemia)	2.085256265

BC069201	FLJ22761	Hexokinase domain containing 1	4.73345014
BC030207	NR0B2	Nuclear receptor subfamily 0, group B, member 2	2.284100365
AL833069	KIAA1434	Hypothetical protein KIAA1434	4.079142767
AK124656	ENO2	Enolase 2 (gamma, neuronal)	2.112298881
AK094474	RHOC	Ras homolog gene family, member C	3.594584812
AK093461	ISYNA1	Myo-inositol 1-phosphate synthase A1	2.735404779
AB053232	GAL3ST3	Galactose-3-O-sulfotransferase 3	2.093680717
AB045292	TMEM8	Transmembrane protein 8 (five membrane-spanning domains)	3.707677792
(n) Lipid metabolism			
NM_004753	DHRS3	Dehydrogenase/reductase (SDR family) member 3	3.595855915
NM_002900	RBP3	Retinol binding protein 3, interstitial	2.028996567
NM_001995	ACSL1	Acyl-CoA synthetase long-chain family member 1	2.361560571
NM_000018	ACADVL	Acyl-Coenzyme A dehydrogenase, very long chain	2.211132906
BC094756	CRA	Myotubularin related protein 11	6.444425873
BC050553	NTE	Neuropathy target esterase	2.090667892
BC033110	HSD17B1	Hydroxysteroid (17-beta) dehydrogenase 1	2.073981426
AY268890	TPP1	Tripeptidyl peptidase I	2.014344437
AK172798	CPT1A	Carnitine palmitoyltransferase 1A (liver)	2.657313685
AK096809	CYP4F8	Cytochrome P450, family 4, subfamily F, polypeptide 8	2.203372749
AK000600	SIAT7D	ST6 (alpha-N-acetyl-neuraminyl-2,3-beta-galactosyl-1,3)-N-acetylgalactosaminide alpha-2,6-sialyltransferase 4	2.507339213

AB002454	CYP4F3	Cytochrome P450, family 4, subfamily F, polypeptide 3	2.080620209
(o) Phosphate metabolism			
Z29093	DDR1	Discoidin domain receptor family, member 1	2.462491605
Z25424	MKNK2	MAP kinase interacting serine/threonine kinase 2	3.947091085
XM_291277	DKFZp761P0423	Hypothetical protein DKFZp761P0423	2.109338154
XM_038150	MAST3	Microtubule associated serine/threonine kinase 3	2.304842007
U88357	ERBB3	V-erb-b2 erythroblastic leukemia viral oncogene homolog 3 (avian)	2.152283406
NM_025195	TRIB1	Tribbles homolog 1 (Drosophila)	2.315137327
NM_020639	RIPK4	Receptor-interacting serine-threonine kinase 4	2.672053723
NM_014172	PHPT1	Phosphohistidine phosphatase 1	2.642737979
NM_006254	PRKCD	Protein kinase C, delta	2.014946828
NM_005415	SLC20A1	Solute carrier family 20 (phosphate transporter), member 1	3.900408718
NM_005026	PIK3CD	Phosphoinositide-3-kinase, catalytic, delta polypeptide	2.165050096
NM_004431	EPHA2	EPH receptor A2	2.243829574
NM_004419	DUSP5	Dual specificity phosphatase 5	20.01504556
NM_004327	BCR	Breakpoint cluster region	2.52856075
NM_004231	ATP6V1F	ATPase, H ⁺ transporting, lysosomal 14kDa, V1 subunit F	2.2322534
NM_004090	DUSP3	Dual specificity phosphatase 3 (vaccinia virus phosphatase VH1-related)	2.065252084
NM_002843	PTPRJ	Protein tyrosine phosphatase, receptor type, J	3.168884768

NM_002496	NDUFS8	NADH dehydrogenase (ubiquinone) Fe-S protein 8, 23kDa (NADH-coenzyme Q reductase)	2.199394599
NM_001001852	PIM3	Pim-3 oncogene	2.180634311
L76191	IRAK1	Interleukin-1 receptor-associated kinase 1	2.360632325
D15049	PTPRH	Protein tyrosine phosphatase, receptor type, H	3.186653351
BC065207	ATP6V0D2	ATPase, H ⁺ transporting, lysosomal 38kDa, V0 subunit d isoform 2	5.710088632
BC035578	STK24	Serine/threonine kinase 24 (STE20 homolog, yeast)	2.566951703
BC028724	DUSP18	Dual specificity phosphatase 18	2.143797295
AL117482	ULK3	Unc-51-like kinase 3 (C. elegans)	2.125849273
AK126879	PCTK3	PCTAIRE protein kinase 3	2.761552709
AB209416	ILK	Integrin-linked kinase-2	2.32916339
(p) Metal-binding			
NM_000782	CYP24A1	Cytochrome P450, family 24, subfamily A, polypeptide 1	5.622641332
CR597101	ZFP36	Zinc finger protein 36, C3H type, homolog (mouse)	5.024789852
CR936799	FHL2	Four and a half LIM domains 2	4.675381268
M24898	NR1D1	Nuclear receptor subfamily 1, group D, member 1	4.136932409
AF132818	KLF5	Kruppel-like factor 5 (intestinal)	4.116680989
AK055337	ZNF213	Zinc finger protein 213	3.518376112
BC008834	PHF1	PHD finger protein 1	3.240448848
AK126918	GLIS2	GLIS family zinc finger 2	3.168801935
(q) Transport			

BC042692	CTL2	Solute carrier family 44, member 2	7.712276719
NM_002224	ITPR3	Inositol 1,4,5-triphosphate receptor, type 3	7.200316133
AK095363	AQP3	Aquaporin 3	7.089311726
NM_174953	ATP2A3	ATPase, Ca++ transporting, ubiquitous	6.667638422
BC042390	VTI1B	Vesicle transport through interaction with t-SNAREs homolog 1B (yeast)	5.395640679
NM_016113	TRPV2	Transient receptor potential cation channel, subfamily V, member 2	5.300948826
BM926478	RBP1	Retinol binding protein 1, cellular	4.257876297
NM_000069	CACNA1S	Calcium channel, voltage-dependent, L type, alpha 1S subunit	3.933811596
AK002107	RAB3B	RAB3B, member RAS oncogene family	3.719880481
NM_013321	SNX8	Sorting nexin 8	3.511433386
AK125026	SLC6A12	Solute carrier family 6 (neurotransmitter transporter, betaine/GABA), member 12	3.496824348
NM_005843	STAM2	Signal transducing adaptor molecule (SH3 domain and ITAM motif) 2	3.317696437
AK092512	SLC16A5	Solute carrier family 16 (monocarboxylic acid transporters), member 5	3.29262947
U49248	ABCC2	ATP-binding cassette, subfamily C (CFTR/MRP), member 2	3.178849389
AK172792	SCNN1A	Sodium channel, nonvoltage-gated 1 alpha	3.097482171
BC044656	CASC3	Cancer susceptibility candidate 3	3.092820884
(r) The others			
NM_203403	C9orf150	Chromosome 9 open reading frame 150	4.32887613

NM_080388	S100A16	S100 calcium binding protein A16	2.941590973
NM_031286	SH3BGRL3	SH3 domain binding glutamic acid-rich protein like 3	3.942471639
NM_022153	PP2135	Chromosome 10 open reading frame 54	3.916865889
NM_004864	GDF15	Growth differentiation factor 15	8.033459664
NM_003330	TXNRD1	Thioredoxin reductase 1	2.016171386
NM_001013632	LOC343521	Similar to hypothetical protein 4833401D15	6.265797951
BX537968	LOC51149	Hypothetical LOC51149	6.382479399
BU945318	MT2A	Hypothetical gene supported by X97260; BC070289	5.223401447
BQ683841	S100A11	S100 calcium binding protein A11 (calgizzarin)	6.425793559
BQ276852	TMSB10	Thymosin, beta 10	3.458398131
AK126182	KIAA1949	KIAA1949	4.256619831
AK124751	CAPN2	Calpain 2, (m/II) large subunit	3.00713376
AK095079	RGC32	Response gene to complement 32	2.452170107
AB075871	FLJ42654	Golgi transport 1 homolog A (S. cerevisiae)	2.344751749

Table 3**Genes down-regulated by phenanthrene**

Accession number	Gene name	Gene abbreviation	Ratio of intermediate value
(a) MAPKinase Signaling Pathway			
AK125150	MAPK8	Mitogen-activated protein kinase 8	0.37158159
NM_002758	MAP2K6	Mitogen-activated protein kinase kinase 6	0.273414428

NM_004612	TGFBR1	Transforming growth factor, beta receptor I (activin A receptor type II-like kinase, 53kDa)	0.458974249
NM_145686	MAP4K4	Mitogen-activated protein kinase kinase kinase kinase 4	0.376276674
XM_042066	MAP3K1	Mitogen-activated protein kinase kinase kinase 1	0.491648823
(b) MAPKKK cascade			
AB011123	TNIK	TRAF2 and NCK interacting kinase	0.425973256
AB209031	C5	Complement component 5	0.372750614
NM_022740	HIPK2	Homeodomain interacting protein kinase 2	0.470548821
NM_148957	TNFRSF19	Tumor necrosis factor receptor superfamily, member 19	0.291773985
(c) Apoptosis			
AB208909	ITGB2	Integrin, beta 2 (antigen CD18 (p95), lymphocyte function-associated antigen 1; macrophage antigen 1 (mac-1) beta subunit)	0.282414049
AB209211	TIA1	TIA1 cytotoxic granule-associated RNA binding protein	0.359273874
AB209613	DNASE1L3	Deoxyribonuclease I-like 3	0.482302919
AK122825	HMGB1	High-mobility group box 1	0.405416859
AK127326	PHF17	PHD finger protein 17	0.448219525
AK223503	CASP1	Caspase 1, apoptosis-related cysteine peptidase (interleukin 1, beta, convertase)	0.362727675
BC013326	GAS2	Growth arrest-specific 2	0.305181325
BC047698	IL7	Interleukin 7	0.391176777
D79987	ESPL1	Extra spindle poles like 1 (S. cerevisiae)	0.473063461

NM_000893	KNG1	Kininogen 1	0.31561985 2
NM_001012 271	BIRC5	Effector cell peptidase receptor 1	0.34723579 2
NM_004938	DAPK1	Death-associated protein kinase 1	0.41447005 5
NM_005879	TRIP	TRAF interacting protein	0.34319736 1
NM_014739	BCLAF1	BCL2-associated transcription factor 1	0.49443407 3
NM_018947	CYCS	Cytochrome c, somatic	0.48443405 8
(d) Mitotic cell cycle			
AB033337	MPHOSPH1	M-phase phosphoprotein 1	0.35026381 1
AB209179	PLK1	Polo-like kinase 1 (Drosophila)	0.45148721 5
AB209337	CDC7	CDC7 cell division cycle 7 (S. cerevisiae)	0.49029004 3
AF053305	BUB1	BUB1 budding uninhibited by benzimidazoles 1 homolog (yeast)	0.22625094 4
AF053306	BUB1B	BUB1 budding uninhibited by benzimidazoles 1 homolog beta (yeast)	0.28715064 9
AF345347	SPAG5	Sperm associated antigen 5	0.38459872 1
AK092638	CCNG2	Cyclin G2	0.36926731 9
AK222819	NUSAP1	Nucleolar and spindle associated protein 1	0.26971190 7
AL833191	SMC2L1	SMC2 structural maintenance of chromosomes 2-like 1 (yeast)	0.35846967 5
AY257469	CIT	Citron (rho-interacting, serine/threonine kinase 21)	0.33270040 7
AY367065	ASPM	Asp (abnormal spindle)-like, microcephaly associated (Drosophila)	0.19099046 9
BC011000	CDCA5	Cell division cycle associated 5	0.36478921 1
BC032677	UBE2C	Ubiquitin-conjugating enzyme	0.27478447

		E2C	5
BC043502	NEK2	NIMA (never in mitosis gene a)-related kinase 2	0.358793697
BU675073	PTTG1	Pituitary tumor-transforming 1	0.384934848
BX647885	STMN1	Stathmin 1/oncoprotein 18	0.438589617
CR592757	BRRN1	Barren homolog 1 (Drosophila)	0.44212003
CR597075	MAPRE2	Microtubule-associated protein, RP/EB family, member 2	0.401874825
CR604810	CCNA2	Cyclin A2	0.271797927
CR933728	CDC2	Cell division cycle 2, G1 to S and G2 to M	0.262198533
NM_000919	PAM	Peptidylglycine alpha-amidating monooxygenase	0.395925124
NM_001790	CDC25C	Cell division cycle 25C	0.286608881
NM_001798	CDK2	Cyclin-dependent kinase 2	0.483624317
NM_001813	CENPE	Centromere protein E, 312kDa	0.197401094
NM_003318	TTK	TTK protein kinase	0.216107553
NM_003981	PRC1	Protein regulator of cytokinesis 1	0.276570556
NM_004523	KIF11	Kinesin family member 11	0.324812081
NM_004701	CCNB2	Cyclin B2	0.265952387
NM_005983	SKP2	S-phase kinase-associated protein 2 (p45)	0.406254031
NM_006101	KNTC2	Kinetochore associated 2	0.156679448
NM_006845	KIF2C	Kinesin family member 2C	0.427743351
NM_007375	TARDBP	TAR DNA binding protein	0.465230823
NM_012112	TPX2	TPX2, microtubule-associated,	0.43715029

		homolog (Xenopus laevis)	1
NM_014750	DLG7	Discs, large homolog 7 (Drosophila)	0.241818618
NM_015097	CLASP2	Cytoplasmic linker associated protein 2	0.48734501
NM_016343	CENPF	Centromere protein F, 350/400ka (mitosin)	0.245619925
NM_016426	GTSE1	G-2 and S-phase expressed 1	0.457747746
NM_018492	PBK	PDZ binding kinase	0.250239701
NM_018685	ANLN	Anillin, actin binding protein (scraps homolog, Drosophila)	0.293495946
NM_020242	KNSL7	Kinesin family member 15	0.308252464
NM_031966	CCNB1	Cyclin B1	0.349528487
NM_138555	KIF23	Kinesin family member 23	0.339120457
U65410	MAD2L1	MAD2 mitotic arrest deficient-like 1 (yeast)	0.287300335
(e) Cell cycle			
AB020656	CYLD	Cylindromatosis (turban tumor syndrome)	0.499315321
AF033122	SESN1	Sestrin 1	0.479265095
AK074377	UHRF1	Chromosome 19 open reading frame 31	0.370230035
AK091170	CDKN2C	Cyclin-dependent kinase inhibitor 2C (p18, inhibits CDK4)	0.438659688
AK094323	NFYC	Nuclear transcription factor Y, gamma	0.487100993
AY366508	LOH11CR2 A	Loss of heterozygosity, 11, chromosomal region 2, gene A	0.376070815
BC033086	TCF19	Transcription factor 19 (SC1)	0.419154236
BC040303	PTP4A1	Protein tyrosine phosphatase type IVA, member 1	0.290256096

BC040991	TFDP2	Transcription factor Dp-2 (E2F dimerization partner 2)	0.48207664 3
BC092412	SGOL2	Shugoshin-like 2 (<i>S. pombe</i>)	0.28860332 3
BQ278454	CKS1B	CDC28 protein kinase regulatory subunit 1B	0.47644757 9
BX649128	SESN3	Sestrin 3	0.21228109 3
CD049340	AURKB	Aurora kinase B	0.45842130 9
M89914	NF1	Neurofibromin 1 (neurofibromatosis, von Recklinghausen disease, Watson disease)	0.44875470 2
NM_001005414	ZWINT	ZW10 interactor antisense	0.30502683 9
NM_001008491	02-Sep	Septin 2	0.43338328 2
NM_001274	CHEK1	CHK1 checkpoint homolog (<i>S. pombe</i>)	0.39947066 4
NM_002105	H2AFX	H2A histone family, member X	0.46210454 7
NM_002388	MCM3	MCM3 minichromosome maintenance deficient 3 (<i>S. cerevisiae</i>)	0.49334736 2
NM_002417	MKI67	Antigen identified by monoclonal antibody Ki-67	0.21119795 1
NM_002875	RAD51	RAD51 homolog (RecA homolog, <i>E. coli</i>) (<i>S. cerevisiae</i>)	0.46849635 8
NM_003884	PCAF	P300/CBP-associated factor	0.34787563 3
NM_004526	MCM2	MCM2 minichromosome maintenance deficient 2, mitotin (<i>S. cerevisiae</i>)	0.45198386 7
NM_004847	AIF1	Allograft inflammatory factor 1	0.47451403
NM_005915	MCM6	MCM6 minichromosome maintenance deficient 6 (MIS5 homolog, <i>S. pombe</i>) (<i>S. cerevisiae</i>)	0.49238472 3
NM_012090	MACF1	Microtubule-actin crosslinking	0.48194655

		factor 1	
NM_012415	RAD54B	RAD54 homolog B (<i>S. cerevisiae</i>)	0.416656782
NM_014264	PLK4	Polo-like kinase 4 (<i>Drosophila</i>)	0.305708065
NM_015714	G0S2	G0/G1switch 2	0.212617258
NM_024680	FLJ23311	E2F transcription factor 8	0.383774423
XM_034274	MYBL1	V-myb myeloblastosis viral oncogene homolog (avian)-like 1	0.400969019
(f) Response to DNA damage stimulus			
AK001720	FLJ10858	Nei endonuclease VIII-like 3 (<i>E. coli</i>)	0.291006629
AY032677	POLQ	Polymerase (DNA directed), theta	0.467324921
BC034480	BLM	Bloom syndrome	0.451571042
BC073161	RAD51C	RAD51 homolog C (<i>S. cerevisiae</i>)	0.450189769
CR600021	HMGB2	High-mobility group box 2	0.396981715
CR625391	RAD51AP1	RAD51 associated protein 1	0.284692163
CR936783	FLJ40869	Hypothetical protein LOC284952	0.35548351
DQ140356	KIAA1596	Fanconi anemia, complementation group M	0.41287346
NM_001067	TOP2A	Topoisomerase (DNA) II alpha 170kDa	0.223422783
NM_001618	PARP1	Poly (ADP-ribose) polymerase family, member 1	0.41644492
NM_003362	UNG	Uracil-DNA glycosylase	0.338199742
NM_006904	PRKDC	Protein kinase, DNA-activated, catalytic polypeptide	0.484515215
NM_130398	EXO1	Exonuclease 1	0.466620279
(g) Response to stress			
AB020807	TLR6	Toll-like receptor 6	0.44647764

			1
AB032980	DCDC2	Doublecortin domain containing 2	0.296124827
AB209866	TFPI	Tissue factor pathway inhibitor (lipoprotein-associated coagulation inhibitor)	0.379601518
AK057015	HSPA4	Heat shock 70kDa protein 4	0.414580368
AK095515	IFIT1	Interferon-induced protein with tetratricopeptide repeats 1	0.227639802
AK122686	IF	I factor (complement)	0.319972831
AK123010	RRM2	Ribonucleotide reductase M2 polypeptide	0.359436757
BC035582	TRIM22	Tripartite motif-containing 22	0.429859693
BX537894	LOC493869	Similar to RIKEN cDNA 2310016C16	0.430808753
M14338	PROS1	Protein S (alpha)	0.38758587
NM_000821	GGCX	Gamma-glutamyl carboxylase	0.44786698
NM_000963	PTGS2	Prostaglandin-endoperoxide synthase 2 (prostaglandin G/H synthase and cyclooxygenase)	0.238558588
NM_001001547	CD36	CD36 antigen (collagen type I receptor, thrombospondin receptor)	0.427582662
NM_001512	GSTA4	Glutathione S-transferase A4	0.409696133
NM_001629	ALOX5AP	Arachidonate 5-lipoxygenase-activating protein	0.370258001
NM_001752	CAT	Catalase	0.48229097
NM_001837	CCR3	Chemokine (C-C motif) receptor 3	0.392999815
NM_001979	EPHX2	Epoxide hydrolase 2, cytoplasmic	0.409748537
NM_001994	F13B	Coagulation factor XIII, B polypeptide	0.417103615
NM_002182	IL1RAP	Interleukin 1 receptor accessory protein	0.470544224

NM_006120	HLA-DMA	Major histocompatibility complex, class II, DM alpha	0.409381691
NM_173216	SIAT1	ST6 beta-galactosamide alpha-2,6-sialyltransferase 1	0.395048885
NM_202002	FOXM1	Forkhead box M1	0.343164799
(h) Immune response			
AB163917	LRAP	Leukocyte-derived arginine aminopeptidase	0.389545152
BC027881	AFP	Alpha-fetoprotein	0.482598986
NM_015915	SPG3A	Spastic paraplegia 3A (autosomal dominant)	0.320598706
(i) Metabolism of xenobiotics by cytochrome p450			
NM_000671	ADH5	Alcohol dehydrogenase 5 (class III), chi polypeptide	0.415769885
J05428	UGT2B7	UDP glucuronosyltransferase 2 family, polypeptide B7	0.355949899
NM_000672	ADH6	Alcohol dehydrogenase 6 (class V)	0.240017477
M15943	ADH4	Alcohol dehydrogenase 4 (class II), pi polypeptide	0.369002372
(j) Alcohol metabolism			
AK223395	FBP1	Fructose-1,6-bisphosphatase 1	0.345975924
NM_000151	G6PC	Glucose-6-phosphatase, catalytic (glycogen storage disease type I, von Gierke disease)	0.483865486
XM_113962	KIAA0650	Structural maintenance of chromosomes flexible hinge domain containing 1	0.481113604
(k) Lipid metabolism			
AB020644	ACSL6	Acyl-CoA synthetase long-chain family member 6	0.366796579
AB209907	PLD1	Phospholipase D1, phosphatidylcholine-specific	0.49794399
AF285167	ABCA1	ATP-binding cassette, sub-family A (ABC1), member 1	0.400576212
AF297872	TRERF1	Transcriptional regulating	0.42442444

		factor 1	2
AF303134	ALDH8A1	Aldehyde dehydrogenase 8 family, member A1	0.327216749
AF339053	PLA2G12B	Phospholipase A2, group XIIB	0.403910882
AK096018	HADHSC	L-3-hydroxyacyl-Coenzyme A dehydrogenase, short chain	0.477072516
AK124635	PCSK9	Proprotein convertase subtilisin/kexin type 9	0.354529299
AK127346	SIAT9	ST3 beta-galactoside alpha-2,3-sialyltransferase 5	0.499800758
AL359559	AGPS	Alkylglycerone phosphate synthase	0.466443577
AY691170	PLCL3	Phospholipase C-like 3	0.450889711
BG567934	APOM	Apolipoprotein M	0.427865838
BX538214	C6orf167	Chromosome 6 open reading frame 167	0.361451579
BX640945	FADS2	Fatty acid desaturase 2	0.336986957
BX648473	PIGK	Phosphatidylinositol glycan, class K	0.447642673
BX648557	HSD17B2	Hydroxysteroid (17-beta) dehydrogenase 2	0.423413453
CR749601	ETNK1	Death-associated protein kinase 3	0.342843288
NM_000859	HMGCR	3-hydroxy-3-methylglutaryl-Coenzyme A reductase	0.433628828
NM_001443	FABP1	Fatty acid binding protein 1, liver	0.462365086
NM_002130	HMGCS1	3-hydroxy-3-methylglutaryl-Coenzyme A synthase 1 (soluble)	0.425602232
NM_003725	RODH	Hydroxysteroid (17-beta) dehydrogenase 6	0.369285922
NM_004845	PCYT1B	Phosphate cytidylyltransferase 1, choline, beta	0.325080042
NM_014762	DHCR24	24-dehydrocholesterol reductase	0.482309072

NM_020139	DHRS6	Dehydrogenase/reductase (SDR family) member 6	0.485337426
NM_020918	GPAM	Glycerol-3-phosphate acyltransferase, mitochondrial	0.487746412
NM_032523	OSBPL6	Oxysterol binding protein-like 6	0.450067001
NM_033505	SELI	Selenoprotein I	0.451056253
Z28339	AKR1D1	Aldo-keto reductase family 1, member D1 (delta 4-3-ketosteroid-5-beta-reductase)	0.452191754
(1) Phosphate metabolism			
AK024899	ENPP3	Ectonucleotide pyrophosphatase/phosphodiesterase 3	0.427540305
AK025546	PTPN4	Protein tyrosine phosphatase, non-receptor type 4 (megakaryocyte)	0.472674412
AK124910	ENPP2	Ectonucleotide pyrophosphatase/phosphodiesterase 2 (autotaxin)	0.360666366
BC035116	FLJ35059 fis	CDNA FLJ30761 fis, clone FEBRA2000538	0.404383659
BC050565	PASK	PAS domain containing serine/threonine kinase	0.448921606
L13436	NPR2	Natriuretic peptide receptor B/guanylate cyclase B (atrionatriuretic peptide receptor B)	0.354388276
NM_001005862	ERBB2	V-erb-b2 erythroblastic leukemia viral oncogene homolog 2, neuro/glioblastoma derived oncogene homolog (avian)	0.474857704
NM_005012	ROR1	Receptor tyrosine kinase-like orphan receptor 1	0.397847795
NM_006035	CDC42BPB	CDC42 binding protein kinase beta (DMPK-like)	0.474850606
NM_014791	MELK	Maternal embryonic leucine zipper kinase	0.300625391

NM_023028	FGFR2	Fibroblast growth factor receptor 2 (bacteria-expressed kinase, keratinocyte growth factor receptor, craniofacial dysostosis 1, Crouzon syndrome, Pfeiffer syndrome, Jackson-Weiss syndrome)	0.24232216 1
NM_080836	STK35	Serine/threonine kinase 35	0.42496712 5
(m) RNA metabolism			
AF419331	FUSIP1	FUS interacting protein (serine/arginine-rich) 1	0.41275974 8
AK091927	SFRS3	Splicing factor, arginine/serine-rich 3	0.42044948 5
BC010266	HNRNPA1	Heterogeneous nuclear ribonucleoprotein A1	0.46231114 4
BC012360	CTAGE5	CTAGE family, member 5	0.43141869 2
BC036046	PLRG1	Pleiotropic regulator 1 (PRL1 homolog, Arabidopsis)	0.33089654
BC065384	PCF11	PCF11, cleavage and polyadenylation factor subunit, homolog (S. cerevisiae)	0.39661398
BX537360	CPSF5	Nudix (nucleoside diphosphate linked moiety X)-type motif 21	0.47490358 3
BX537494	HNRPA2B1	Heterogeneous nuclear ribonucleoprotein A2/B1	0.48323595 8
BX647784	HNRPR	Heterogeneous nuclear ribonucleoprotein R	0.49383291 4
CA455267	PPIH	Peptidyl prolyl isomerase H (cyclophilin H)	0.45273569 2
CR596214	HNRPA0	Heterogeneous nuclear ribonucleoprotein A0	0.49283085 6
NM_001326	CSTF3	Hypothetical protein LOC283267	0.48836956 6
NM_004640	BAT1	HLA-B associated transcript 1	0.46467880 2
NM_005463	HNRPDL	Heterogeneous nuclear ribonucleoprotein D-like	0.44943189

NM_006924	SFRS1	Splicing factor, arginine/serine-rich 1 (splicing factor 2, alternate splicing factor)	0.409985251
NM_012426	SF3B3	Splicing factor 3b, subunit 3, 130kDa	0.409610607
NM_018048	FLJ10292	Mago-nashi homolog	0.476610453
NM_030919	C20orf129	Chromosome 20 open reading frame 129	0.332805196
NM_031370	HNRPD	Heterogeneous nuclear ribonucleoprotein D (AU-rich element RNA binding protein 1, 37kDa)	0.425073079
NM_138933	ACF	Apobec-1 complementation factor	0.49507629
(n) Metal-binding			
AB193259	ACE2	Angiotensin I converting enzyme (peptidyl-dipeptidase A) 2	0.239856518
BX648769	EWSR1	Ewing sarcoma breakpoint region 1	0.257110535
AB023154	DTX4	Deltex 4 homolog (Drosophila)	0.267621475
AL543755	VAV3	Vav 3 oncogene	0.299264024
M75106	CPB2	Carboxypeptidase B2 (plasma, carboxypeptidase U)	0.313049686
NM_021045	ZNF248	Zinc finger protein 248	0.320140997
AB209194	B4GALT6	UDP-Gal:betaGlcNAc beta 1,4-galactosyltransferase, polypeptide 6	0.320685631
AF279145	ANTXR1	Anthrax toxin receptor 1	0.39857674
NM_025074	FRAS1	Fraser syndrome 1	0.481764106
(o) Transport			
AK025790	KIF20A	Kinesin family member 20A	0.14986715
NM_006152	LRMP	Lymphoid-restricted membrane protein	0.156975893

NM_000340	SLC2A2	Solute carrier family 2 (facilitated glucose transporter), member 2	0.199699724
AF071592	KIF4A	Kinesin family member 4A	0.212426381
NM_013277	RACGAP1	Rac GTPase activating protein 1	0.219596171
AY043484	SCN1A	Sodium channel, voltage-gated, type I, alpha	0.22219969
AY791349	KIF18A	Kinesin family member 18A	0.225454794
NM_018018	SLC38A4	Solute carrier family 38, member 4	0.236711775
AK094603	FLJ37284 fis	unnamed protein product; Homo sapiens cDNA FLJ37284 fis, clone BRAMY2013590.	0.280097743
NM_021069	ARGBP2	Sorbin and SH3 domain containing 2	0.288175356
NM_001005747	CACNB4	Calcium channel, voltage-dependent, beta 4 subunit	0.306040228
AJ496568	SLC25A12	Solute carrier family 25 (mitochondrial carrier, Aralar), member 12	0.310081864
NM_030641	APOL6	Apolipoprotein L, 6	0.320365934
NM_173512	FLJ39822	Hypothetical protein FLJ39822	0.32237774
NM_000037	ANK1	Ankyrin 1, erythrocytic	0.329795837
NM_001011554	SLC13A3	Solute carrier family 13 (sodium-dependent dicarboxylate transporter), member 3	0.435944386
(p) The others			
AB091343	C10orf3	Centrosomal protein 55kDa	0.428171982
AK000643	ASB9	Ankyrin repeat and SOCS box-containing 9	0.260478398
AK055221	FBXO5	F-box protein 5	0.433580607
AK075271	SPTLC2L	Serine palmitoyltransferase, long chain base subunit 2-like	0.321365941

		(aminotransferase 2)	
AK122685	GLUD1	Glutamate dehydrogenase 1	0.41366521 2
AK127098	FLJ10706	Chromosome 1 open reading frame 112	0.39408587 7
AL133031	MLR1	Transcription factor MLR1	0.32371076 4
AY007723	MAL2	Mal, T-cell differentiation protein 2	0.44755178 2
BC022255	Spc25	Spindle pole body component 25 homolog (S. cerevisiae)	0.39936416 8
BC041882	ATF7IP2	Activating transcription factor 7 interacting protein 2	0.39875789 5
BC052951	LMNB1	Lamin B1	0.28601024 3
BC098313	FLJ20641	Hypothetical protein FLJ20641	0.35237748 5
NM_001809	CENPA	Centromere protein A, 17kDa	0.31644803 8
NM_145061	C13orf3	Chromosome 13 open reading frame 3	0.28209645 3
XM_372695	LOC39085 9	PREDICTED: Homo sapiens similar to Chain A, Crystal Structure Of The R463a Mutant Of Human Glutamate Dehydrogenase (LOC390859), mRNA	0.46121665 6

Example 3: Quantification by real-time RT-PCR (reverse transcriptase polymerase chain reaction)

Among those genes up-regulated or down-regulated at
5 least double the normal level by phenanthrene, 19 up-
regulated genes and 9 down regulated genes were selected.
These genes are as follows: GeneBank accession No: BM913048
(TIMP metalloproteinase inhibitor 1), GeneBank accession No:

BX649164 (serpin peptidase inhibitor, clade E (nexin, plasminogen activator inhibitor type 1), member 1), GeneBank accession No: NM_004864 (Growth differentiation factor 15), GeneBank accession No: NM_000499 (Cytochrome P450, family 1, subfamily A, polypeptide 1), GeneBank accession No: AK095363 (Aquaporin 3), GeneBank accession No: NM_001013632 (Similar to hypothetical protein 4833401D15), GeneBank accession No: BC042390 (Vesicle transport through interaction with t-SNAREs homolog 1B (yeast)), GeneBank accession No: BQ683841 (S100 calcium binding protein A11 (calgizzarin)), GeneBank accession No: NM_003897 (Immediate early response 3), GeneBank accession No: BM926478 (Retinol binding protein 1, cellular), GeneBank accession No: BU945318 (metallothionein 2A), GeneBank accession No: AK094474 (Ras homolog gene family, member C), GeneBank accession No: Y11307 (Cysteine-rich, angiogenic inducer, 61), GeneBank accession No: AY247738 (Tribbles homolog 3 (Drosophila)), GeneBank accession No: Z25424 (MAP kinase interacting serine/threonine kinase 2), GeneBank accession No: NM_001769 (CD9 antigen (p24)), GeneBank accession No: Y12692 (Wingless-type MMTV integration site family, member 11), GeneBank accession No: X02812 (Transforming growth factor, beta 1 (Camurati-Engelmann disease)), GeneBank accession No: NM_000596 (Insulin-like growth factor binding protein 1), GeneBank

accession No: NM_006101 (Kinetochore associated 2),
GeneBank accession No: NM_003318 (TTK protein kinase),
GeneBank accession No: NM_001067 (Topoisomerase (DNA) II
alpha 170kDa), GeneBank accession No: NM_018492 (PDZ
5 binding kinase), GeneBank accession No: U65410 (MAD2
mitotic arrest deficient-like 1 (yeast)), GeneBank
accession No: AK074377 (Chromosome 19 open reading frame
31), GeneBank accession No: CR600021 (High-mobility group
box 2), GeneBank accession No: BC022255 (Spindle pole body
10 component 25 homolog (*S. cerevisiae*)), GeneBank accession
No: AB091343 (Centrosomal protein 55kDa).

To investigate expression patterns of those genes and
quantify their expressions, quantitative real-time RT-PCR
was performed using My IQ Real-time PCR (Bio-rad, USA).

15 Particularly, cDNA was synthesized by reverse
transcription using oligo dT primer and Superscript kit
(Omniscipt™ kit, Qiagen, Co., USA). To quantify the PCR
product, SYBR Green I staining (Bio-rad, USA) was
performed. SYBR Green I staining is a double stranded DNA
20 conjugation based staining method. During PCR, as double
stranded DNA generates, fluorescence intensity increases.
First, target gene used for PCR and endogenous control
(GAPDH) primer were added to SYBR Green master mix,
followed by PCR. Then, primer optimization was performed
25 to determine the proper concentration. The synthesized

cDNA and each primer were mixed (Table 4), to which SYBR Green master mix was added, followed by PCR. The PCR product was analyzed by using quantification software (Table 5).

5

Table 4**Primer sequences**

Accession number	Gene name	PCR primer sequence	
BM913048	TIMP metalloproteinase inhibitor 1	sense (sequence number 1)	GATACTTCCACAGGTCCCAC AAC
BM913048	TIMP metalloproteinase inhibitor 1	antisense (sequence number 2)	GCAAGAGTCCATCCTGCAGT T
BX649164	serpin peptidase inhibitor, clade E (nexin, plasminogen activator inhibitor type 1), member 1	sense (sequence number 3)	CAGACCAAGAGCCTCTCCAC
BX649164	serpin peptidase inhibitor, clade E (nexin, plasminogen activator inhibitor type 1), member 1	antisense (sequence number 4)	ATCACTTGGCCCATGAAAAG
NM_004864	Growth differentiation factor 15	sense (sequence number 5)	CCTGAGACACCCGATTCCT
NM_004864	Growth differentiation factor 15	antisense (sequence number 6)	ACAGTTCCATCAGACCAGCC
NM_000499	Cytochrome P450, family 1,	sense (sequence	CACCATCCCCACAGCAC

	subfamily A, polypeptide 1	number 7)	
NM_00049 9	Cytochrome P450, family 1, subfamily A, polypeptide 1	antisense (sequence number 8)	ACAAAGACACAACGCCCCCTT
AK095363	Aquaporin 3	sense (sequence number 9)	TTCACGATCCACCCTTTCAG GCTA
AK095363	Aquaporin 3	antisense (sequence number 10)	ACACATACCTGCTGCCCATT CTCT
NM_00101 3632	polo-like kinase 3 (Drosophila)	sense (sequence number 11)	GACTACTCCAATAAGTTCCG CTTTG
NM_00101 3632	polo-like kinase 3 (Drosophila)	antisense (sequence number 12)	CATATGTGTGCCATCGTTGA AGA
BC042390	Vesicle transport through interaction with t-SNAREs homolog 1B (yeast)	sense (sequence number 13)	GGGGGACTAACCTATCGAGA A
BC042390	Vesicle transport through interaction with t-SNAREs homolog 1B (yeast)	antisense (sequence number 14)	GATCCAGTGCTGATAGCAAC C
BQ683841	S100 calcium binding protein All (calgizzarin)	sense (sequence number 15)	AGTCCCTGATTGCTGTCTTC CAGA
BQ683841	S100 calcium binding protein All (calgizzarin)	antisense (sequence number 16)	ACCAGGGTCCTTCTGGTTCT TTGT
NM_00389 7	Immediate early response 3	sense (sequence number 17)	AGCCCTTTAATCTGACTTCG GAGC

NM_003897	Immediate early response 3	antisense (sequence number 18)	CAGGTACGCCTGGTGTTCCTTTGT
BM926478	Retinol binding protein 1, cellular	sense (sequence number 19)	AGGCATAGATGACCGCAAGT
BM926478	Retinol binding protein 1, cellular	antisense (sequence number 20)	ACCCTTCTGCACACACTGG
BU945318	metallothionein 2A	sense (sequence number 21)	CTCTAGCCGCCTCTTCAGC
BU945318	metallothionein 2A	antisense (sequence number 22)	ACTCTTTGCATTTGCAGGAAC
AK094474	Ras homolog gene family, member C	sense (sequence number 23)	ACCTGCCTCCTCATCGTCTTC
AK094474	Ras homolog gene family, member C	antisense (sequence number 24)	CACCTGCTTGCCGTCCAC
Y11307	Cysteine-rich, angiogenic inducer, 61	sense (sequence number 25)	ATTGTAGAAAGGAAGCCTTGCTCAT
Y11307	Cysteine-rich, angiogenic inducer, 61	antisense (sequence number 26)	TCCAATCGTGGCTGCATTAG
AY247738	Tribbles homolog 3 (Drosophila)	sense (sequence number 27)	GTCTTCGCTGACCGTGAGA
AY247738	Tribbles homolog 3 (Drosophila)	antisense (sequence number 28)	CAGTCAGCACGCAGGAGTC
NM_017572	MAP kinase interacting serine/threonine kinase 2	sense (sequence number 29)	CCATGGTCCTGCAGAGGT
NM_017572	MAP kinase interacting serine/threonine kinase 2	antisense (sequence number 30)	TTCTGACCAGTCCTCCAGGT

NM_001769	CD9 antigen (p24)	sense (sequence number 31)	GCACCAAGTGCATCAAATACCTGC
NM_001769	CD9 antigen (p24)	antisense (sequence number 32)	AGCCATAGTCCAATGGCAAGGACA
Y12692	Wingless-type MMTV integration site family, member 11	sense (sequence number 33)	TTCACTTGGAAGCCACCAGGAACA
Y12692	Wingless-type MMTV integration site family, member 11	antisense (sequence number 34)	TGGCCCTGAAAGGTCAAGTCGTGA
X02812	Transforming growth factor, beta 1 (Camurati-Engelmann disease)	sense (sequence number 35)	GCAGCACGTGGAGCTGTA
X02812	Transforming growth factor, beta 1 (Camurati-Engelmann disease)	antisense (sequence number 36)	CAGCCGGTTGCTGAGGTA
NM_000596	Insulin-like growth factor binding protein 1	sense (sequence number 37)	ATCATTCATCCTTTGGGACGCCA
NM_000596	Insulin-like growth factor binding protein 1	antisense (sequence number 38)	TGTCTCCTGTGCCTTGGCTAAACT
NM_006101	Kinetochore associated 2	sense (sequence number 39)	TGCTACACATGTTGGGTCTGTA
NM_006101	Kinetochore associated 2	antisense (sequence number 40)	CCGAGAGATCTTCTGACATGC

NM_003318	TTK protein kinase	sense (sequence number 41)	TCATGCCCATTGGAAGAGT CCCA
NM_003318	TTK protein kinase	antisense (sequence number 42)	AGGCACAACCAAATCTCGGC ATTC
NM_001067	Topoisomerase (DNA) II alpha 170kDa	sense (sequence number 43)	CTAGTTAATGCTGCGGACAA CA
NM_001067	Topoisomerase (DNA) II alpha 170kDa	antisense (sequence number 44)	CATTTGACCACCTGTCACT T
NM_018492	PDZ binding kinase	sense (sequence number 45)	TCTGGACTGAGAGTGGCTTT CACA
NM_018492	PDZ binding kinase	antisense (sequence number 46)	AGCCAAGCTTCTGCATAAAC GGAG
U65410	MAD2 mitotic arrest deficient-like 1 (yeast)	sense (sequence number 47)	ACTTAAATATCTCCCTACCT ATACTGAGTCAA
U65410	MAD2 mitotic arrest deficient-like 1 (yeast)	antisense (sequence number 48)	TAGTAACTGTAGATGGAAAA ACTTGTGCTA
AK074377	Chromosome 19 open reading frame 31	sense (sequence number 49)	CTGGTACGACGCGGAGAT
AK074377	Chromosome 19 open reading frame 31	antisense (sequence number 50)	CGACAGTCGTTCAGAGAATC A
CR600021	High-mobility group box 2	sense (sequence number 51)	CTTGGCACGATATGCAGCAA
CR600021	High-mobility group box 2	antisense (sequence number 52)	CAGCCAAAGATAAACAACCA TATGA
BC022255	Spindle pole body component 25 homolog (S. cerevisiae)	sense (sequence number 53)	GAATGGTTGAGATGTTTCTG GA

BC022255	Spindle pole body component 25 homolog (S. cerevisiae)	antisense (sequence number 54)	GCAATCAATTTTAACAAGTT ATCCTTT
AB091343	Centrosomal protein 55kDa	sense (sequence number 55)	GCTGTGCATTTCTCTTGGCA GTGA
AB091343	Centrosomal protein 55kDa	antisense (sequence number 56)	TAGACGCTGCTCACCACATT CTGT

Table 5**Results of real-time quantitative PCR**

Accession number	Gene name	Gene abbreviation	Microarray (rate of Cy3/Cy5)	Real time PCR (relative rate)
up-regulated gene				
BM913048	TIMP metalloproteinase inhibitor 1	TIMP1	12.63	12.67
BX649164	serpin peptidase inhibitor, clade E (nexin, plasminogen activator inhibitor type 1), member 1	PAI	12.38	15.17
NM_004864	Growth differentiation factor 15	GDF15	8.03	52.89
NM_000499	Cytochrome P450, family 1, subfamily A, polypeptide 1	CYP1A1	7.80	12.67
AK095363	Aquaporin 3	AQP3	7.09	9.06
NM_001013632	Similar to hypothetical protein 4833401D15	LOC343521	6.27	6.68
BC042390	Vesicle transport through interaction with t-SNAREs homolog 1B (yeast)	VTI1B	5.40	8.06

BQ683841	S100 calcium binding protein A11 (calgizzarin)	S100A11	5.14	8.53
NM_003897	Immediate early response 3	IER3	4.95	4.71
BM926478	Retinol binding protein 1, cellular	RBP1	4.26	5.24
BU945318	metallothionein 2A	MT2A	4.12	4.28
AK094474	Ras homolog gene family, member C	RHOC	3.59	1.53
Y11307	Cysteine-rich, angiogenic inducer, 61	CYR61	3.51	5.23
AY247738	Tribbles homolog 3 (Drosophila)	TRIB3	3.43	1.85
Z25424	MAP kinase interacting serine/threonine kinase 2	MKNK2	3.41	4.66
NM_001769	CD9 antigen (p24)	CD9	3.10	4.52
Y12692	Wingless-type MMTV integration site family, member 11	WNT11	3.08	4.00
X02812	Transforming growth factor, beta 1 (Camurati-Engelmann disease)	TGFB1	2.55	4.46
NM_000596	Insulin-like growth factor binding protein 1	IGFBP1	2.54	2.56
down-regulated gene				
NM_006101	Kinetochore associated 2	KNTC2	0.18	0.17
NM_003318	TTK protein kinase	TTK	0.22	0.27
NM_001067	Topoisomerase (DNA) II alpha 170kDa	TOP2A	0.22	0.29
NM_018492	PDZ binding kinase	PBK	0.25	0.23

U65410	MAD2 mitotic arrest deficient-like 1 (yeast)	MAD2L1	0.29	0.29
AK074377	Chromosome 19 open reading frame 31	UHRF1	0.37	0.57
CR600021	High-mobility group box 2	HMGB2	0.40	0.35
BC022255	Spindle pole body component 25 homolog (S. cerevisiae)	Spc25	0.40	0.27
AB091343	Centrosomal protein 55kDa	C10orf3	0.43	0.52

As a result, the expression patterns of those 19 up-regulated genes and 9 down-regulated genes by phenanthrene were similar to those confirmed by oligo-microarray examining the gene expressions by phenanthrene.

Those skilled in the art will appreciate that the conceptions and specific embodiments disclosed in the foregoing description may be readily utilized as a basis for modifying or designing other embodiments for carrying out the same purposes of the present invention. Those skilled in the art will also appreciate that such equivalent embodiments do not depart from the spirit and scope of the invention as set forth in the appended claims.

【CLAIMS】**【Claim 1】**

A kit for identification of exposure to phenanthrene containing oligonucleotide comprising total length or a
5 part of a gene selected from the group consisting of the genes below or its complementary oligonucleotide:

GeneBank accession No: NM_004420(DUSP8, Dual
specificity phosphatase 8), GeneBank accession No:
L11329(DUSP2, Dual specificity phosphatase 2), GeneBank
10 accession No: BC094766(PKN1, Protein kinase N1), GeneBank
accession No: AY247738(TRIB3, Tribbles homolog
3(Drosophila)), GeneBank accession No: AK129595(GADD45B,
Growth arrest and DNA-damage-inducible, beta), GeneBank
accession No: AB208849(SHC1, SHC(Src homology 2 domain
15 containing) transforming protein 1), GeneBank accession No:
X02812(TGFB1, Transforming growth factor, beta 1(Camurati-
Engelmann disease)), GeneBank accession No: NM_198951(TGM2,
Transglutaminase 2(C polypeptide, protein-glutamine-gamma-
glutamyltransferase)), GeneBank accession No:
20 NM_147780(CTSB, Cathepsin B), GeneBank accession No:
NM_078467(CDKN1A, Cyclin-dependent kinase inhibitor 1A(p21,
Cip1)), GeneBank accession No: NM_033027(AXUD1, AXIN1 up-
regulated 1), GeneBank accession No: NM_032797(AMID,
Apoptosis-inducing factor(AIF)-like mitochondrion-
25 associated inducer of death), GeneBank accession No:

NM_021960(MCL1, Myeloid cell leukemia sequence 1(BCL2-related)), GeneBank accession No: NM_016639(TNFRSF12A, Tumor necrosis factor receptor superfamily, member 12A), GeneBank accession No: NM_016222(DDX41, DEAD(Asp-Glu-Ala-Asp) box polypeptide 41), GeneBank accession No: NM_013246(CLC, Cardiotrophin-like cytokine factor 1), GeneBank accession No: NM_004401(DFFA, DNA fragmentation factor, 45kDa, alpha polypeptide), GeneBank accession No: NM_004281(BAG3, BCL2-associated athanogene 3), GeneBank accession No: NM_003897(IER3, Immediate early response 3), GeneBank accession No: NM_003806(HRK, Harakiri, BCL2 interacting protein(contains only BH3 domain)), GeneBank accession No: NM_003639(IKBKG, Inhibitor of kappa light polypeptide gene enhancer in B-cells, kinase gamma), GeneBank accession No: NM_003311(PHLDA2, Pleckstrin homology-like domain, family A, member 2), GeneBank accession No: NM_002737(PRKCA, Protein kinase C, alpha), GeneBank accession No: NM_002648(PIM1, Pim-1 oncogene), GeneBank accession No: NM_002507(NGFR, Nerve growth factor receptor(TNFR superfamily, member 16)), GeneBank accession No: NM_002305(LGALS1, Lectin, galactoside-binding, soluble, 1(galectin 1)), GeneBank accession No: NM_001013398(IGFBP3, Insulin-like growth factor binding protein 3), GeneBank accession No: BX640923(MDM4, Mdm4, transformed 3T3 cell double minute 4, p53 binding protein(mouse)), GeneBank

accession No: BX537586(STK17A, Serine/threonine kinase
 17a(apoptosis-inducing)), GeneBank accession No:
 BG284742(P8, P8 protein(candidate of metastasis 1)),
 GeneBank accession No: BE903247(PDCD6IP, Programmed cell
 5 death 6 interacting protein), GeneBank accession No:
 BC027949(P2RX1, Purinergic receptor P2X, ligand-gated ion
 channel, 1), GeneBank accession No: BC006365(PSEN2,
 Presenilin 2(Alzheimer disease 4)), GeneBank accession No:
 AY869712(PPP1R13L, Protein phosphatase 1,
 10 regulatory(inhibitor) subunit 13 like), GeneBank accession
 No: AY028896(CARD10, Caspase recruitment domain family,
 member 10), GeneBank accession No: AK122614(PPARD,
 Peroxisome proliferative activated receptor, delta),
 GeneBank accession No: AK092872(ERCC2, Excision repair
 15 cross-complementing rodent repair deficiency,
 complementation group 2(xeroderma pigmentosum D)), GeneBank
 accession No: AK092808(RRAGC, Ras-related GTP binding C),
 GeneBank accession No: AJ001898(GDNF, Glial cell derived
 neurotrophic factor), GeneBank accession No:
 20 AF220656(PHLDA1, Pleckstrin homology-like domain, family A,
 member 1), GeneBank accession No: AF055634(UNC5C, Unc-5
 homolog C(C. elegans)), GeneBank accession No:
 AB209485(VEGF, Vascular endothelial growth factor),
 GeneBank accession No: AB096256(UNC5B, Unc-5 homolog B(C.
 25 elegans)), GeneBank accession No: AB007960(SH3GLB1, SH3-

domain GRB2-like endophilin B1), GeneBank accession No:
X06374(PDGFA, Platelet-derived growth factor alpha
polypeptide), GeneBank accession No: S62138(DDIT3, DNA-
damage-inducible transcript 3), GeneBank accession No:
5 NM_078487(CDKN2B, Cyclin-dependent kinase inhibitor 2B(p15,
inhibits CDK4)), GeneBank accession No: NM_012127(CIZ1,
CDKN1A interacting zinc finger protein 1), GeneBank
accession No: NM_005883(APC2, Adenomatosis polyposis coli
2), GeneBank accession No: NM_004196(CDKL1, Cyclin-
10 dependent kinase-like 1(CDC2-related kinase)), GeneBank
accession No: NM_003236(TGFA, Transforming growth factor,
alpha), GeneBank accession No: NM_001261(CDK9, Cyclin-
dependent kinase 9(CDC2-related kinase)), GeneBank
accession No: NM_001007271(DUSP13, Dual specificity
15 phosphatase 13), GeneBank accession No: CR749511(PARC, P53-
associated parkin-like cytoplasmic protein), GeneBank
accession No: CR623038(ID2, Inhibitor of DNA binding 2,
dominant negative helix-loop-helix protein), GeneBank
accession No: CR618371(EGFR, Epidermal growth factor
20 receptor(erythroblastic leukemia viral(v-erb-b) oncogene
homolog, avian)), GeneBank accession No: BF965144(IFITM1,
Interferon induced transmembrane protein 1(9-27)), GeneBank
accession No: AK127679(DUSP1, Dual specificity phosphatase
1), GeneBank accession No: AK096276(CCND3, Cyclin D3),
25 GeneBank accession No: AB209586(MAPK13, Mitogen-activated

protein kinase 13), GeneBank accession No: AB209465(PCTK1,
 PCTAIRE protein kinase 1), GeneBank accession No:
 Z19588(SKIL, SKI-like), GeneBank accession No:
 NM_020429(SMURF1, SMAD specific E3 ubiquitin protein ligase
 5 1), GeneBank accession No: NM_014767(SPOCK2,
 Sparc/osteonectin, cwcw and kazal-like domains
 proteoglycan(testican) 2), GeneBank accession No:
 NM_005979(S100A13, S100 calcium binding protein A13),
 GeneBank accession No: NM_005187(CBFA2T3, Core-binding
 10 factor, runt domain, alpha subunit 2; translocated to, 3),
 GeneBank accession No: NM_004364(CEBPA, CCAAT/enhancer
 binding protein(C/EBP), alpha), GeneBank accession No:
 NM_001769(CD9, CD9 antigen(p24)), GeneBank accession No:
 NM_001718(BMP6, Bone morphogenetic protein 6), GeneBank
 15 accession No: NM_000641(IL11, Interleukin 11), GeneBank
 accession No: BX647459(SERPINE2, Serpin peptidase inhibitor,
 clade E(nexin, plasminogen activator inhibitor type 1),
 member 2), GeneBank accession No: BQ066037(RPS19, Ribosomal
 protein S19), GeneBank accession No: BE791300(EDF1,
 20 Endothelial differentiation-related factor 1), GeneBank
 accession No: BC038504(SNF1LK, SNF1-like kinase), GeneBank
 accession No: AL832287(ZAP70, Zeta-chain(TCR) associated
 protein kinase 70kDa), GeneBank accession No:
 AK125742(PCGF1, Polycomb group ring finger 1), GeneBank
 25 accession No: AK124709(NDRG1, N-myc downstream regulated

gene 1), GeneBank accession No: AB011157(PTDSR, Phosphatidylserine receptor), GeneBank accession No: NM_013255(MKLN1, Muskelein 1, intracellular mediator containing kelch motifs), GeneBank accession No: 5 NM_006572(GNA13, Guanine nucleotide binding protein(G protein), alpha 13), GeneBank accession No: NM_002211(ITGB1, Integrin, beta 1(fibronectin receptor, beta polypeptide, antigen CD29 includes MDF2, MSK12)), GeneBank accession No: CR601067(PLAUR, Plasminogen activator, urokinase receptor), 10 GeneBank accession No: BC050456(THBS4, Thrombospondin 4), GeneBank accession No: AK027389(CXCL16, Chemokine(C-X-C motif) ligand 16), GeneBank accession No: AJ132099(VNN1, Vanin 1), GeneBank accession No: XM_371354(FLJ10157, Hypothetical protein FLJ10157), GeneBank accession No: 15 XM_208313(TPM3, Similar to tropomyosin 4), GeneBank accession No: XM_208270(ACR, Acrosin-like protease), GeneBank accession No: NM_203353(PDLIM7, PDZ and LIM domain 7(enigma)), GeneBank accession No: NM_201382(PLEC1, Plectin 1, intermediate filament binding protein 500kDa), GeneBank 20 accession No: NM_182961(SYNE1, Spectrin repeat containing, nuclear envelope 1), GeneBank accession No: NM_181826(NF2, Neurofibromin 2(bilateral acoustic neuroma)), GeneBank accession No: NM_172069(PLEKHH2, Pleckstrin homology domain containing, family H(with MyTH4 domain) member 2), GeneBank 25 accession No: NM_022648(TNS, Tensin 1), GeneBank accession

No: NM_017556(FBLP-1, Filamin binding LIM protein 1),
 GeneBank accession No: NM_016081(KIAA0992, Palladin,
 cytoskeletal associated protein), GeneBank accession No:
 NM_006617(NES, Nestin), GeneBank accession No:
 5 NM_006262(PRPH, Peripherin), GeneBank accession No:
 NM_005100(AKAP12, A kinase(PRKA) anchor protein(gravin) 12),
 GeneBank accession No: NM_004368(CNN2, Calponin 2),
 GeneBank accession No: NM_003388(CYLN2, Cytoplasmic linker
 2), GeneBank accession No: NM_003370(VASP, Vasodilator-
 10 stimulated phosphoprotein), GeneBank accession No:
 NM_003128(SPTBN1, Spectrin, beta, non-erythrocytic 1),
 GeneBank accession No: NM_002705(PPL, Periplakin), GeneBank
 accession No: NM_002475(MLC1SA, Myosin light chain 1 slow
 a), GeneBank accession No: NM_002018(FLII, Flightless I
 15 homolog(Drosophila)), GeneBank accession No: NM_001465(FYB,
 FYN binding protein(FYB-120/130)), GeneBank accession No:
 NM_001069(TUBB2, Tubulin, beta 2A), GeneBank accession No:
 CR625172(MGC8685, Tubulin, beta 2B), GeneBank accession No:
 CR616919(KRT18, Keratin 18), GeneBank accession No:
 20 CR606241(ACTG1, Actin, gamma 1), GeneBank accession No:
 CB240572(MYH11, Myosin, heavy polypeptide 11, smooth
 muscle), GeneBank accession No: BX648253(PTPN3, Protein
 tyrosine phosphatase, non-receptor type 3), GeneBank
 accession No: BX648190(WDR1, WD repeat domain 1), GeneBank
 25 accession No: BX641076(ACTN1, Actinin, alpha 1), GeneBank

accession No: BX537978(EPB41L1, Erythrocyte membrane
 protein band 4.1-like 1), GeneBank accession No:
 BG121847(NUDC, Nuclear distribution gene C homolog(A.
 nidulans)), GeneBank accession No: BC068013(MYO1C, Myosin
 5 IC), GeneBank accession No: BC065499(MAST2, Microtubule
 associated serine/threonine kinase 2), GeneBank accession
 No: BC051890(TUBG2, Tubulin, gamma 2), GeneBank accession
 No: BC041874(MAP1LC3B, Microtubule-associated protein 1
 light chain 3 beta), GeneBank accession No: BC012597(ACTA1,
 10 Actin, alpha 1, skeletal muscle), GeneBank accession No:
 AY484427(KIF17, Kinesin family member 17), GeneBank
 accession No: AK130546(STOML2, Stomatin(EPB72)-like 2),
 GeneBank accession No: AK124711(CORO2B, Coronin, actin
 binding protein, 2B), GeneBank accession No: AK123974(MYL5,
 15 Myosin, light polypeptide 5, regulatory), GeneBank
 accession No: AK092792(LOC389833, Similar to hypothetical
 protein MGC27019), GeneBank accession No: AK026518(MYOHD1,
 Myosin head domain containing 1), GeneBank accession No:
 AK024500(NICAL, Microtubule associated monooxygenase,
 20 calponin and LIM domain containing 1), GeneBank accession
 No: AF085886(FLJ46675, Ribosomal protein L29 pseudogene 2),
 GeneBank accession No: AB209997(MYO9B, Myosin IXB),
 GeneBank accession No: Y12692(WNT11, Wingless-type MMTV
 integration site family, member 11), GeneBank accession No:
 25 Y11307(CYR61, Cysteine-rich, angiogenic inducer, 61),

GeneBank accession No: X17033(ITGA2, Integrin, alpha 2(CD49B, alpha 2 subunit of VLA-2 receptor)), GeneBank accession No: U41763(CLTCL1, Clathrin, heavy polypeptide-like 1), GeneBank accession No: NM_153609(TMPRSS6, Transmembrane protease, serine 6), GeneBank accession No: NM_031483(ITCH, Itchy homolog E3 ubiquitin protein ligase(mouse)), GeneBank accession No: NM_024342(GRLF1, Glucocorticoid receptor DNA binding factor 1), GeneBank accession No: NM_017555(EGLN2, Egl nine homolog 2(C. elegans)), GeneBank accession No: NM_016569(TBX3, T-box 3(ulnar mammary syndrome)), GeneBank accession No: NM_004148(NINJ1, Ninjurin 1), GeneBank accession No: NM_003377(VEGFB, Vascular endothelial growth factor B), GeneBank accession No: NM_001983(ERCC1, Excision repair cross-complementing rodent repair deficiency, complementation group 1(includes overlapping antisense sequence)), GeneBank accession No: NM_001552(IGFBP4, Insulin-like growth factor binding protein 4), GeneBank accession No: NM_001430(EPAS1, Endothelial PAS domain protein 1), GeneBank accession No: NM_001300(KLF6, Kruppel-like factor 6), GeneBank accession No: NM_001012661(SLC3A2, Solute carrier family 3(activators of dibasic and neutral amino acid transport), member 2), GeneBank accession No: NM_000596(IGFBP1, Insulin-like growth factor binding protein 1), GeneBank accession No: NM_000474(TWIST1, Twist

homolog 1(acrocephalosyndactyly 3; Saethre-Chotzen syndrome)(Drosophila)), GeneBank accession No: BX649103(ChGn, Chondroitin beta1,4 N-acetylgalactosaminyltransferase), GeneBank accession No: 5 BM913048(TIMP1, TIMP metalloproteinase inhibitor 1), GeneBank accession No: BM904612(S100A6, S100 calcium binding protein A6(calycyclin)), GeneBank accession No: BM556279(EMP3, Epithelial membrane protein 3), GeneBank accession No: BC015041(VAT1, Family with sequence 10 similarity 82, member C), GeneBank accession No: AY258066(OKL38, Pregnancy-induced growth inhibitor), GeneBank accession No: AK126729(NDRG4, NDRG family member 4), GeneBank accession No: AK090459(NFE2L1, Nuclear factor(erythroid-derived 2)-like 1), GeneBank accession No: 15 AK074163(ROBO4, Roundabout homolog 4, magic roundabout(Drosophila)), GeneBank accession No: AK024680(FLJ21027 fis, CDNA: FLJ21027 fis, clone CAE07110), GeneBank accession No: AF176422(HEY1, Hairy/enhancer-of-split related with YRPW motif 1), GeneBank accession No: 20 AF003837(JAG1, Jagged 1(Alagille syndrome)), GeneBank accession No: AB209322(SEMA3B, Sema domain, immunoglobulin domain(Ig), short basic domain, secreted,(semaphorin) 3B), GeneBank accession No: AB011150(NRXN1, Neurexin 1), GeneBank accession No: NM_201589(MAFA, V-maf 25 musculoaponeurotic fibrosarcoma oncogene homolog A(avian)),

GeneBank accession No: NM_052999(CKLFSF1, CKLF-like MARVEL transmembrane domain containing 1), GeneBank accession No: NM_006644(HSPH1, Heat shock 105kDa/110kDa protein 1), GeneBank accession No: NM_005438(FOSL1, FOS-like antigen 1),

5 GeneBank accession No: NM_004996(ABCC1, ATP-binding cassette, sub-family C(CFTR/MRP), member 1), GeneBank accession No: NM_002658(PLAU, Plasminogen activator, urokinase), GeneBank accession No: NM_001353(AKR1C1, Aldo-keto reductase family 1, member C1(dihydrodiol

10 dehydrogenase 1; 20-alpha(3-alpha)-hydroxysteroid dehydrogenase)), GeneBank accession No: H18681(C20orf139, Sulfiredoxin 1 homolog(*S. cerevisiae*)), GeneBank accession No: DR004094(HAMP, Hecpidin antimicrobial peptide), GeneBank accession No: BC082272(KCNMB3, Potassium large

15 conductance calcium-activated channel, subfamily M beta member 3), GeneBank accession No: BC040494(DNAJB2, DnaJ(Hsp40) homolog, subfamily B, member 2), GeneBank accession No: BC018064(ATF6, Activating transcription factor 6), GeneBank accession No: BC006523(SGK2,

20 Serum/glucocorticoid regulated kinase 2), GeneBank accession No: AK090482(CXCL12, Chemokine(C-X-C motif) ligand 12(stromal cell-derived factor 1)), GeneBank accession No: AF219946(TULP4, Tubby like protein 4), GeneBank accession No: AB209112(SLC2A8, Solute carrier

25 family 2,(facilitated glucose transporter) member 8),

GeneBank accession No: NM_005242(F2RL1, Coagulation factor
II(thrombin) receptor-like 1), GeneBank accession No:
NM_001002029(C4A, Complement component 4B, telomeric),
GeneBank accession No: NM_000539(RHO, Rhodopsin(opsin 2,
5 rod pigment)(retinitis pigmentosa 4, autosomal dominant)),
GeneBank accession No: BX649164(PAI, serpin peptidase
inhibitor, clade E(nexin, plasminogen activator inhibitor
type 1), member 1), GeneBank accession No: BM918324(LY96,
Lymphocyte antigen 96), GeneBank accession No:
10 AB209647(NCF2, Neutrophil cytosolic factor 2(65kDa, chronic
granulomatous disease, autosomal 2)), GeneBank accession
No: NM_152221(CSNK1E, Casein kinase 1, epsilon), GeneBank
accession No: NM_017999(RNF31, Ring finger protein 31),
GeneBank accession No: NM_016819(OGG1, 8-oxoguanine DNA
15 glycosylase), GeneBank accession No: NM_016816(OAS1, 2',5'-
oligoadenylate synthetase 1, 40/46kDa), GeneBank accession
No: NM_012235(SCAP, SREBP cleavage-activating protein),
GeneBank accession No: NM_006384(CIB1, Calcium and integrin
binding 1(calmyrin)), GeneBank accession No: NM_001779(CD58,
20 CD58 antigen,(lymphocyte function-associated antigen 3)),
GeneBank accession No: CB055213(ICOSLG, Inducible T-cell
co-stimulator ligand), GeneBank accession No:
BX641029(MASP1, Mannan-binding lectin serine peptidase
1(C4/C2 activating component of Ra-reactive factor)),
25 GeneBank accession No: BQ053419(BATF, Basic leucine zipper

transcription factor, ATF-like), GeneBank accession No:
 BC039299(STIP1, Stress-induced-phosphoprotein
 1(Hsp70/Hsp90-organizing protein)), GeneBank accession No:
 AY055760(DAF, Decay accelerating factor for complement(CD55,
 5 Cromer blood group system)), GeneBank accession No:
 AK130188(FGR, Gardner-Rasheed feline sarcoma viral(v-fgr)
 oncogene homolog), GeneBank accession No: AK095326(MUS81,
 MUS81 endonuclease homolog(yeast)), GeneBank accession No:
 NM_017670(OTUB1, OTU domain, ubiquitin aldehyde binding 1),
 10 GeneBank accession No: NM_003004(SECTM1, Secreted and
 transmembrane 1), GeneBank accession No: NM_002309(LIF,
 Hypothetical protein MGC20647), GeneBank accession No:
 NM_001421(ELF4, E74-like factor 4(ets domain transcription
 factor)), GeneBank accession No: NM_000418(IL4R,
 15 Interleukin 4 receptor), GeneBank accession No:
 BI909222(FCER1G, Fc fragment of IgE, high affinity I,
 receptor for; gamma polypeptide), GeneBank accession No:
 BF569086(NK4, Interleukin 32), GeneBank accession No:
 BC014470(AZGP1, Alpha-2-glycoprotein 1, zinc), GeneBank
 20 accession No: BC020744(AKR1C4, Aldo-keto reductase family 1,
 member C4(chlordecone reductase; 3-alpha hydroxysteroid
 dehydrogenase, type I; dihydrodiol),dehydrogenase 4),
 GeneBank accession No: BQ939577(AKR1C3, Aldo-keto reductase
 family 1, member C3(3-alpha hydroxysteroid dehydrogenase,
 25 type II)), GeneBank accession No: NM_000499(CYP1A1,

Cytochrome P450, family 1, subfamily A, polypeptide 1),
 GeneBank accession No: NM_030622(CYP2S1, Cytochrome P450,
 family 2, subfamily S, polypeptide 1), GeneBank accession
 No: NM_184041(ALDOA, Aldolase A, fructose-bisphosphate),
 5 GeneBank accession No: NM_024307(MGC4171, Hypothetical
 protein LOC283901), GeneBank accession No: NM_005336(HDLBP,
 High density lipoprotein binding protein(vigilin)),
 GeneBank accession No: NM_002627(PFKP, Phosphofructokinase,
 platelet), GeneBank accession No: BX648281(LDLR, Low
 10 density lipoprotein receptor(familial
 hypercholesterolemia)), GeneBank accession No:
 BC069201(FLJ22761, Hexokinase domain containing 1),
 GeneBank accession No: BC030207(NR0B2, Nuclear receptor
 subfamily 0, group B, member 2), GeneBank accession No:
 15 AL833069(KIAA1434, Hypothetical protein KIAA1434), GeneBank
 accession No: AK124656(ENO2, Enolase 2(gamma, neuronal)),
 GeneBank accession No: AK094474(RHOC, Ras homolog gene
 family, member C), GeneBank accession No: AK093461(ISYNA1,
 Myo-inositol 1-phosphate synthase A1), GeneBank accession
 20 No: AB053232(GAL3ST3, Galactose-3-O-sulfotransferase 3),
 GeneBank accession No: AB045292(TMEM8, Transmembrane
 protein 8(five membrane-spanning domains)), GeneBank
 accession No: NM_004753(DHRS3, Dehydrogenase/reductase(SDR
 family) member 3), GeneBank accession No: NM_002900(RBP3,
 25 Retinol binding protein 3, interstitial), GeneBank

accession No: NM_001995(ACSL1, Acyl-CoA synthetase long-
 chain family member 1), GeneBank accession No:
 NM_000018(ACADVL, Acyl-Coenzyme A dehydrogenase, very long
 chain), GeneBank accession No: BC094756(CRA, Myotubularin
 5 related protein 11), GeneBank accession No: BC050553(NTE,
 Neuropathy target esterase), GeneBank accession No:
 BC033110(HSD17B1, Hydroxysteroid(17-beta) dehydrogenase 1),
 GeneBank accession No: AY268890(TPP1, Tripeptidyl peptidase
 I), GeneBank accession No: AK172798(CPT1A, Carnitine
 10 palmitoyltransferase 1A(liver)), GeneBank accession No:
 AK096809(CYP4F8, Cytochrome P450, family 4, subfamily F,
 polypeptide 8), GeneBank accession No: AK000600(SIAT7D,
 ST6(alpha-N-acetyl-neuraminyl-2,3-beta- galactosyl-1,3)-N-
 acetylgalactosaminide alpha-2,6-sialyltransferase 4),
 15 GeneBank accession No: AB002454(CYP4F3, Cytochrome P450,
 family 4, subfamily F, polypeptide 3), GeneBank accession
 No: Z29093(DDR1, Discoidin domain receptor family, member
 1), GeneBank accession No: Z25424(MKNK2, MAP kinase
 interacting serine/threonine kinase 2), GeneBank accession
 20 No: XM_291277(DKFZp761P0423, Hypothetical protein
 DKFZp761P0423), GeneBank accession No: XM_038150(MAST3,
 Microtubule associated serine/threonine kinase 3), GeneBank
 accession No: U88357(ERBB3, V-erb-b2 erythroblastic
 leukemia viral oncogene homolog 3(avian)), GeneBank
 25 accession No: NM_025195(TRIB1, Tribbles homolog

1(Drosophila)), GeneBank accession No: NM_020639(RIPK4,
 Receptor-interacting serine-threonine kinase 4), GeneBank
 accession No: NM_014172(PHPT1, Phosphohistidine phosphatase
 1), GeneBank accession No: NM_006254(PRKCD, Protein kinase
 5 C, delta), GeneBank accession No: NM_005415(SLC20A1, Solute
 carrier family 20(phosphate transporter), member 1),
 GeneBank accession No: NM_005026(PIK3CD, Phosphoinositide-
 3-kinase, catalytic, delta polypeptide), GeneBank accession
 No: NM_004431(EPHA2, EPH receptor A2), GeneBank accession
 10 No: NM_004419(DUSP5, Dual specificity phosphatase 5),
 GeneBank accession No: NM_004327(BCR, Breakpoint cluster
 region), GeneBank accession No: NM_004231(ATP6V1F, ATPase,
 H⁺ transporting, lysosomal 14kDa, V1 subunit F), GeneBank
 accession No: NM_004090(DUSP3, Dual specificity phosphatase
 15 3(vaccinia virus phosphatase VH1-related)), GeneBank
 accession No: NM_002843(PTPRJ, Protein tyrosine phosphatase,
 receptor type, J), GeneBank accession No: NM_002496(NDUFS8,
 NADH dehydrogenase(ubiquinone) Fe-S protein 8, 23kDa(NADH-
 coenzyme Q reductase)), GeneBank accession No:
 20 NM_001001852(PIM3, Pim-3 oncogene), GeneBank accession No:
 L76191(IRAK1, Interleukin-1 receptor-associated kinase 1),
 GeneBank accession No: D15049(PTPRH, Protein tyrosine
 phosphatase, receptor type, H), GeneBank accession No:
 BC065207(ATP6V0D2, ATPase, H⁺ transporting, lysosomal 38kDa,
 25 V0 subunit d isoform 2), GeneBank accession No:

BC035578(STK24, Serine/threonine kinase 24(STE20 homolog, yeast)), GeneBank accession No: BC028724(DUSP18, Dual specificity phosphatase 18), GeneBank accession No: AL117482(ULK3, Unc-51-like kinase 3(C. elegans)), GeneBank
5 accession No: AK126879(PCTK3, PCTAIRE protein kinase 3), GeneBank accession No: AB209416(ILK, Integrin-linked kinase-2), GeneBank accession No: NM_000782(CYP24A1, Cytochrome P450, family 24, subfamily A, polypeptide 1), GeneBank accession No: CR597101(ZFP36, Zinc finger protein
10 36, C3H type, homolog(mouse)), GeneBank accession No: CR936799(FHL2, Four and a half LIM domains 2), GeneBank accession No: M24898(NR1D1, Nuclear receptor subfamily 1, group D, member 1), GeneBank accession No: AF132818(KLF5, Kruppel-like factor 5(intestinal)), GeneBank accession No:
15 AK055337(ZNF213, Zinc finger protein 213), GeneBank accession No: BC008834(PHF1, PHD finger protein 1), GeneBank accession No: AK126918(GLIS2, GLIS family zinc finger 2), GeneBank accession No: BC042692(CTL2, Solute carrier family 44, member 2), GeneBank accession No:
20 NM_002224(ITPR3, Inositol 1,4,5-triphosphate receptor, type 3), GeneBank accession No: AK095363(AQP3, Aquaporin 3), GeneBank accession No: NM_174953(ATP2A3, ATPase, Ca++ transporting, ubiquitous), GeneBank accession No: BC042390(VTI1B, Vesicle transport through interaction with
25 t-SNAREs homolog 1B(yeast)), GeneBank accession No:

NM_016113(TRPV2, Transient receptor potential cation channel, subfamily V, member 2), GeneBank accession No: BM926478(RBP1, Retinol binding protein 1, cellular), GeneBank accession No: NM_000069(CACNA1S, Calcium channel, voltage-dependent, L type, alpha 1S subunit), GeneBank accession No: AK002107(RAB3B, RAB3B, member RAS oncogene family), GeneBank accession No: NM_013321(SNX8, Sorting nexin 8), GeneBank accession No: AK125026(SLC6A12, Solute carrier family 6(neurotransmitter transporter, betaine/GABA), member 12), GeneBank accession No: NM_005843(STAM2, Signal transducing adaptor molecule(SH3 domain and ITAM motif) 2), GeneBank accession No: AK092512(SLC16A5, Solute carrier family 16(monocarboxylic acid transporters), member 5), GeneBank accession No: U49248(ABCC2, ATP-binding cassette, sub-family C(CFTR/MRP), member 2), GeneBank accession No: AK172792(SCNN1A, Sodium channel, nonvoltage-gated 1 alpha), GeneBank accession No: BC044656(CASC3, Cancer susceptibility candidate 3), GeneBank accession No: NM_203403(C9orf150, Chromosome 9 open reading frame 150), GeneBank accession No: NM_080388(S100A16, S100 calcium binding protein A16), GeneBank accession No: NM_031286(SH3BGRL3, SH3 domain binding glutamic acid-rich protein like 3), GeneBank accession No: NM_022153(PP2135, Chromosome 10 open reading frame 54), GeneBank accession No: NM_004864(GDF15, Growth

differentiation factor 15), GeneBank accession No:
 NM_003330(TXNRD1, Thioredoxin reductase 1), GeneBank
 accession No: NM_001013632(LOC343521, Similar to
 hypothetical protein 4833401D15), GeneBank accession No:
 5 BX537968(LOC51149, Hypothetical LOC51149), GeneBank
 accession No: BU945318(MT2A, Hypothetical gene supported by
 X97260; BC070289), GeneBank accession No: BQ683841(S100A11,
 S100 calcium binding protein A11(calgizzarin)), GeneBank
 accession No: BQ276852(TMSB10, Thymosin, beta 10), GeneBank
 10 accession No: AK126182(KIAA1949, KIAA1949), GeneBank
 accession No: AK124751(CAPN2, Calpain 2,(m/II) large
 subunit), GeneBank accession No: AK095079(RGC32, Response
 gene to complement 32), GeneBank accession No:
 AB075871(FLJ42654, Golgi transport 1 homolog A(S.
 15 cerevisiae)), GeneBank accession No: AK125150(MAPK8,
 Mitogen-activated protein kinase 8), GeneBank accession No:
 NM_002758(MAP2K6, Mitogen-activated protein kinase kinase
 6), GeneBank accession No: NM_004612(TGFBR1, Transforming
 growth factor, beta receptor I(activin A receptor type II-
 20 like kinase, 53kDa)), GeneBank accession No:
 NM_145686(MAP4K4, Mitogen-activated protein kinase kinase
 kinase kinase 4), GeneBank accession No: XM_042066(MAP3K1,
 Mitogen-activated protein kinase kinase kinase 1), GeneBank
 accession No: AB011123(TNIK, TRAF2 and NCK interacting
 25 kinase), GeneBank accession No: AB209031(C5, Complement

component 5), GeneBank accession No: NM_022740(HIPK2, Homeodomain interacting protein kinase 2), GeneBank accession No: NM_148957(TNFRSF19, Tumor necrosis factor receptor superfamily, member 19), GeneBank accession No: 5 AB208909(ITGB2, Integrin, beta 2(antigen CD18(p95), lymphocyte function-associated antigen 1; macrophage antigen 1(mac-1) beta subunit)), GeneBank accession No: AB209211(TIA1, TIA1 cytotoxic granule-associated RNA binding protein), GeneBank accession No: AB209613(DNASE1L3, 10 Deoxyribonuclease I-like 3), GeneBank accession No: AK122825(HMGB1, High-mobility group box 1), GeneBank accession No: AK127326(PHF17, PHD finger protein 17), GeneBank accession No: AK223503(CASP1, Caspase 1, apoptosis-related cysteine peptidase(interleukin 1, beta, 15 convertase)), GeneBank accession No: BC013326(GAS2, Growth arrest-specific 2), GeneBank accession No: BC047698(IL7, Interleukin 7), GeneBank accession No: D79987(ESPL1, Extra spindle poles like 1(*S. cerevisiae*)), GeneBank accession No: NM_000893(KNG1, Kininogen 1), GeneBank accession No: 20 NM_001012271(BIRC5, Effector cell peptidase receptor 1), GeneBank accession No: NM_004938(DAPK1, Death-associated protein kinase 1), GeneBank accession No: NM_005879(TRIP, TRAF interacting protein), GeneBank accession No: NM_014739(BCLAF1, BCL2-associated transcription factor 1), 25 GeneBank accession No: NM_018947(CYCS, Cytochrome c,

somatic), GeneBank accession No: AB033337(MPHOSPH1, M-phase phosphoprotein 1), GeneBank accession No: AB209179(PLK1, Polo-like kinase 1(Drosophila)), GeneBank accession No: AB209337(CDC7, CDC7 cell division cycle 7(S. cerevisiae)),

5 GeneBank accession No: AF053305(BUB1, BUB1 budding uninhibited by benzimidazoles 1 homolog(yeast)), GeneBank accession No: AF053306(BUB1B, BUB1 budding uninhibited by benzimidazoles 1 homolog beta(yeast)), GeneBank accession No: AF345347(SPAG5, Sperm associated antigen 5), GeneBank

10 accession No: AK092638(CCNG2, Cyclin G2), GeneBank accession No: AK222819(NUSAP1, Nucleolar and spindle associated protein 1), GeneBank accession No: AL833191(SMC2L1, SMC2 structural maintenance of chromosomes 2-like 1(yeast)), GeneBank accession No: AY257469(CIT, Citron(rho-interacting, serine/threonine kinase 21)),

15 GeneBank accession No: AY367065(ASPM, Asp(abnormal spindle)-like, microcephaly associated(Drosophila)), GeneBank accession No: BC011000(CDCA5, Cell division cycle associated 5), GeneBank accession No: BC032677(UBE2C, Ubiquitin-conjugating enzyme E2C), GeneBank accession No: BC043502(NEK2, NIMA(never in mitosis gene a)-related kinase 2), GeneBank accession No: BU675073(PTTG1, Pituitary tumor-transforming 1), GeneBank accession No: BX647885(STMN1, Stathmin 1/oncoprotein 18), GeneBank accession No:

20 CR592757(BRRN1, Barren homolog 1(Drosophila)), GeneBank

25

accession No: CR597075(MAPRE2, Microtubule-associated
 protein, RP/EB family, member 2), GeneBank accession No:
 CR604810(CCNA2, Cyclin A2), GeneBank accession No:
 CR933728(CDC2, Cell division cycle 2, G1 to S and G2 to M),
 5 GeneBank accession No: NM_000919(PAM, Peptidylglycine
 alpha-amidating monooxygenase), GeneBank accession No:
 NM_001790(CDC25C, Cell division cycle 25C), GeneBank
 accession No: NM_001798(CDK2, Cyclin-dependent kinase 2),
 GeneBank accession No: NM_001813(CENPE, Centromere protein
 10 E, 312kDa), GeneBank accession No: NM_003318(TTK, TTK
 protein kinase), GeneBank accession No: NM_003981(PRC1,
 Protein regulator of cytokinesis 1), GeneBank accession No:
 NM_004523(KIF11, Kinesin family member 11), GeneBank
 accession No: NM_004701(CCNB2, Cyclin B2), GeneBank
 15 accession No: NM_005983(SKP2, S-phase kinase-associated
 protein 2(p45)), GeneBank accession No: NM_006101(KNTC2,
 Kinetochore associated 2), GeneBank accession No:
 NM_006845(KIF2C, Kinesin family member 2C), GeneBank
 accession No: NM_007375(TARDBP, TAR DNA binding protein),
 20 GeneBank accession No: NM_012112(TPX2, TPX2, microtubule-
 associated, homolog(Xenopus laevis)), GeneBank accession
 No: NM_014750(DLG7, Discs, large homolog 7(Drosophila)),
 GeneBank accession No: NM_015097(CLASP2, Cytoplasmic linker
 associated protein 2), GeneBank accession No:
 25 NM_016343(CENPF, Centromere protein F, 350/400ka(mitotin)),

GeneBank accession No: NM_016426(GTSE1, G-2 and S-phase expressed 1), GeneBank accession No: NM_018492(PBK, PDZ binding kinase), GeneBank accession No: NM_018685(ANLN, Anillin, actin binding protein(scrap homolog, Drosophila)),

5 GeneBank accession No: NM_020242(KNSL7, Kinesin family member 15), GeneBank accession No: NM_031966(CCNB1, Cyclin B1), GeneBank accession No: NM_138555(KIF23, Kinesin family member 23), GeneBank accession No: U65410(MAD2L1, MAD2 mitotic arrest deficient-like 1(yeast)), GeneBank accession

10 No: AB020656(CYLD, Cyldromatosis(turban tumor syndrome)), GeneBank accession No: AF033122(SESNI, Sestrin 1), GeneBank accession No: AK074377(UHRF1, Chromosome 19 open reading frame 31), GeneBank accession No: AK091170(CDKN2C, Cyclin-dependent kinase inhibitor 2C(p18, inhibits CDK4)),

15 GeneBank accession No: AK094323(NFYC, Nuclear transcription factor Y, gamma), GeneBank accession No: AY366508(LOH11CR2A, Loss of heterozygosity, 11, chromosomal region 2, gene A), GeneBank accession No: BC033086(TCF19, Transcription factor 19(SC1)), GeneBank accession No: BC040303(PTP4A1, Protein tyrosine phosphatase type IVA, member 1), GeneBank

20 accession No: BC040991(TFDP2, Transcription factor Dp-2(E2F dimerization partner 2)), GeneBank accession No: BC092412(SGOL2, Shugoshin-like 2(S. pombe)), GeneBank accession No: BQ278454(CKS1B, CDC28 protein kinase regulatory subunit 1B), GeneBank accession No:

25

BX649128(SES3, Sestrin 3), GeneBank accession No:
 CD049340(AURKB, Aurora kinase B), GeneBank accession No:
 M89914(NF1, Neurofibromin 1(neurofibromatosis, von
 Recklinghausen disease, Watson disease)), GeneBank
 5 accession No: NM_001005414(ZWINT, ZW10 interactor
 antisense), GeneBank accession No: NM_001008491(Sep 2,
 Septin 2), GeneBank accession No: NM_001274(CHEK1, CHK1
 checkpoint homolog(*S. pombe*)), GeneBank accession No:
 NM_002105(H2AFX, H2A histone family, member X), GeneBank
 10 accession No: NM_002388(MCM3, MCM3 minichromosome
 maintenance deficient 3(*S. cerevisiae*)), GeneBank accession
 No: NM_002417(MKI67, Antigen identified by monoclonal
 antibody Ki-67), GeneBank accession No: NM_002875(RAD51,
 RAD51 homolog(RecA homolog, *E. coli*)(*S. cerevisiae*)),
 15 GeneBank accession No: NM_003884(PCAF, P300/CBP-associated
 factor), GeneBank accession No: NM_004526(MCM2, MCM2
 minichromosome maintenance deficient 2, mitotin(*S.*
cerevisiae)), GeneBank accession No: NM_004847(AIF1,
 Allograft inflammatory factor 1), GeneBank accession No:
 20 NM_005915(MCM6, MCM6 minichromosome maintenance deficient
 6(MIS5 homolog, *S. pombe*)(*S. cerevisiae*)), GeneBank
 accession No: NM_012090(MACF1, Microtubule-actin
 crosslinking factor 1), GeneBank accession No:
 NM_012415(RAD54B, RAD54 homolog B(*S. cerevisiae*)), GeneBank
 25 accession No: NM_014264(PLK4, Polo-like kinase

4(*Drosophila*)), GeneBank accession No: NM_015714(G0S2, G0/G1switch 2), GeneBank accession No: NM_024680(FLJ23311, E2F transcription factor 8), GeneBank accession No: XM_034274(MYBL1, V-myb myeloblastosis viral oncogene homolog(avian)-like 1), GeneBank accession No: AK001720(FLJ10858, Nei endonuclease VIII-like 3(*E. coli*)), GeneBank accession No: AY032677(POLQ, Polymerase(DNA directed), theta), GeneBank accession No: BC034480(BLM, Bloom syndrome), GeneBank accession No: BC073161(RAD51C, RAD51 homolog C(*S. cerevisiae*)), GeneBank accession No: CR600021(HMGB2, High-mobility group box 2), GeneBank accession No: CR625391(RAD51AP1, RAD51 associated protein 1), GeneBank accession No: CR936783(FLJ40869, Hypothetical protein LOC284952), GeneBank accession No: DQ140356(KIAA1596, Fanconi anemia, complementation group M), GeneBank accession No: NM_001067(TOP2A, Topoisomerase(DNA) II alpha 170kDa), GeneBank accession No: NM_001618(PARP1, Poly(ADP-ribose) polymerase family, member 1), GeneBank accession No: NM_003362(UNG, Uracil-DNA glycosylase), GeneBank accession No: NM_006904(PRKDC, Protein kinase, DNA-activated, catalytic polypeptide), GeneBank accession No: NM_130398(EXO1, Exonuclease 1), GeneBank accession No: AB020807(TLR6, Toll-like receptor 6), GeneBank accession No: AB032980(DCDC2, Doublecortin domain containing 2), GeneBank accession No: AB209866(TFPI, Tissue factor pathway

inhibitor(lipoprotein-associated coagulation inhibitor)),
 GeneBank accession No: AK057015(HSPA4, Heat shock 70kDa
 protein 4), GeneBank accession No: AK095515(IFIT1,
 Interferon-induced protein with tetratricopeptide repeats
 5 1), GeneBank accession No: AK122686(IF, I
 factor(complement)), GeneBank accession No: AK123010(RRM2,
 Ribonucleotide reductase M2 polypeptide), GeneBank
 accession No: BC035582(TRIM22, Tripartite motif-containing
 22), GeneBank accession No: BX537894(LOC493869, Similar to
 10 RIKEN cDNA 2310016C16), GeneBank accession No: M14338(PROS1,
 Protein S(alpha)), GeneBank accession No: NM_000821(GGCX,
 Gamma-glutamyl carboxylase), GeneBank accession No:
 NM_000963(PTGS2, Prostaglandin-endoperoxide synthase
 2(prostaglandin G/H synthase and cyclooxygenase)), GeneBank
 15 accession No: NM_001001547(CD36, CD36 antigen(collagen type
 I receptor, thrombospondin receptor)), GeneBank accession
 No: NM_001512(GSTA4, Glutathione S-transferase A4),
 GeneBank accession No: NM_001629(ALOX5AP, Arachidonate 5-
 lipxygenase-activating protein), GeneBank accession No:
 20 NM_001752(CAT, Catalase), GeneBank accession No:
 NM_001837(CCR3, Chemokine(C-C motif) receptor 3), GeneBank
 accession No: NM_001979(EPHX2, Epoxide hydrolase 2,
 cytoplasmic), GeneBank accession No: NM_001994(F13B,
 Coagulation factor XIII, B polypeptide), GeneBank accession
 25 No: NM_002182(IL1RAP, Interleukin 1 receptor accessory

protein), GeneBank accession No: NM_006120(HLA-DMA, Major histocompatibility complex, class II, DM alpha), GeneBank accession No: NM_173216(SIAT1, ST6 beta-galactosamide alpha-2,6-sialyltransferase 1), GeneBank accession No: 5 NM_202002(FOXM1, Forkhead box M1), GeneBank accession No: AB163917(LRAP, Leukocyte-derived arginine aminopeptidase), GeneBank accession No: BC027881(AFP, Alpha-fetoprotein), GeneBank accession No: NM_015915(SPG3A, Spastic paraplegia 3A(autosomal dominant)), GeneBank accession No: 10 NM_000671(ADH5, Alcohol dehydrogenase 5(class III), chi polypeptide), GeneBank accession No: J05428(UGT2B7, UDP glucuronosyltransferase 2 family, polypeptide B7), GeneBank accession No: NM_000672(ADH6, Alcohol dehydrogenase 6(class V)), GeneBank accession No: M15943(ADH4, Alcohol 15 dehydrogenase 4(class II), pi polypeptide), GeneBank accession No: AK223395(FBP1, Fructose-1,6-bisphosphatase 1), GeneBank accession No: NM_000151(G6PC, Glucose-6-phosphatase, catalytic(glycogen storage disease type I, von Gierke disease)), GeneBank accession No: XM_113962(KIAA0650, 20 Structural maintenance of chromosomes flexible hinge domain containing 1), GeneBank accession No: AB020644(ACSL6, Acyl-CoA synthetase long-chain family member 6), GeneBank accession No: AB209907(PLD1, Phospholipase D1, phosphatidylcholine-specific), GeneBank accession No: 25 AF285167(ABCA1, ATP-binding cassette, sub-family A(ABC1),

member 1), GeneBank accession No: AF297872(TrERF1, Transcriptional regulating factor 1), GeneBank accession No: AF303134(ALDH8A1, Aldehyde dehydrogenase 8 family, member A1), GeneBank accession No: AF339053(PLA2G12B, 5 Phospholipase A2, group XIIB), GeneBank accession No: AK096018(HADHSC, L-3-hydroxyacyl-Coenzyme A dehydrogenase, short chain), GeneBank accession No: AK124635(PCSK9, Proprotein convertase subtilisin/kexin type 9), GeneBank accession No: AK127346(SIAT9, ST3 beta-galactoside alpha- 10 2,3-sialyltransferase 5), GeneBank accession No: AL359559(AGPS, Alkylglycerone phosphate synthase), GeneBank accession No: AY691170(PLCL3, Phospholipase C-like 3), GeneBank accession No: BG567934(APOM, Apolipoprotein M), GeneBank accession No: BX538214(C6orf167, Chromosome 6 open 15 reading frame 167), GeneBank accession No: BX640945(FADS2, Fatty acid desaturase 2), GeneBank accession No: BX648473(PIGK, Phosphatidylinositol glycan, class K), GeneBank accession No: BX648557(HSD17B2, Hydroxysteroid(17-beta) dehydrogenase 2), GeneBank accession No: 20 CR749601(ETNK1, Death-associated protein kinase 3), GeneBank accession No: NM_000859(HMGCR, 3-hydroxy-3-methylglutaryl-Coenzyme A reductase), GeneBank accession No: NM_001443(FABP1, Fatty acid binding protein 1, liver), GeneBank accession No: NM_002130(HMGCS1, 3-hydroxy-3- 25 methylglutaryl-Coenzyme A synthase 1(soluble)), GeneBank

accession No: NM_003725(RODH, Hydroxysteroid(17-beta)
 dehydrogenase 6), GeneBank accession No: NM_004845(PCYT1B,
 Phosphate cytidylyltransferase 1, choline, beta), GeneBank
 accession No: NM_014762(DHCR24, 24-dehydrocholesterol
 5 reductase), GeneBank accession No: NM_020139(DHRS6,
 Dehydrogenase/reductase(SDR family) member 6), GeneBank
 accession No: NM_020918(GPAM, Glycerol-3-phosphate
 acyltransferase, mitochondrial), GeneBank accession No:
 NM_032523(OSBPL6, Oxysterol binding protein-like 6),
 10 GeneBank accession No: NM_033505(SELI, Selenoprotein I),
 GeneBank accession No: Z28339(AKR1D1, Aldo-keto reductase
 family 1, member D1(delta 4-3-ketosteroid-5-beta-
 reductase)), GeneBank accession No: AK024899(ENPP3,
 Ectonucleotide pyrophosphatase/phosphodiesterase 3),
 15 GeneBank accession No: AK025546(PTPN4, Protein tyrosine
 phosphatase, non-receptor type 4(megakaryocyte)), GeneBank
 accession No: AK124910(ENPP2, Ectonucleotide
 pyrophosphatase/phosphodiesterase 2(autotaxin)), GeneBank
 accession No: BC035116(FLJ35059 fis, CDNA FLJ30761 fis,
 20 clone FEBRA2000538), GeneBank accession No: BC050565(PASK,
 PAS domain containing serine/threonine kinase), GeneBank
 accession No: L13436(NPR2, Natriuretic peptide receptor
 B/guanylate cyclase B(atrionatriuretic peptide receptor B)),
 GeneBank accession No: NM_001005862(ERBB2, V-erb-b2
 25 erythroblastic leukemia viral oncogene homolog 2,

neuro/glioblastoma derived oncogene homolog(avian)),
 GeneBank accession No: NM_005012(ROR1, Receptor tyrosine
 kinase-like orphan receptor 1), GeneBank accession No:
 NM_006035(CDC42BPB, CDC42 binding protein kinase beta(DMPK-
 5 like)), GeneBank accession No: NM_014791(MELK, Maternal
 embryonic leucine zipper kinase), GeneBank accession No:
 NM_023028(FGFR2, Fibroblast growth factor receptor
 2(bacteria-expressed kinase, keratinocyte growth factor
 receptor, craniofacial dysostosis 1, Crouzon syndrome,
 10 Pfeiffer yndrome, Jackson-Weiss syndrome)), GeneBank
 accession No: NM_080836(STK35, Serine/threonine kinase 35),
 GeneBank accession No: AF419331(FUSIP1, FUS interacting
 protein(serine/arginine-rich) 1), GeneBank accession No:
 AK091927(SFRS3, Splicing factor, arginine/serine-rich 3),
 15 GeneBank accession No: BC010266(HNRNPA1, Heterogeneous
 nuclear ribonucleoprotein A1), GeneBank accession No:
 BC012360(CTAGE5, CTAGE family, member 5), GeneBank
 accession No: BC036046(PLRG1, Pleiotropic regulator 1(PRL1
 homolog, Arabidopsis)), GeneBank accession No:
 20 BC065384(PCF11, PCF11, cleavage and polyadenylation factor
 subunit, homolog(S. cerevisiae)), GeneBank accession No:
 BX537360(CPSF5, Nudix(nucleoside diphosphate linked moiety
 X)-type motif 21), GeneBank accession No: BX537494(HNRPA2B1,
 Heterogeneous nuclear ribonucleoprotein A2/B1), GeneBank
 25 accession No: BX647784(HNRPR, Heterogeneous nuclear

ribonucleoprotein R), GeneBank accession No: CA455267(PPIH, Peptidyl prolyl isomerase H(cyclophilin H)), GeneBank accession No: CR596214(HNRPA0, Heterogeneous nuclear ribonucleoprotein A0), GeneBank accession No:

5 NM_001326(CSTF3, Hypothetical protein LOC283267), GeneBank accession No: NM_004640(BAT1, HLA-B associated transcript 1), GeneBank accession No: NM_005463(HNRPDL, Heterogeneous nuclear ribonucleoprotein D-like), GeneBank accession No: NM_006924(SFRS1, Splicing factor, arginine/serine-rich

10 1(splicing factor 2, alternate splicing factor)), GeneBank accession No: NM_012426(SF3B3, Splicing factor 3b, subunit 3, 130kDa), GeneBank accession No: NM_018048(FLJ10292, Mago-nashi homolog), GeneBank accession No: NM_030919(C20orf129, Chromosome 20 open reading frame 129),

15 GeneBank accession No: NM_031370(HNRPD, Heterogeneous nuclear ribonucleoprotein D(AU-rich element RNA binding protein 1, 37kDa)), GeneBank accession No: NM_138933(ACF, Apobec-1 complementation factor), GeneBank accession No: AB193259(ACE2, Angiotensin I converting enzyme(peptidyl-

20 dipeptidase A) 2), GeneBank accession No: BX648769(EWSR1, Ewing sarcoma breakpoint region 1), GeneBank accession No: AB023154(DTX4, Deltex 4 homolog(Drosophila)), GeneBank accession No: AL543755(VAV3, Vav 3 oncogene), GeneBank accession No: M75106(CPB2, Carboxypeptidase B2(plasma,

25 carboxypeptidase U)), GeneBank accession No:

NM_021045(ZNF248, Zinc finger protein 248), GeneBank
 accession No: AB209194(B4GALT6, UDP-Gal:betaGlcNAc beta
 1,4- galactosyltransferase, polypeptide 6), GeneBank
 accession No: AF279145(ANTXR1, Anthrax toxin receptor 1),
 5 GeneBank accession No: NM_025074(FRAS1, Fraser syndrome 1),
 GeneBank accession No: AK025790(KIF20A, Kinesin family
 member 20A), GeneBank accession No: NM_006152(LRMP,
 Lymphoid-restricted membrane protein), GeneBank accession
 No: NM_000340(SLC2A2, Solute carrier family 2(facilitated
 10 glucose transporter), member 2), GeneBank accession No:
 AF071592(KIF4A, Kinesin family member 4A), GeneBank
 accession No: NM_013277(RACGAP1, Rac GTPase activating
 protein 1), GeneBank accession No: AY043484(SCN1A, Sodium
 channel, voltage-gated, type I, alpha), GeneBank accession
 15 No: AY791349(KIF18A, Kinesin family member 18A), GeneBank
 accession No: NM_018018(SLC38A4, Solute carrier family 38,
 member 4), GeneBank accession No: AK094603(FLJ37284 fis,
 unnamed protein product; Homo sapiens cDNA FLJ37284 fis,
 clone BRAMY2013590.), GeneBank accession No:
 20 NM_021069(ARGBP2, Sorbin and SH3 domain containing 2),
 GeneBank accession No: NM_001005747(CACNB4, Calcium channel,
 voltage-dependent, beta 4 subunit), GeneBank accession No:
 AJ496568(SLC25A12, Solute carrier family 25(mitochondrial
 carrier, Aralar), member 12), GeneBank accession No:
 25 NM_030641(APOL6, Apolipoprotein L, 6), GeneBank accession

No: NM_173512(FLJ39822, Hypothetical protein FLJ39822),
 GeneBank accession No: NM_000037(ANK1, Ankyrin 1,
 erythrocytic), GeneBank accession No: NM_001011554(SLC13A3,
 Solute carrier family 13(sodium-dependent dicarboxylate
 5 transporter), member 3), GeneBank accession No:
 AB091343(C10orf3, Centrosomal protein 55kDa), GeneBank
 accession No: AK000643(ASB9, Ankyrin repeat and SOCS box-
 containing 9), GeneBank accession No: AK055221(FBXO5, F-box
 protein 5), GeneBank accession No: AK075271(SPTLC2L, Serine
 10 palmitoyltransferase, long chain base subunit 2-
 like(aminotransferase 2)), GeneBank accession No:
 AK122685(GLUD1, Glutamate dehydrogenase 1), GeneBank
 accession No: AK127098(FLJ10706, Chromosome 1 open reading
 frame 112), GeneBank accession No: AL133031(MLR1,
 15 Transcription factor MLR1), GeneBank accession No:
 AY007723(MAL2, Mal, T-cell differentiation protein 2),
 GeneBank accession No: BC022255(Spc25, Spindle pole body
 component 25 homolog(S. cerevisiae)), GeneBank accession
 No: BC041882(ATF7IP2, Activating transcription factor 7
 20 interacting protein 2), GeneBank accession No:
 BC052951(LMNB1, Lamin B1), GeneBank accession No:
 BC098313(FLJ20641, Hypothetical protein FLJ20641), GeneBank
 accession No: NM_001809(CENPA, Centromere protein A, 17kDa),
 GeneBank accession No: NM_145061(C13orf3, Chromosome 13
 25 open reading frame 3), GeneBank accession No:

XM_372695(LOC390859, PREDICTED: Homo sapiens similar to Chain A, Crystal Structure Of The R463a Mutant Of Human Glutamate Dehydrogenase(LOC390859), mRNA).

5 **【Claim 2】**

The kit according to claim 1, wherein the below genes are up-regulated by exposure to phenanthrene:

GeneBank accession No: NM_004420(DUSP8, Dual specificity phosphatase 8), GeneBank accession No:
 10 L11329(DUSP2, Dual specificity phosphatase 2), GeneBank accession No: BC094766(PKN1, Protein kinase N1), GeneBank accession No: AY247738(TRIB3, Tribbles homolog 3(Drosophila)), GeneBank accession No: AK129595(GADD45B, Growth arrest and DNA-damage-inducible, beta), GeneBank
 15 accession No: AB208849(SHC1, SHC(Src homology 2 domain containing) transforming protein 1), GeneBank accession No: X02812(TGFB1, Transforming growth factor, beta 1(Camurati-Engelmann disease)), GeneBank accession No: NM_198951(TGM2, Transglutaminase 2(C polypeptide, protein-glutamine-gamma-glutamyltransferase)), GeneBank accession No:
 20 NM_147780(CTSB, Cathepsin B), GeneBank accession No: NM_078467(CDKN1A, Cyclin-dependent kinase inhibitor 1A(p21, Cip1)), GeneBank accession No: NM_033027(AXUD1, AXIN1 up-regulated 1), GeneBank accession No: NM_032797(AMID, Apoptosis-inducing factor(AIF)-like mitochondrion-

25

associated inducer of death), GeneBank accession No:
NM_021960(MCL1, Myeloid cell leukemia sequence 1(BCL2-
related)), GeneBank accession No: NM_016639(TNFRSF12A,
Tumor necrosis factor receptor superfamily, member 12A),
5 GeneBank accession No: NM_016222(DDX41, DEAD(Asp-Glu-Ala-
Asp) box polypeptide 41), GeneBank accession No:
NM_013246(CLC, Cardiotrophin-like cytokine factor 1),
GeneBank accession No: NM_004401(DFFA, DNA fragmentation
factor, 45kDa, alpha polypeptide), GeneBank accession No:
10 NM_004281(BAG3, BCL2-associated athanogene 3), GeneBank
accession No: NM_003897(IER3, Immediate early response 3),
GeneBank accession No: NM_003806(HRK, Harakiri, BCL2
interacting protein(contains only BH3 domain)), GeneBank
accession No: NM_003639(IKBKG, Inhibitor of kappa light
15 polypeptide gene enhancer in B-cells, kinase gamma),
GeneBank accession No: NM_003311(PHLDA2, Pleckstrin
homology-like domain, family A, member 2), GeneBank
accession No: NM_002737(PRKCA, Protein kinase C, alpha),
GeneBank accession No: NM_002648(PIM1, Pim-1 oncogene),
20 GeneBank accession No: NM_002507(NGFR, Nerve growth factor
receptor(TNFR superfamily, member 16)), GeneBank accession
No: NM_002305(LGALS1, Lectin, galactoside-binding, soluble,
1(galectin 1)), GeneBank accession No: NM_001013398(IGFBP3,
Insulin-like growth factor binding protein 3), GeneBank
25 accession No: BX640923(MDM4, Mdm4, transformed 3T3 cell

double minute 4, p53 binding protein(mouse)), GeneBank
 accession No: BX537586(STK17A, Serine/threonine kinase
 17a(apoptosis-inducing)), GeneBank accession No:
 BG284742(P8, P8 protein(candidate of metastasis 1)),
 5 GeneBank accession No: BE903247(PDCD6IP, Programmed cell
 death 6 interacting protein), GeneBank accession No:
 BC027949(P2RX1, Purinergic receptor P2X, ligand-gated ion
 channel, 1), GeneBank accession No: BC006365(PSEN2,
 Presenilin 2(Alzheimer disease 4)), GeneBank accession No:
 10 AY869712(PPP1R13L, Protein phosphatase 1,
 regulatory(inhibitor) subunit 13 like), GeneBank accession
 No: AY028896(CARD10, Caspase recruitment domain family,
 member 10), GeneBank accession No: AK122614(PPARD,
 Peroxisome proliferative activated receptor, delta),
 15 GeneBank accession No: AK092872(ERCC2, Excision repair
 cross-complementing rodent repair deficiency,
 complementation group 2(xeroderma pigmentosum D)), GeneBank
 accession No: AK092808(RRAGC, Ras-related GTP binding C),
 GeneBank accession No: AJ001898(GDNF, Glial cell derived
 20 neurotrophic factor), GeneBank accession No:
 AF220656(PHLDA1, Pleckstrin homology-like domain, family A,
 member 1), GeneBank accession No: AF055634(UNC5C, Unc-5
 homolog C(C. elegans)), GeneBank accession No:
 AB209485(VEGF, Vascular endothelial growth factor),
 25 GeneBank accession No: AB096256(UNC5B, Unc-5 homolog B(C.

elegans)), GeneBank accession No: AB007960(SH3GLB1, SH3-domain GRB2-like endophilin B1), GeneBank accession No: X06374(PDGFA, Platelet-derived growth factor alpha polypeptide), GeneBank accession No: S62138(DDIT3, DNA-damage-inducible transcript 3), GeneBank accession No: NM_078487(CDKN2B, Cyclin-dependent kinase inhibitor 2B(p15, inhibits CDK4)), GeneBank accession No: NM_012127(CIZ1, CDKN1A interacting zinc finger protein 1), GeneBank accession No: NM_005883(APC2, Adenomatosis polyposis coli 2), GeneBank accession No: NM_004196(CDKL1, Cyclin-dependent kinase-like 1(CDC2-related kinase)), GeneBank accession No: NM_003236(TGFA, Transforming growth factor, alpha), GeneBank accession No: NM_001261(CDK9, Cyclin-dependent kinase 9(CDC2-related kinase)), GeneBank accession No: NM_001007271(DUSP13, Dual specificity phosphatase 13), GeneBank accession No: CR749511(PARC, P53-associated parkin-like cytoplasmic protein), GeneBank accession No: CR623038(ID2, Inhibitor of DNA binding 2, dominant negative helix-loop-helix protein), GeneBank accession No: CR618371(EGFR, Epidermal growth factor receptor(erythroblastic leukemia viral(v-erb-b) oncogene homolog, avian)), GeneBank accession No: BF965144(IFITM1, Interferon induced transmembrane protein 1(9-27)), GeneBank accession No: AK127679(DUSP1, Dual specificity phosphatase 1), GeneBank accession No: AK096276(CCND3, Cyclin D3),

GeneBank accession No: AB209586(MAPK13, Mitogen-activated protein kinase 13), GeneBank accession No: AB209465(PCTK1, PCTAIRE protein kinase 1), GeneBank accession No: Z19588(SKIL, SKI-like), GeneBank accession No: NM_020429(SMURF1, SMAD specific E3 ubiquitin protein ligase 1), GeneBank accession No: NM_014767(SPOCK2, Sparc/osteonectin, cwcw and kazal-like domains proteoglycan(testican) 2), GeneBank accession No: NM_005979(S100A13, S100 calcium binding protein A13), GeneBank accession No: NM_005187(CBFA2T3, Core-binding factor, runt domain, alpha subunit 2; translocated to, 3), GeneBank accession No: NM_004364(CEBPA, CCAAT/enhancer binding protein(C/EBP), alpha), GeneBank accession No: NM_001769(CD9, CD9 antigen(p24)), GeneBank accession No: NM_001718(BMP6, Bone morphogenetic protein 6), GeneBank accession No: NM_000641(IL11, Interleukin 11), GeneBank accession No: BX647459(SERPINE2, Serpin peptidase inhibitor, clade E(nexin, plasminogen activator inhibitor type 1), member 2), GeneBank accession No: BQ066037(RPS19, Ribosomal protein S19), GeneBank accession No: BE791300(EDF1, Endothelial differentiation-related factor 1), GeneBank accession No: BC038504(SNF1LK, SNF1-like kinase), GeneBank accession No: AL832287(ZAP70, Zeta-chain(TCR) associated protein kinase 70kDa), GeneBank accession No: AK125742(PCGF1, Polycomb group ring finger 1), GeneBank

accession No: AK124709(NDRG1, N-myc downstream regulated
 gene 1), GeneBank accession No: AB011157(PTDSR,
 Phosphatidylserine receptor), GeneBank accession No:
 NM_013255(MKLN1, Muskelein 1, intracellular mediator
 5 containing kelch motifs), GeneBank accession No:
 NM_006572(GNA13, Guanine nucleotide binding protein(G
 protein), alpha 13), GeneBank accession No: NM_002211(ITGB1,
 Integrin, beta 1(fibronectin receptor, beta polypeptide,
 antigen CD29 includes MDF2, MSK12)), GeneBank accession No:
 10 CR601067(PLAUR, Plasminogen activator, urokinase receptor),
 GeneBank accession No: BC050456(THBS4, Thrombospondin 4),
 GeneBank accession No: AK027389(CXCL16, Chemokine(C-X-C
 motif) ligand 16), GeneBank accession No: AJ132099(VNN1,
 Vanin 1), GeneBank accession No: XM_371354(FLJ10157,
 15 Hypothetical protein FLJ10157), GeneBank accession No:
 XM_208313(TPM3, Similar to tropomyosin 4), GeneBank
 accession No: XM_208270(ACR, Acrosin-like protease),
 GeneBank accession No: NM_203353(PDLIM7, PDZ and LIM domain
 7(enigma)), GeneBank accession No: NM_201382(PLEC1, Plectin
 20 1, intermediate filament binding protein 500kDa), GeneBank
 accession No: NM_182961(SYNE1, Spectrin repeat containing,
 nuclear envelope 1), GeneBank accession No: NM_181826(NF2,
 Neurofibromin 2(bilateral acoustic neuroma)), GeneBank
 accession No: NM_172069(PLEKHH2, Pleckstrin homology domain
 25 containing, family H(with MyTH4 domain) member 2), GeneBank

accession No: NM_022648(TNS, Tensin 1), GeneBank accession
 No: NM_017556(FBLP-1, Filamin binding LIM protein 1),
 GeneBank accession No: NM_016081(KIAA0992, Palladin,
 cytoskeletal associated protein), GeneBank accession No:
 5 NM_006617(NES, Nestin), GeneBank accession No:
 NM_006262(PRPB, Peripherin), GeneBank accession No:
 NM_005100(AKAP12, A kinase(PRKA) anchor protein(gravin) 12),
 GeneBank accession No: NM_004368(CNN2, Calponin 2),
 GeneBank accession No: NM_003388(CYLN2, Cytoplasmic linker
 10 2), GeneBank accession No: NM_003370(VASP, Vasodilator-
 stimulated phosphoprotein), GeneBank accession No:
 NM_003128(SPTBN1, Spectrin, beta, non-erythrocytic 1),
 GeneBank accession No: NM_002705(PPL, Periplakin), GeneBank
 accession No: NM_002475(MLC1SA, Myosin light chain 1 slow
 15 a), GeneBank accession No: NM_002018(FLII, Flightless I
 homolog(Drosophila)), GeneBank accession No: NM_001465(FYB,
 FYN binding protein(FYB-120/130)), GeneBank accession No:
 NM_001069(TUBB2, Tubulin, beta 2A), GeneBank accession No:
 CR625172(MGC8685, Tubulin, beta 2B), GeneBank accession No:
 20 CR616919(KRT18, Keratin 18), GeneBank accession No:
 CR606241(ACTG1, Actin, gamma 1), GeneBank accession No:
 CB240572(MYH11, Myosin, heavy polypeptide 11, smooth
 muscle), GeneBank accession No: BX648253(PTPN3, Protein
 tyrosine phosphatase, non-receptor type 3), GeneBank
 25 accession No: BX648190(WDR1, WD repeat domain 1), GeneBank

accession No: BX641076(ACTN1, Actinin, alpha 1), GeneBank
 accession No: BX537978(EPB41L1, Erythrocyte membrane
 protein band 4.1-like 1), GeneBank accession No:
 BG121847(NUDC, Nuclear distribution gene C homolog(A.
 5 nidulans)), GeneBank accession No: BC068013(MYO1C, Myosin
 IC), GeneBank accession No: BC065499(MAST2, Microtubule
 associated serine/threonine kinase 2), GeneBank accession
 No: BC051890(TUBG2, Tubulin, gamma 2), GeneBank accession
 No: BC041874(MAP1LC3B, Microtubule-associated protein 1
 10 light chain 3 beta), GeneBank accession No: BC012597(ACTA1,
 Actin, alpha 1, skeletal muscle), GeneBank accession No:
 AY484427(KIF17, Kinesin family member 17), GeneBank
 accession No: AK130546(STOML2, Stomatin(EPB72)-like 2),
 GeneBank accession No: AK124711(CORO2B, Coronin, actin
 15 binding protein, 2B), GeneBank accession No: AK123974(MYL5,
 Myosin, light polypeptide 5, regulatory), GeneBank
 accession No: AK092792(LOC389833, Similar to hypothetical
 protein MGC27019), GeneBank accession No: AK026518(MYOHD1,
 Myosin head domain containing 1), GeneBank accession No:
 20 AK024500(NICAL, Microtubule associated monooxygenase,
 calponin and LIM domain containing 1), GeneBank accession
 No: AF085886(FLJ46675, Ribosomal protein L29 pseudogene 2),
 GeneBank accession No: AB209997(MYO9B, Myosin IXB),
 GeneBank accession No: Y12692(WNT11, Wingless-type MMTV
 25 integration site family, member 11), GeneBank accession No:

Y11307(CYR61, Cysteine-rich, angiogenic inducer, 61),
 GeneBank accession No: X17033(ITGA2, Integrin, alpha
 2(CD49B, alpha 2 subunit of VLA-2 receptor)), GeneBank
 accession No: U41763(CLTCL1, Clathrin, heavy polypeptide-
 5 like 1), GeneBank accession No: NM_153609(TMPRSS6,
 Transmembrane protease, serine 6), GeneBank accession No:
 NM_031483(ITCH, Itchy homolog E3 ubiquitin protein
 ligase(mouse)), GeneBank accession No: NM_024342(GRLF1,
 Glucocorticoid receptor DNA binding factor 1), GeneBank
 10 accession No: NM_017555(EGLN2, Egl nine homolog 2(C.
 elegans)), GeneBank accession No: NM_016569(TBX3, T-box
 3(ulnar mammary syndrome)), GeneBank accession No:
 NM_004148(NINJ1, Ninjurin 1), GeneBank accession No:
 NM_003377(VEGFB, Vascular endothelial growth factor B),
 15 GeneBank accession No: NM_001983(ERCC1, Excision repair
 cross-complementing rodent repair deficiency,
 complementation group 1(includes overlapping antisense
 sequence)), GeneBank accession No: NM_001552(IGFBP4,
 Insulin-like growth factor binding protein 4), GeneBank
 20 accession No: NM_001430(EPAS1, Endothelial PAS domain
 protein 1), GeneBank accession No: NM_001300(KLF6, Kruppel-
 like factor 6), GeneBank accession No: NM_001012661(SLC3A2,
 Solute carrier family 3(activators of dibasic and neutral
 amino acid transport), member 2), GeneBank accession No:
 25 NM_000596(IGFBP1, Insulin-like growth factor binding

protein 1), GeneBank accession No: NM_000474(TWIST1, Twist
homolog 1(acrocephalosyndactyly 3; Saethre-Chotzen
syndrome)(Drosophila)), GeneBank accession No:
BX649103(ChGn, Chondroitin beta1,4 N-
5 acetylgalactosaminyltransferase), GeneBank accession No:
BM913048(TIMP1, TIMP metalloproteinase inhibitor 1),
GeneBank accession No: BM904612(S100A6, S100 calcium
binding protein A6(calcyclin)), GeneBank accession No:
BM556279(EMP3, Epithelial membrane protein 3), GeneBank
10 accession No: BC015041(VAT1, Family with sequence
similarity 82, member C), GeneBank accession No:
AY258066(OKL38, Pregnancy-induced growth inhibitor),
GeneBank accession No: AK126729(NDRG4, NDRG family member
4), GeneBank accession No: AK090459(NFE2L1, Nuclear
15 factor(erythroid-derived 2)-like 1), GeneBank accession No:
AK074163(ROBO4, Roundabout homolog 4, magic
roundabout(Drosophila)), GeneBank accession No:
AK024680(FLJ21027 fis, CDNA: FLJ21027 fis, clone CAE07110),
GeneBank accession No: AF176422(HEY1, Hairy/enhancer-of-
20 split related with YRPW motif 1), GeneBank accession No:
AF003837(JAG1, Jagged 1(Alagille syndrome)), GeneBank
accession No: AB209322(SEMA3B, Sema domain, immunoglobulin
domain(Ig), short basic domain, secreted,(semaphorin) 3B),
GeneBank accession No: AB011150(NRXN1, Neurexin 1),
25 GeneBank accession No: NM_201589(MAFA, V-maf

musculoaponeurotic fibrosarcoma oncogene homolog A(avian)),
GeneBank accession No: NM_052999(CKLFSF1, CKLF-like MARVEL
transmembrane domain containing 1), GeneBank accession No:
NM_006644(HSPH1, Heat shock 105kDa/110kDa protein 1),
5 GeneBank accession No: NM_005438(FOSL1, FOS-like antigen 1),
GeneBank accession No: NM_004996(ABCC1, ATP-binding
cassette, sub-family C(CFTR/MRP), member 1), GeneBank
accession No: NM_002658(PLAU, Plasminogen activator,
urokinase), GeneBank accession No: NM_001353(AKR1C1, Aldo-
10 keto reductase family 1, member C1(dihydrodiol
dehydrogenase 1; 20-alpha(3-alpha)-hydroxysteroid
dehydrogenase)), GeneBank accession No: H18681(C20orf139,
Sulfiredoxin 1 homolog(*S. cerevisiae*)), GeneBank accession
No: DR004094(HAMP, Hecidin antimicrobial peptide),
15 GeneBank accession No: BC082272(KCNMB3, Potassium large
conductance calcium-activated channel, subfamily M beta
member 3), GeneBank accession No: BC040494(DNAJB2,
DnaJ(Hsp40) homolog, subfamily B, member 2), GeneBank
accession No: BC018064(ATF6, Activating transcription
20 factor 6), GeneBank accession No: BC006523(SGK2,
Serum/glucocorticoid regulated kinase 2), GeneBank
accession No: AK090482(CXCL12, Chemokine(C-X-C motif)
ligand 12(stromal cell-derived factor 1)), GeneBank
accession No: AF219946(TULP4, Tubby like protein 4),
25 GeneBank accession No: AB209112(SLC2A8, Solute carrier

family 2,(facilitated glucose transporter) member 8),
 GeneBank accession No: NM_005242(F2RL1, Coagulation factor
 II(thrombin) receptor-like 1), GeneBank accession No:
 NM_001002029(C4A, Complement component 4B, telomeric),
 5 GeneBank accession No: NM_000539(RHO, Rhodopsin(opsin 2,
 rod pigment)(retinitis pigmentosa 4, autosomal dominant)),
 GeneBank accession No: BX649164(PAI, serpin peptidase
 inhibitor, clade E(nexin, plasminogen activator inhibitor
 type 1), member 1), GeneBank accession No: BM918324(LY96,
 10 Lymphocyte antigen 96), GeneBank accession No:
 AB209647(NCF2, Neutrophil cytosolic factor 2(65kDa, chronic
 granulomatous disease, autosomal 2)), GeneBank accession
 No: NM_152221(CSNK1E, Casein kinase 1, epsilon), GeneBank
 accession No: NM_017999(RNF31, Ring finger protein 31),
 15 GeneBank accession No: NM_016819(OGG1, 8-oxoguanine DNA
 glycosylase), GeneBank accession No: NM_016816(OAS1, 2',5'-
 oligoadenylate synthetase 1, 40/46kDa), GeneBank accession
 No: NM_012235(SCAP, SREBP cleavage-activating protein),
 GeneBank accession No: NM_006384(CIB1, Calcium and integrin
 20 binding 1(calmyrin)), GeneBank accession No: NM_001779(CD58,
 CD58 antigen,(lymphocyte function-associated antigen 3)),
 GeneBank accession No: CB055213(ICOSLG, Inducible T-cell
 co-stimulator ligand), GeneBank accession No:
 BX641029(MASP1, Mannan-binding lectin serine peptidase
 25 1(C4/C2 activating component of Ra-reactive factor)),

GeneBank accession No: BQ053419(BATF, Basic leucine zipper transcription factor, ATF-like), GeneBank accession No: BC039299(STIP1, Stress-induced-phosphoprotein 1(Hsp70/Hsp90-organizing protein)), GeneBank accession No: 5 AY055760(DAF, Decay accelerating factor for complement(CD55, Cromer blood group system)), GeneBank accession No: AK130188(FGR, Gardner-Rasheed feline sarcoma viral(v-fgr) oncogene homolog), GeneBank accession No: AK095326(MUS81, MUS81 endonuclease homolog(yeast)), GeneBank accession No: 10 NM_017670(OTUB1, OTU domain, ubiquitin aldehyde binding 1), GeneBank accession No: NM_003004(SECTM1, Secreted and transmembrane 1), GeneBank accession No: NM_002309(LIF, Hypothetical protein MGC20647), GeneBank accession No: NM_001421(ELF4, E74-like factor 4(ets domain transcription 15 factor)), GeneBank accession No: NM_000418(IL4R, Interleukin 4 receptor), GeneBank accession No: BI909222(FCER1G, Fc fragment of IgE, high affinity I, receptor for; gamma polypeptide), GeneBank accession No: BF569086(NK4, Interleukin 32), GeneBank accession No: 20 BC014470(AZGP1, Alpha-2-glycoprotein 1, zinc), GeneBank accession No: BC020744(AKR1C4, Aldo-keto reductase family 1, member C4(chlordecone reductase; 3-alpha hydroxysteroid dehydrogenase, type I; dihydrodiol),dehydrogenase 4), GeneBank accession No: BQ939577(AKR1C3, Aldo-keto reductase 25 family 1, member C3(3-alpha hydroxysteroid dehydrogenase,

type II)), GeneBank accession No: NM_000499(CYP1A1, Cytochrome P450, family 1, subfamily A, polypeptide 1), GeneBank accession No: NM_030622(CYP2S1, Cytochrome P450, family 2, subfamily S, polypeptide 1), GeneBank accession
 5 No: NM_184041(ALDOA, Aldolase A, fructose-bisphosphate), GeneBank accession No: NM_024307(MGC4171, Hypothetical protein LOC283901), GeneBank accession No: NM_005336(HDLBP, High density lipoprotein binding protein(vigilin)), GeneBank accession No: NM_002627(PFKP, Phosphofructokinase,
 10 platelet), GeneBank accession No: BX648281(LDLR, Low density lipoprotein receptor(familial hypercholesterolemia)), GeneBank accession No: BC069201(FLJ22761, Hexokinase domain containing 1), GeneBank accession No: BC030207(NR0B2, Nuclear receptor
 15 subfamily 0, group B, member 2), GeneBank accession No: AL833069(KIAA1434, Hypothetical protein KIAA1434), GeneBank accession No: AK124656(ENO2, Enolase 2(gamma, neuronal)), GeneBank accession No: AK094474(RHOC, Ras homolog gene family, member C), GeneBank accession No: AK093461(ISYNA1,
 20 Myo-inositol 1-phosphate synthase A1), GeneBank accession No: AB053232(GAL3ST3, Galactose-3-O-sulfotransferase 3), GeneBank accession No: AB045292(TMEM8, Transmembrane protein 8(five membrane-spanning domains)), GeneBank
 25 accession No: NM_004753(DHRS3, Dehydrogenase/reductase(SDR family) member 3), GeneBank accession No: NM_002900(RBP3,

Retinol binding protein 3, interstitial), GeneBank
 accession No: NM_001995(ACSL1, Acyl-CoA synthetase long-
 chain family member 1), GeneBank accession No:
 NM_000018(ACADVL, Acyl-Coenzyme A dehydrogenase, very long
 5 chain), GeneBank accession No: BC094756(CRA, Myotubularin
 related protein 11), GeneBank accession No: BC050553(NTE,
 Neuropathy target esterase), GeneBank accession No:
 BC033110(HSD17B1, Hydroxysteroid(17-beta) dehydrogenase 1),
 GeneBank accession No: AY268890(TPP1, Tripeptidyl peptidase
 10 I), GeneBank accession No: AK172798(CPT1A, Carnitine
 palmitoyltransferase 1A(liver)), GeneBank accession No:
 AK096809(CYP4F8, Cytochrome P450, family 4, subfamily F,
 polypeptide 8), GeneBank accession No: AK000600(SIAT7D,
 ST6(alpha-N-acetyl-neuraminyl-2,3-beta- galactosyl-1,3)-N-
 15 acetylgalactosaminide alpha-2,6-sialyltransferase 4),
 GeneBank accession No: AB002454(CYP4F3, Cytochrome P450,
 family 4, subfamily F, polypeptide 3), GeneBank accession
 No: Z29093(DDR1, Discoidin domain receptor family, member
 1), GeneBank accession No: Z25424(MKNK2, MAP kinase
 20 interacting serine/threonine kinase 2), GeneBank accession
 No: XM_291277(DKFZp761P0423, Hypothetical protein
 DKFZp761P0423), GeneBank accession No: XM_038150(MAST3,
 Microtubule associated serine/threonine kinase 3), GeneBank
 accession No: U88357(ERBB3, V-erb-b2 erythroblastic
 25 leukemia viral oncogene homolog 3(avian)), GeneBank

accession No: NM_025195(TRIB1, Tribbles homolog
 1(Drosophila)), GeneBank accession No: NM_020639(RIPK4,
 Receptor-interacting serine-threonine kinase 4), GeneBank
 accession No: NM_014172(PHPT1, Phosphohistidine phosphatase
 5 1), GeneBank accession No: NM_006254(PRKCD, Protein kinase
 C, delta), GeneBank accession No: NM_005415(SLC20A1, Solute
 carrier family 20(phosphate transporter), member 1),
 GeneBank accession No: NM_005026(PIK3CD, Phosphoinositide-
 3-kinase, catalytic, delta polypeptide), GeneBank accession
 10 No: NM_004431(EPHA2, EPH receptor A2), GeneBank accession
 No: NM_004419(DUSP5, Dual specificity phosphatase 5),
 GeneBank accession No: NM_004327(BCR, Breakpoint cluster
 region), GeneBank accession No: NM_004231(ATP6V1F, ATPase,
 H⁺ transporting, lysosomal 14kDa, V1 subunit F), GeneBank
 15 accession No: NM_004090(DUSP3, Dual specificity phosphatase
 3(vaccinia virus phosphatase VH1-related)), GeneBank
 accession No: NM_002843(PTPRJ, Protein tyrosine phosphatase,
 receptor type, J), GeneBank accession No: NM_002496(NDUFS8,
 NADH dehydrogenase(ubiquinone) Fe-S protein 8, 23kDa(NADH-
 20 coenzyme Q reductase)), GeneBank accession No:
 NM_001001852(PIM3, Pim-3 oncogene), GeneBank accession No:
 L76191(IRAK1, Interleukin-1 receptor-associated kinase 1),
 GeneBank accession No: D15049(PTPRH, Protein tyrosine
 phosphatase, receptor type, H), GeneBank accession No:
 25 BC065207(ATP6V0D2, ATPase, H⁺ transporting, lysosomal 38kDa,

V0 subunit d isoform 2), GeneBank accession No: BC035578(STK24, Serine/threonine kinase 24(STE20 homolog, yeast)), GeneBank accession No: BC028724(DUSP18, Dual specificity phosphatase 18), GeneBank accession No: 5 AL117482(ULK3, Unc-51-like kinase 3(C. elegans)), GeneBank accession No: AK126879(PCK3, PCKAIRE protein kinase 3), GeneBank accession No: AB209416(ILK, Integrin-linked kinase-2), GeneBank accession No: NM_000782(CYP24A1, Cytochrome P450, family 24, subfamily A, polypeptide 1), 10 GeneBank accession No: CR597101(ZFP36, Zinc finger protein 36, C3H type, homolog(mouse)), GeneBank accession No: CR936799(FHL2, Four and a half LIM domains 2), GeneBank accession No: M24898(NR1D1, Nuclear receptor subfamily 1, group D, member 1), GeneBank accession No: AF132818(KLF5, 15 Kruppel-like factor 5(intestinal)), GeneBank accession No: AK055337(ZNF213, Zinc finger protein 213), GeneBank accession No: BC008834(PHF1, PHD finger protein 1), GeneBank accession No: AK126918(GLIS2, GLIS family zinc finger 2), GeneBank accession No: BC042692(CTL2, Solute 20 carrier family 44, member 2), GeneBank accession No: NM_002224(ITPR3, Inositol 1,4,5-triphosphate receptor, type 3), GeneBank accession No: AK095363(AQP3, Aquaporin 3), GeneBank accession No: NM_174953(ATP2A3, ATPase, Ca++ transporting, ubiquitous), GeneBank accession No: 25 BC042390(VTI1B, Vesicle transport through interaction with

t-SNARES homolog 1B(yeast)), GeneBank accession No: NM_016113(TRPV2, Transient receptor potential cation channel, subfamily V, member 2), GeneBank accession No: BM926478(RBP1, Retinol binding protein 1, cellular),

5 GeneBank accession No: NM_000069(CACNA1S, Calcium channel, voltage-dependent, L type, alpha 1S subunit), GeneBank accession No: AK002107(RAB3B, RAB3B, member RAS oncogene family), GeneBank accession No: NM_013321(SNX8, Sorting nexin 8), GeneBank accession No: AK125026(SLC6A12, Solute

10 carrier family 6(neurotransmitter transporter, betaine/GABA), member 12), GeneBank accession No: NM_005843(STAM2, Signal transducing adaptor molecule(SH3 domain and ITAM motif) 2), GeneBank accession No: AK092512(SLC16A5, Solute carrier family 16(monocarboxylic

15 acid transporters), member 5), GeneBank accession No: U49248(ABCC2, ATP-binding cassette, sub-family C(CFTR/MRP), member 2), GeneBank accession No: AK172792(SCNN1A, Sodium channel, nonvoltage-gated 1 alpha), GeneBank accession No: BC044656(CASC3, Cancer susceptibility candidate 3),

20 GeneBank accession No: NM_203403(C9orf150, Chromosome 9 open reading frame 150), GeneBank accession No: NM_080388(S100A16, S100 calcium binding protein A16), GeneBank accession No: NM_031286(SH3BGRL3, SH3 domain binding glutamic acid-rich protein like 3), GeneBank

25 accession No: NM_022153(PP2135, Chromosome 10 open reading

frame 54), GeneBank accession No: NM_004864(GDF15, Growth
differentiation factor 15), GeneBank accession No:
NM_003330(TXNRD1, Thioredoxin reductase 1), GeneBank
accession No: NM_001013632(LOC343521, Similar to
5 hypothetical protein 4833401D15), GeneBank accession No:
BX537968(LOC51149, Hypothetical LOC51149), GeneBank
accession No: BU945318(MT2A, Hypothetical gene supported by
X97260; BC070289), GeneBank accession No: BQ683841(S100A11,
S100 calcium binding protein A11(calgizzarin)), GeneBank
10 accession No: BQ276852(TMSB10, Thymosin, beta 10), GeneBank
accession No: AK126182(KIAA1949, KIAA1949), GeneBank
accession No: AK124751(CAPN2, Calpain 2,(m/II) large
subunit), GeneBank accession No: AK095079(RGC32, Response
gene to complement 32), GeneBank accession No:
15 AB075871(FLJ42654, Golgi transport 1 homolog A(S.
cerevisiae)).

【Claim 3】

The kit according to claim 1, wherein the below genes
20 are down-regulated by exposure to phenanthrene:

GeneBank accession No: AK125150(MAPK8, Mitogen-
activated protein kinase 8), GeneBank accession No:
NM_002758(MAP2K6, Mitogen-activated protein kinase kinase
6), GeneBank accession No: NM_004612(TGFBR1, Transforming
25 growth factor, beta receptor I(activin A receptor type II-

like kinase, 53kDa)), GeneBank accession No:
NM_145686(MAP4K4, Mitogen-activated protein kinase kinase
kinase kinase 4), GeneBank accession No: XM_042066(MAP3K1,
Mitogen-activated protein kinase kinase kinase 1), GeneBank
5 accession No: AB011123(TNIK, TRAF2 and NCK interacting
kinase), GeneBank accession No: AB209031(C5, Complement
component 5), GeneBank accession No: NM_022740(HIPK2,
Homeodomain interacting protein kinase 2), GeneBank
accession No: NM_148957(TNFRSF19, Tumor necrosis factor
10 receptor superfamily, member 19), GeneBank accession No:
AB208909(ITGB2, Integrin, beta 2(antigen CD18(p95),
lymphocyte function-associated antigen 1; macrophage
antigen 1(mac-1) beta subunit)), GeneBank accession No:
AB209211(TIA1, TIA1 cytotoxic granule-associated RNA
15 binding protein), GeneBank accession No: AB209613(DNASE1L3,
Deoxyribonuclease I-like 3), GeneBank accession No:
AK122825(HMGB1, High-mobility group box 1), GeneBank
accession No: AK127326(PHF17, PHD finger protein 17),
GeneBank accession No: AK223503(CASP1, Caspase 1,
20 apoptosis-related cysteine peptidase(interleukin 1, beta,
convertase)), GeneBank accession No: BC013326(GAS2, Growth
arrest-specific 2), GeneBank accession No: BC047698(IL7,
Interleukin 7), GeneBank accession No: D79987(ESPL1, Extra
spindle poles like 1(*S. cerevisiae*)), GeneBank accession
25 No: NM_000893(KNG1, Kininogen 1), GeneBank accession No:

NM_001012271(BIRC5, Effector cell peptidase receptor 1),
GeneBank accession No: NM_004938(DAPK1, Death-associated
protein kinase 1), GeneBank accession No: NM_005879(TRIP,
TRAF interacting protein), GeneBank accession No:
5 NM_014739(BCLAF1, BCL2-associated transcription factor 1),
GeneBank accession No: NM_018947(CYCS, Cytochrome c,
somatic), GeneBank accession No: AB033337(MPHOSPH1, M-phase
phosphoprotein 1), GeneBank accession No: AB209179(PLK1,
Polo-like kinase 1(Drosophila)), GeneBank accession No:
10 AB209337(CDC7, CDC7 cell division cycle 7(S. cerevisiae)),
GeneBank accession No: AF053305(BUB1, BUB1 budding
uninhibited by benzimidazoles 1 homolog(yeast)), GeneBank
accession No: AF053306(BUB1B, BUB1 budding uninhibited by
benzimidazoles 1 homolog beta(yeast)), GeneBank accession
15 No: AF345347(SPAG5, Sperm associated antigen 5), GeneBank
accession No: AK092638(CCNG2, Cyclin G2), GeneBank
accession No: AK222819(NUSAP1, Nucleolar and spindle
associated protein 1), GeneBank accession No:
AL833191(SMC2L1, SMC2 structural maintenance of chromosomes
20 2-like 1(yeast)), GeneBank accession No: AY257469(CIT,
Citron(rho-interacting, serine/threonine kinase 21)),
GeneBank accession No: AY367065(ASPM, Asp(abnormal
spindle)-like, microcephaly associated(Drosophila)),
GeneBank accession No: BC011000(CDCA5, Cell division cycle
25 associated 5), GeneBank accession No: BC032677(UBE2C,

Ubiquitin-conjugating enzyme E2C), GeneBank accession No: BC043502(NEK2, NIMA(never in mitosis gene a)-related kinase 2), GeneBank accession No: BU675073(PTTG1, Pituitary tumor-transforming 1), GeneBank accession No: BX647885(STMN1, Stathmin 1/oncoprotein 18), GeneBank accession No: CR592757(BRRN1, Barren homolog 1(Drosophila)), GeneBank accession No: CR597075(MAPRE2, Microtubule-associated protein, RP/EB family, member 2), GeneBank accession No: CR604810(CCNA2, Cyclin A2), GeneBank accession No: CR933728(CDC2, Cell division cycle 2, G1 to S and G2 to M), GeneBank accession No: NM_000919(PAM, Peptidylglycine alpha-amidating monooxygenase), GeneBank accession No: NM_001790(CDC25C, Cell division cycle 25C), GeneBank accession No: NM_001798(CDK2, Cyclin-dependent kinase 2), GeneBank accession No: NM_001813(CENPE, Centromere protein E, 312kDa), GeneBank accession No: NM_003318(TTK, TTK protein kinase), GeneBank accession No: NM_003981(PRC1, Protein regulator of cytokinesis 1), GeneBank accession No: NM_004523(KIF11, Kinesin family member 11), GeneBank accession No: NM_004701(CCNB2, Cyclin B2), GeneBank accession No: NM_005983(SKP2, S-phase kinase-associated protein 2(p45)), GeneBank accession No: NM_006101(KNTC2, Kinetochore associated 2), GeneBank accession No: NM_006845(KIF2C, Kinesin family member 2C), GeneBank accession No: NM_007375(TARDBP, TAR DNA binding protein),

GeneBank accession No: NM_012112(TPX2, TPX2, microtubule-associated, homolog(Xenopus laevis)), GeneBank accession No: NM_014750(DLG7, Discs, large homolog 7(Drosophila)), GeneBank accession No: NM_015097(CLASP2, Cytoplasmic linker associated protein 2), GeneBank accession No: NM_016343(CENPF, Centromere protein F, 350/400ka(mitosis)), GeneBank accession No: NM_016426(GTSE1, G-2 and S-phase expressed 1), GeneBank accession No: NM_018492(PBK, PDZ binding kinase), GeneBank accession No: NM_018685(ANLN, Anillin, actin binding protein(scraps homolog, Drosophila)), GeneBank accession No: NM_020242(KNSL7, Kinesin family member 15), GeneBank accession No: NM_031966(CCNB1, Cyclin B1), GeneBank accession No: NM_138555(KIF23, Kinesin family member 23), GeneBank accession No: U65410(MAD2L1, MAD2 mitotic arrest deficient-like 1(yeast)), GeneBank accession No: AB020656(CYLD, Cyldromatosis(turban tumor syndrome)), GeneBank accession No: AF033122(SESNI, Sestrin 1), GeneBank accession No: AK074377(UHRF1, Chromosome 19 open reading frame 31), GeneBank accession No: AK091170(CDKN2C, Cyclin-dependent kinase inhibitor 2C(p18, inhibits CDK4)), GeneBank accession No: AK094323(NFYC, Nuclear transcription factor Y, gamma), GeneBank accession No: AY366508(LOH11CR2A, Loss of heterozygosity, 11, chromosomal region 2, gene A), GeneBank accession No: BC033086(TCF19, Transcription factor 19(SC1)), GeneBank accession No: BC040303(PTP4A1, Protein

tyrosine phosphatase type IVA, member 1), GeneBank
 accession No: BC040991(TFDP2, Transcription factor Dp-2(E2F
 dimerization partner 2)), GeneBank accession No:
 BC092412(SGOL2, Shugoshin-like 2(S. pombe)), GeneBank
 5 accession No: BQ278454(CKS1B, CDC28 protein kinase
 regulatory subunit 1B), GeneBank accession No:
 BX649128(SESN3, Sestrin 3), GeneBank accession No:
 CD049340(AURKB, Aurora kinase B), GeneBank accession No:
 M89914(NF1, Neurofibromin 1(neurofibromatosis, von
 10 Recklinghausen disease, Watson disease)), GeneBank
 accession No: NM_001005414(ZWINT, ZW10 interactor
 antisense), GeneBank accession No: NM_001008491(Sep 2,
 Septin 2), GeneBank accession No: NM_001274(CHEK1, CHK1
 checkpoint homolog(S. pombe)), GeneBank accession No:
 15 NM_002105(H2AFX, H2A histone family, member X), GeneBank
 accession No: NM_002388(MCM3, MCM3 minichromosome
 maintenance deficient 3(S. cerevisiae)), GeneBank accession
 No: NM_002417(MKI67, Antigen identified by monoclonal
 antibody Ki-67), GeneBank accession No: NM_002875(RAD51,
 20 RAD51 homolog(RecA homolog, E. coli)(S. cerevisiae)),
 GeneBank accession No: NM_003884(PCAF, P300/CBP-associated
 factor), GeneBank accession No: NM_004526(MCM2, MCM2
 minichromosome maintenance deficient 2, mitotin(S.
 cerevisiae)), GeneBank accession No: NM_004847(AIF1,
 25 Allograft inflammatory factor 1), GeneBank accession No:

NM_005915(MCM6, MCM6 minichromosome maintenance deficient
 6(MIS5 homolog, S. pombe)(S. cerevisiae)), GeneBank
 accession No: NM_012090(MACF1, Microtubule-actin
 crosslinking factor 1), GeneBank accession No:
 5 NM_012415(RAD54B, RAD54 homolog B(S. cerevisiae)), GeneBank
 accession No: NM_014264(PLK4, Polo-like kinase
 4(Drosophila)), GeneBank accession No: NM_015714(G0S2,
 G0/G1switch 2), GeneBank accession No: NM_024680(FLJ23311,
 E2F transcription factor 8), GeneBank accession No:
 10 XM_034274(MYBL1, V-myb myeloblastosis viral oncogene
 homolog(avian)-like 1), GeneBank accession No:
 AK001720(FLJ10858, Nei endonuclease VIII-like 3(E. coli)),
 GeneBank accession No: AY032677(POLQ, Polymerase(DNA
 directed), theta), GeneBank accession No: BC034480(BLM,
 15 Bloom syndrome), GeneBank accession No: BC073161(RAD51C,
 RAD51 homolog C(S. cerevisiae)), GeneBank accession No:
 CR600021(HMGB2, High-mobility group box 2), GeneBank
 accession No: CR625391(RAD51AP1, RAD51 associated protein
 1), GeneBank accession No: CR936783(FLJ40869, Hypothetical
 20 protein LOC284952), GeneBank accession No:
 DQ140356(KIAA1596, Fanconi anemia, complementation group M),
 GeneBank accession No: NM_001067(TOP2A, Topoisomerase(DNA)
 II alpha 170kDa), GeneBank accession No: NM_001618(PARP1,
 Poly(ADP-ribose) polymerase family, member 1), GeneBank
 25 accession No: NM_003362(UNG, Uracil-DNA glycosylase),

GeneBank accession No: NM_006904(PRKDC, Protein kinase, DNA-activated, catalytic polypeptide), GeneBank accession No: NM_130398(EXO1, Exonuclease 1), GeneBank accession No: AB020807(TLR6, Toll-like receptor 6), GeneBank accession
5 No: AB032980(DCDC2, Doublecortin domain containing 2), GeneBank accession No: AB209866(TFPI, Tissue factor pathway inhibitor(lipoprotein-associated coagulation inhibitor)), GeneBank accession No: AK057015(HSPA4, Heat shock 70kDa protein 4), GeneBank accession No: AK095515(IFIT1,
10 Interferon-induced protein with tetratricopeptide repeats 1), GeneBank accession No: AK122686(IF, I factor(complement)), GeneBank accession No: AK123010(RRM2, Ribonucleotide reductase M2 polypeptide), GeneBank accession No: BC035582(TRIM22, Tripartite motif-containing
15 22), GeneBank accession No: BX537894(LOC493869, Similar to RIKEN cDNA 2310016C16), GeneBank accession No: M14338(PROS1, Protein S(alpha)), GeneBank accession No: NM_000821(GGCX, Gamma-glutamyl carboxylase), GeneBank accession No: NM_000963(PTGS2, Prostaglandin-endoperoxide synthase
20 2(prostaglandin G/H synthase and cyclooxygenase)), GeneBank accession No: NM_001001547(CD36, CD36 antigen(collagen type I receptor, thrombospondin receptor)), GeneBank accession No: NM_001512(GSTA4, Glutathione S-transferase A4), GeneBank accession No: NM_001629(ALOX5AP, Arachidonate 5-
25 lipoxygenase-activating protein), GeneBank accession No:

NM_001752(CAT, Catalase), GeneBank accession No:
 NM_001837(CCR3, Chemokine(C-C motif) receptor 3), GeneBank
 accession No: NM_001979(EPHX2, Epoxide hydrolase 2,
 cytoplasmic), GeneBank accession No: NM_001994(F13B,
 5 Coagulation factor XIII, B polypeptide), GeneBank accession
 No: NM_002182(IL1RAP, Interleukin 1 receptor accessory
 protein), GeneBank accession No: NM_006120(HLA-DMA, Major
 histocompatibility complex, class II, DM alpha), GeneBank
 accession No: NM_173216(SIAT1, ST6 beta-galactosamide
 10 alpha-2,6-sialyltransferase 1), GeneBank accession No:
 NM_202002(FOXM1, Forkhead box M1), GeneBank accession No:
 AB163917(LRAP, Leukocyte-derived arginine aminopeptidase),
 GeneBank accession No: BC027881(AFP, Alpha-fetoprotein),
 GeneBank accession No: NM_015915(SPG3A, Spastic paraplegia
 15 3A(autosomal dominant)), GeneBank accession No:
 NM_000671(ADH5, Alcohol dehydrogenase 5(class III), chi
 polypeptide), GeneBank accession No: J05428(UGT2B7, UDP
 glucuronosyltransferase 2 family, polypeptide B7), GeneBank
 accession No: NM_000672(ADH6, Alcohol dehydrogenase 6(class
 20 V)), GeneBank accession No: M15943(ADH4, Alcohol
 dehydrogenase 4(class II), pi polypeptide), GeneBank
 accession No: AK223395(FBP1, Fructose-1,6-bisphosphatase 1),
 GeneBank accession No: NM_000151(G6PC, Glucose-6-
 phosphatase, catalytic(glycogen storage disease type I, von
 25 Gierke disease)), GeneBank accession No: XM_113962(KIAA0650,

Structural maintenance of chromosomes flexible hinge domain containing 1), GeneBank accession No: AB020644(ACSL6, Acyl-CoA synthetase long-chain family member 6), GeneBank accession No: AB209907(PLD1, Phospholipase D1, phosphatidylcholine-specific), GeneBank accession No: AF285167(ABCA1, ATP-binding cassette, sub-family A(ABC1), member 1), GeneBank accession No: AF297872(TRERF1, Transcriptional regulating factor 1), GeneBank accession No: AF303134(ALDH8A1, Aldehyde dehydrogenase 8 family, member A1), GeneBank accession No: AF339053(PLA2G12B, Phospholipase A2, group XIIB), GeneBank accession No: AK096018(HADHSC, L-3-hydroxyacyl-Coenzyme A dehydrogenase, short chain), GeneBank accession No: AK124635(PCSK9, Proprotein convertase subtilisin/kexin type 9), GeneBank accession No: AK127346(SIAT9, ST3 beta-galactoside alpha-2,3-sialyltransferase 5), GeneBank accession No: AL359559(AGPS, Alkylglycerone phosphate synthase), GeneBank accession No: AY691170(PLCL3, Phospholipase C-like 3), GeneBank accession No: BG567934(APOM, Apolipoprotein M), GeneBank accession No: BX538214(C6orf167, Chromosome 6 open reading frame 167), GeneBank accession No: BX640945(FADS2, Fatty acid desaturase 2), GeneBank accession No: BX648473(PIGK, Phosphatidylinositol glycan, class K), GeneBank accession No: BX648557(HSD17B2, Hydroxysteroid(17-beta) dehydrogenase 2), GeneBank accession No:

CR749601(ETNK1, Death-associated protein kinase 3),
 GeneBank accession No: NM_000859(HMGCR, 3-hydroxy-3-
 methylglutaryl-Coenzyme A reductase), GeneBank accession
 No: NM_001443(FABP1, Fatty acid binding protein 1, liver),
 5 GeneBank accession No: NM_002130(HMGCS1, 3-hydroxy-3-
 methylglutaryl-Coenzyme A synthase 1(soluble)), GeneBank
 accession No: NM_003725(RODH, Hydroxysteroid(17-beta)
 dehydrogenase 6), GeneBank accession No: NM_004845(PCYT1B,
 Phosphate cytidylyltransferase 1, choline, beta), GeneBank
 10 accession No: NM_014762(DHCR24, 24-dehydrocholesterol
 reductase), GeneBank accession No: NM_020139(DHRS6,
 Dehydrogenase/reductase(SDR family) member 6), GeneBank
 accession No: NM_020918(GPAM, Glycerol-3-phosphate
 acyltransferase, mitochondrial), GeneBank accession No:
 15 NM_032523(OSBPL6, Oxysterol binding protein-like 6),
 GeneBank accession No: NM_033505(SELI, Selenoprotein I),
 GeneBank accession No: Z28339(AKR1D1, Aldo-keto reductase
 family 1, member D1(delta 4-3-ketosteroid-5-beta-
 reductase)), GeneBank accession No: AK024899(ENPP3,
 20 Ectonucleotide pyrophosphatase/ phosphodiesterase 3),
 GeneBank accession No: AK025546(PTPN4, Protein tyrosine
 phosphatase, non-receptor type 4(megakaryocyte)), GeneBank
 accession No: AK124910(ENPP2, Ectonucleotide
 pyrophosphatase/phosphodiesterase 2(autotaxin)), GeneBank
 25 accession No: BC035116(FLJ35059 fis, CDNA FLJ30761 fis,

clone FEBRA2000538), GeneBank accession No: BC050565(PASK, PAS domain containing serine/threonine kinase), GeneBank accession No: L13436(NPR2, Natriuretic peptide receptor B/guanylate cyclase B(atrionatriuretic peptide receptor B)),

5 GeneBank accession No: NM_001005862(ERBB2, V-erb-b2 erythroblastic leukemia viral oncogene homolog 2, neuro/glioblastoma derived oncogene homolog(avian)), GeneBank accession No: NM_005012(ROR1, Receptor tyrosine kinase-like orphan receptor 1), GeneBank accession No:

10 NM_006035(CDC42BPB, CDC42 binding protein kinase beta(DMPK-like)), GeneBank accession No: NM_014791(MELK, Maternal embryonic leucine zipper kinase), GeneBank accession No: NM_023028(FGFR2, Fibroblast growth factor receptor 2(bacteria-expressed kinase, keratinocyte growth factor

15 receptor, craniofacial dysostosis 1, Crouzon syndrome, Pfeiffer syndrome, Jackson-Weiss syndrome)), GeneBank accession No: NM_080836(STK35, Serine/threonine kinase 35), GeneBank accession No: AF419331(FUSIP1, FUS interacting protein(serine/arginine-rich) 1), GeneBank accession No:

20 AK091927(SFRS3, Splicing factor, arginine/serine-rich 3), GeneBank accession No: BC010266(HNRNPA1, Heterogeneous nuclear ribonucleoprotein A1), GeneBank accession No: BC012360(CTAGE5, CTAGE family, member 5), GeneBank accession No: BC036046(PLRG1, Pleiotropic regulator 1(PRL1

25 homolog, Arabidopsis)), GeneBank accession No:

BC065384(PCF11, PCF11, cleavage and polyadenylation factor subunit, homolog(*S. cerevisiae*)), GeneBank accession No: BX537360(CPSF5, Nudix(nucleoside diphosphate linked moiety X)-type motif 21), GeneBank accession No: BX537494(HNRPA2B1, Heterogeneous nuclear ribonucleoprotein A2/B1), GeneBank accession No: BX647784(HNRPR, Heterogeneous nuclear ribonucleoprotein R), GeneBank accession No: CA455267(PPIH, Peptidyl prolyl isomerase H(cyclophilin H)), GeneBank accession No: CR596214(HNRPA0, Heterogeneous nuclear ribonucleoprotein A0), GeneBank accession No: NM_001326(CSTF3, Hypothetical protein LOC283267), GeneBank accession No: NM_004640(BAT1, HLA-B associated transcript 1), GeneBank accession No: NM_005463(HNRPDL, Heterogeneous nuclear ribonucleoprotein D-like), GeneBank accession No: NM_006924(SFRS1, Splicing factor, arginine/serine-rich 1(splicing factor 2, alternate splicing factor)), GeneBank accession No: NM_012426(SF3B3, Splicing factor 3b, subunit 3, 130kDa), GeneBank accession No: NM_018048(FLJ10292, Mago-nashi homolog), GeneBank accession No: NM_030919(C20orf129, Chromosome 20 open reading frame 129), GeneBank accession No: NM_031370(HNRPD, Heterogeneous nuclear ribonucleoprotein D(AU-rich element RNA binding protein 1, 37kDa)), GeneBank accession No: NM_138933(ACF, Apobec-1 complementation factor), GeneBank accession No: AB193259(ACE2, Angiotensin I converting enzyme(peptidyl-

dipeptidase A) 2), GeneBank accession No: BX648769(EWSR1,
 Ewing sarcoma breakpoint region 1), GeneBank accession No:
 AB023154(DTX4, Deltex 4 homolog(Drosophila)), GeneBank
 accession No: AL543755(VAV3, Vav 3 oncogene), GeneBank
 5 accession No: M75106(CPB2, Carboxypeptidase B2(plasma,
 carboxypeptidase U)), GeneBank accession No:
 NM_021045(ZNF248, Zinc finger protein 248), GeneBank
 accession No: AB209194(B4GALT6, UDP-Gal:betaGlcNAc beta
 1,4- galactosyltransferase, polypeptide 6), GeneBank
 10 accession No: AF279145(ANTXR1, Anthrax toxin receptor 1),
 GeneBank accession No: NM_025074(FRAS1, Fraser syndrome 1),
 GeneBank accession No: AK025790(KIF20A, Kinesin family
 member 20A), GeneBank accession No: NM_006152(LRMP,
 Lymphoid-restricted membrane protein), GeneBank accession
 15 No: NM_000340(SLC2A2, Solute carrier family 2(facilitated
 glucose transporter), member 2), GeneBank accession No:
 AF071592(KIF4A, Kinesin family member 4A), GeneBank
 accession No: NM_013277(RACGAP1, Rac GTPase activating
 protein 1), GeneBank accession No: AY043484(SCN1A, Sodium
 20 channel, voltage-gated, type I, alpha), GeneBank accession
 No: AY791349(KIF18A, Kinesin family member 18A), GeneBank
 accession No: NM_018018(SLC38A4, Solute carrier family 38,
 member 4), GeneBank accession No: AK094603(FLJ37284 fis,
 unnamed protein product; Homo sapiens cDNA FLJ37284 fis,
 25 clone BRAMY2013590.), GeneBank accession No:

NM_021069(ARGBP2, Sorbin and SH3 domain containing 2),
GeneBank accession No: NM_001005747(CACNB4, Calcium channel,
voltage-dependent, beta 4 subunit), GeneBank accession No:
AJ496568(SLC25A12, Solute carrier family 25(mitochondrial
5 carrier, Aralar), member 12), GeneBank accession No:
NM_030641(APOL6, Apolipoprotein L, 6), GeneBank accession
No: NM_173512(FLJ39822, Hypothetical protein FLJ39822),
GeneBank accession No: NM_000037(ANK1, Ankyrin 1,
erythrocytic), GeneBank accession No: NM_001011554(SLC13A3,
10 Solute carrier family 13(sodium-dependent dicarboxylate
transporter), member 3), GeneBank accession No:
AB091343(C10orf3, Centrosomal protein 55kDa), GeneBank
accession No: AK000643(ASB9, Ankyrin repeat and SOCS box-
containing 9), GeneBank accession No: AK055221(FBXO5, F-box
15 protein 5), GeneBank accession No: AK075271(SPTLC2L, Serine
palmitoyltransferase, long chain base subunit 2-
like(aminotransferase 2)), GeneBank accession No:
AK122685(GLUD1, Glutamate dehydrogenase 1), GeneBank
accession No: AK127098(FLJ10706, Chromosome 1 open reading
20 frame 112), GeneBank accession No: AL133031(MLR1,
Transcription factor MLR1), GeneBank accession No:
AY007723(MAL2, Mal, T-cell differentiation protein 2),
GeneBank accession No: BC022255(Spc25, Spindle pole body
component 25 homolog(*S. cerevisiae*)), GeneBank accession
25 No: BC041882(ATF7IP2, Activating transcription factor 7

interacting protein 2), GeneBank accession No:
BC052951(LMNB1, Lamin B1), GeneBank accession No:
BC098313(FLJ20641, Hypothetical protein FLJ20641), GeneBank
accession No: NM_001809(CENPA, Centromere protein A, 17kDa),
5 GeneBank accession No: NM_145061(C13orf3, Chromosome 13
open reading frame 3), GeneBank accession No:
XM_372695(LOC390859, PREDICTED: Homo sapiens similar to
Chain A, Crystal Structure Of The R463a Mutant Of Human
Glutamate Dehydrogenase(LOC390859), mRNA).

10

【Claim 4】

A kit for identification of exposure to phenanthrene
containing a primer set capable of amplifying the genes of
claim 1.

15

【Claim 5】

The kit according to claim 4, wherein the primer set
is composed of at least 2 forward primers and reverse
primers selected from the group consisting of sequences
20 represented by SEQ. ID. NO: 1 -NO: 56.

【Claim 6】

A method for detecting the below genes for the
identification of exposure to phenanthrene comprising the
25 following steps:

1) comparing expressions of genes up- or down-regulated by phenanthrene in the experimental group somatic cells and the control group somatic cells; and

2) determining exposure to phenanthrene if the expression of the said gene of step 1) is significantly different from that of the control.

GeneBank accession No: NM_004420(DUSP8, Dual specificity phosphatase 8), GeneBank accession No: L11329(DUSP2, Dual specificity phosphatase 2), GeneBank accession No: BC094766(PKN1, Protein kinase N1), GeneBank accession No: AY247738(TRIB3, Tribbles homolog 3(Drosophila)), GeneBank accession No: AK129595(GADD45B, Growth arrest and DNA-damage-inducible, beta), GeneBank accession No: AB208849(SHC1, SHC(Src homology 2 domain containing) transforming protein 1), GeneBank accession No: X02812(TGFB1, Transforming growth factor, beta 1(Camurati-Engelmann disease)), GeneBank accession No: NM_198951(TGM2, Transglutaminase 2(C polypeptide, protein-glutamine-gamma-glutamyltransferase)), GeneBank accession No: NM_147780(CTSB, Cathepsin B), GeneBank accession No: NM_078467(CDKN1A, Cyclin-dependent kinase inhibitor 1A(p21, Cip1)), GeneBank accession No: NM_033027(AXUD1, AXIN1 up-regulated 1), GeneBank accession No: NM_032797(AMID, Apoptosis-inducing factor(AIF)-like mitochondrion-associated inducer of death), GeneBank accession No:

NM_021960(MCL1, Myeloid cell leukemia sequence 1(BCL2-related)), GeneBank accession No: NM_016639(TNFRSF12A, Tumor necrosis factor receptor superfamily, member 12A), GeneBank accession No: NM_016222(DDX41, DEAD(Asp-Glu-Ala-Asp) box polypeptide 41), GeneBank accession No: NM_013246(CLC, Cardiotrophin-like cytokine factor 1), GeneBank accession No: NM_004401(DFFA, DNA fragmentation factor, 45kDa, alpha polypeptide), GeneBank accession No: NM_004281(BAG3, BCL2-associated athanogene 3), GeneBank accession No: NM_003897(IER3, Immediate early response 3), GeneBank accession No: NM_003806(HRK, Harakiri, BCL2 interacting protein(contains only BH3 domain)), GeneBank accession No: NM_003639(IKBKG, Inhibitor of kappa light polypeptide gene enhancer in B-cells, kinase gamma), GeneBank accession No: NM_003311(PHLDA2, Pleckstrin homology-like domain, family A, member 2), GeneBank accession No: NM_002737(PRKCA, Protein kinase C, alpha), GeneBank accession No: NM_002648(PIM1, Pim-1 oncogene), GeneBank accession No: NM_002507(NGFR, Nerve growth factor receptor(TNFR superfamily, member 16)), GeneBank accession No: NM_002305(LGALS1, Lectin, galactoside-binding, soluble, 1(galectin 1)), GeneBank accession No: NM_001013398(IGFBP3, Insulin-like growth factor binding protein 3), GeneBank accession No: BX640923(MDM4, Mdm4, transformed 3T3 cell double minute 4, p53 binding protein(mouse)), GeneBank

accession No: BX537586(STK17A, Serine/threonine kinase
17a(apoptosis-inducing)), GeneBank accession No:
BG284742(P8, P8 protein(candidate of metastasis 1)),
GeneBank accession No: BE903247(PDCD6IP, Programmed cell
5 death 6 interacting protein), GeneBank accession No:
BC027949(P2RX1, Purinergic receptor P2X, ligand-gated ion
channel, 1), GeneBank accession No: BC006365(PSEN2,
Presenilin 2(Alzheimer disease 4)), GeneBank accession No:
AY869712(PPP1R13L, Protein phosphatase 1,
10 regulatory(inhibitor) subunit 13 like), GeneBank accession
No: AY028896(CARD10, Caspase recruitment domain family,
member 10), GeneBank accession No: AK122614(PPARD,
Peroxisome proliferative activated receptor, delta),
GeneBank accession No: AK092872(ERCC2, Excision repair
15 cross-complementing rodent repair deficiency,
complementation group 2(xeroderma pigmentosum D)), GeneBank
accession No: AK092808(RRAGC, Ras-related GTP binding C),
GeneBank accession No: AJ001898(GDNF, Glial cell derived
neurotrophic factor), GeneBank accession No:
20 AF220656(PHLDA1, Pleckstrin homology-like domain, family A,
member 1), GeneBank accession No: AF055634(UNC5C, Unc-5
homolog C(C. elegans)), GeneBank accession No:
AB209485(VEGF, Vascular endothelial growth factor),
GeneBank accession No: AB096256(UNC5B, Unc-5 homolog B(C.
25 elegans)), GeneBank accession No: AB007960(SH3GLB1, SH3-

domain GRB2-like endophilin B1), GeneBank accession No:
X06374(PDGFA, Platelet-derived growth factor alpha
polypeptide), GeneBank accession No: S62138(DDIT3, DNA-
damage-inducible transcript 3), GeneBank accession No:
5 NM_078487(CDKN2B, Cyclin-dependent kinase inhibitor 2B(p15,
inhibits CDK4)), GeneBank accession No: NM_012127(CIZ1,
CDKN1A interacting zinc finger protein 1), GeneBank
accession No: NM_005883(APC2, Adenomatosis polyposis coli
2), GeneBank accession No: NM_004196(CDKL1, Cyclin-
10 dependent kinase-like 1(CDC2-related kinase)), GeneBank
accession No: NM_003236(TGFA, Transforming growth factor,
alpha), GeneBank accession No: NM_001261(CDK9, Cyclin-
dependent kinase 9(CDC2-related kinase)), GeneBank
accession No: NM_001007271(DUSP13, Dual specificity
15 phosphatase 13), GeneBank accession No: CR749511(PARC, P53-
associated parkin-like cytoplasmic protein), GeneBank
accession No: CR623038(ID2, Inhibitor of DNA binding 2,
dominant negative helix-loop-helix protein), GeneBank
accession No: CR618371(EGFR, Epidermal growth factor
20 receptor(erythroblastic leukemia viral(v-erb-b) oncogene
homolog, avian)), GeneBank accession No: BF965144(IFITM1,
Interferon induced transmembrane protein 1(9-27)), GeneBank
accession No: AK127679(DUSP1, Dual specificity phosphatase
1), GeneBank accession No: AK096276(CCND3, Cyclin D3),
25 GeneBank accession No: AB209586(MAPK13, Mitogen-activated

protein kinase 13), GeneBank accession No: AB209465(PCTK1,
 PCTAIRE protein kinase 1), GeneBank accession No:
 Z19588(SKIL, SKI-like), GeneBank accession No:
 NM_020429(SMURF1, SMAD specific E3 ubiquitin protein ligase
 5 1), GeneBank accession No: NM_014767(SPOCK2,
 Sparc/osteonectin, cwcw and kazal-like domains
 proteoglycan(testican) 2), GeneBank accession No:
 NM_005979(S100A13, S100 calcium binding protein A13),
 GeneBank accession No: NM_005187(CBFA2T3, Core-binding
 10 factor, runt domain, alpha subunit 2; translocated to, 3),
 GeneBank accession No: NM_004364(CEBPA, CCAAT/enhancer
 binding protein(C/EBP), alpha), GeneBank accession No:
 NM_001769(CD9, CD9 antigen(p24)), GeneBank accession No:
 NM_001718(BMP6, Bone morphogenetic protein 6), GeneBank
 15 accession No: NM_000641(IL11, Interleukin 11), GeneBank
 accession No: BX647459(SERPINE2, Serpin peptidase inhibitor,
 clade E(nexin, plasminogen activator inhibitor type 1),
 member 2), GeneBank accession No: BQ066037(RPS19, Ribosomal
 protein S19), GeneBank accession No: BE791300(EDF1,
 20 Endothelial differentiation-related factor 1), GeneBank
 accession No: BC038504(SNF1LK, SNF1-like kinase), GeneBank
 accession No: AL832287(ZAP70, Zeta-chain(TCR) associated
 protein kinase 70kDa), GeneBank accession No:
 AK125742(PCGF1, Polycomb group ring finger 1), GeneBank
 25 accession No: AK124709(NDRG1, N-myc downstream regulated

gene 1), GeneBank accession No: AB011157(PTDSR, Phosphatidylserine receptor), GeneBank accession No: NM_013255(MKLN1, Muskelein 1, intracellular mediator containing kelch motifs), GeneBank accession No: 5 NM_006572(GNA13, Guanine nucleotide binding protein(G protein), alpha 13), GeneBank accession No: NM_002211(ITGB1, Integrin, beta 1(fibronectin receptor, beta polypeptide, antigen CD29 includes MDF2, MSK12)), GeneBank accession No: CR601067(PLAUR, Plasminogen activator, urokinase receptor), 10 GeneBank accession No: BC050456(THBS4, Thrombospondin 4), GeneBank accession No: AK027389(CXCL16, Chemokine(C-X-C motif) ligand 16), GeneBank accession No: AJ132099(VNN1, Vanin 1), GeneBank accession No: XM_371354(FLJ10157, Hypothetical protein FLJ10157), GeneBank accession No: 15 XM_208313(TPM3, Similar to tropomyosin 4), GeneBank accession No: XM_208270(ACR, Acrosin-like protease), GeneBank accession No: NM_203353(PDLIM7, PDZ and LIM domain 7(enigma)), GeneBank accession No: NM_201382(PLEC1, Plectin 1, intermediate filament binding protein 500kDa), GeneBank 20 accession No: NM_182961(SYNE1, Spectrin repeat containing, nuclear envelope 1), GeneBank accession No: NM_181826(NF2, Neurofibromin 2(bilateral acoustic neuroma)), GeneBank accession No: NM_172069(PLEKHH2, Pleckstrin homology domain containing, family H(with MyTH4 domain) member 2), GeneBank 25 accession No: NM_022648(TNS, Tensin 1), GeneBank accession

No: NM_017556(FBLP-1, Filamin binding LIM protein 1),
 GeneBank accession No: NM_016081(KIAA0992, Palladin,
 cytoskeletal associated protein), GeneBank accession No:
 NM_006617(NES, Nestin), GeneBank accession No:
 5 NM_006262(PRPH, Peripherin), GeneBank accession No:
 NM_005100(AKAP12, A kinase(PRKA) anchor protein(gravin) 12),
 GeneBank accession No: NM_004368(CNN2, Calponin 2),
 GeneBank accession No: NM_003388(CYLN2, Cytoplasmic linker
 2), GeneBank accession No: NM_003370(VASP, Vasodilator-
 10 stimulated phosphoprotein), GeneBank accession No:
 NM_003128(SPTBN1, Spectrin, beta, non-erythrocytic 1),
 GeneBank accession No: NM_002705(PPL, Periplakin), GeneBank
 accession No: NM_002475(MLC1SA, Myosin light chain 1 slow
 a), GeneBank accession No: NM_002018(FLII, Flightless I
 15 homolog(Drosophila)), GeneBank accession No: NM_001465(FYB,
 FYN binding protein(FYB-120/130)), GeneBank accession No:
 NM_001069(TUBB2, Tubulin, beta 2A), GeneBank accession No:
 CR625172(MGC8685, Tubulin, beta 2B), GeneBank accession No:
 CR616919(KRT18, Keratin 18), GeneBank accession No:
 20 CR606241(ACTG1, Actin, gamma 1), GeneBank accession No:
 CB240572(MYH11, Myosin, heavy polypeptide 11, smooth
 muscle), GeneBank accession No: BX648253(PTPN3, Protein
 tyrosine phosphatase, non-receptor type 3), GeneBank
 accession No: BX648190(WDR1, WD repeat domain 1), GeneBank
 25 accession No: BX641076(ACTN1, Actinin, alpha 1), GeneBank

accession No: BX537978(EPB41L1, Erythrocyte membrane
 protein band 4.1-like 1), GeneBank accession No:
 BG121847(NUDC, Nuclear distribution gene C homolog(A.
 nidulans)), GeneBank accession No: BC068013(MYO1C, Myosin
 5 IC), GeneBank accession No: BC065499(MAST2, Microtubule
 associated serine/threonine kinase 2), GeneBank accession
 No: BC051890(TUBG2, Tubulin, gamma 2), GeneBank accession
 No: BC041874(MAP1LC3B, Microtubule-associated protein 1
 light chain 3 beta), GeneBank accession No: BC012597(ACTA1,
 10 Actin, alpha 1, skeletal muscle), GeneBank accession No:
 AY484427(KIF17, Kinesin family member 17), GeneBank
 accession No: AK130546(STOML2, Stomatin(EPB72)-like 2),
 GeneBank accession No: AK124711(CORO2B, Coronin, actin
 binding protein, 2B), GeneBank accession No: AK123974(MYL5,
 15 Myosin, light polypeptide 5, regulatory), GeneBank
 accession No: AK092792(LOC389833, Similar to hypothetical
 protein MGC27019), GeneBank accession No: AK026518(MYOHD1,
 Myosin head domain containing 1), GeneBank accession No:
 AK024500(NICAL, Microtubule associated monooxygenase,
 20 calponin and LIM domain containing 1), GeneBank accession
 No: AF085886(FLJ46675, Ribosomal protein L29 pseudogene 2),
 GeneBank accession No: AB209997(MYO9B, Myosin IXB),
 GeneBank accession No: Y12692(WNT11, Wingless-type MMTV
 integration site family, member 11), GeneBank accession No:
 25 Y11307(CYR61, Cysteine-rich, angiogenic inducer, 61),

GeneBank accession No: X17033(ITGA2, Integrin, alpha 2(CD49B, alpha 2 subunit of VLA-2 receptor)), GeneBank accession No: U41763(CLTCL1, Clathrin, heavy polypeptide-like 1), GeneBank accession No: NM_153609(TMPRSS6, Transmembrane protease, serine 6), GeneBank accession No: NM_031483(ITCH, Itchy homolog E3 ubiquitin protein ligase(mouse)), GeneBank accession No: NM_024342(GRLF1, Glucocorticoid receptor DNA binding factor 1), GeneBank accession No: NM_017555(EGLN2, Egl nine homolog 2(C. elegans)), GeneBank accession No: NM_016569(TBX3, T-box 3(ulnar mammary syndrome)), GeneBank accession No: NM_004148(NINJ1, Ninjurin 1), GeneBank accession No: NM_003377(VEGFB, Vascular endothelial growth factor B), GeneBank accession No: NM_001983(ERCC1, Excision repair cross-complementing rodent repair deficiency, complementation group 1(includes overlapping antisense sequence)), GeneBank accession No: NM_001552(IGFBP4, Insulin-like growth factor binding protein 4), GeneBank accession No: NM_001430(EPAS1, Endothelial PAS domain protein 1), GeneBank accession No: NM_001300(KLF6, Kruppel-like factor 6), GeneBank accession No: NM_001012661(SLC3A2, Solute carrier family 3(activators of dibasic and neutral amino acid transport), member 2), GeneBank accession No: NM_000596(IGFBP1, Insulin-like growth factor binding protein 1), GeneBank accession No: NM_000474(TWIST1, Twist

homolog 1(acrocephalosyndactyly 3; Saethre-Chotzen syndrome)(Drosophila)), GeneBank accession No: BX649103(ChGn, Chondroitin beta1,4 N-acetylgalactosaminyltransferase), GeneBank accession No: 5 BM913048(TIMP1, TIMP metalloproteinase inhibitor 1), GeneBank accession No: BM904612(S100A6, S100 calcium binding protein A6(calcyclin)), GeneBank accession No: BM556279(EMP3, Epithelial membrane protein 3), GeneBank accession No: BC015041(VAT1, Family with sequence 10 similarity 82, member C), GeneBank accession No: AY258066(OKL38, Pregnancy-induced growth inhibitor), GeneBank accession No: AK126729(NDRG4, NDRG family member 4), GeneBank accession No: AK090459(NFE2L1, Nuclear factor(erythroid-derived 2)-like 1), GeneBank accession No: 15 AK074163(ROBO4, Roundabout homolog 4, magic roundabout(Drosophila)), GeneBank accession No: AK024680(FLJ21027 fis, CDNA: FLJ21027 fis, clone CAE07110), GeneBank accession No: AF176422(HEY1, Hairy/enhancer-of-split related with YRPW motif 1), GeneBank accession No: 20 AF003837(JAG1, Jagged 1(Alagille syndrome)), GeneBank accession No: AB209322(SEMA3B, Sema domain, immunoglobulin domain(Ig), short basic domain, secreted,(semaphorin) 3B), GeneBank accession No: AB011150(NRXN1, Neurexin 1), GeneBank accession No: NM_201589(MAFA, V-maf 25 musculoaponeurotic fibrosarcoma oncogene homolog A(avian)),

GeneBank accession No: NM_052999(CKLFSF1, CKLF-like MARVEL transmembrane domain containing 1), GeneBank accession No: NM_006644(HSPH1, Heat shock 105kDa/110kDa protein 1), GeneBank accession No: NM_005438(FOSL1, FOS-like antigen 1),

5 GeneBank accession No: NM_004996(ABCC1, ATP-binding cassette, sub-family C(CFTR/MRP), member 1), GeneBank accession No: NM_002658(PLAU, Plasminogen activator, urokinase), GeneBank accession No: NM_001353(AKR1C1, Aldo-keto reductase family 1, member C1(dihydrodiol

10 dehydrogenase 1; 20-alpha(3-alpha)-hydroxysteroid dehydrogenase)), GeneBank accession No: H18681(C20orf139, Sulfiredoxin 1 homolog(*S. cerevisiae*)), GeneBank accession No: DR004094(HAMP, Hecidin antimicrobial peptide), GeneBank accession No: BC082272(KCNMB3, Potassium large

15 conductance calcium-activated channel, subfamily M beta member 3), GeneBank accession No: BC040494(DNAJB2, DnaJ(Hsp40) homolog, subfamily B, member 2), GeneBank accession No: BC018064(ATF6, Activating transcription factor 6), GeneBank accession No: BC006523(SGK2,

20 Serum/glucocorticoid regulated kinase 2), GeneBank accession No: AK090482(CXCL12, Chemokine(C-X-C motif) ligand 12(stromal cell-derived factor 1)), GeneBank accession No: AF219946(TULP4, Tubby like protein 4), GeneBank accession No: AB209112(SLC2A8, Solute carrier

25 family 2,(facilitated glucose transporter) member 8),

GeneBank accession No: NM_005242(F2RL1, Coagulation factor
 II(thrombin) receptor-like 1), GeneBank accession No:
 NM_001002029(C4A, Complement component 4B, telomeric),
 GeneBank accession No: NM_000539(RHO, Rhodopsin(opsin 2,
 5 rod pigment)(retinitis pigmentosa 4, autosomal dominant)),
 GeneBank accession No: BX649164(PAI, serpin peptidase
 inhibitor, clade E(nexin, plasminogen activator inhibitor
 type 1), member 1), GeneBank accession No: BM918324(LY96,
 Lymphocyte antigen 96), GeneBank accession No:
 10 AB209647(NCF2, Neutrophil cytosolic factor 2(65kDa, chronic
 granulomatous disease, autosomal 2)), GeneBank accession
 No: NM_152221(CSNK1E, Casein kinase 1, epsilon), GeneBank
 accession No: NM_017999(RNF31, Ring finger protein 31),
 GeneBank accession No: NM_016819(OGG1, 8-oxoguanine DNA
 15 glycosylase), GeneBank accession No: NM_016816(OAS1, 2',5'-
 oligoadenylate synthetase 1, 40/46kDa), GeneBank accession
 No: NM_012235(SCAP, SREBP cleavage-activating protein),
 GeneBank accession No: NM_006384(CIB1, Calcium and integrin
 binding 1(calmyrin)), GeneBank accession No: NM_001779(CD58,
 20 CD58 antigen,(lymphocyte function-associated antigen 3)),
 GeneBank accession No: CB055213(ICOSLG, Inducible T-cell
 co-stimulator ligand), GeneBank accession No:
 BX641029(MASP1, Mannan-binding lectin serine peptidase
 1(C4/C2 activating component of Ra-reactive factor)),
 25 GeneBank accession No: BQ053419(BATF, Basic leucine zipper

transcription factor, ATF-like), GeneBank accession No:
 BC039299(STIP1, Stress-induced-phosphoprotein
 1(Hsp70/Hsp90-organizing protein)), GeneBank accession No:
 AY055760(DAF, Decay accelerating factor for complement(CD55,
 5 Cromer blood group system)), GeneBank accession No:
 AK130188(FGR, Gardner-Rasheed feline sarcoma viral(v-fgr)
 oncogene homolog), GeneBank accession No: AK095326(MUS81,
 MUS81 endonuclease homolog(yeast)), GeneBank accession No:
 NM_017670(OTUB1, OTU domain, ubiquitin aldehyde binding 1),
 10 GeneBank accession No: NM_003004(SECTM1, Secreted and
 transmembrane 1), GeneBank accession No: NM_002309(LIF,
 Hypothetical protein MGC20647), GeneBank accession No:
 NM_001421(ELF4, E74-like factor 4(ets domain transcription
 factor)), GeneBank accession No: NM_000418(IL4R,
 15 Interleukin 4 receptor), GeneBank accession No:
 BI909222(FCER1G, Fc fragment of IgE, high affinity I,
 receptor for; gamma polypeptide), GeneBank accession No:
 BF569086(NK4, Interleukin 32), GeneBank accession No:
 BC014470(AZGP1, Alpha-2-glycoprotein 1, zinc), GeneBank
 20 accession No: BC020744(AKR1C4, Aldo-keto reductase family 1,
 member C4(chlordecone reductase; 3-alpha hydroxysteroid
 dehydrogenase, type I; dihydrodiol),dehydrogenase 4),
 GeneBank accession No: BQ939577(AKR1C3, Aldo-keto reductase
 family 1, member C3(3-alpha hydroxysteroid dehydrogenase,
 25 type II)), GeneBank accession No: NM_000499(CYP1A1,

Cytochrome P450, family 1, subfamily A, polypeptide 1),
 GeneBank accession No: NM_030622(CYP2S1, Cytochrome P450,
 family 2, subfamily S, polypeptide 1), GeneBank accession
 No: NM_184041(ALDOA, Aldolase A, fructose-bisphosphate),
 5 GeneBank accession No: NM_024307(MGC4171, Hypothetical
 protein LOC283901), GeneBank accession No: NM_005336(HDLBP,
 High density lipoprotein binding protein(vigilin)),
 GeneBank accession No: NM_002627(PFKP, Phosphofructokinase,
 platelet), GeneBank accession No: BX648281(LDLR, Low
 10 density lipoprotein receptor(familial
 hypercholesterolemia)), GeneBank accession No:
 BC069201(FLJ22761, Hexokinase domain containing 1),
 GeneBank accession No: BC030207(NR0B2, Nuclear receptor
 subfamily 0, group B, member 2), GeneBank accession No:
 15 AL833069(KIAA1434, Hypothetical protein KIAA1434), GeneBank
 accession No: AK124656(ENO2, Enolase 2(gamma, neuronal)),
 GeneBank accession No: AK094474(RHOC, Ras homolog gene
 family, member C), GeneBank accession No: AK093461(ISYNA1,
 Myo-inositol 1-phosphate synthase A1), GeneBank accession
 20 No: AB053232(GAL3ST3, Galactose-3-O-sulfotransferase 3),
 GeneBank accession No: AB045292(TMEN8, Transmembrane
 protein 8(five membrane-spanning domains)), GeneBank
 accession No: NM_004753(DHRS3, Dehydrogenase/reductase(SDR
 family) member 3), GeneBank accession No: NM_002900(RBP3,
 25 Retinol binding protein 3, interstitial), GeneBank

accession No: NM_001995(ACSL1, Acyl-CoA synthetase long-
 chain family member 1), GeneBank accession No:
 NM_000018(ACADVL, Acyl-Coenzyme A dehydrogenase, very long
 chain), GeneBank accession No: BC094756(CRA, Myotubularin
 5 related protein 11), GeneBank accession No: BC050553(NTE,
 Neuropathy target esterase), GeneBank accession No:
 BC033110(HSD17B1, Hydroxysteroid(17-beta) dehydrogenase 1),
 GeneBank accession No: AY268890(TPP1, Tripeptidyl peptidase
 I), GeneBank accession No: AK172798(CPT1A, Carnitine
 10 palmitoyltransferase 1A(liver)), GeneBank accession No:
 AK096809(CYP4F8, Cytochrome P450, family 4, subfamily F,
 polypeptide 8), GeneBank accession No: AK000600(SIAT7D,
 ST6(alpha-N-acetyl-neuraminyl-2,3-beta- galactosyl-1,3)-N-
 acetylgalactosaminide alpha-2,6-sialyltransferase 4),
 15 GeneBank accession No: AB002454(CYP4F3, Cytochrome P450,
 family 4, subfamily F, polypeptide 3), GeneBank accession
 No: Z29093(DDR1, Discoidin domain receptor family, member
 1), GeneBank accession No: Z25424(MKNK2, MAP kinase
 interacting serine/threonine kinase 2), GeneBank accession
 20 No: XM_291277(DKFZp761P0423, Hypothetical protein
 DKFZp761P0423), GeneBank accession No: XM_038150(MAST3,
 Microtubule associated serine/threonine kinase 3), GeneBank
 accession No: U88357(ERBB3, V-erb-b2 erythroblastic
 leukemia viral oncogene homolog 3(avian)), GeneBank
 25 accession No: NM_025195(TRIB1, Tribbles homolog

1(Drosophila)), GeneBank accession No: NM_020639(RIPK4,
 Receptor-interacting serine-threonine kinase 4), GeneBank
 accession No: NM_014172(PHPT1, Phosphohistidine phosphatase
 1), GeneBank accession No: NM_006254(PRKCD, Protein kinase
 5 C, delta), GeneBank accession No: NM_005415(SLC20A1, Solute
 carrier family 20(phosphate transporter), member 1),
 GeneBank accession No: NM_005026(PIK3CD, Phosphoinositide-
 3-kinase, catalytic, delta polypeptide), GeneBank accession
 No: NM_004431(EPHA2, EPH receptor A2), GeneBank accession
 10 No: NM_004419(DUSP5, Dual specificity phosphatase 5),
 GeneBank accession No: NM_004327(BCR, Breakpoint cluster
 region), GeneBank accession No: NM_004231(ATP6V1F, ATPase,
 H⁺ transporting, lysosomal 14kDa, V1 subunit F), GeneBank
 accession No: NM_004090(DUSP3, Dual specificity phosphatase
 15 3(vaccinia virus phosphatase VH1-related)), GeneBank
 accession No: NM_002843(PTPRJ, Protein tyrosine phosphatase,
 receptor type, J), GeneBank accession No: NM_002496(NDUFS8,
 NADH dehydrogenase(ubiquinone) Fe-S protein 8, 23kDa(NADH-
 coenzyme Q reductase)), GeneBank accession No:
 20 NM_001001852(PIM3, Pim-3 oncogene), GeneBank accession No:
 L76191(IRAK1, Interleukin-1 receptor-associated kinase 1),
 GeneBank accession No: D15049(PTPRH, Protein tyrosine
 phosphatase, receptor type, H), GeneBank accession No:
 BC065207(ATP6V0D2, ATPase, H⁺ transporting, lysosomal 38kDa,
 25 V0 subunit d isoform 2), GeneBank accession No:

BC035578(STK24, Serine/threonine kinase 24(STE20 homolog, yeast)), GeneBank accession No: BC028724(DUSP18, Dual specificity phosphatase 18), GeneBank accession No: AL117482(ULK3, Unc-51-like kinase 3(C. elegans)), GeneBank
5 accession No: AK126879(PCTK3, PCTAIRE protein kinase 3), GeneBank accession No: AB209416(ILK, Integrin-linked kinase-2), GeneBank accession No: NM_000782(CYP24A1, Cytochrome P450, family 24, subfamily A, polypeptide 1), GeneBank accession No: CR597101(ZFP36, Zinc finger protein
10 36, C3H type, homolog(mouse)), GeneBank accession No: CR936799(FHL2, Four and a half LIM domains 2), GeneBank accession No: M24898(NR1D1, Nuclear receptor subfamily 1, group D, member 1), GeneBank accession No: AF132818(KLF5, Kruppel-like factor 5(intestinal)), GeneBank accession No:
15 AK055337(ZNF213, Zinc finger protein 213), GeneBank accession No: BC008834(PHF1, PHD finger protein 1), GeneBank accession No: AK126918(GLIS2, GLIS family zinc finger 2), GeneBank accession No: BC042692(CTL2, Solute carrier family 44, member 2), GeneBank accession No:
20 NM_002224(ITPR3, Inositol 1,4,5-triphosphate receptor, type 3), GeneBank accession No: AK095363(AQP3, Aquaporin 3), GeneBank accession No: NM_174953(ATP2A3, ATPase, Ca⁺⁺ transporting, ubiquitous), GeneBank accession No: BC042390(VTI1B, Vesicle transport through interaction with
25 t-SNAREs homolog 1B(yeast)), GeneBank accession No:

NM_016113(TRPV2, Transient receptor potential cation channel, subfamily V, member 2), GeneBank accession No: BM926478(RBP1, Retinol binding protein 1, cellular), GeneBank accession No: NM_000069(CACNA1S, Calcium channel, voltage-dependent, L type, alpha 1S subunit), GeneBank accession No: AK002107(RAB3B, RAB3B, member RAS oncogene family), GeneBank accession No: NM_013321(SNX8, Sorting nexin 8), GeneBank accession No: AK125026(SLC6A12, Solute carrier family 6(neurotransmitter transporter, betaine/GABA), member 12), GeneBank accession No: NM_005843(STAM2, Signal transducing adaptor molecule(SH3 domain and ITAM motif) 2), GeneBank accession No: AK092512(SLC16A5, Solute carrier family 16(monocarboxylic acid transporters), member 5), GeneBank accession No: U49248(ABCC2, ATP-binding cassette, sub-family C(CFTR/MRP), member 2), GeneBank accession No: AK172792(SCNN1A, Sodium channel, nonvoltage-gated 1 alpha), GeneBank accession No: BC044656(CASC3, Cancer susceptibility candidate 3), GeneBank accession No: NM_203403(C9orf150, Chromosome 9 open reading frame 150), GeneBank accession No: NM_080388(S100A16, S100 calcium binding protein A16), GeneBank accession No: NM_031286(SH3BGRL3, SH3 domain binding glutamic acid-rich protein like 3), GeneBank accession No: NM_022153(PP2135, Chromosome 10 open reading frame 54), GeneBank accession No: NM_004864(GDF15, Growth

differentiation factor 15), GeneBank accession No:
NM_003330(TXNRD1, Thioredoxin reductase 1), GeneBank
accession No: NM_001013632(LOC343521, Similar to
hypothetical protein 4833401D15), GeneBank accession No:
5 BX537968(LOC51149, Hypothetical LOC51149), GeneBank
accession No: BU945318(MT2A, Hypothetical gene supported by
X97260; BC070289), GeneBank accession No: BQ683841(S100A11,
S100 calcium binding protein A11(calgizzarin)), GeneBank
accession No: BQ276852(TMSB10, Thymosin, beta 10), GeneBank
10 accession No: AK126182(KIAA1949, KIAA1949), GeneBank
accession No: AK124751(CAPN2, Calpain 2,(m/II) large
subunit), GeneBank accession No: AK095079(RGC32, Response
gene to complement 32), GeneBank accession No:
AB075871(FLJ42654, Golgi transport 1 homolog A(S.
15 cerevisiae)), GeneBank accession No: AK125150(MAPK8,
Mitogen-activated protein kinase 8), GeneBank accession No:
NM_002758(MAP2K6, Mitogen-activated protein kinase kinase
6), GeneBank accession No: NM_004612(TGFBR1, Transforming
growth factor, beta receptor I(activin A receptor type II-
20 like kinase, 53kDa)), GeneBank accession No:
NM_145686(MAP4K4, Mitogen-activated protein kinase kinase
kinase kinase 4), GeneBank accession No: XM_042066(MAP3K1,
Mitogen-activated protein kinase kinase kinase 1), GeneBank
accession No: AB011123(TNIK, TRAF2 and NCK interacting
25 kinase), GeneBank accession No: AB209031(C5, Complement

component 5), GeneBank accession No: NM_022740(HIPK2,
 Homeodomain interacting protein kinase 2), GeneBank
 accession No: NM_148957(TNFRSF19, Tumor necrosis factor
 receptor superfamily, member 19), GeneBank accession No:
 5 AB208909(ITGB2, Integrin, beta 2(antigen CD18(p95),
 lymphocyte function-associated antigen 1; macrophage
 antigen 1(mac-1) beta subunit)), GeneBank accession No:
 AB209211(TIA1, TIA1 cytotoxic granule-associated RNA
 binding protein), GeneBank accession No: AB209613(DNASE1L3,
 10 Deoxyribonuclease I-like 3), GeneBank accession No:
 AK122825(HMGB1, High-mobility group box 1), GeneBank
 accession No: AK127326(PHF17, PHD finger protein 17),
 GeneBank accession No: AK223503(CASP1, Caspase 1,
 apoptosis-related cysteine peptidase(interleukin 1, beta,
 15 convertase)), GeneBank accession No: BC013326(GAS2, Growth
 arrest-specific 2), GeneBank accession No: BC047698(IL7,
 Interleukin 7), GeneBank accession No: D79987(ESPL1, Extra
 spindle poles like 1(*S. cerevisiae*)), GeneBank accession
 No: NM_000893(KNG1, Kininogen 1), GeneBank accession No:
 20 NM_001012271(BIRC5, Effector cell peptidase receptor 1),
 GeneBank accession No: NM_004938(DAPK1, Death-associated
 protein kinase 1), GeneBank accession No: NM_005879(TRIP,
 TRAF interacting protein), GeneBank accession No:
 NM_014739(BCLAF1, BCL2-associated transcription factor 1),
 25 GeneBank accession No: NM_018947(CYCS, Cytochrome c,

somatic), GeneBank accession No: AB033337(MPHOSPH1, M-phase phosphoprotein 1), GeneBank accession No: AB209179(PLK1, Polo-like kinase 1(Drosophila)), GeneBank accession No: AB209337(CDC7, CDC7 cell division cycle 7(S. cerevisiae)),

5 GeneBank accession No: AF053305(BUB1, BUB1 budding uninhibited by benzimidazoles 1 homolog(yeast)), GeneBank accession No: AF053306(BUB1B, BUB1 budding uninhibited by benzimidazoles 1 homolog beta(yeast)), GeneBank accession No: AF345347(SPAG5, Sperm associated antigen 5), GeneBank

10 accession No: AK092638(CCNG2, Cyclin G2), GeneBank accession No: AK222819(NUSAP1, Nucleolar and spindle associated protein 1), GeneBank accession No: AL833191(SMC2L1, SMC2 structural maintenance of chromosomes 2-like 1(yeast)), GeneBank accession No: AY257469(CIT, Citron(rho-interacting, serine/threonine kinase 21)),

15 GeneBank accession No: AY367065(ASPM, Asp(abnormal spindle)-like, microcephaly associated(Drosophila)), GeneBank accession No: BC011000(CDCA5, Cell division cycle associated 5), GeneBank accession No: BC032677(UBE2C, Ubiquitin-conjugating enzyme E2C), GeneBank accession No: BC043502(NEK2, NIMA(never in mitosis gene a)-related kinase 2), GeneBank accession No: BU675073(PTTG1, Pituitary tumor-transforming 1), GeneBank accession No: BX647885(STMN1, Stathmin 1/oncoprotein 18), GeneBank accession No:

20 CR592757(BRRN1, Barren homolog 1(Drosophila)), GeneBank

25

accession No: CR597075(MAPRE2, Microtubule-associated
 protein, RP/EB family, member 2), GeneBank accession No:
 CR604810(CCNA2, Cyclin A2), GeneBank accession No:
 CR933728(CDC2, Cell division cycle 2, G1 to S and G2 to M),
 5 GeneBank accession No: NM_000919(PAM, Peptidylglycine
 alpha-amidating monooxygenase), GeneBank accession No:
 NM_001790(CDC25C, Cell division cycle 25C), GeneBank
 accession No: NM_001798(CDK2, Cyclin-dependent kinase 2),
 GeneBank accession No: NM_001813(CENPE, Centromere protein
 10 E, 312kDa), GeneBank accession No: NM_003318(TTK, TTK
 protein kinase), GeneBank accession No: NM_003981(PRC1,
 Protein regulator of cytokinesis 1), GeneBank accession No:
 NM_004523(KIF11, Kinesin family member 11), GeneBank
 accession No: NM_004701(CCNB2, Cyclin B2), GeneBank
 15 accession No: NM_005983(SKP2, S-phase kinase-associated
 protein 2(p45)), GeneBank accession No: NM_006101(KNTC2,
 Kinetochore associated 2), GeneBank accession No:
 NM_006845(KIF2C, Kinesin family member 2C), GeneBank
 accession No: NM_007375(TARDBP, TAR DNA binding protein),
 20 GeneBank accession No: NM_012112(TPX2, TPX2, microtubule-
 associated, homolog(Xenopus laevis)), GeneBank accession
 No: NM_014750(DLG7, Discs, large homolog 7(Drosophila)),
 GeneBank accession No: NM_015097(CLASP2, Cytoplasmic linker
 associated protein 2), GeneBank accession No:
 25 NM_016343(CENPF, Centromere protein F, 350/400ka(mitotin)),

GeneBank accession No: NM_016426(GTSE1, G-2 and S-phase expressed 1), GeneBank accession No: NM_018492(PBK, PDZ binding kinase), GeneBank accession No: NM_018685(ANLN, Anillin, actin binding protein(scrap homolog, Drosophila)),

5 GeneBank accession No: NM_020242(KNSL7, Kinesin family member 15), GeneBank accession No: NM_031966(CCNB1, Cyclin B1), GeneBank accession No: NM_138555(KIF23, Kinesin family member 23), GeneBank accession No: U65410(MAD2L1, MAD2 mitotic arrest deficient-like 1(yeast)), GeneBank accession

10 No: AB020656(CYLD, Cyldromatosis(turban tumor syndrome)), GeneBank accession No: AF033122(SESNI, Sestrin 1), GeneBank accession No: AK074377(UHRF1, Chromosome 19 open reading frame 31), GeneBank accession No: AK091170(CDKN2C, Cyclin-dependent kinase inhibitor 2C(p18, inhibits CDK4)),

15 GeneBank accession No: AK094323(NFYC, Nuclear transcription factor Y, gamma), GeneBank accession No: AY366508(LOH11CR2A, Loss of heterozygosity, 11, chromosomal region 2, gene A), GeneBank accession No: BC033086(TCF19, Transcription factor 19(SC1)), GeneBank accession No: BC040303(PTP4A1, Protein tyrosine phosphatase type IVA, member 1), GeneBank

20 accession No: BC040991(TFDP2, Transcription factor Dp-2(E2F dimerization partner 2)), GeneBank accession No: BC092412(SGOL2, Shugoshin-like 2(S. pombe)), GeneBank accession No: BQ278454(CKS1B, CDC28 protein kinase regulatory subunit 1B), GeneBank accession No:

25

BX649128(SESN3, Sestrin 3), GeneBank accession No:
CD049340(AURKB, Aurora kinase B), GeneBank accession No:
M89914(NF1, Neurofibromin 1(neurofibromatosis, von
Recklinghausen disease, Watson disease)), GeneBank
5 accession No: NM_001005414(ZWINT, ZW10 interactor
antisense), GeneBank accession No: NM_001008491(Sep 2,
Septin 2), GeneBank accession No: NM_001274(CHEK1, CHK1
checkpoint homolog(*S. pombe*)), GeneBank accession No:
NM_002105(H2AFX, H2A histone family, member X), GeneBank
10 accession No: NM_002388(MCM3, MCM3 minichromosome
maintenance deficient 3(*S. cerevisiae*)), GeneBank accession
No: NM_002417(MKI67, Antigen identified by monoclonal
antibody Ki-67), GeneBank accession No: NM_002875(RAD51,
RAD51 homolog(RecA homolog, *E. coli*)(*S. cerevisiae*)),
15 GeneBank accession No: NM_003884(PCAF, P300/CBP-associated
factor), GeneBank accession No: NM_004526(MCM2, MCM2
minichromosome maintenance deficient 2, mitotin(*S.*
cerevisiae)), GeneBank accession No: NM_004847(AIF1,
Allograft inflammatory factor 1), GeneBank accession No:
20 NM_005915(MCM6, MCM6 minichromosome maintenance deficient
6(MIS5 homolog, *S. pombe*)(*S. cerevisiae*)), GeneBank
accession No: NM_012090(MACF1, Microtubule-actin
crosslinking factor 1), GeneBank accession No:
NM_012415(RAD54B, RAD54 homolog B(*S. cerevisiae*)), GeneBank
25 accession No: NM_014264(PLK4, Polo-like kinase

4(*Drosophila*)), GeneBank accession No: NM_015714(G0S2,
 G0/G1switch 2), GeneBank accession No: NM_024680(FLJ23311,
 E2F transcription factor 8), GeneBank accession No:
 XM_034274(MYBL1, V-myb myeloblastosis viral oncogene
 5 homolog(avian)-like 1), GeneBank accession No:
 AK001720(FLJ10858, Nei endonuclease VIII-like 3(*E. coli*)),
 GeneBank accession No: AY032677(POLQ, Polymerase(DNA
 directed), theta), GeneBank accession No: BC034480(BLM,
 Bloom syndrome), GeneBank accession No: BC073161(RAD51C,
 10 RAD51 homolog C(*S. cerevisiae*)), GeneBank accession No:
 CR600021(HMGB2, High-mobility group box 2), GeneBank
 accession No: CR625391(RAD51AP1, RAD51 associated protein
 1), GeneBank accession No: CR936783(FLJ40869, Hypothetical
 protein LOC284952), GeneBank accession No:
 15 DQ140356(KIAA1596, Fanconi anemia, complementation group M),
 GeneBank accession No: NM_001067(TOP2A, Topoisomerase(DNA)
 II alpha 170kDa), GeneBank accession No: NM_001618(PARP1,
 Poly(ADP-ribose) polymerase family, member 1), GeneBank
 accession No: NM_003362(UNG, Uracil-DNA glycosylase),
 20 GeneBank accession No: NM_006904(PRKDC, Protein kinase,
 DNA-activated, catalytic polypeptide), GeneBank accession
 No: NM_130398(EXO1, Exonuclease 1), GeneBank accession No:
 AB020807(TLR6, Toll-like receptor 6), GeneBank accession
 No: AB032980(DCDC2, Doublecortin domain containing 2),
 25 GeneBank accession No: AB209866(TFPI, Tissue factor pathway

inhibitor(lipoprotein-associated coagulation inhibitor)),
 GeneBank accession No: AK057015(HSPA4, Heat shock 70kDa
 protein 4), GeneBank accession No: AK095515(IFIT1,
 Interferon-induced protein with tetratricopeptide repeats
 5 1), GeneBank accession No: AK122686(IF, I
 factor(complement)), GeneBank accession No: AK123010(RRM2,
 Ribonucleotide reductase M2 polypeptide), GeneBank
 accession No: BC035582(TRIM22, Tripartite motif-containing
 22), GeneBank accession No: BX537894(LOC493869, Similar to
 10 RIKEN cDNA 2310016C16), GeneBank accession No: M14338(PROS1,
 Protein S(alpha)), GeneBank accession No: NM_000821(GGCX,
 Gamma-glutamyl carboxylase), GeneBank accession No:
 NM_000963(PTGS2, Prostaglandin-endoperoxide synthase
 2(prostaglandin G/H synthase and cyclooxygenase)), GeneBank
 15 accession No: NM_001001547(CD36, CD36 antigen(collagen type
 I receptor, thrombospondin receptor)), GeneBank accession
 No: NM_001512(GSTA4, Glutathione S-transferase A4),
 GeneBank accession No: NM_001629(ALOX5AP, Arachidonate 5-
 lipoxygenase-activating protein), GeneBank accession No:
 20 NM_001752(CAT, Catalase), GeneBank accession No:
 NM_001837(CCR3, Chemokine(C-C motif) receptor 3), GeneBank
 accession No: NM_001979(EPHX2, Epoxide hydrolase 2,
 cytoplasmic), GeneBank accession No: NM_001994(F13B,
 Coagulation factor XIII, B polypeptide), GeneBank accession
 25 No: NM_002182(IL1RAP, Interleukin 1 receptor accessory

protein), GeneBank accession No: NM_006120(HLA-DMA, Major histocompatibility complex, class II, DM alpha), GeneBank accession No: NM_173216(SIAT1, ST6 beta-galactosamide alpha-2,6-sialyltransferase 1), GeneBank accession No: 5 NM_202002(FOXM1, Forkhead box M1), GeneBank accession No: AB163917(LRAP, Leukocyte-derived arginine aminopeptidase), GeneBank accession No: BC027881(AFP, Alpha-fetoprotein), GeneBank accession No: NM_015915(SPG3A, Spastic paraplegia 3A(autosomal dominant)), GeneBank accession No: 10 NM_000671(ADH5, Alcohol dehydrogenase 5(class III), chi polypeptide), GeneBank accession No: J05428(UGT2B7, UDP glucuronosyltransferase 2 family, polypeptide B7), GeneBank accession No: NM_000672(ADH6, Alcohol dehydrogenase 6(class V)), GeneBank accession No: M15943(ADH4, Alcohol 15 dehydrogenase 4(class II), pi polypeptide), GeneBank accession No: AK223395(FBP1, Fructose-1,6-bisphosphatase 1), GeneBank accession No: NM_000151(G6PC, Glucose-6-phosphatase, catalytic(glycogen storage disease type I, von Gierke disease)), GeneBank accession No: XM_113962(KIAA0650, 20 Structural maintenance of chromosomes flexible hinge domain containing 1), GeneBank accession No: AB020644(ACSL6, Acyl-CoA synthetase long-chain family member 6), GeneBank accession No: AB209907(PLD1, Phospholipase D1, phosphatidylcholine-specific), GeneBank accession No: 25 AF285167(ABCA1, ATP-binding cassette, sub-family A(ABC1),

member 1), GeneBank accession No: AF297872(TrERF1, Transcriptional regulating factor 1), GeneBank accession No: AF303134(ALDH8A1, Aldehyde dehydrogenase 8 family, member A1), GeneBank accession No: AF339053(PLA2G12B, Phospholipase A2, group XIIB), GeneBank accession No: AK096018(HADHSC, L-3-hydroxyacyl-Coenzyme A dehydrogenase, short chain), GeneBank accession No: AK124635(PCSK9, Proprotein convertase subtilisin/kexin type 9), GeneBank accession No: AK127346(SIAT9, ST3 beta-galactoside alpha-2,3-sialyltransferase 5), GeneBank accession No: AL359559(AGPS, Alkylglycerone phosphate synthase), GeneBank accession No: AY691170(PLCL3, Phospholipase C-like 3), GeneBank accession No: BG567934(APOM, Apolipoprotein M), GeneBank accession No: BX538214(C6orf167, Chromosome 6 open reading frame 167), GeneBank accession No: BX640945(FADS2, Fatty acid desaturase 2), GeneBank accession No: BX648473(PIGK, Phosphatidylinositol glycan, class K), GeneBank accession No: BX648557(HSD17B2, Hydroxysteroid(17-beta) dehydrogenase 2), GeneBank accession No: CR749601(ETNK1, Death-associated protein kinase 3), GeneBank accession No: NM_000859(HMGCR, 3-hydroxy-3-methylglutaryl-Coenzyme A reductase), GeneBank accession No: NM_001443(FABP1, Fatty acid binding protein 1, liver), GeneBank accession No: NM_002130(HMGCS1, 3-hydroxy-3-methylglutaryl-Coenzyme A synthase 1(soluble)), GeneBank

accession No: NM_003725(RODH, Hydroxysteroid(17-beta)
 dehydrogenase 6), GeneBank accession No: NM_004845(PCYT1B,
 Phosphate cytidylyltransferase 1, choline, beta), GeneBank
 accession No: NM_014762(DHCR24, 24-dehydrocholesterol
 5 reductase), GeneBank accession No: NM_020139(DHRS6,
 Dehydrogenase/reductase(SDR family) member 6), GeneBank
 accession No: NM_020918(GPAM, Glycerol-3-phosphate
 acyltransferase, mitochondrial), GeneBank accession No:
 NM_032523(OSBPL6, Oxysterol binding protein-like 6),
 10 GeneBank accession No: NM_033505(SELI, Selenoprotein I),
 GeneBank accession No: Z28339(AKR1D1, Aldo-keto reductase
 family 1, member D1(delta 4-3-ketosteroid-5-beta-
 reductase)), GeneBank accession No: AK024899(ENPP3,
 Ectonucleotide pyrophosphatase/phosphodiesterase 3),
 15 GeneBank accession No: AK025546(PTPN4, Protein tyrosine
 phosphatase, non-receptor type 4(megakaryocyte)), GeneBank
 accession No: AK124910(ENPP2, Ectonucleotide
 pyrophosphatase/phosphodiesterase 2(autotaxin)), GeneBank
 accession No: BC035116(FLJ35059 fis, CDNA FLJ30761 fis,
 20 clone FEBRA2000538), GeneBank accession No: BC050565(PASK,
 PAS domain containing serine/threonine kinase), GeneBank
 accession No: L13436(NPR2, Natriuretic peptide receptor
 B/guanylate cyclase B(atrionatriuretic peptide receptor B)),
 GeneBank accession No: NM_001005862(ERBB2, V-erb-b2
 25 erythroblastic leukemia viral oncogene homolog 2,

neuro/glioblastoma derived oncogene homolog(avian)),
 GeneBank accession No: NM_005012(ROR1, Receptor tyrosine
 kinase-like orphan receptor 1), GeneBank accession No:
 NM_006035(CDC42BPB, CDC42 binding protein kinase beta(DMPK-
 5 like)), GeneBank accession No: NM_014791(MELK, Maternal
 embryonic leucine zipper kinase), GeneBank accession No:
 NM_023028(FGFR2, Fibroblast growth factor receptor
 2(bacteria-expressed kinase, keratinocyte growth factor
 receptor, craniofacial dysostosis 1, Crouzon syndrome,
 10 Pfeiffer syndrome, Jackson-Weiss syndrome)), GeneBank
 accession No: NM_080836(STK35, Serine/threonine kinase 35),
 GeneBank accession No: AF419331(FUSIP1, FUS interacting
 protein(serine/arginine-rich) 1), GeneBank accession No:
 AK091927(SFRS3, Splicing factor, arginine/serine-rich 3),
 15 GeneBank accession No: BC010266(HNRNPA1, Heterogeneous
 nuclear ribonucleoprotein A1), GeneBank accession No:
 BC012360(CTAGE5, CTAGE family, member 5), GeneBank
 accession No: BC036046(PLRG1, Pleiotropic regulator 1(PRL1
 homolog, Arabidopsis)), GeneBank accession No:
 20 BC065384(PCF11, PCF11, cleavage and polyadenylation factor
 subunit, homolog(S. cerevisiae)), GeneBank accession No:
 BX537360(CPSF5, Nudix(nucleoside diphosphate linked moiety
 X)-type motif 21), GeneBank accession No: BX537494(HNRPA2B1,
 Heterogeneous nuclear ribonucleoprotein A2/B1), GeneBank
 25 accession No: BX647784(HNRPR, Heterogeneous nuclear

ribonucleoprotein R), GeneBank accession No: CA455267(PPIH, Peptidyl prolyl isomerase H(cyclophilin H)), GeneBank accession No: CR596214(HNRPA0, Heterogeneous nuclear ribonucleoprotein A0), GeneBank accession No: NM_001326(CSTF3, Hypothetical protein LOC283267), GeneBank accession No: NM_004640(BAT1, HLA-B associated transcript 1), GeneBank accession No: NM_005463(HNRPDL, Heterogeneous nuclear ribonucleoprotein D-like), GeneBank accession No: NM_006924(SFRS1, Splicing factor, arginine/serine-rich 1(splicing factor 2, alternate splicing factor)), GeneBank accession No: NM_012426(SF3B3, Splicing factor 3b, subunit 3, 130kDa), GeneBank accession No: NM_018048(FLJ10292, Mago-nashi homolog), GeneBank accession No: NM_030919(C20orf129, Chromosome 20 open reading frame 129), GeneBank accession No: NM_031370(HNRPD, Heterogeneous nuclear ribonucleoprotein D(AU-rich element RNA binding protein 1, 37kDa)), GeneBank accession No: NM_138933(ACF, Apobec-1 complementation factor), GeneBank accession No: AB193259(ACE2, Angiotensin I converting enzyme(peptidyl-dipeptidase A) 2), GeneBank accession No: BX648769(EWSR1, Ewing sarcoma breakpoint region 1), GeneBank accession No: AB023154(DTX4, Deltex 4 homolog(Drosophila)), GeneBank accession No: AL543755(VAV3, Vav 3 oncogene), GeneBank accession No: M75106(CPB2, Carboxypeptidase B2(plasma, carboxypeptidase U)), GeneBank accession No:

NM_021045(ZNF248, Zinc finger protein 248), GeneBank
 accession No: AB209194(B4GALT6, UDP-Gal:betaGlcNAc beta
 1,4- galactosyltransferase, polypeptide 6), GeneBank
 accession No: AF279145(ANTXR1, Anthrax toxin receptor 1),
 5 GeneBank accession No: NM_025074(FRAS1, Fraser syndrome 1),
 GeneBank accession No: AK025790(KIF20A, Kinesin family
 member 20A), GeneBank accession No: NM_006152(LRMP,
 Lymphoid-restricted membrane protein), GeneBank accession
 No: NM_000340(SLC2A2, Solute carrier family 2(facilitated
 10 glucose transporter), member 2), GeneBank accession No:
 AF071592(KIF4A, Kinesin family member 4A), GeneBank
 accession No: NM_013277(RACGAP1, Rac GTPase activating
 protein 1), GeneBank accession No: AY043484(SCN1A, Sodium
 channel, voltage-gated, type I, alpha), GeneBank accession
 15 No: AY791349(KIF18A, Kinesin family member 18A), GeneBank
 accession No: NM_018018(SLC38A4, Solute carrier family 38,
 member 4), GeneBank accession No: AK094603(FLJ37284 fis,
 unnamed protein product; Homo sapiens cDNA FLJ37284 fis,
 clone BRAMY2013590.), GeneBank accession No:
 20 NM_021069(ARGBP2, Sorbin and SH3 domain containing 2),
 GeneBank accession No: NM_001005747(CACNB4, Calcium channel,
 voltage-dependent, beta 4 subunit), GeneBank accession No:
 AJ496568(SLC25A12, Solute carrier family 25(mitochondrial
 carrier, Aralar), member 12), GeneBank accession No:
 25 NM_030641(APOL6, Apolipoprotein L, 6), GeneBank accession

No: NM_173512(FLJ39822, Hypothetical protein FLJ39822),
 GeneBank accession No: NM_000037(ANK1, Ankyrin 1,
 erythrocytic), GeneBank accession No: NM_001011554(SLC13A3,
 Solute carrier family 13(sodium-dependent dicarboxylate
 5 transporter), member 3), GeneBank accession No:
 AB091343(C10orf3, Centrosomal protein 55kDa), GeneBank
 accession No: AK000643(ASB9, Ankyrin repeat and SOCS box-
 containing 9), GeneBank accession No: AK055221(FBXO5, F-box
 protein 5), GeneBank accession No: AK075271(SPTLC2L, Serine
 10 palmitoyltransferase, long chain base subunit 2-
 like(aminotransferase 2)), GeneBank accession No:
 AK122685(GLUD1, Glutamate dehydrogenase 1), GeneBank
 accession No: AK127098(FLJ10706, Chromosome 1 open reading
 frame 112), GeneBank accession No: AL133031(MLR1,
 15 Transcription factor MLR1), GeneBank accession No:
 AY007723(MAL2, Mal, T-cell differentiation protein 2),
 GeneBank accession No: BC022255(Spc25, Spindle pole body
 component 25 homolog(*S. cerevisiae*)), GeneBank accession
 No: BC041882(ATF7IP2, Activating transcription factor 7
 20 interacting protein 2), GeneBank accession No:
 BC052951(LMNB1, Lamin B1), GeneBank accession No:
 BC098313(FLJ20641, Hypothetical protein FLJ20641), GeneBank
 accession No: NM_001809(CENPA, Centromere protein A, 17kDa),
 GeneBank accession No: NM_145061(C13orf3, Chromosome 13
 25 open reading frame 3), GeneBank accession No:

XM_372695(LOC390859, PREDICTED: Homo sapiens similar to Chain A, Crystal Structure Of The R463a Mutant Of Human Glutamate Dehydrogenase(LOC390859), mRNA).

5 **【Claim 7】**

The method according to claim 6, wherein the below genes are up-regulated by exposure to phenanthrene:

GeneBank accession No: NM_004420(DUSP8, Dual specificity phosphatase 8), GeneBank accession No:
 10 L11329(DUSP2, Dual specificity phosphatase 2), GeneBank accession No: BC094766(PKN1, Protein kinase N1), GeneBank accession No: AY247738(TRIB3, Tribbles homolog 3(Drosophila)), GeneBank accession No: AK129595(GADD45B, Growth arrest and DNA-damage-inducible, beta), GeneBank
 15 accession No: AB208849(SHC1, SHC(Src homology 2 domain containing) transforming protein 1), GeneBank accession No: X02812(TGFB1, Transforming growth factor, beta 1(Camurati-Engelmann disease)), GeneBank accession No: NM_198951(TGM2, Transglutaminase 2(C polypeptide, protein-glutamine-gamma-glutamyltransferase)), GeneBank accession No:
 20 NM_147780(CTSB, Cathepsin B), GeneBank accession No: NM_078467(CDKN1A, Cyclin-dependent kinase inhibitor 1A(p21, Cip1)), GeneBank accession No: NM_033027(AXUD1, AXIN1 up-regulated 1), GeneBank accession No: NM_032797(AMID, Apoptosis-inducing factor(AIF)-like mitochondrion-

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associated inducer of death), GeneBank accession No: NM_021960(MCL1, Myeloid cell leukemia sequence 1(BCL2-related)), GeneBank accession No: NM_016639(TNFRSF12A, Tumor necrosis factor receptor superfamily, member 12A),

5 GeneBank accession No: NM_016222(DDX41, DEAD(Asp-Glu-Ala-Asp) box polypeptide 41), GeneBank accession No: NM_013246(CLC, Cardiotrophin-like cytokine factor 1), GeneBank accession No: NM_004401(DFFA, DNA fragmentation factor, 45kDa, alpha polypeptide), GeneBank accession No:

10 NM_004281(BAG3, BCL2-associated athanogene 3), GeneBank accession No: NM_003897(IER3, Immediate early response 3), GeneBank accession No: NM_003806(HRK, Harakiri, BCL2 interacting protein(contains only BH3 domain)), GeneBank accession No: NM_003639(IKBKG, Inhibitor of kappa light

15 polypeptide gene enhancer in B-cells, kinase gamma), GeneBank accession No: NM_003311(PHLDA2, Pleckstrin homology-like domain, family A, member 2), GeneBank accession No: NM_002737(PRKCA, Protein kinase C, alpha), GeneBank accession No: NM_002648(PIM1, Pim-1 oncogene),

20 GeneBank accession No: NM_002507(NGFR, Nerve growth factor receptor(TNFR superfamily, member 16)), GeneBank accession No: NM_002305(LGALS1, Lectin, galactoside-binding, soluble, 1(galectin 1)), GeneBank accession No: NM_001013398(IGFBP3, Insulin-like growth factor binding protein 3), GeneBank

25 accession No: BX640923(MDM4, Mdm4, transformed 3T3 cell

double minute 4, p53 binding protein(mouse)), GeneBank
accession No: BX537586(STK17A, Serine/threonine kinase
17a(apoptosis-inducing)), GeneBank accession No:
BG284742(P8, P8 protein(candidate of metastasis 1)),
5 GeneBank accession No: BE903247(PDCD6IP, Programmed cell
death 6 interacting protein), GeneBank accession No:
BC027949(P2RX1, Purinergic receptor P2X, ligand-gated ion
channel, 1), GeneBank accession No: BC006365(PSEN2,
Presenilin 2(Alzheimer disease 4)), GeneBank accession No:
10 AY869712(PPP1R13L, Protein phosphatase 1,
regulatory(inhibitor) subunit 13 like), GeneBank accession
No: AY028896(CARD10, Caspase recruitment domain family,
member 10), GeneBank accession No: AK122614(PPARD,
Peroxisome proliferative activated receptor, delta),
15 GeneBank accession No: AK092872(ERCC2, Excision repair
cross-complementing rodent repair deficiency,
complementation group 2(xeroderma pigmentosum D)), GeneBank
accession No: AK092808(RRAGC, Ras-related GTP binding C),
GeneBank accession No: AJ001898(GDNF, Glial cell derived
20 neurotrophic factor), GeneBank accession No:
AF220656(PHLDA1, Pleckstrin homology-like domain, family A,
member 1), GeneBank accession No: AF055634(UNC5C, Unc-5
homolog C(C. elegans)), GeneBank accession No:
AB209485(VEGF, Vascular endothelial growth factor),
25 GeneBank accession No: AB096256(UNC5B, Unc-5 homolog B(C.

elegans)), GeneBank accession No: AB007960(SH3GLB1, SH3-domain GRB2-like endophilin B1), GeneBank accession No: X06374(PDGFA, Platelet-derived growth factor alpha polypeptide), GeneBank accession No: S62138(DDIT3, DNA-damage-inducible transcript 3), GeneBank accession No: NM_078487(CDKN2B, Cyclin-dependent kinase inhibitor 2B(p15, inhibits CDK4)), GeneBank accession No: NM_012127(CIZ1, CDKN1A interacting zinc finger protein 1), GeneBank accession No: NM_005883(APC2, Adenomatosis polyposis coli 2), GeneBank accession No: NM_004196(CDKL1, Cyclin-dependent kinase-like 1(CDC2-related kinase)), GeneBank accession No: NM_003236(TGFA, Transforming growth factor, alpha), GeneBank accession No: NM_001261(CDK9, Cyclin-dependent kinase 9(CDC2-related kinase)), GeneBank accession No: NM_001007271(DUSP13, Dual specificity phosphatase 13), GeneBank accession No: CR749511(PARC, P53-associated parkin-like cytoplasmic protein), GeneBank accession No: CR623038(ID2, Inhibitor of DNA binding 2, dominant negative helix-loop-helix protein), GeneBank accession No: CR618371(EGFR, Epidermal growth factor receptor(erythroblastic leukemia viral(v-erb-b) oncogene homolog, avian)), GeneBank accession No: BF965144(IFITM1, Interferon induced transmembrane protein 1(9-27)), GeneBank accession No: AK127679(DUSP1, Dual specificity phosphatase 1), GeneBank accession No: AK096276(CCND3, Cyclin D3),

GeneBank accession No: AB209586(MAPK13, Mitogen-activated protein kinase 13), GeneBank accession No: AB209465(PCTK1, PCTAIRE protein kinase 1), GeneBank accession No: Z19588(SKIL, SKI-like), GeneBank accession No: NM_020429(SMURF1, SMAD specific E3 ubiquitin protein ligase 1), GeneBank accession No: NM_014767(SPOCK2, Sparc/osteonectin, cwcw and kazal-like domains proteoglycan(testican) 2), GeneBank accession No: NM_005979(S100A13, S100 calcium binding protein A13), GeneBank accession No: NM_005187(CBFA2T3, Core-binding factor, runt domain, alpha subunit 2; translocated to, 3), GeneBank accession No: NM_004364(CEBPA, CCAAT/enhancer binding protein(C/EBP), alpha), GeneBank accession No: NM_001769(CD9, CD9 antigen(p24)), GeneBank accession No: NM_001718(BMP6, Bone morphogenetic protein 6), GeneBank accession No: NM_000641(IL11, Interleukin 11), GeneBank accession No: BX647459(SERPINE2, Serpin peptidase inhibitor, clade E(nexin, plasminogen activator inhibitor type 1), member 2), GeneBank accession No: BQ066037(RPS19, Ribosomal protein S19), GeneBank accession No: BE791300(EDF1, Endothelial differentiation-related factor 1), GeneBank accession No: BC038504(SNF1LK, SNF1-like kinase), GeneBank accession No: AL832287(ZAP70, Zeta-chain(TCR) associated protein kinase 70kDa), GeneBank accession No: AK125742(PCGF1, Polycomb group ring finger 1), GeneBank

accession No: AK124709(NDRG1, N-myc downstream regulated
 gene 1), GeneBank accession No: AB011157(PTDSR,
 Phosphatidylserine receptor), GeneBank accession No:
 NM_013255(MKLN1, Muskelein 1, intracellular mediator
 5 containing kelch motifs), GeneBank accession No:
 NM_006572(GNA13, Guanine nucleotide binding protein(G
 protein), alpha 13), GeneBank accession No: NM_002211(ITGB1,
 Integrin, beta 1(fibronectin receptor, beta polypeptide,
 antigen CD29 includes MDF2, MSK12)), GeneBank accession No:
 10 CR601067(PLAUR, Plasminogen activator, urokinase receptor),
 GeneBank accession No: BC050456(THBS4, Thrombospondin 4),
 GeneBank accession No: AK027389(CXCL16, Chemokine(C-X-C
 motif) ligand 16), GeneBank accession No: AJ132099(VNN1,
 Vanin 1), GeneBank accession No: XM_371354(FLJ10157,
 15 Hypothetical protein FLJ10157), GeneBank accession No:
 XM_208313(TPM3, Similar to tropomyosin 4), GeneBank
 accession No: XM_208270(ACR, Acrosin-like protease),
 GeneBank accession No: NM_203353(PDLIM7, PDZ and LIM domain
 7(enigma)), GeneBank accession No: NM_201382(PLEC1, Plectin
 20 1, intermediate filament binding protein 500kDa), GeneBank
 accession No: NM_182961(SYNE1, Spectrin repeat containing,
 nuclear envelope 1), GeneBank accession No: NM_181826(NF2,
 Neurofibromin 2(bilateral acoustic neuroma)), GeneBank
 accession No: NM_172069(PLEKHH2, Pleckstrin homology domain
 25 containing, family H(with MyTH4 domain) member 2), GeneBank

accession No: NM_022648(TNS, Tensin 1), GeneBank accession
 No: NM_017556(FBLP-1, Filamin binding LIM protein 1),
 GeneBank accession No: NM_016081(KIAA0992, Palladin,
 cytoskeletal associated protein), GeneBank accession No:
 5 NM_006617(NES, Nestin), GeneBank accession No:
 NM_006262(PRPB, Peripherin), GeneBank accession No:
 NM_005100(AKAP12, A kinase(PRKA) anchor protein(gravin) 12),
 GeneBank accession No: NM_004368(CNN2, Calponin 2),
 GeneBank accession No: NM_003388(CYLN2, Cytoplasmic linker
 10 2), GeneBank accession No: NM_003370(VASP, Vasodilator-
 stimulated phosphoprotein), GeneBank accession No:
 NM_003128(SPTBN1, Spectrin, beta, non-erythrocytic 1),
 GeneBank accession No: NM_002705(PPL, Periplakin), GeneBank
 accession No: NM_002475(MLC1SA, Myosin light chain 1 slow
 15 a), GeneBank accession No: NM_002018(FLII, Flightless I
 homolog(Drosophila)), GeneBank accession No: NM_001465(FYB,
 FYN binding protein(FYB-120/130)), GeneBank accession No:
 NM_001069(TUBB2, Tubulin, beta 2A), GeneBank accession No:
 CR625172(MGC8685, Tubulin, beta 2B), GeneBank accession No:
 20 CR616919(KRT18, Keratin 18), GeneBank accession No:
 CR606241(ACTG1, Actin, gamma 1), GeneBank accession No:
 CB240572(MYH11, Myosin, heavy polypeptide 11, smooth
 muscle), GeneBank accession No: BX648253(PTPN3, Protein
 tyrosine phosphatase, non-receptor type 3), GeneBank
 25 accession No: BX648190(WDR1, WD repeat domain 1), GeneBank

accession No: BX641076(ACTN1, Actinin, alpha 1), GeneBank
 accession No: BX537978(EPB41L1, Erythrocyte membrane
 protein band 4.1-like 1), GeneBank accession No:
 BG121847(NUDC, Nuclear distribution gene C homolog(A.
 5 nidulans)), GeneBank accession No: BC068013(MYO1C, Myosin
 IC), GeneBank accession No: BC065499(MAST2, Microtubule
 associated serine/threonine kinase 2), GeneBank accession
 No: BC051890(TUBG2, Tubulin, gamma 2), GeneBank accession
 No: BC041874(MAP1LC3B, Microtubule-associated protein 1
 10 light chain 3 beta), GeneBank accession No: BC012597(ACTA1,
 Actin, alpha 1, skeletal muscle), GeneBank accession No:
 AY484427(KIF17, Kinesin family member 17), GeneBank
 accession No: AK130546(STOML2, Stomatin(EPB72)-like 2),
 GeneBank accession No: AK124711(CORO2B, Coronin, actin
 15 binding protein, 2B), GeneBank accession No: AK123974(MYL5,
 Myosin, light polypeptide 5, regulatory), GeneBank
 accession No: AK092792(LOC389833, Similar to hypothetical
 protein MGC27019), GeneBank accession No: AK026518(MYOHD1,
 Myosin head domain containing 1), GeneBank accession No:
 20 AK024500(NICAL, Microtubule associated monooxygenase,
 calponin and LIM domain containing 1), GeneBank accession
 No: AF085886(FLJ46675, Ribosomal protein L29 pseudogene 2),
 GeneBank accession No: AB209997(MYO9B, Myosin IXB),
 GeneBank accession No: Y12692(WNT11, Wingless-type MMTV
 25 integration site family, member 11), GeneBank accession No:

Y11307(CYR61, Cysteine-rich, angiogenic inducer, 61),
GeneBank accession No: X17033(ITGA2, Integrin, alpha
2(CD49B, alpha 2 subunit of VLA-2 receptor)), GeneBank
accession No: U41763(CLTCL1, Clathrin, heavy polypeptide-
5 like 1), GeneBank accession No: NM_153609(TMPRSS6,
Transmembrane protease, serine 6), GeneBank accession No:
NM_031483(ITCH, Itchy homolog E3 ubiquitin protein
ligase(mouse)), GeneBank accession No: NM_024342(GRLF1,
Glucocorticoid receptor DNA binding factor 1), GeneBank
10 accession No: NM_017555(EGLN2, Egl nine homolog 2(C.
elegans)), GeneBank accession No: NM_016569(TBX3, T-box
3(ulnar mammary syndrome)), GeneBank accession No:
NM_004148(NINJ1, Ninjurin 1), GeneBank accession No:
NM_003377(VEGFB, Vascular endothelial growth factor B),
15 GeneBank accession No: NM_001983(ERCC1, Excision repair
cross-complementing rodent repair deficiency,
complementation group 1(includes overlapping antisense
sequence)), GeneBank accession No: NM_001552(IGFBP4,
Insulin-like growth factor binding protein 4), GeneBank
20 accession No: NM_001430(EPAS1, Endothelial PAS domain
protein 1), GeneBank accession No: NM_001300(KLF6, Kruppel-
like factor 6), GeneBank accession No: NM_001012661(SLC3A2,
Solute carrier family 3(activators of dibasic and neutral
amino acid transport), member 2), GeneBank accession No:
25 NM_000596(IGFBP1, Insulin-like growth factor binding

protein 1), GeneBank accession No: NM_000474(TWIST1, Twist
homolog 1(acrocephalosyndactyly 3; Saethre-Chotzen
syndrome)(Drosophila)), GeneBank accession No:
BX649103(ChGn, Chondroitin beta1,4 N-
5 acetylgalactosaminyltransferase), GeneBank accession No:
BM913048(TIMP1, TIMP metalloproteinase inhibitor 1),
GeneBank accession No: BM904612(S100A6, S100 calcium
binding protein A6(calcyclin)), GeneBank accession No:
BM556279(EMP3, Epithelial membrane protein 3), GeneBank
10 accession No: BC015041(VAT1, Family with sequence
similarity 82, member C), GeneBank accession No:
AY258066(OKL38, Pregnancy-induced growth inhibitor),
GeneBank accession No: AK126729(NDRG4, NDRG family member
4), GeneBank accession No: AK090459(NFE2L1, Nuclear
15 factor(erythroid-derived 2)-like 1), GeneBank accession No:
AK074163(ROBO4, Roundabout homolog 4, magic
roundabout(Drosophila)), GeneBank accession No:
AK024680(FLJ21027 fis, CDNA: FLJ21027 fis, clone CAE07110),
GeneBank accession No: AF176422(HEY1, Hairy/enhancer-of-
20 split related with YRPW motif 1), GeneBank accession No:
AF003837(JAG1, Jagged 1(Alagille syndrome)), GeneBank
accession No: AB209322(SEMA3B, Sema domain, immunoglobulin
domain(Ig), short basic domain, secreted,(semaphorin) 3B),
GeneBank accession No: AB011150(NRXN1, Neurexin 1),
25 GeneBank accession No: NM_201589(MAFA, V-maf

musculoaponeurotic fibrosarcoma oncogene homolog A(avian)),
GeneBank accession No: NM_052999(CKLFSF1, CKLF-like MARVEL
transmembrane domain containing 1), GeneBank accession No:
NM_006644(HSPH1, Heat shock 105kDa/110kDa protein 1),
5 GeneBank accession No: NM_005438(FOSL1, FOS-like antigen 1),
GeneBank accession No: NM_004996(ABCC1, ATP-binding
cassette, sub-family C(CFTR/MRP), member 1), GeneBank
accession No: NM_002658(PLAU, Plasminogen activator,
urokinase), GeneBank accession No: NM_001353(AKR1C1, Aldo-
10 keto reductase family 1, member C1(dihydrodiol
dehydrogenase 1; 20-alpha(3-alpha)-hydroxysteroid
dehydrogenase)), GeneBank accession No: H18681(C20orf139,
Sulfiredoxin 1 homolog(S. cerevisiae)), GeneBank accession
No: DR004094(HAMP, Hepcidin antimicrobial peptide),
15 GeneBank accession No: BC082272(KCNMB3, Potassium large
conductance calcium-activated channel, subfamily M beta
member 3), GeneBank accession No: BC040494(DNAJB2,
DnaJ(Hsp40) homolog, subfamily B, member 2), GeneBank
accession No: BC018064(ATF6, Activating transcription
20 factor 6), GeneBank accession No: BC006523(SGK2,
Serum/glucocorticoid regulated kinase 2), GeneBank
accession No: AK090482(CXCL12, Chemokine(C-X-C motif)
ligand 12(stromal cell-derived factor 1)), GeneBank
accession No: AF219946(TULP4, Tubby like protein 4),
25 GeneBank accession No: AB209112(SLC2A8, Solute carrier

family 2,(facilitated glucose transporter) member 8),
 GeneBank accession No: NM_005242(F2RL1, Coagulation factor
 II(thrombin) receptor-like 1), GeneBank accession No:
 NM_001002029(C4A, Complement component 4B, telomeric),
 5 GeneBank accession No: NM_000539(RHO, Rhodopsin(opsin 2,
 rod pigment)(retinitis pigmentosa 4, autosomal dominant)),
 GeneBank accession No: BX649164(PAI, serpin peptidase
 inhibitor, clade E(nexin, plasminogen activator inhibitor
 type 1), member 1), GeneBank accession No: BM918324(LY96,
 10 Lymphocyte antigen 96), GeneBank accession No:
 AB209647(NCF2, Neutrophil cytosolic factor 2(65kDa, chronic
 granulomatous disease, autosomal 2)), GeneBank accession
 No: NM_152221(CSNK1E, Casein kinase 1, epsilon), GeneBank
 accession No: NM_017999(RNF31, Ring finger protein 31),
 15 GeneBank accession No: NM_016819(OGG1, 8-oxoguanine DNA
 glycosylase), GeneBank accession No: NM_016816(OAS1, 2',5'-
 oligoadenylate synthetase 1, 40/46kDa), GeneBank accession
 No: NM_012235(SCAP, SREBP cleavage-activating protein),
 GeneBank accession No: NM_006384(CIB1, Calcium and integrin
 20 binding 1(calmyrin)), GeneBank accession No: NM_001779(CD58,
 CD58 antigen,(lymphocyte function-associated antigen 3)),
 GeneBank accession No: CB055213(ICOSLG, Inducible T-cell
 co-stimulator ligand), GeneBank accession No:
 BX641029(MASP1, Mannan-binding lectin serine peptidase
 25 1(C4/C2 activating component of Ra-reactive factor)),

GeneBank accession No: BQ053419(BATF, Basic leucine zipper transcription factor, ATF-like), GeneBank accession No: BC039299(STIP1, Stress-induced-phosphoprotein 1(Hsp70/Hsp90-organizing protein)), GeneBank accession No: 5 AY055760(DAF, Decay accelerating factor for complement(CD55, Cromer blood group system)), GeneBank accession No: AK130188(FGR, Gardner-Rasheed feline sarcoma viral(v-fgr) oncogene homolog), GeneBank accession No: AK095326(MUS81, MUS81 endonuclease homolog(yeast)), GeneBank accession No: 10 NM_017670(OTUB1, OTU domain, ubiquitin aldehyde binding 1), GeneBank accession No: NM_003004(SECTM1, Secreted and transmembrane 1), GeneBank accession No: NM_002309(LIF, Hypothetical protein MGC20647), GeneBank accession No: NM_001421(ELF4, E74-like factor 4(ets domain transcription 15 factor)), GeneBank accession No: NM_000418(IL4R, Interleukin 4 receptor), GeneBank accession No: BI909222(FCER1G, Fc fragment of IgE, high affinity I, receptor for; gamma polypeptide), GeneBank accession No: BF569086(NK4, Interleukin 32), GeneBank accession No: 20 BC014470(AZGP1, Alpha-2-glycoprotein 1, zinc), GeneBank accession No: BC020744(AKR1C4, Aldo-keto reductase family 1, member C4(chlordecone reductase; 3-alpha hydroxysteroid dehydrogenase, type I; dihydrodiol),dehydrogenase 4), GeneBank accession No: BQ939577(AKR1C3, Aldo-keto reductase 25 family 1, member C3(3-alpha hydroxysteroid dehydrogenase,

type II)), GeneBank accession No: NM_000499(CYP1A1, Cytochrome P450, family 1, subfamily A, polypeptide 1), GeneBank accession No: NM_030622(CYP2S1, Cytochrome P450, family 2, subfamily S, polypeptide 1), GeneBank accession
 5 No: NM_184041(ALDOA, Aldolase A, fructose-bisphosphate), GeneBank accession No: NM_024307(MGC4171, Hypothetical protein LOC283901), GeneBank accession No: NM_005336(HDLBP, High density lipoprotein binding protein(vigilin)), GeneBank accession No: NM_002627(PFKP, Phosphofructokinase,
 10 platelet), GeneBank accession No: BX648281(LDLR, Low density lipoprotein receptor(familial hypercholesterolemia)), GeneBank accession No: BC069201(FLJ22761, Hexokinase domain containing 1), GeneBank accession No: BC030207(NR0B2, Nuclear receptor
 15 subfamily 0, group B, member 2), GeneBank accession No: AL833069(KIAA1434, Hypothetical protein KIAA1434), GeneBank accession No: AK124656(ENO2, Enolase 2(gamma, neuronal)), GeneBank accession No: AK094474(RHOC, Ras homolog gene family, member C), GeneBank accession No: AK093461(ISYNA1,
 20 Myo-inositol 1-phosphate synthase A1), GeneBank accession No: AB053232(GAL3ST3, Galactose-3-O-sulfotransferase 3), GeneBank accession No: AB045292(TMEM8, Transmembrane protein 8(five membrane-spanning domains)), GeneBank accession No: NM_004753(DHRS3, Dehydrogenase/reductase(SDR
 25 family) member 3), GeneBank accession No: NM_002900(RBP3,

Retinol binding protein 3, interstitial), GeneBank
 accession No: NM_001995(ACSL1, Acyl-CoA synthetase long-
 chain family member 1), GeneBank accession No:
 NM_000018(ACADVL, Acyl-Coenzyme A dehydrogenase, very long
 5 chain), GeneBank accession No: BC094756(CRA, Myotubularin
 related protein 11), GeneBank accession No: BC050553(NTE,
 Neuropathy target esterase), GeneBank accession No:
 BC033110(HSD17B1, Hydroxysteroid(17-beta) dehydrogenase 1),
 GeneBank accession No: AY268890(TPP1, Tripeptidyl peptidase
 10 I), GeneBank accession No: AK172798(CPT1A, Carnitine
 palmitoyltransferase 1A(liver)), GeneBank accession No:
 AK096809(CYP4F8, Cytochrome P450, family 4, subfamily F,
 polypeptide 8), GeneBank accession No: AK000600(SIAT7D,
 ST6(alpha-N-acetyl-neuraminy1-2,3-beta- galactosyl-1,3)-N-
 15 acetylgalactosaminide alpha-2,6-sialyltransferase 4),
 GeneBank accession No: AB002454(CYP4F3, Cytochrome P450,
 family 4, subfamily F, polypeptide 3), GeneBank accession
 No: Z29093(DDR1, Discoidin domain receptor family, member
 1), GeneBank accession No: Z25424(MKKN2, MAP kinase
 20 interacting serine/threonine kinase 2), GeneBank accession
 No: XM_291277(DKFZp761P0423, Hypothetical protein
 DKFZp761P0423), GeneBank accession No: XM_038150(MAST3,
 Microtubule associated serine/threonine kinase 3), GeneBank
 accession No: U88357(ERBB3, V-erb-b2 erythroblastic
 25 leukemia viral oncogene homolog 3(avian)), GeneBank

accession No: NM_025195(TRIB1, Tribbles homolog
1(Drosophila)), GeneBank accession No: NM_020639(RIPK4,
Receptor-interacting serine-threonine kinase 4), GeneBank
accession No: NM_014172(PHPT1, Phosphohistidine phosphatase
5 1), GeneBank accession No: NM_006254(PRKCD, Protein kinase
C, delta), GeneBank accession No: NM_005415(SLC20A1, Solute
carrier family 20(phosphate transporter), member 1),
GeneBank accession No: NM_005026(PIK3CD, Phosphoinositide-
3-kinase, catalytic, delta polypeptide), GeneBank accession
10 No: NM_004431(EPHA2, EPH receptor A2), GeneBank accession
No: NM_004419(DUSP5, Dual specificity phosphatase 5),
GeneBank accession No: NM_004327(BCR, Breakpoint cluster
region), GeneBank accession No: NM_004231(ATP6V1F, ATPase,
H⁺ transporting, lysosomal 14kDa, V1 subunit F), GeneBank
15 accession No: NM_004090(DUSP3, Dual specificity phosphatase
3(vaccinia virus phosphatase VH1-related)), GeneBank
accession No: NM_002843(PTPRJ, Protein tyrosine phosphatase,
receptor type, J), GeneBank accession No: NM_002496(NDUFS8,
NADH dehydrogenase(ubiquinone) Fe-S protein 8, 23kDa(NADH-
20 coenzyme Q reductase)), GeneBank accession No:
NM_001001852(PIM3, Pim-3 oncogene), GeneBank accession No:
L76191(IRAK1, Interleukin-1 receptor-associated kinase 1),
GeneBank accession No: D15049(PTPRH, Protein tyrosine
phosphatase, receptor type, H), GeneBank accession No:
25 BC065207(ATP6V0D2, ATPase, H⁺ transporting, lysosomal 38kDa,

V0 subunit d isoform 2), GeneBank accession No: BC035578(STK24, Serine/threonine kinase 24(STE20 homolog, yeast)), GeneBank accession No: BC028724(DUSP18, Dual specificity phosphatase 18), GeneBank accession No: 5 AL117482(ULK3, Unc-51-like kinase 3(C. elegans)), GeneBank accession No: AK126879(PCTK3, PCTAIRE protein kinase 3), GeneBank accession No: AB209416(ILK, Integrin-linked kinase-2), GeneBank accession No: NM_000782(CYP24A1, Cytochrome P450, family 24, subfamily A, polypeptide 1), 10 GeneBank accession No: CR597101(ZFP36, Zinc finger protein 36, C3H type, homolog(mouse)), GeneBank accession No: CR936799(FHL2, Four and a half LIM domains 2), GeneBank accession No: M24898(NR1D1, Nuclear receptor subfamily 1, group D, member 1), GeneBank accession No: AF132818(KLF5, 15 Kruppel-like factor 5(intestinal)), GeneBank accession No: AK055337(ZNF213, Zinc finger protein 213), GeneBank accession No: BC008834(PHF1, PHD finger protein 1), GeneBank accession No: AK126918(GLIS2, GLIS family zinc finger 2), GeneBank accession No: BC042692(CTL2, Solute 20 carrier family 44, member 2), GeneBank accession No: NM_002224(ITPR3, Inositol 1,4,5-triphosphate receptor, type 3), GeneBank accession No: AK095363(AQP3, Aquaporin 3), GeneBank accession No: NM_174953(ATP2A3, ATPase, Ca++ transporting, ubiquitous), GeneBank accession No: 25 BC042390(VTI1B, Vesicle transport through interaction with

t-SNAREs homolog 1B(yeast)), GeneBank accession No: NM_016113(TRPV2, Transient receptor potential cation channel, subfamily V, member 2), GeneBank accession No: BM926478(RBP1, Retinol binding protein 1, cellular),

5 GeneBank accession No: NM_000069(CACNA1S, Calcium channel, voltage-dependent, L type, alpha 1S subunit), GeneBank accession No: AK002107(RAB3B, RAB3B, member RAS oncogene family), GeneBank accession No: NM_013321(SNX8, Sorting nexin 8), GeneBank accession No: AK125026(SLC6A12, Solute

10 carrier family 6(neurotransmitter transporter, betaine/GABA), member 12), GeneBank accession No: NM_005843(STAM2, Signal transducing adaptor molecule(SH3 domain and ITAM motif) 2), GeneBank accession No: AK092512(SLC16A5, Solute carrier family 16(monocarboxylic

15 acid transporters), member 5), GeneBank accession No: U49248(ABCC2, ATP-binding cassette, sub-family C(CFTR/MRP), member 2), GeneBank accession No: AK172792(SCNN1A, Sodium channel, nonvoltage-gated 1 alpha), GeneBank accession No: BC044656(CASC3, Cancer susceptibility candidate 3),

20 GeneBank accession No: NM_203403(C9orf150, Chromosome 9 open reading frame 150), GeneBank accession No: NM_080388(S100A16, S100 calcium binding protein A16), GeneBank accession No: NM_031286(SH3BGRL3, SH3 domain binding glutamic acid-rich protein like 3), GeneBank

25 accession No: NM_022153(PP2135, Chromosome 10 open reading

frame 54), GeneBank accession No: NM_004864(GDF15, Growth differentiation factor 15), GeneBank accession No: NM_003330(TXNRD1, Thioredoxin reductase 1), GeneBank accession No: NM_001013632(LOC343521, Similar to
5 hypothetical protein 4833401D15), GeneBank accession No: BX537968(LOC51149, Hypothetical LOC51149), GeneBank accession No: BU945318(MT2A, Hypothetical gene supported by X97260; BC070289), GeneBank accession No: BQ683841(S100A11, S100 calcium binding protein A11(calgizzarin)), GeneBank
10 accession No: BQ276852(TMSB10, Thymosin, beta 10), GeneBank accession No: AK126182(KIAA1949, KIAA1949), GeneBank accession No: AK124751(CAPN2, Calpain 2,(m/II) large subunit), GeneBank accession No: AK095079(RGC32, Response gene to complement 32), GeneBank accession No:
15 AB075871(FLJ42654, Golgi transport 1 homolog A(S. cerevisiae)).

【Claim 8】

The method according to claim 6, wherein the below
20 genes are down-regulated by exposure to phenanthrene:

GeneBank accession No: AK125150(MAPK8, Mitogen-activated protein kinase 8), GeneBank accession No: NM_002758(MAP2K6, Mitogen-activated protein kinase kinase 6), GeneBank accession No: NM_004612(TGFBR1, Transforming
25 growth factor, beta receptor I(activin A receptor type II-

like kinase, 53kDa)), GeneBank accession No:
NM_145686(MAP4K4, Mitogen-activated protein kinase kinase
kinase kinase 4), GeneBank accession No: XM_042066(MAP3K1,
Mitogen-activated protein kinase kinase kinase 1), GeneBank
5 accession No: AB011123(TNIK, TRAF2 and NCK interacting
kinase), GeneBank accession No: AB209031(C5, Complement
component 5), GeneBank accession No: NM_022740(HIPK2,
Homeodomain interacting protein kinase 2), GeneBank
accession No: NM_148957(TNFRSF19, Tumor necrosis factor
10 receptor superfamily, member 19), GeneBank accession No:
AB208909(ITGB2, Integrin, beta 2(antigen CD18(p95),
lymphocyte function-associated antigen 1; macrophage
antigen 1(mac-1) beta subunit)), GeneBank accession No:
AB209211(TIA1, TIA1 cytotoxic granule-associated RNA
15 binding protein), GeneBank accession No: AB209613(DNASE1L3,
Deoxyribonuclease I-like 3), GeneBank accession No:
AK122825(HMGB1, High-mobility group box 1), GeneBank
accession No: AK127326(PHF17, PHD finger protein 17),
GeneBank accession No: AK223503(CASP1, Caspase 1,
20 apoptosis-related cysteine peptidase(interleukin 1, beta,
convertase)), GeneBank accession No: BC013326(GAS2, Growth
arrest-specific 2), GeneBank accession No: BC047698(IL7,
Interleukin 7), GeneBank accession No: D79987(ESPL1, Extra
spindle poles like 1(*S. cerevisiae*)), GeneBank accession
25 No: NM_000893(KNG1, Kininogen 1), GeneBank accession No:

NM_001012271(BIRC5, Effector cell peptidase receptor 1),
GeneBank accession No: NM_004938(DAPK1, Death-associated
protein kinase 1), GeneBank accession No: NM_005879(TRIP,
TRAF interacting protein), GeneBank accession No:
5 NM_014739(BCLAF1, BCL2-associated transcription factor 1),
GeneBank accession No: NM_018947(CYCS, Cytochrome c,
somatic), GeneBank accession No: AB033337(MPHOSPH1, M-phase
phosphoprotein 1), GeneBank accession No: AB209179(PLK1,
Polo-like kinase 1(Drosophila)), GeneBank accession No:
10 AB209337(CDC7, CDC7 cell division cycle 7(S. cerevisiae)),
GeneBank accession No: AF053305(BUB1, BUB1 budding
uninhibited by benzimidazoles 1 homolog(yeast)), GeneBank
accession No: AF053306(BUB1B, BUB1 budding uninhibited by
benzimidazoles 1 homolog beta(yeast)), GeneBank accession
15 No: AF345347(SPAG5, Sperm associated antigen 5), GeneBank
accession No: AK092638(CCNG2, Cyclin G2), GeneBank
accession No: AK222819(NUSAP1, Nucleolar and spindle
associated protein 1), GeneBank accession No:
AL833191(SMC2L1, SMC2 structural maintenance of chromosomes
20 2-like 1(yeast)), GeneBank accession No: AY257469(CIT,
Citron(rho-interacting, serine/threonine kinase 21)),
GeneBank accession No: AY367065(ASPM, Asp(abnormal
spindle)-like, microcephaly associated(Drosophila)),
GeneBank accession No: BC011000(CDCA5, Cell division cycle
25 associated 5), GeneBank accession No: BC032677(UBE2C,

Ubiquitin-conjugating enzyme E2C), GeneBank accession No: BC043502(NEK2, NIMA(never in mitosis gene a)-related kinase 2), GeneBank accession No: BU675073(PTTG1, Pituitary tumor-transforming 1), GeneBank accession No: BX647885(STMN1, Stathmin 1/oncoprotein 18), GeneBank accession No: CR592757(BRRN1, Barren homolog 1(Drosophila)), GeneBank accession No: CR597075(MAPRE2, Microtubule-associated protein, RP/EB family, member 2), GeneBank accession No: CR604810(CCNA2, Cyclin A2), GeneBank accession No: CR933728(CDC2, Cell division cycle 2, G1 to S and G2 to M), GeneBank accession No: NM_000919(PAM, Peptidylglycine alpha-amidating monooxygenase), GeneBank accession No: NM_001790(CDC25C, Cell division cycle 25C), GeneBank accession No: NM_001798(CDK2, Cyclin-dependent kinase 2), GeneBank accession No: NM_001813(CENPE, Centromere protein E, 312kDa), GeneBank accession No: NM_003318(TTK, TTK protein kinase), GeneBank accession No: NM_003981(PRC1, Protein regulator of cytokinesis 1), GeneBank accession No: NM_004523(KIF11, Kinesin family member 11), GeneBank accession No: NM_004701(CCNB2, Cyclin B2), GeneBank accession No: NM_005983(SKP2, S-phase kinase-associated protein 2(p45)), GeneBank accession No: NM_006101(KNTC2, Kinetochore associated 2), GeneBank accession No: NM_006845(KIF2C, Kinesin family member 2C), GeneBank accession No: NM_007375(TARDBP, TAR DNA binding protein),

GeneBank accession No: NM_012112(TPX2, TPX2, microtubule-associated, homolog(Xenopus laevis)), GeneBank accession No: NM_014750(DLG7, Discs, large homolog 7(Drosophila)), GeneBank accession No: NM_015097(CLASP2, Cytoplasmic linker associated protein 2), GeneBank accession No: NM_016343(CENPF, Centromere protein F, 350/400ka(mitosis)), GeneBank accession No: NM_016426(GTSE1, G-2 and S-phase expressed 1), GeneBank accession No: NM_018492(PBK, PDZ binding kinase), GeneBank accession No: NM_018685(ANLN, Anillin, actin binding protein(scraps homolog, Drosophila)), GeneBank accession No: NM_020242(KNSL7, Kinesin family member 15), GeneBank accession No: NM_031966(CCNB1, Cyclin B1), GeneBank accession No: NM_138555(KIF23, Kinesin family member 23), GeneBank accession No: U65410(MAD2L1, MAD2 mitotic arrest deficient-like 1(yeast)), GeneBank accession No: AB020656(CYLD, Cyldromatosis(turban tumor syndrome)), GeneBank accession No: AF033122(SESNI, Sestrin 1), GeneBank accession No: AK074377(UHRF1, Chromosome 19 open reading frame 31), GeneBank accession No: AK091170(CDKN2C, Cyclin-dependent kinase inhibitor 2C(p18, inhibits CDK4)), GeneBank accession No: AK094323(NFYC, Nuclear transcription factor Y, gamma), GeneBank accession No: AY366508(LOH11CR2A, Loss of heterozygosity, 11, chromosomal region 2, gene A), GeneBank accession No: BC033086(TCF19, Transcription factor 19(SC1)), GeneBank accession No: BC040303(PTP4A1, Protein

tyrosine phosphatase type IVA, member 1), GeneBank
 accession No: BC040991(TFDP2, Transcription factor Dp-2(E2F
 dimerization partner 2)), GeneBank accession No:
 BC092412(SGOL2, Shugoshin-like 2(S. pombe)), GeneBank
 5 accession No: BQ278454(CKS1B, CDC28 protein kinase
 regulatory subunit 1B), GeneBank accession No:
 BX649128(SES3, Sestrin 3), GeneBank accession No:
 CD049340(AURKB, Aurora kinase B), GeneBank accession No:
 M89914(NF1, Neurofibromin 1(neurofibromatosis, von
 10 Recklinghausen disease, Watson disease)), GeneBank
 accession No: NM_001005414(ZWINT, ZW10 interactor
 antisense), GeneBank accession No: NM_001008491(Sep 2,
 Septin 2), GeneBank accession No: NM_001274(CHEK1, CHK1
 checkpoint homolog(S. pombe)), GeneBank accession No:
 15 NM_002105(H2AFX, H2A histone family, member X), GeneBank
 accession No: NM_002388(MCM3, MCM3 minichromosome
 maintenance deficient 3(S. cerevisiae)), GeneBank accession
 No: NM_002417(MKI67, Antigen identified by monoclonal
 antibody Ki-67), GeneBank accession No: NM_002875(RAD51,
 20 RAD51 homolog(RecA homolog, E. coli)(S. cerevisiae)),
 GeneBank accession No: NM_003884(PCAF, P300/CBP-associated
 factor), GeneBank accession No: NM_004526(MCM2, MCM2
 minichromosome maintenance deficient 2, mitotin(S.
 cerevisiae)), GeneBank accession No: NM_004847(AIF1,
 25 Allograft inflammatory factor 1), GeneBank accession No:

NM_005915(MCM6, MCM6 minichromosome maintenance deficient
 6(MIS5 homolog, *S. pombe*)(*S. cerevisiae*)), GeneBank
 accession No: NM_012090(MACF1, Microtubule-actin
 crosslinking factor 1), GeneBank accession No:
 5 NM_012415(RAD54B, RAD54 homolog B(*S. cerevisiae*)), GeneBank
 accession No: NM_014264(PLK4, Polo-like kinase
 4(*Drosophila*)), GeneBank accession No: NM_015714(G0S2,
 G0/G1switch 2), GeneBank accession No: NM_024680(FLJ23311,
 E2F transcription factor 8), GeneBank accession No:
 10 XM_034274(MYBL1, V-myb myeloblastosis viral oncogene
 homolog(avian)-like 1), GeneBank accession No:
 AK001720(FLJ10858, Nei endonuclease VIII-like 3(*E. coli*)),
 GeneBank accession No: AY032677(POLQ, Polymerase(DNA
 directed), theta), GeneBank accession No: BC034480(BLM,
 15 Bloom syndrome), GeneBank accession No: BC073161(RAD51C,
 RAD51 homolog C(*S. cerevisiae*)), GeneBank accession No:
 CR600021(HMGB2, High-mobility group box 2), GeneBank
 accession No: CR625391(RAD51AP1, RAD51 associated protein
 1), GeneBank accession No: CR936783(FLJ40869, Hypothetical
 20 protein LOC284952), GeneBank accession No:
 DQ140356(KIAA1596, Fanconi anemia, complementation group M),
 GeneBank accession No: NM_001067(TOP2A, Topoisomerase(DNA)
 II alpha 170kDa), GeneBank accession No: NM_001618(PARP1,
 Poly(ADP-ribose) polymerase family, member 1), GeneBank
 25 accession No: NM_003362(UNG, Uracil-DNA glycosylase),

GeneBank accession No: NM_006904(PRKDC, Protein kinase, DNA-activated, catalytic polypeptide), GeneBank accession No: NM_130398(EXO1, Exonuclease 1), GeneBank accession No: AB020807(TLR6, Toll-like receptor 6), GeneBank accession No: AB032980(DCDC2, Doublecortin domain containing 2), GeneBank accession No: AB209866(TFPI, Tissue factor pathway inhibitor(lipoprotein-associated coagulation inhibitor)), GeneBank accession No: AK057015(HSPA4, Heat shock 70kDa protein 4), GeneBank accession No: AK095515(IFIT1, Interferon-induced protein with tetratricopeptide repeats 1), GeneBank accession No: AK122686(IF, I factor(complement)), GeneBank accession No: AK123010(RRM2, Ribonucleotide reductase M2 polypeptide), GeneBank accession No: BC035582(TRIM22, Tripartite motif-containing 22), GeneBank accession No: BX537894(LOC493869, Similar to RIKEN cDNA 2310016C16), GeneBank accession No: M14338(PROS1, Protein S(alpha)), GeneBank accession No: NM_000821(GGCX, Gamma-glutamyl carboxylase), GeneBank accession No: NM_000963(PTGS2, Prostaglandin-endoperoxide synthase 2(prostaglandin G/H synthase and cyclooxygenase)), GeneBank accession No: NM_001001547(CD36, CD36 antigen(collagen type I receptor, thrombospondin receptor)), GeneBank accession No: NM_001512(GSTA4, Glutathione S-transferase A4), GeneBank accession No: NM_001629(ALOX5AP, Arachidonate 5-lipoxygenase-activating protein), GeneBank accession No:

NM_001752(CAT, Catalase), GeneBank accession No:
 NM_001837(CCR3, Chemokine(C-C motif) receptor 3), GeneBank
 accession No: NM_001979(EPHX2, Epoxide hydrolase 2,
 cytoplasmic), GeneBank accession No: NM_001994(F13B,
 5 Coagulation factor XIII, B polypeptide), GeneBank accession
 No: NM_002182(IL1RAP, Interleukin 1 receptor accessory
 protein), GeneBank accession No: NM_006120(HLA-DMA, Major
 histocompatibility complex, class II, DM alpha), GeneBank
 accession No: NM_173216(SIAT1, ST6 beta-galactosamide
 10 alpha-2,6-sialyltransferase 1), GeneBank accession No:
 NM_202002(FOXM1, Forkhead box M1), GeneBank accession No:
 AB163917(LRAP, Leukocyte-derived arginine aminopeptidase),
 GeneBank accession No: BC027881(AFP, Alpha-fetoprotein),
 GeneBank accession No: NM_015915(SPG3A, Spastic paraplegia
 15 3A(autosomal dominant)), GeneBank accession No:
 NM_000671(ADH5, Alcohol dehydrogenase 5(class III), chi
 polypeptide), GeneBank accession No: J05428(UGT2B7, UDP
 glucuronosyltransferase 2 family, polypeptide B7), GeneBank
 accession No: NM_000672(ADH6, Alcohol dehydrogenase 6(class
 20 V)), GeneBank accession No: M15943(ADH4, Alcohol
 dehydrogenase 4(class II), pi polypeptide), GeneBank
 accession No: AK223395(FBP1, Fructose-1,6-bisphosphatase 1),
 GeneBank accession No: NM_000151(G6PC, Glucose-6-
 phosphatase, catalytic(glycogen storage disease type I, von
 25 Gierke disease)), GeneBank accession No: XM_113962(KIAA0650,

Structural maintenance of chromosomes flexible hinge domain containing 1), GeneBank accession No: AB020644(ACSL6, Acyl-CoA synthetase long-chain family member 6), GeneBank accession No: AB209907(PLD1, Phospholipase D1, 5 phosphatidylcholine-specific), GeneBank accession No: AF285167(ABCA1, ATP-binding cassette, sub-family A(ABC1), member 1), GeneBank accession No: AF297872(TRERF1, Transcriptional regulating factor 1), GeneBank accession No: AF303134(ALDH8A1, Aldehyde dehydrogenase 8 family, 10 member A1), GeneBank accession No: AF339053(PLA2G12B, Phospholipase A2, group XIIB), GeneBank accession No: AK096018(HADHSC, L-3-hydroxyacyl-Coenzyme A dehydrogenase, short chain), GeneBank accession No: AK124635(PCSK9, Proprotein convertase subtilisin/kexin type 9), GeneBank 15 accession No: AK127346(SIAT9, ST3 beta-galactoside alpha-2,3-sialyltransferase 5), GeneBank accession No: AL359559(AGPS, Alkylglycerone phosphate synthase), GeneBank accession No: AY691170(PLCL3, Phospholipase C-like 3), GeneBank accession No: BG567934(APOM, Apolipoprotein M), 20 GeneBank accession No: BX538214(C6orf167, Chromosome 6 open reading frame 167), GeneBank accession No: BX640945(FADS2, Fatty acid desaturase 2), GeneBank accession No: BX648473(PIGK, Phosphatidylinositol glycan, class K), GeneBank accession No: BX648557(HSD17B2, Hydroxysteroid(17-beta) dehydrogenase 2), GeneBank accession No: 25

CR749601(ETNK1, Death-associated protein kinase 3),
 GeneBank accession No: NM_000859(HMGCR, 3-hydroxy-3-
 methylglutaryl-Coenzyme A reductase), GeneBank accession
 No: NM_001443(FABP1, Fatty acid binding protein 1, liver),
 5 GeneBank accession No: NM_002130(HMGCS1, 3-hydroxy-3-
 methylglutaryl-Coenzyme A synthase 1(soluble)), GeneBank
 accession No: NM_003725(RODH, Hydroxysteroid(17-beta)
 dehydrogenase 6), GeneBank accession No: NM_004845(PCYT1B,
 Phosphate cytidylyltransferase 1, choline, beta), GeneBank
 10 accession No: NM_014762(DHCR24, 24-dehydrocholesterol
 reductase), GeneBank accession No: NM_020139(DHRS6,
 Dehydrogenase/reductase(SDR family) member 6), GeneBank
 accession No: NM_020918(GPAM, Glycerol-3-phosphate
 acyltransferase, mitochondrial), GeneBank accession No:
 15 NM_032523(OSBPL6, Oxysterol binding protein-like 6),
 GeneBank accession No: NM_033505(SELI, Selenoprotein I),
 GeneBank accession No: Z28339(AKR1D1, Aldo-keto reductase
 family 1, member D1(delta 4-3-ketosteroid-5-beta-
 reductase)), GeneBank accession No: AK024899(ENPP3,
 20 Ectonucleotide pyrophosphatase/ phosphodiesterase 3),
 GeneBank accession No: AK025546(PTPN4, Protein tyrosine
 phosphatase, non-receptor type 4(megakaryocyte)), GeneBank
 accession No: AK124910(ENPP2, Ectonucleotide
 pyrophosphatase/phosphodiesterase 2(autotaxin)), GeneBank
 25 accession No: BC035116(FLJ35059 fis, CDNA FLJ30761 fis,

clone FEBRA2000538), GeneBank accession No: BC050565(PASK, PAS domain containing serine/threonine kinase), GeneBank accession No: L13436(NPR2, Natriuretic peptide receptor B/guanylate cyclase B(atrionatriuretic peptide receptor B)),

5 GeneBank accession No: NM_001005862(ERBB2, V-erb-b2 erythroblastic leukemia viral oncogene homolog 2, neuro/glioblastoma derived oncogene homolog(avian)), GeneBank accession No: NM_005012(ROR1, Receptor tyrosine kinase-like orphan receptor 1), GeneBank accession No:

10 NM_006035(CDC42BPB, CDC42 binding protein kinase beta(DMPK-like)), GeneBank accession No: NM_014791(MELK, Maternal embryonic leucine zipper kinase), GeneBank accession No: NM_023028(FGFR2, Fibroblast growth factor receptor 2(bacteria-expressed kinase, keratinocyte growth factor

15 receptor, craniofacial dysostosis 1, Crouzon syndrome, Pfeiffer syndrome, Jackson-Weiss syndrome)), GeneBank accession No: NM_080836(STK35, Serine/threonine kinase 35), GeneBank accession No: AF419331(FUSIP1, FUS interacting protein(serine/arginine-rich) 1), GeneBank accession No:

20 AK091927(SFRS3, Splicing factor, arginine/serine-rich 3), GeneBank accession No: BC010266(HNRNPA1, Heterogeneous nuclear ribonucleoprotein A1), GeneBank accession No: BC012360(CTAGE5, CTAGE family, member 5), GeneBank accession No: BC036046(PLRG1, Pleiotropic regulator 1(PRL1

25 homolog, Arabidopsis)), GeneBank accession No:

BC065384(PCF11, PCF11, cleavage and polyadenylation factor subunit, homolog(*S. cerevisiae*)), GeneBank accession No: BX537360(CPSF5, Nudix(nucleoside diphosphate linked moiety X)-type motif 21), GeneBank accession No: BX537494(HNRPA2B1, Heterogeneous nuclear ribonucleoprotein A2/B1), GeneBank accession No: BX647784(HNRPR, Heterogeneous nuclear ribonucleoprotein R), GeneBank accession No: CA455267(PPIH, Peptidyl prolyl isomerase H(cyclophilin H)), GeneBank accession No: CR596214(HNRPA0, Heterogeneous nuclear ribonucleoprotein A0), GeneBank accession No: NM_001326(CSTF3, Hypothetical protein LOC283267), GeneBank accession No: NM_004640(BAT1, HLA-B associated transcript 1), GeneBank accession No: NM_005463(HNRPD, Heterogeneous nuclear ribonucleoprotein D-like), GeneBank accession No: NM_006924(SFRS1, Splicing factor, arginine/serine-rich 1(splicing factor 2, alternate splicing factor)), GeneBank accession No: NM_012426(SF3B3, Splicing factor 3b, subunit 3, 130kDa), GeneBank accession No: NM_018048(FLJ10292, Mago-nashi homolog), GeneBank accession No: NM_030919(C20orf129, Chromosome 20 open reading frame 129), GeneBank accession No: NM_031370(HNRPD, Heterogeneous nuclear ribonucleoprotein D(AU-rich element RNA binding protein 1, 37kDa)), GeneBank accession No: NM_138933(ACF, Apobec-1 complementation factor), GeneBank accession No: AB193259(ACE2, Angiotensin I converting enzyme(peptidyl-

dipeptidase A) 2), GeneBank accession No: BX648769(EWSR1,
 Ewing sarcoma breakpoint region 1), GeneBank accession No:
 AB023154(DTX4, Deltex 4 homolog(Drosophila)), GeneBank
 accession No: AL543755(VAV3, Vav 3 oncogene), GeneBank
 5 accession No: M75106(CPB2, Carboxypeptidase B2(plasma,
 carboxypeptidase U)), GeneBank accession No:
 NM_021045(ZNF248, Zinc finger protein 248), GeneBank
 accession No: AB209194(B4GALT6, UDP-Gal:betaGlcNAc beta
 1,4- galactosyltransferase, polypeptide 6), GeneBank
 10 accession No: AF279145(ANTXR1, Anthrax toxin receptor 1),
 GeneBank accession No: NM_025074(FRAS1, Fraser syndrome 1),
 GeneBank accession No: AK025790(KIF20A, Kinesin family
 member 20A), GeneBank accession No: NM_006152(LRMP,
 Lymphoid-restricted membrane protein), GeneBank accession
 15 No: NM_000340(SLC2A2, Solute carrier family 2(facilitated
 glucose transporter), member 2), GeneBank accession No:
 AF071592(KIF4A, Kinesin family member 4A), GeneBank
 accession No: NM_013277(RACGAP1, Rac GTPase activating
 protein 1), GeneBank accession No: AY043484(SCN1A, Sodium
 20 channel, voltage-gated, type I, alpha), GeneBank accession
 No: AY791349(KIF18A, Kinesin family member 18A), GeneBank
 accession No: NM_018018(SLC38A4, Solute carrier family 38,
 member 4), GeneBank accession No: AK094603(FLJ37284 fis,
 unnamed protein product; Homo sapiens cDNA FLJ37284 fis,
 25 clone BRAMY2013590.), GeneBank accession No:

NM_021069(ARGBP2, Sorbin and SH3 domain containing 2),
GeneBank accession No: NM_001005747(CACNB4, Calcium channel,
voltage-dependent, beta 4 subunit), GeneBank accession No:
AJ496568(SLC25A12, Solute carrier family 25(mitochondrial
5 carrier, Aralar), member 12), GeneBank accession No:
NM_030641(APOL6, Apolipoprotein L, 6), GeneBank accession
No: NM_173512(FLJ39822, Hypothetical protein FLJ39822),
GeneBank accession No: NM_000037(ANK1, Ankyrin 1,
erythrocytic), GeneBank accession No: NM_001011554(SLC13A3,
10 Solute carrier family 13(sodium-dependent dicarboxylate
transporter), member 3), GeneBank accession No:
AB091343(C10orf3, Centrosomal protein 55kDa), GeneBank
accession No: AK000643(ASB9, Ankyrin repeat and SOCS box-
containing 9), GeneBank accession No: AK055221(FBXO5, F-box
15 protein 5), GeneBank accession No: AK075271(SPTLC2L, Serine
palmitoyltransferase, long chain base subunit 2-
like(aminotransferase 2)), GeneBank accession No:
AK122685(GLUD1, Glutamate dehydrogenase 1), GeneBank
accession No: AK127098(FLJ10706, Chromosome 1 open reading
20 frame 112), GeneBank accession No: AL133031(MLR1,
Transcription factor MLR1), GeneBank accession No:
AY007723(MAL2, Mal, T-cell differentiation protein 2),
GeneBank accession No: BC022255(Spc25, Spindle pole body
component 25 homolog(*S. cerevisiae*)), GeneBank accession
25 No: BC041882(ATF7IP2, Activating transcription factor 7

interacting protein 2), GeneBank accession No:
BC052951(LMNB1, Lamin B1), GeneBank accession No:
BC098313(FLJ20641, Hypothetical protein FLJ20641), GeneBank
accession No: NM_001809(CENPA, Centromere protein A, 17kDa),
5 GeneBank accession No: NM_145061(C13orf3, Chromosome 13
open reading frame 3), GeneBank accession No:
XM_372695(LOC390859, PREDICTED: Homo sapiens similar to
Chain A, Crystal Structure Of The R463a Mutant Of Human
Glutamate Dehydrogenase(LOC390859), mRNA).

10

【Claim 9】

The method according to claim 6, wherein the human
somatic cell of step 1) is originated from human liver or
liver cancer cells or tissues.

15

【Claim 10】

The method according to claim 9, wherein the human
liver cancer cell is HepG2.

20

【Claim 11】

The method according to claim 6, wherein the gene
expression is measured at mRNA level or protein level.

【Claim 12】

25

A method for detecting the below genes for the

identification of exposure to phenanthrene, comprising the following steps:

1) extracting RNAs from the experimental group human somatic cells and the control group human somatic cells;

5 2) synthesizing cDNAs from the RNAs of the experimental group and the control group of step 1), and labeling the cDNAs with different fluorescent materials;

10 3) hybridizing the cDNAs labeled with different fluorescent materials in step 2) with DNA microarray containing oligonucleotide comprising total length or a part of a gene selected from the group consisting of the genes below or its complementary oligonucleotide;

4) analyzing the DNA microarray reacted in step 3);
and

15 5) determining exposure to phenanthrene by comparing the expression of the gene between the experimental group and the control group, precisely if the gene expression of the experimental group is significantly changed by phenanthrene, compared with that of the control group, it
20 is judged that the gene is exposed to phenanthrene.

GeneBank accession No: NM_004420(DUSP8, Dual specificity phosphatase 8), GeneBank accession No: L11329(DUSP2, Dual specificity phosphatase 2), GeneBank accession No: BC094766(PKN1, Protein kinase N1), GeneBank
25 accession No: AY247738(TRIB3, Tribbles homolog

3(Drosophila)), GeneBank accession No: AK129595(GADD45B, Growth arrest and DNA-damage-inducible, beta), GeneBank accession No: AB208849(SHC1, SHC(Src homology 2 domain containing) transforming protein 1), GeneBank accession No:

5 X02812(TGFB1, Transforming growth factor, beta 1(Camurati-Engelmann disease)), GeneBank accession No: NM_198951(TGM2, Transglutaminase 2(C polypeptide, protein-glutamine-gamma-glutamyltransferase)), GeneBank accession No: NM_147780(CTSB, Cathepsin B), GeneBank accession No:

10 NM_078467(CDKN1A, Cyclin-dependent kinase inhibitor 1A(p21, Cip1)), GeneBank accession No: NM_033027(AXUD1, AXIN1 up-regulated 1), GeneBank accession No: NM_032797(AMID, Apoptosis-inducing factor(AIF)-like mitochondrion-associated inducer of death), GeneBank accession No:

15 NM_021960(MCL1, Myeloid cell leukemia sequence 1(BCL2-related)), GeneBank accession No: NM_016639(TNFRSF12A, Tumor necrosis factor receptor superfamily, member 12A), GeneBank accession No: NM_016222(DDX41, DEAD(Asp-Glu-Ala-Asp) box polypeptide 41), GeneBank accession No:

20 NM_013246(CLC, Cardiotrophin-like cytokine factor 1), GeneBank accession No: NM_004401(DFFA, DNA fragmentation factor, 45kDa, alpha polypeptide), GeneBank accession No: NM_004281(BAG3, BCL2-associated athanogene 3), GeneBank accession No: NM_003897(IER3, Immediate early response 3),

25 GeneBank accession No: NM_003806(HRK, Harakiri, BCL2

interacting protein(contains only BH3 domain)), GeneBank
accession No: NM_003639(IKBKG, Inhibitor of kappa light
polypeptide gene enhancer in B-cells, kinase gamma),
GeneBank accession No: NM_003311(PHLDA2, Pleckstrin
5 homology-like domain, family A, member 2), GeneBank
accession No: NM_002737(PRKCA, Protein kinase C, alpha),
GeneBank accession No: NM_002648(PIM1, Pim-1 oncogene),
GeneBank accession No: NM_002507(NGFR, Nerve growth factor
receptor(TNFR superfamily, member 16)), GeneBank accession
10 No: NM_002305(LGALS1, Lectin, galactoside-binding, soluble,
1(galectin 1)), GeneBank accession No: NM_001013398(IGFBP3,
Insulin-like growth factor binding protein 3), GeneBank
accession No: BX640923(MDM4, Mdm4, transformed 3T3 cell
double minute 4, p53 binding protein(mouse)), GeneBank
15 accession No: BX537586(STK17A, Serine/threonine kinase
17a(apoptosis-inducing)), GeneBank accession No:
BG284742(P8, P8 protein(candidate of metastasis 1)),
GeneBank accession No: BE903247(PDCD6IP, Programmed cell
death 6 interacting protein), GeneBank accession No:
20 BC027949(P2RX1, Purinergic receptor P2X, ligand-gated ion
channel, 1), GeneBank accession No: BC006365(PSEN2,
Presenilin 2(Alzheimer disease 4)), GeneBank accession No:
AY869712(PPP1R13L, Protein phosphatase 1,
regulatory(inhibitor) subunit 13 like), GeneBank accession
25 No: AY028896(CARD10, Caspase recruitment domain family,

member 10), GeneBank accession No: AK122614(PPARD, Peroxisome proliferative activated receptor, delta), GeneBank accession No: AK092872(ERCC2, Excision repair cross-complementing rodent repair deficiency, complementation group 2(xeroderma pigmentosum D)), GeneBank accession No: AK092808(RRAGC, Ras-related GTP binding C), GeneBank accession No: AJ001898(GDNF, Glial cell derived neurotrophic factor), GeneBank accession No: AF220656(PHLDA1, Pleckstrin homology-like domain, family A, member 1), GeneBank accession No: AF055634(UNC5C, Unc-5 homolog C(C. elegans)), GeneBank accession No: AB209485(VEGF, Vascular endothelial growth factor), GeneBank accession No: AB096256(UNC5B, Unc-5 homolog B(C. elegans)), GeneBank accession No: AB007960(SH3GLB1, SH3-domain GRB2-like endophilin B1), GeneBank accession No: X06374(PDGFA, Platelet-derived growth factor alpha polypeptide), GeneBank accession No: S62138(DDIT3, DNA-damage-inducible transcript 3), GeneBank accession No: NM_078487(CDKN2B, Cyclin-dependent kinase inhibitor 2B(p15, inhibits CDK4)), GeneBank accession No: NM_012127(CIZ1, CDKN1A interacting zinc finger protein 1), GeneBank accession No: NM_005883(APC2, Adenomatosis polyposis coli 2), GeneBank accession No: NM_004196(CDKL1, Cyclin-dependent kinase-like 1(CDC2-related kinase)), GeneBank accession No: NM_003236(TGFA, Transforming growth factor,

alpha), GeneBank accession No: NM_001261(CDK9, Cyclin-
 dependent kinase 9(CDC2-related kinase)), GeneBank
 accession No: NM_001007271(DUSP13, Dual specificity
 phosphatase 13), GeneBank accession No: CR749511(PARC, P53-
 5 associated parkin-like cytoplasmic protein), GeneBank
 accession No: CR623038(ID2, Inhibitor of DNA binding 2,
 dominant negative helix-loop-helix protein), GeneBank
 accession No: CR618371(EGFR, Epidermal growth factor
 receptor(erythroblastic leukemia viral(v-erb-b) oncogene
 10 homolog, avian)), GeneBank accession No: BF965144(IFITM1,
 Interferon induced transmembrane protein 1(9-27)), GeneBank
 accession No: AK127679(DUSP1, Dual specificity phosphatase
 1), GeneBank accession No: AK096276(CCND3, Cyclin D3),
 GeneBank accession No: AB209586(MAPK13, Mitogen-activated
 15 protein kinase 13), GeneBank accession No: AB209465(PCTK1,
 PCTAIRE protein kinase 1), GeneBank accession No:
 Z19588(SKIL, SKI-like), GeneBank accession No:
 NM_020429(SMURF1, SMAD specific E3 ubiquitin protein ligase
 1), GeneBank accession No: NM_014767(SPOCK2,
 20 Sparc/osteonectin, cwcw and kazal-like domains
 proteoglycan(testican) 2), GeneBank accession No:
 NM_005979(S100A13, S100 calcium binding protein A13),
 GeneBank accession No: NM_005187(CBFA2T3, Core-binding
 factor, runt domain, alpha subunit 2; translocated to, 3),
 25 GeneBank accession No: NM_004364(CEBPA, CCAAT/enhancer

binding protein(C/EBP), alpha), GeneBank accession No:
NM_001769(CD9, CD9 antigen(p24)), GeneBank accession No:
NM_001718(BMP6, Bone morphogenetic protein 6), GeneBank
accession No: NM_000641(IL11, Interleukin 11), GeneBank
5 accession No: BX647459(SERPINE2, Serpin peptidase inhibitor,
clade E(nexin, plasminogen activator inhibitor type 1),
member 2), GeneBank accession No: BQ066037(RPS19, Ribosomal
protein S19), GeneBank accession No: BE791300(EDF1,
Endothelial differentiation-related factor 1), GeneBank
10 accession No: BC038504(SNF1LK, SNF1-like kinase), GeneBank
accession No: AL832287(ZAP70, Zeta-chain(TCR) associated
protein kinase 70kDa), GeneBank accession No:
AK125742(PCGF1, Polycomb group ring finger 1), GeneBank
accession No: AK124709(NDRG1, N-myc downstream regulated
15 gene 1), GeneBank accession No: AB011157(PTDSR,
Phosphatidylserine receptor), GeneBank accession No:
NM_013255(MKLN1, Muskelin 1, intracellular mediator
containing kelch motifs), GeneBank accession No:
NM_006572(GNA13, Guanine nucleotide binding protein(G
20 protein), alpha 13), GeneBank accession No: NM_002211(ITGB1,
Integrin, beta 1(fibronectin receptor, beta polypeptide,
antigen CD29 includes MDF2, MSK12)), GeneBank accession No:
CR601067(PLAUR, Plasminogen activator, urokinase receptor),
GeneBank accession No: BC050456(THBS4, Thrombospondin 4),
25 GeneBank accession No: AK027389(CXCL16, Chemokine(C-X-C

motif) ligand 16), GeneBank accession No: AJ132099(VNN1,
 Vanin 1), GeneBank accession No: XM_371354(FLJ10157,
 Hypothetical protein FLJ10157), GeneBank accession No:
 XM_208313(TPM3, Similar to tropomyosin 4), GeneBank
 5 accession No: XM_208270(ACR, Acrosin-like protease),
 GeneBank accession No: NM_203353(PDLIM7, PDZ and LIM domain
 7(enigma)), GeneBank accession No: NM_201382(PLEC1, Plectin
 1, intermediate filament binding protein 500kDa), GeneBank
 accession No: NM_182961(SYNE1, Spectrin repeat containing,
 10 nuclear envelope 1), GeneBank accession No: NM_181826(NF2,
 Neurofibromin 2(bilateral acoustic neuroma)), GeneBank
 accession No: NM_172069(PLEKHH2, Pleckstrin homology domain
 containing, family H(with MyTH4 domain) member 2), GeneBank
 accession No: NM_022648(TNS, Tensin 1), GeneBank accession
 15 No: NM_017556(FBLP-1, Filamin binding LIM protein 1),
 GeneBank accession No: NM_016081(KIAA0992, Palladin,
 cytoskeletal associated protein), GeneBank accession No:
 NM_006617(NES, Nestin), GeneBank accession No:
 NM_006262(PRPB, Peripherin), GeneBank accession No:
 20 NM_005100(AKAP12, A kinase(PRKA) anchor protein(gravin) 12),
 GeneBank accession No: NM_004368(CNN2, Calponin 2),
 GeneBank accession No: NM_003388(CYLN2, Cytoplasmic linker
 2), GeneBank accession No: NM_003370(VASP, Vasodilator-
 stimulated phosphoprotein), GeneBank accession No:
 25 NM_003128(SPTBN1, Spectrin, beta, non-erythrocytic 1),

GeneBank accession No: NM_002705(PPL, Periplakin), GeneBank
 accession No: NM_002475(MLC1SA, Myosin light chain 1 slow
 a), GeneBank accession No: NM_002018(FLII, Flightless I
 homolog(Drosophila)), GeneBank accession No: NM_001465(FYB,
 5 FYN binding protein(FYB-120/130)), GeneBank accession No:
 NM_001069(TUBB2, Tubulin, beta 2A), GeneBank accession No:
 CR625172(MGC8685, Tubulin, beta 2B), GeneBank accession No:
 CR616919(KRT18, Keratin 18), GeneBank accession No:
 CR606241(ACTG1, Actin, gamma 1), GeneBank accession No:
 10 CB240572(MYH11, Myosin, heavy polypeptide 11, smooth
 muscle), GeneBank accession No: BX648253(PTPN3, Protein
 tyrosine phosphatase, non-receptor type 3), GeneBank
 accession No: BX648190(WDR1, WD repeat domain 1), GeneBank
 accession No: BX641076(ACTN1, Actinin, alpha 1), GeneBank
 15 accession No: BX537978(EPB41L1, Erythrocyte membrane
 protein band 4.1-like 1), GeneBank accession No:
 BG121847(NUDC, Nuclear distribution gene C homolog(A.
 nidulans)), GeneBank accession No: BC068013(MYO1C, Myosin
 IC), GeneBank accession No: BC065499(MAST2, Microtubule
 20 associated serine/threonine kinase 2), GeneBank accession
 No: BC051890(TUBG2, Tubulin, gamma 2), GeneBank accession
 No: BC041874(MAP1LC3B, Microtubule-associated protein 1
 light chain 3 beta), GeneBank accession No: BC012597(ACTA1,
 Actin, alpha 1, skeletal muscle), GeneBank accession No:
 25 AY484427(KIF17, Kinesin family member 17), GeneBank

accession No: AK130546(STOML2, Stomatin(EPB72)-like 2),
GeneBank accession No: AK124711(CORO2B, Coronin, actin
binding protein, 2B), GeneBank accession No: AK123974(MYL5,
Myosin, light polypeptide 5, regulatory), GeneBank
5 accession No: AK092792(LOC389833, Similar to hypothetical
protein MGC27019), GeneBank accession No: AK026518(MYOHD1,
Myosin head domain containing 1), GeneBank accession No:
AK024500(NICAL, Microtubule associated monooxygenase,
calponin and LIM domain containing 1), GeneBank accession
10 No: AF085886(FLJ46675, Ribosomal protein L29 pseudogene 2),
GeneBank accession No: AB209997(MYO9B, Myosin IXB),
GeneBank accession No: Y12692(WNT11, Wingless-type MMTV
integration site family, member 11), GeneBank accession No:
Y11307(CYR61, Cysteine-rich, angiogenic inducer, 61),
15 GeneBank accession No: X17033(ITGA2, Integrin, alpha
2(CD49B, alpha 2 subunit of VLA-2 receptor)), GeneBank
accession No: U41763(CLTCL1, Clathrin, heavy polypeptide-
like 1), GeneBank accession No: NM_153609(TMPRSS6,
Transmembrane protease, serine 6), GeneBank accession No:
20 NM_031483(ITCH, Itchy homolog E3 ubiquitin protein
ligase(mouse)), GeneBank accession No: NM_024342(GRLF1,
Glucocorticoid receptor DNA binding factor 1), GeneBank
accession No: NM_017555(EGLN2, Egl nine homolog 2(C.
elegans)), GeneBank accession No: NM_016569(TBX3, T-box
25 3(ulnar mammary syndrome)), GeneBank accession No:

NM_004148(NINJ1, Ninjurin 1), GeneBank accession No:
 NM_003377(VEGFB, Vascular endothelial growth factor B),
 GeneBank accession No: NM_001983(ERCC1, Excision repair
 cross-complementing rodent repair deficiency,
 5 complementation group 1(includes overlapping antisense
 sequence)), GeneBank accession No: NM_001552(IGFBP4,
 Insulin-like growth factor binding protein 4), GeneBank
 accession No: NM_001430(EPAS1, Endothelial PAS domain
 protein 1), GeneBank accession No: NM_001300(KLF6, Kruppel-
 10 like factor 6), GeneBank accession No: NM_001012661(SLC3A2,
 Solute carrier family 3(activators of dibasic and neutral
 amino acid transport), member 2), GeneBank accession No:
 NM_000596(IGFBP1, Insulin-like growth factor binding
 protein 1), GeneBank accession No: NM_000474(TWIST1, Twist
 15 homolog 1(acrocephalosyndactyly 3; Saethre-Chotzen
 syndrome)(Drosophila)), GeneBank accession No:
 BX649103(ChGn, Chondroitin beta1,4 N-
 acetylgalactosaminyltransferase), GeneBank accession No:
 BM913048(TIMPI, TIMP metalloproteinase inhibitor 1),
 20 GeneBank accession No: BM904612(S100A6, S100 calcium
 binding protein A6(calcyclin)), GeneBank accession No:
 BM556279(EMP3, Epithelial membrane protein 3), GeneBank
 accession No: BC015041(VAT1, Family with sequence
 similarity 82, member C), GeneBank accession No:
 25 AY258066(OKL38, Pregnancy-induced growth inhibitor),

GeneBank accession No: AK126729(NDRG4, NDRG family member 4), GeneBank accession No: AK090459(NFE2L1, Nuclear factor(erythroid-derived 2)-like 1), GeneBank accession No: AK074163(ROBO4, Roundabout homolog 4, magic roundabout(Drosophila)), GeneBank accession No: AK024680(FLJ21027 fis, CDNA: FLJ21027 fis, clone CAE07110), GeneBank accession No: AF176422(HEY1, Hairy/enhancer-of-split related with YRPW motif 1), GeneBank accession No: AF003837(JAG1, Jagged 1(Alagille syndrome)), GeneBank accession No: AB209322(SEMA3B, Sema domain, immunoglobulin domain(Ig), short basic domain, secreted,(semaphorin) 3B), GeneBank accession No: AB011150(NRXN1, Neurexin 1), GeneBank accession No: NM_201589(MAFA, V-maf musculoaponeurotic fibrosarcoma oncogene homolog A(avian)), GeneBank accession No: NM_052999(CKLF1, CKLF-like MARVEL transmembrane domain containing 1), GeneBank accession No: NM_006644(HSPH1, Heat shock 105kDa/110kDa protein 1), GeneBank accession No: NM_005438(FOSL1, FOS-like antigen 1), GeneBank accession No: NM_004996(ABCC1, ATP-binding cassette, sub-family C(CFTR/MRP), member 1), GeneBank accession No: NM_002658(PLAU, Plasminogen activator, urokinase), GeneBank accession No: NM_001353(AKR1C1, Aldo-keto reductase family 1, member C1(dihydrodiol dehydrogenase 1; 20-alpha(3-alpha)-hydroxysteroid dehydrogenase)), GeneBank accession No: H18681(C20orf139,

Sulfiredoxin 1 homolog(*S. cerevisiae*)), GeneBank accession
 No: DR004094(HAMP, Hepcidin antimicrobial peptide),
 GeneBank accession No: BC082272(KCNMB3, Potassium large
 conductance calcium-activated channel, subfamily M beta
 5 member 3), GeneBank accession No: BC040494(DNAJB2,
 DnaJ(Hsp40) homolog, subfamily B, member 2), GeneBank
 accession No: BC018064(ATF6, Activating transcription
 factor 6), GeneBank accession No: BC006523(SGK2,
 Serum/glucocorticoid regulated kinase 2), GeneBank
 10 accession No: AK090482(CXCL12, Chemokine(C-X-C motif)
 ligand 12(stromal cell-derived factor 1)), GeneBank
 accession No: AF219946(TULP4, Tubby like protein 4),
 GeneBank accession No: AB209112(SLC2A8, Solute carrier
 family 2,(facilitated glucose transporter) member 8),
 15 GeneBank accession No: NM_005242(F2RL1, Coagulation factor
 II(thrombin) receptor-like 1), GeneBank accession No:
 NM_001002029(C4A, Complement component 4B, telomeric),
 GeneBank accession No: NM_000539(RHO, Rhodopsin(opsin 2,
 rod pigment)(retinitis pigmentosa 4, autosomal dominant)),
 20 GeneBank accession No: BX649164(PAI, serpin peptidase
 inhibitor, clade E(nexin, plasminogen activator inhibitor
 type 1), member 1), GeneBank accession No: BM918324(LY96,
 Lymphocyte antigen 96), GeneBank accession No:
 AB209647(NCF2, Neutrophil cytosolic factor 2(65kDa, chronic
 25 granulomatous disease, autosomal 2)), GeneBank accession

No: NM_152221(CSNK1E, Casein kinase 1, epsilon), GeneBank
 accession No: NM_017999(RNF31, Ring finger protein 31),
 GeneBank accession No: NM_016819(OGG1, 8-oxoguanine DNA
 glycosylase), GeneBank accession No: NM_016816(OAS1, 2',5'-
 5 oligoadenylate synthetase 1, 40/46kDa), GeneBank accession
 No: NM_012235(SCAP, SREBP cleavage-activating protein),
 GeneBank accession No: NM_006384(CIB1, Calcium and integrin
 binding 1(calmyrin)), GeneBank accession No: NM_001779(CD58,
 CD58 antigen,(lymphocyte function-associated antigen 3)),
 10 GeneBank accession No: CB055213(ICOSLG, Inducible T-cell
 co-stimulator ligand), GeneBank accession No:
 BX641029(MASP1, Mannan-binding lectin serine peptidase
 1(C4/C2 activating component of Ra-reactive factor)),
 GeneBank accession No: BQ053419(BATF, Basic leucine zipper
 15 transcription factor, ATF-like), GeneBank accession No:
 BC039299(STIP1, Stress-induced-phosphoprotein
 1(Hsp70/Hsp90-organizing protein)), GeneBank accession No:
 AY055760(DAF, Decay accelerating factor for complement(CD55,
 Cromer blood group system)), GeneBank accession No:
 20 AK130188(FGR, Gardner-Rasheed feline sarcoma viral(v-fgr)
 oncogene homolog), GeneBank accession No: AK095326(MUS81,
 MUS81 endonuclease homolog(yeast)), GeneBank accession No:
 NM_017670(OTUB1, OTU domain, ubiquitin aldehyde binding 1),
 GeneBank accession No: NM_003004(SECTM1, Secreted and
 25 transmembrane 1), GeneBank accession No: NM_002309(LIF,

Hypothetical protein MGC20647), GeneBank accession No: NM_001421(ELF4, E74-like factor 4(ets domain transcription factor)), GeneBank accession No: NM_000418(IL4R, Interleukin 4 receptor), GeneBank accession No: BI909222(FCER1G, Fc fragment of IgE, high affinity I, receptor for; gamma polypeptide), GeneBank accession No: BF569086(NK4, Interleukin 32), GeneBank accession No: BC014470(AZGP1, Alpha-2-glycoprotein 1, zinc), GeneBank accession No: BC020744(AKR1C4, Aldo-keto reductase family 1, member C4(chlordecone reductase; 3-alpha hydroxysteroid dehydrogenase, type I; dihydrodiol), dehydrogenase 4), GeneBank accession No: BQ939577(AKR1C3, Aldo-keto reductase family 1, member C3(3-alpha hydroxysteroid dehydrogenase, type II)), GeneBank accession No: NM_000499(CYP1A1, Cytochrome P450, family 1, subfamily A, polypeptide 1), GeneBank accession No: NM_030622(CYP2S1, Cytochrome P450, family 2, subfamily S, polypeptide 1), GeneBank accession No: NM_184041(ALDOA, Aldolase A, fructose-bisphosphate), GeneBank accession No: NM_024307(MGC4171, Hypothetical protein LOC283901), GeneBank accession No: NM_005336(HDLBP, High density lipoprotein binding protein(vigilin)), GeneBank accession No: NM_002627(PFKP, Phosphofructokinase, platelet), GeneBank accession No: BX648281(LDLR, Low density lipoprotein receptor(familial hypercholesterolemia)), GeneBank accession No:

BC069201(FLJ22761, Hexokinase domain containing 1),
 GeneBank accession No: BC030207(NR0B2, Nuclear receptor
 subfamily 0, group B, member 2), GeneBank accession No:
 AL833069(KIAA1434, Hypothetical protein KIAA1434), GeneBank
 5 accession No: AK124656(ENO2, Enolase 2(gamma, neuronal)),
 GeneBank accession No: AK094474(RHOC, Ras homolog gene
 family, member C), GeneBank accession No: AK093461(ISYNA1,
 Myo-inositol 1-phosphate synthase A1), GeneBank accession
 No: AB053232(GAL3ST3, Galactose-3-O-sulfotransferase 3),
 10 GeneBank accession No: AB045292(TMEM8, Transmembrane
 protein 8(five membrane-spanning domains)), GeneBank
 accession No: NM_004753(DHRS3, Dehydrogenase/reductase(SDR
 family) member 3), GeneBank accession No: NM_002900(RBP3,
 Retinol binding protein 3, interstitial), GeneBank
 15 accession No: NM_001995(ACSL1, Acyl-CoA synthetase long-
 chain family member 1), GeneBank accession No:
 NM_000018(ACADVL, Acyl-Coenzyme A dehydrogenase, very long
 chain), GeneBank accession No: BC094756(CRA, Myotubularin
 related protein 11), GeneBank accession No: BC050553(NTE,
 20 Neuropathy target esterase), GeneBank accession No:
 BC033110(HSD17B1, Hydroxysteroid(17-beta) dehydrogenase 1),
 GeneBank accession No: AY268890(TPP1, Tripeptidyl peptidase
 I), GeneBank accession No: AK172798(CPT1A, Carnitine
 palmitoyltransferase 1A(liver)), GeneBank accession No:
 25 AK096809(CYP4F8, Cytochrome P450, family 4, subfamily F,

polypeptide 8), GeneBank accession No: AK000600(SIAT7D,
 ST6(alpha-N-acetyl-neuraminy1-2,3-beta- galactosyl-1,3)-N-
 acetylgalactosaminide alpha-2,6-sialyltransferase 4),
 GeneBank accession No: AB002454(CYP4F3, Cytochrome P450,
 5 family 4, subfamily F, polypeptide 3), GeneBank accession
 No: Z29093(DDR1, Discoidin domain receptor family, member
 1), GeneBank accession No: Z25424(MKNK2, MAP kinase
 interacting serine/threonine kinase 2), GeneBank accession
 No: XM_291277(DKFZp761P0423, Hypothetical protein
 10 DKFZp761P0423), GeneBank accession No: XM_038150(MAST3,
 Microtubule associated serine/threonine kinase 3), GeneBank
 accession No: U88357(ERBB3, V-erb-b2 erythroblastic
 leukemia viral oncogene homolog 3(avian)), GeneBank
 accession No: NM_025195(TRIB1, Tribbles homolog
 15 1(Drosophila)), GeneBank accession No: NM_020639(RIPK4,
 Receptor-interacting serine-threonine kinase 4), GeneBank
 accession No: NM_014172(PHPT1, Phosphohistidine phosphatase
 1), GeneBank accession No: NM_006254(PRKCD, Protein kinase
 C, delta), GeneBank accession No: NM_005415(SLC20A1, Solute
 20 carrier family 20(phosphate transporter), member 1),
 GeneBank accession No: NM_005026(PIK3CD, Phosphoinositide-
 3-kinase, catalytic, delta polypeptide), GeneBank accession
 No: NM_004431(EPHA2, EPH receptor A2), GeneBank accession
 No: NM_004419(DUSP5, Dual specificity phosphatase 5),
 25 GeneBank accession No: NM_004327(BCR, Breakpoint cluster

region), GeneBank accession No: NM_004231(ATP6V1F, ATPase, H⁺ transporting, lysosomal 14kDa, V1 subunit F), GeneBank accession No: NM_004090(DUSP3, Dual specificity phosphatase 3(vaccinia virus phosphatase VH1-related)), GeneBank
5 accession No: NM_002843(PTPRJ, Protein tyrosine phosphatase, receptor type, J), GeneBank accession No: NM_002496(NDUFS8, NADH dehydrogenase(ubiquinone) Fe-S protein 8, 23kDa(NADH-coenzyme Q reductase)), GeneBank accession No: NM_001001852(PIM3, Pim-3 oncogene), GeneBank accession No:
10 L76191(IRAK1, Interleukin-1 receptor-associated kinase 1), GeneBank accession No: D15049(PTPRH, Protein tyrosine phosphatase, receptor type, H), GeneBank accession No: BC065207(ATP6V0D2, ATPase, H⁺ transporting, lysosomal 38kDa, V0 subunit d isoform 2), GeneBank accession No:
15 BC035578(STK24, Serine/threonine kinase 24(STE20 homolog, yeast)), GeneBank accession No: BC028724(DUSP18, Dual specificity phosphatase 18), GeneBank accession No: AL117482(ULK3, Unc-51-like kinase 3(C. elegans)), GeneBank accession No: AK126879(PCTK3, PCTAIRE protein kinase 3),
20 GeneBank accession No: AB209416(ILK, Integrin-linked kinase-2), GeneBank accession No: NM_000782(CYP24A1, Cytochrome P450, family 24, subfamily A, polypeptide 1), GeneBank accession No: CR597101(ZFP36, Zinc finger protein 36, C3H type, homolog(mouse)), GeneBank accession No:
25 CR936799(FHL2, Four and a half LIM domains 2), GeneBank

accession No: M24898(NR1D1, Nuclear receptor subfamily 1,
 group D, member 1), GeneBank accession No: AF132818(KLF5,
 Kruppel-like factor 5(intestinal)), GeneBank accession No:
 AK055337(ZNF213, Zinc finger protein 213), GeneBank
 5 accession No: BC008834(PHF1, PHD finger protein 1),
 GeneBank accession No: AK126918(GLIS2, GLIS family zinc
 finger 2), GeneBank accession No: BC042692(CTL2, Solute
 carrier family 44, member 2), GeneBank accession No:
 NM_002224(ITPR3, Inositol 1,4,5-triphosphate receptor, type
 10 3), GeneBank accession No: AK095363(AQP3, Aquaporin 3),
 GeneBank accession No: NM_174953(ATP2A3, ATPase, Ca++
 transporting, ubiquitous), GeneBank accession No:
 BC042390(VTI1B, Vesicle transport through interaction with
 t-SNAREs homolog 1B(yeast)), GeneBank accession No:
 15 NM_016113(TRPV2, Transient receptor potential cation
 channel, subfamily V, member 2), GeneBank accession No:
 BM926478(RBP1, Retinol binding protein 1, cellular),
 GeneBank accession No: NM_000069(CACNA1S, Calcium channel,
 voltage-dependent, L type, alpha 1S subunit), GeneBank
 20 accession No: AK002107(RAB3B, RAB3B, member RAS oncogene
 family), GeneBank accession No: NM_013321(SNX8, Sorting
 nexin 8), GeneBank accession No: AK125026(SLC6A12, Solute
 carrier family 6(neurotransmitter transporter,
 betaine/GABA), member 12), GeneBank accession No:
 25 NM_005843(STAM2, Signal transducing adaptor molecule(SH3

domain and ITAM motif) 2), GeneBank accession No:
 AK092512(SLC16A5, Solute carrier family 16(monocarboxylic
 acid transporters), member 5), GeneBank accession No:
 U49248(ABCC2, ATP-binding cassette, sub-family C(CFTR/MRP),
 5 member 2), GeneBank accession No: AK172792(SCNN1A, Sodium
 channel, nonvoltage-gated 1 alpha), GeneBank accession No:
 BC044656(CASC3, Cancer susceptibility candidate 3),
 GeneBank accession No: NM_203403(C9orf150, Chromosome 9
 open reading frame 150), GeneBank accession No:
 10 NM_080388(S100A16, S100 calcium binding protein A16),
 GeneBank accession No: NM_031286(SH3BGRL3, SH3 domain
 binding glutamic acid-rich protein like 3), GeneBank
 accession No: NM_022153(PP2135, Chromosome 10 open reading
 frame 54), GeneBank accession No: NM_004864(GDF15, Growth
 15 differentiation factor 15), GeneBank accession No:
 NM_003330(TXNRD1, Thioredoxin reductase 1), GeneBank
 accession No: NM_001013632(LOC343521, Similar to
 hypothetical protein 4833401D15), GeneBank accession No:
 BX537968(LOC51149, Hypothetical LOC51149), GeneBank
 20 accession No: BU945318(MT2A, Hypothetical gene supported by
 X97260; BC070289), GeneBank accession No: BQ683841(S100A11,
 S100 calcium binding protein A11(calgizzarin)), GeneBank
 accession No: BQ276852(TMSB10, Thymosin, beta 10), GeneBank
 accession No: AK126182(KIAA1949, KIAA1949), GeneBank
 25 accession No: AK124751(CAPN2, Calpain 2,(m/II) large

subunit), GeneBank accession No: AK095079(RGC32, Response gene to complement 32), GeneBank accession No: AB075871(FLJ42654, Golgi transport 1 homolog A(*S. cerevisiae*)), GeneBank accession No: AK125150(MAPK8, Mitogen-activated protein kinase 8), GeneBank accession No: NM_002758(MAP2K6, Mitogen-activated protein kinase kinase 6), GeneBank accession No: NM_004612(TGFBR1, Transforming growth factor, beta receptor I(activin A receptor type II-like kinase, 53kDa)), GeneBank accession No: NM_145686(MAP4K4, Mitogen-activated protein kinase kinase kinase 4), GeneBank accession No: XM_042066(MAP3K1, Mitogen-activated protein kinase kinase kinase 1), GeneBank accession No: AB011123(TNIK, TRAF2 and NCK interacting kinase), GeneBank accession No: AB209031(C5, Complement component 5), GeneBank accession No: NM_022740(HIPK2, Homeodomain interacting protein kinase 2), GeneBank accession No: NM_148957(TNFRSF19, Tumor necrosis factor receptor superfamily, member 19), GeneBank accession No: AB208909(ITGB2, Integrin, beta 2(antigen CD18(p95), lymphocyte function-associated antigen 1; macrophage antigen 1(mac-1) beta subunit)), GeneBank accession No: AB209211(TIA1, TIA1 cytotoxic granule-associated RNA binding protein), GeneBank accession No: AB209613(DNASE1L3, Deoxyribonuclease I-like 3), GeneBank accession No: AK122825(HMGB1, High-mobility group box 1), GeneBank

accession No: AK127326(PHF17, PHD finger protein 17),
GeneBank accession No: AK223503(CASP1, Caspase 1,
apoptosis-related cysteine peptidase(interleukin 1, beta,
convertase)), GeneBank accession No: BC013326(GAS2, Growth
5 arrest-specific 2), GeneBank accession No: BC047698(IL7,
Interleukin 7), GeneBank accession No: D79987(ESPL1, Extra
spindle poles like 1(*S. cerevisiae*)), GeneBank accession
No: NM_000893(KNG1, Kininogen 1), GeneBank accession No:
NM_001012271(BIRC5, Effector cell peptidase receptor 1),
10 GeneBank accession No: NM_004938(DAPK1, Death-associated
protein kinase 1), GeneBank accession No: NM_005879(TRIP,
TRAF interacting protein), GeneBank accession No:
NM_014739(BCLAF1, BCL2-associated transcription factor 1),
GeneBank accession No: NM_018947(CYCS, Cytochrome c,
15 somatic), GeneBank accession No: AB033337(MPHOSPH1, M-phase
phosphoprotein 1), GeneBank accession No: AB209179(PLK1,
Polo-like kinase 1(*Drosophila*)), GeneBank accession No:
AB209337(CDC7, CDC7 cell division cycle 7(*S. cerevisiae*)),
GeneBank accession No: AF053305(BUB1, BUB1 budding
20 uninhibited by benzimidazoles 1 homolog(yeast)), GeneBank
accession No: AF053306(BUB1B, BUB1 budding uninhibited by
benzimidazoles 1 homolog beta(yeast)), GeneBank accession
No: AF345347(SPAG5, Sperm associated antigen 5), GeneBank
accession No: AK092638(CCNG2, Cyclin G2), GeneBank
25 accession No: AK222819(NUSAP1, Nucleolar and spindle

associated protein 1), GeneBank accession No: AL833191(SMC2L1, SMC2 structural maintenance of chromosomes 2-like 1(yeast)), GeneBank accession No: AY257469(CIT, Citron(rho-interacting, serine/threonine kinase 21)),

5 GeneBank accession No: AY367065(ASPM, Asp(abnormal spindle)-like, microcephaly associated(Drosophila)), GeneBank accession No: BC011000(CDCA5, Cell division cycle associated 5), GeneBank accession No: BC032677(UBE2C, Ubiquitin-conjugating enzyme E2C), GeneBank accession No:

10 BC043502(NEK2, NIMA(never in mitosis gene a)-related kinase 2), GeneBank accession No: BU675073(PTTG1, Pituitary tumor-transforming 1), GeneBank accession No: BX647885(STMN1, Stathmin 1/oncoprotein 18), GeneBank accession No: CR592757(BRRN1, Barren homolog 1(Drosophila)), GeneBank

15 accession No: CR597075(MAPRE2, Microtubule-associated protein, RP/EB family, member 2), GeneBank accession No: CR604810(CCNA2, Cyclin A2), GeneBank accession No: CR933728(CDC2, Cell division cycle 2, G1 to S and G2 to M), GeneBank accession No: NM_000919(PAM, Peptidylglycine

20 alpha-amidating monooxygenase), GeneBank accession No: NM_001790(CDC25C, Cell division cycle 25C), GeneBank accession No: NM_001798(CDK2, Cyclin-dependent kinase 2), GeneBank accession No: NM_001813(CENPE, Centromere protein E, 312kDa), GeneBank accession No: NM_003318(TTK, TTK

25 protein kinase), GeneBank accession No: NM_003981(PRC1,

Protein regulator of cytokinesis 1), GeneBank accession No:
NM_004523(KIF11, Kinesin family member 11), GeneBank
accession No: NM_004701(CCNB2, Cyclin B2), GeneBank
accession No: NM_005983(SKP2, S-phase kinase-associated
5 protein 2(p45)), GeneBank accession No: NM_006101(KNTC2,
Kinetochore associated 2), GeneBank accession No:
NM_006845(KIF2C, Kinesin family member 2C), GeneBank
accession No: NM_007375(TARDBP, TAR DNA binding protein),
GeneBank accession No: NM_012112(TPX2, TPX2, microtubule-
10 associated, homolog(Xenopus laevis)), GeneBank accession
No: NM_014750(DLG7, Discs, large homolog 7(Drosophila)),
GeneBank accession No: NM_015097(CLASP2, Cytoplasmic linker
associated protein 2), GeneBank accession No:
NM_016343(CENPF, Centromere protein F, 350/400ka(mitosis)),
15 GeneBank accession No: NM_016426(GTSE1, G-2 and S-phase
expressed 1), GeneBank accession No: NM_018492(PBK, PDZ
binding kinase), GeneBank accession No: NM_018685(ANLN,
Anillin, actin binding protein(scraps homolog, Drosophila)),
GeneBank accession No: NM_020242(KNSL7, Kinesin family
20 member 15), GeneBank accession No: NM_031966(CCNB1, Cyclin
B1), GeneBank accession No: NM_138555(KIF23, Kinesin family
member 23), GeneBank accession No: U65410(MAD2L1, MAD2
mitotic arrest deficient-like 1(yeast)), GeneBank accession
No: AB020656(CYLD, Cyldromatosis(turban tumor syndrome)),
25 GeneBank accession No: AF033122(SESN1, Sestrin 1), GeneBank

accession No: AK074377(UHRF1, Chromosome 19 open reading
 frame 31), GeneBank accession No: AK091170(CDKN2C, Cyclin-
 dependent kinase inhibitor 2C(p18, inhibits CDK4)),
 GeneBank accession No: AK094323(NFYC, Nuclear transcription
 5 factor Y, gamma), GeneBank accession No: AY366508(LOH11CR2A,
 Loss of heterozygosity, 11, chromosomal region 2, gene A),
 GeneBank accession No: BC033086(TCF19, Transcription factor
 19(SC1)), GeneBank accession No: BC040303(PTP4A1, Protein
 tyrosine phosphatase type IVA, member 1), GeneBank
 10 accession No: BC040991(TFDP2, Transcription factor Dp-2(E2F
 dimerization partner 2)), GeneBank accession No:
 BC092412(SGOL2, Shugoshin-like 2(S. pombe)), GeneBank
 accession No: BQ278454(CKS1B, CDC28 protein kinase
 regulatory subunit 1B), GeneBank accession No:
 15 BX649128(SESN3, Sestrin 3), GeneBank accession No:
 CD049340(AURKB, Aurora kinase B), GeneBank accession No:
 M89914(NF1, Neurofibromin 1(neurofibromatosis, von
 Recklinghausen disease, Watson disease)), GeneBank
 accession No: NM_001005414(ZWINT, ZW10 interactor
 20 antisense), GeneBank accession No: NM_001008491(Sep 2,
 Septin 2), GeneBank accession No: NM_001274(CHEK1, CHK1
 checkpoint homolog(S. pombe)), GeneBank accession No:
 NM_002105(H2AFX, H2A histone family, member X), GeneBank
 accession No: NM_002388(MCM3, MCM3 minichromosome
 25 maintenance deficient 3(S. cerevisiae)), GeneBank accession

No: NM_002417(MKI67, Antigen identified by monoclonal
 antibody Ki-67), GeneBank accession No: NM_002875(RAD51,
 RAD51 homolog(RecA homolog, E. coli)(S. cerevisiae)),
 GeneBank accession No: NM_003884(PCAF, P300/CBP-associated
 5 factor), GeneBank accession No: NM_004526(MCM2, MCM2
 minichromosome maintenance deficient 2, mitotin(S.
 cerevisiae)), GeneBank accession No: NM_004847(AIF1,
 Allograft inflammatory factor 1), GeneBank accession No:
 NM_005915(MCM6, MCM6 minichromosome maintenance deficient
 10 6(MIS5 homolog, S. pombe)(S. cerevisiae)), GeneBank
 accession No: NM_012090(MACF1, Microtubule-actin
 crosslinking factor 1), GeneBank accession No:
 NM_012415(RAD54B, RAD54 homolog B(S. cerevisiae)), GeneBank
 accession No: NM_014264(PLK4, Polo-like kinase
 15 4(Drosophila)), GeneBank accession No: NM_015714(G0S2,
 G0/G1switch 2), GeneBank accession No: NM_024680(FLJ23311,
 E2F transcription factor 8), GeneBank accession No:
 XM_034274(MYBL1, V-myb myeloblastosis viral oncogene
 homolog(avian)-like 1), GeneBank accession No:
 20 AK001720(FLJ10858, Nei endonuclease VIII-like 3(E. coli)),
 GeneBank accession No: AY032677(POLQ, Polymerase(DNA
 directed), theta), GeneBank accession No: BC034480(BLM,
 Bloom syndrome), GeneBank accession No: BC073161(RAD51C,
 RAD51 homolog C(S. cerevisiae)), GeneBank accession No:
 25 CR600021(HMGB2, High-mobility group box 2), GeneBank

accession No: CR625391(RAD51AP1, RAD51 associated protein
 1), GeneBank accession No: CR936783(FLJ40869, Hypothetical
 protein LOC284952), GeneBank accession No:
 DQ140356(KIAA1596, Fanconi anemia, complementation group M),
 5 GeneBank accession No: NM_001067(TOP2A, Topoisomerase(DNA)
 II alpha 170kDa), GeneBank accession No: NM_001618(PARP1,
 Poly(ADP-ribose) polymerase family, member 1), GeneBank
 accession No: NM_003362(UNG, Uracil-DNA glycosylase),
 GeneBank accession No: NM_006904(PRKDC, Protein kinase,
 10 DNA-activated, catalytic polypeptide), GeneBank accession
 No: NM_130398(EXO1, Exonuclease 1), GeneBank accession No:
 AB020807(TLR6, Toll-like receptor 6), GeneBank accession
 No: AB032980(DCDC2, Doublecortin domain containing 2),
 GeneBank accession No: AB209866(TFPI, Tissue factor pathway
 15 inhibitor(lipoprotein-associated coagulation inhibitor)),
 GeneBank accession No: AK057015(HSPA4, Heat shock 70kDa
 protein 4), GeneBank accession No: AK095515(IFIT1,
 Interferon-induced protein with tetratricopeptide repeats
 1), GeneBank accession No: AK122686(IF, I
 20 factor(complement)), GeneBank accession No: AK123010(RRM2,
 Ribonucleotide reductase M2 polypeptide), GeneBank
 accession No: BC035582(TRIM22, Tripartite motif-containing
 22), GeneBank accession No: BX537894(LOC493869, Similar to
 RIKEN cDNA 2310016C16), GeneBank accession No: M14338(PROS1,
 25 Protein S(alpha)), GeneBank accession No: NM_000821(GGCX,

Gamma-glutamyl carboxylase), GeneBank accession No:
 NM_000963(PTGS2, Prostaglandin-endoperoxide synthase
 2(prostaglandin G/H synthase and cyclooxygenase)), GeneBank
 accession No: NM_001001547(CD36, CD36 antigen(collagen type
 5 I receptor, thrombospondin receptor)), GeneBank accession
 No: NM_001512(GSTA4, Glutathione S-transferase A4),
 GeneBank accession No: NM_001629(ALOX5AP, Arachidonate 5-
 lipooxygenase-activating protein), GeneBank accession No:
 NM_001752(CAT, Catalase), GeneBank accession No:
 10 NM_001837(CCR3, Chemokine(C-C motif) receptor 3), GeneBank
 accession No: NM_001979(EPHX2, Epoxide hydrolase 2,
 cytoplasmic), GeneBank accession No: NM_001994(F13B,
 Coagulation factor XIII, B polypeptide), GeneBank accession
 No: NM_002182(IL1RAP, Interleukin 1 receptor accessory
 15 protein), GeneBank accession No: NM_006120(HLA-DMA, Major
 histocompatibility complex, class II, DM alpha), GeneBank
 accession No: NM_173216(SIAT1, ST6 beta-galactosamide
 alpha-2,6-sialyltransferase 1), GeneBank accession No:
 NM_202002(FOXM1, Forkhead box M1), GeneBank accession No:
 20 AB163917(LRAP, Leukocyte-derived arginine aminopeptidase),
 GeneBank accession No: BC027881(AFP, Alpha-fetoprotein),
 GeneBank accession No: NM_015915(SPG3A, Spastic paraplegia
 3A(autosomal dominant)), GeneBank accession No:
 NM_000671(ADH5, Alcohol dehydrogenase 5(class III), chi
 25 polypeptide), GeneBank accession No: J05428(UGT2B7, UDP

glucuronosyltransferase 2 family, polypeptide B7), GeneBank
 accession No: NM_000672(ADH6, Alcohol dehydrogenase 6(class
 V)), GeneBank accession No: M15943(ADH4, Alcohol
 dehydrogenase 4(class II), pi polypeptide), GeneBank
 5 accession No: AK223395(FBP1, Fructose-1,6-bisphosphatase 1),
 GeneBank accession No: NM_000151(G6PC, Glucose-6-
 phosphatase, catalytic(glycogen storage disease type I, von
 Gierke disease)), GeneBank accession No: XM_113962(KIAA0650,
 Structural maintenance of chromosomes flexible hinge domain
 10 containing 1), GeneBank accession No: AB020644(ACSL6, Acyl-
 CoA synthetase long-chain family member 6), GeneBank
 accession No: AB209907(PLD1, Phospholipase D1,
 phophatidylcholine-specific), GeneBank accession No:
 AF285167(ABCA1, ATP-binding cassette, sub-family A(ABC1),
 15 member 1), GeneBank accession No: AF297872(TRERF1,
 Transcriptional regulating factor 1), GeneBank accession
 No: AF303134(ALDH8A1, Aldehyde dehydrogenase 8 family,
 member A1), GeneBank accession No: AF339053(PLA2G12B,
 Phospholipase A2, group XIIB), GeneBank accession No:
 20 AK096018(HADHSC, L-3-hydroxyacyl-Coenzyme A dehydrogenase,
 short chain), GeneBank accession No: AK124635(PCSK9,
 Proprotein convertase subtilisin/kexin type 9), GeneBank
 accession No: AK127346(SIAT9, ST3 beta-galactoside alpha-
 2,3-sialyltransferase 5), GeneBank accession No:
 25 AL359559(AGPS, Alkylglycerone phosphate synthase), GeneBank

accession No: AY691170(PLCL3, Phospholipase C-like 3),
GeneBank accession No: BG567934(APOM, Apolipoprotein M),
GeneBank accession No: BX538214(C6orf167, Chromosome 6 open
reading frame 167), GeneBank accession No: BX640945(FADS2,
5 Fatty acid desaturase 2), GeneBank accession No:
BX648473(PIGK, Phosphatidylinositol glycan, class K),
GeneBank accession No: BX648557(HSD17B2, Hydroxysteroid(17-
beta) dehydrogenase 2), GeneBank accession No:
CR749601(ETNK1, Death-associated protein kinase 3),
10 GeneBank accession No: NM_000859(HMGCR, 3-hydroxy-3-
methylglutaryl-Coenzyme A reductase), GeneBank accession
No: NM_001443(FABP1, Fatty acid binding protein 1, liver),
GeneBank accession No: NM_002130(HMGCS1, 3-hydroxy-3-
methylglutaryl-Coenzyme A synthase 1(soluble)), GeneBank
15 accession No: NM_003725(RODH, Hydroxysteroid(17-beta)
dehydrogenase 6), GeneBank accession No: NM_004845(PCYT1B,
Phosphate cytidylyltransferase 1, choline, beta), GeneBank
accession No: NM_014762(DHCR24, 24-dehydrocholesterol
reductase), GeneBank accession No: NM_020139(DHRS6,
20 Dehydrogenase/reductase(SDR family) member 6), GeneBank
accession No: NM_020918(GPAM, Glycerol-3-phosphate
acyltransferase, mitochondrial), GeneBank accession No:
NM_032523(OSBPL6, Oxysterol binding protein-like 6),
GeneBank accession No: NM_033505(SELI, Selenoprotein I),
25 GeneBank accession No: Z28339(AKR1D1, Aldo-keto reductase

family 1, member D1(delta 4-3-ketosteroid-5-beta-reductase)), GeneBank accession No: AK024899(ENPP3, Ectonucleotide pyrophosphatase/phosphodiesterase 3), GeneBank accession No: AK025546(PTPN4, Protein tyrosine
 5 phosphatase, non-receptor type 4(megakaryocyte)), GeneBank accession No: AK124910(ENPP2, Ectonucleotide pyrophosphatase/phosphodiesterase 2(autotaxin)), GeneBank accession No: BC035116(FLJ35059 fis, CDNA FLJ30761 fis, clone FEBRA2000538), GeneBank accession No: BC050565(PASK,
 10 PAS domain containing serine/threonine kinase), GeneBank accession No: L13436(NPR2, Natriuretic peptide receptor B/guanylate cyclase B(atrionatriuretic peptide receptor B)), GeneBank accession No: NM_001005862(ERBB2, V-erb-b2 erythroblastic leukemia viral oncogene homolog 2,
 15 neuro/glioblastoma derived oncogene homolog(avian)), GeneBank accession No: NM_005012(ROR1, Receptor tyrosine kinase-like orphan receptor 1), GeneBank accession No: NM_006035(CDC42BPB, CDC42 binding protein kinase beta(DMPK-like)), GeneBank accession No: NM_014791(MELK, Maternal embryonic leucine zipper kinase), GeneBank accession No:
 20 NM_023028(FGFR2, Fibroblast growth factor receptor 2(bacteria-expressed kinase, keratinocyte growth factor receptor, craniofacial dysostosis 1, Crouzon syndrome, Pfeiffer syndrome, Jackson-Weiss syndrome)), GeneBank
 25 accession No: NM_080836(STK35, Serine/threonine kinase 35),

GeneBank accession No: AF419331(FUSIP1, FUS interacting protein(serine/arginine-rich) 1), GeneBank accession No: AK091927(SFRS3, Splicing factor, arginine/serine-rich 3), GeneBank accession No: BC010266(HNRNPA1, Heterogeneous nuclear ribonucleoprotein A1), GeneBank accession No: BC012360(CTAGE5, CTAGE family, member 5), GeneBank accession No: BC036046(PLRG1, Pleiotropic regulator 1(PRL1 homolog, Arabidopsis)), GeneBank accession No: BC065384(PCF11, PCF11, cleavage and polyadenylation factor subunit, homolog(S. cerevisiae)), GeneBank accession No: BX537360(CPSF5, Nudix(nucleoside diphosphate linked moiety X)-type motif 21), GeneBank accession No: BX537494(HNRPA2B1, Heterogeneous nuclear ribonucleoprotein A2/B1), GeneBank accession No: BX647784(HNRPR, Heterogeneous nuclear ribonucleoprotein R), GeneBank accession No: CA455267(PPIH, Peptidyl prolyl isomerase H(cyclophilin H)), GeneBank accession No: CR596214(HNRPA0, Heterogeneous nuclear ribonucleoprotein A0), GeneBank accession No: NM_001326(CSTF3, Hypothetical protein LOC283267), GeneBank accession No: NM_004640(BAT1, HLA-B associated transcript 1), GeneBank accession No: NM_005463(HNRPDL, Heterogeneous nuclear ribonucleoprotein D-like), GeneBank accession No: NM_006924(SFRS1, Splicing factor, arginine/serine-rich 1(splicing factor 2, alternate splicing factor)), GeneBank accession No: NM_012426(SF3B3, Splicing factor 3b, subunit

3, 130kDa), GeneBank accession No: NM_018048(FLJ10292, Mago-nashi homolog), GeneBank accession No: NM_030919(C20orf129, Chromosome 20 open reading frame 129), GeneBank accession No: NM_031370(HNRPD, Heterogeneous nuclear ribonucleoprotein D(AU-rich element RNA binding protein 1, 37kDa)), GeneBank accession No: NM_138933(ACF, Apobec-1 complementation factor), GeneBank accession No: AB193259(ACE2, Angiotensin I converting enzyme(peptidyl-dipeptidase A) 2), GeneBank accession No: BX648769(EWSR1, Ewing sarcoma breakpoint region 1), GeneBank accession No: AB023154(DTX4, Deltex 4 homolog(Drosophila)), GeneBank accession No: AL543755(VAV3, Vav 3 oncogene), GeneBank accession No: M75106(CPB2, Carboxypeptidase B2(plasma, carboxypeptidase U)), GeneBank accession No: NM_021045(ZNF248, Zinc finger protein 248), GeneBank accession No: AB209194(B4GALT6, UDP-Gal:betaGlcNAc beta 1,4- galactosyltransferase, polypeptide 6), GeneBank accession No: AF279145(ANTXR1, Anthrax toxin receptor 1), GeneBank accession No: NM_025074(FRAS1, Fraser syndrome 1), GeneBank accession No: AK025790(KIF20A, Kinesin family member 20A), GeneBank accession No: NM_006152(LRMP, Lymphoid-restricted membrane protein), GeneBank accession No: NM_000340(SLC2A2, Solute carrier family 2(facilitated glucose transporter), member 2), GeneBank accession No: AF071592(KIF4A, Kinesin family member 4A), GeneBank

accession No: NM_013277(RACGAP1, Rac GTPase activating
 protein 1), GeneBank accession No: AY043484(SCN1A, Sodium
 channel, voltage-gated, type I, alpha), GeneBank accession
 No: AY791349(KIF18A, Kinesin family member 18A), GeneBank
 5 accession No: NM_018018(SLC38A4, Solute carrier family 38,
 member 4), GeneBank accession No: AK094603(FLJ37284 fis,
 unnamed protein product; Homo sapiens cDNA FLJ37284 fis,
 clone BRAMY2013590.), GeneBank accession No:
 NM_021069(ARGBP2, Sorbin and SH3 domain containing 2),
 10 GeneBank accession No: NM_001005747(CACNB4, Calcium channel,
 voltage-dependent, beta 4 subunit), GeneBank accession No:
 AJ496568(SLC25A12, Solute carrier family 25(mitochondrial
 carrier, Aralar), member 12), GeneBank accession No:
 NM_030641(APOL6, Apolipoprotein L, 6), GeneBank accession
 15 No: NM_173512(FLJ39822, Hypothetical protein FLJ39822),
 GeneBank accession No: NM_000037(ANK1, Ankyrin 1,
 erythrocytic), GeneBank accession No: NM_001011554(SLC13A3,
 Solute carrier family 13(sodium-dependent dicarboxylate
 transporter), member 3), GeneBank accession No:
 20 AB091343(C10orf3, Centrosomal protein 55kDa), GeneBank
 accession No: AK000643(ASB9, Ankyrin repeat and SOCS box-
 containing 9), GeneBank accession No: AK055221(FBXO5, F-box
 protein 5), GeneBank accession No: AK075271(SPTLC2L, Serine
 palmitoyltransferase, long chain base subunit 2-
 25 like(aminotransferase 2)), GeneBank accession No:

AK122685(GLUD1, Glutamate dehydrogenase 1), GeneBank
 accession No: AK127098(FLJ10706, Chromosome 1 open reading
 frame 112), GeneBank accession No: AL133031(MLR1,
 Transcription factor MLR1), GeneBank accession No:
 5 AY007723(MAL2, Mal, T-cell differentiation protein 2),
 GeneBank accession No: BC022255(Spc25, Spindle pole body
 component 25 homolog(*S. cerevisiae*)), GeneBank accession
 No: BC041882(ATF7IP2, Activating transcription factor 7
 interacting protein 2), GeneBank accession No:
 10 BC052951(LMNB1, Lamin B1), GeneBank accession No:
 BC098313(FLJ20641, Hypothetical protein FLJ20641), GeneBank
 accession No: NM_001809(CENPA, Centromere protein A, 17kDa),
 GeneBank accession No: NM_145061(C13orf3, Chromosome 13
 open reading frame 3), GeneBank accession No:
 15 XM_372695(LOC390859, PREDICTED: Homo sapiens similar to
 Chain A, Crystal Structure Of The R463a Mutant Of Human
 Glutamate Dehydrogenase(LOC390859), mRNA).

【Claim 13】

20 The method according to claim 12, wherein the below
 genes are up-regulated by exposure to phenanthrene:

GeneBank accession No: NM_004420(DUSP8, Dual
 specificity phosphatase 8), GeneBank accession No:
 L11329(DUSP2, Dual specificity phosphatase 2), GeneBank
 25 accession No: BC094766(PKN1, Protein kinase N1), GeneBank

accession No: AY247738(TRIB3, Tribbles homolog
 3(Drosophila)), GeneBank accession No: AK129595(GADD45B,
 Growth arrest and DNA-damage-inducible, beta), GeneBank
 accession No: AB208849(SHC1, SHC(Src homology 2 domain
 5 containing) transforming protein 1), GeneBank accession No:
 X02812(TGFB1, Transforming growth factor, beta 1(Camurati-
 Engelmann disease)), GeneBank accession No: NM_198951(TGM2,
 Transglutaminase 2(C polypeptide, protein-glutamine-gamma-
 glutamyltransferase)), GeneBank accession No:
 10 NM_147780(CTSB, Cathepsin B), GeneBank accession No:
 NM_078467(CDKN1A, Cyclin-dependent kinase inhibitor 1A(p21,
 Cip1)), GeneBank accession No: NM_033027(AXUD1, AXIN1 up-
 regulated 1), GeneBank accession No: NM_032797(AMID,
 Apoptosis-inducing factor(AIF)-like mitochondrion-
 15 associated inducer of death), GeneBank accession No:
 NM_021960(MCL1, Myeloid cell leukemia sequence 1(BCL2-
 related)), GeneBank accession No: NM_016639(TNFRSF12A,
 Tumor necrosis factor receptor superfamily, member 12A),
 GeneBank accession No: NM_016222(DDX41, DEAD(Asp-Glu-Ala-
 20 Asp) box polypeptide 41), GeneBank accession No:
 NM_013246(CLC, Cardiotrophin-like cytokine factor 1),
 GeneBank accession No: NM_004401(DFFA, DNA fragmentation
 factor, 45kDa, alpha polypeptide), GeneBank accession No:
 NM_004281(BAG3, BCL2-associated athanogene 3), GeneBank
 25 accession No: NM_003897(IER3, Immediate early response 3),

GeneBank accession No: NM_003806(HRK, Harakiri, BCL2 interacting protein(contains only BH3 domain)), GeneBank accession No: NM_003639(IKBKG, Inhibitor of kappa light polypeptide gene enhancer in B-cells, kinase gamma),
5 GeneBank accession No: NM_003311(PHLDA2, Pleckstrin homology-like domain, family A, member 2), GeneBank accession No: NM_002737(PRKCA, Protein kinase C, alpha), GeneBank accession No: NM_002648(PIM1, Pim-1 oncogene), GeneBank accession No: NM_002507(NGFR, Nerve growth factor
10 receptor(TNFR superfamily, member 16)), GeneBank accession No: NM_002305(LGALS1, Lectin, galactoside-binding, soluble, 1(galectin 1)), GeneBank accession No: NM_001013398(IGFBP3, Insulin-like growth factor binding protein 3), GeneBank accession No: BX640923(MDM4, Mdm4, transformed 3T3 cell
15 double minute 4, p53 binding protein(mouse)), GeneBank accession No: BX537586(STK17A, Serine/threonine kinase 17a(apoptosis-inducing)), GeneBank accession No: BG284742(P8, P8 protein(candidate of metastasis 1)), GeneBank accession No: BE903247(PDCD6IP, Programmed cell
20 death 6 interacting protein), GeneBank accession No: BC027949(P2RX1, Purinergic receptor P2X, ligand-gated ion channel, 1), GeneBank accession No: BC006365(PSEN2, Presenilin 2(Alzheimer disease 4)), GeneBank accession No: AY869712(PPP1R13L, Protein phosphatase 1,
25 regulatory(inhibitor) subunit 13 like), GeneBank accession

No: AY028896(CARD10, Caspase recruitment domain family, member 10), GeneBank accession No: AK122614(PPARD, Peroxisome proliferative activated receptor, delta), GeneBank accession No: AK092872(ERCC2, Excision repair cross-complementing rodent repair deficiency, complementation group 2(xeroderma pigmentosum D)), GeneBank accession No: AK092808(RRAGC, Ras-related GTP binding C), GeneBank accession No: AJ001898(GDNF, Glial cell derived neurotrophic factor), GeneBank accession No: AF220656(PHLDA1, Pleckstrin homology-like domain, family A, member 1), GeneBank accession No: AF055634(UNC5C, Unc-5 homolog C(C. elegans)), GeneBank accession No: AB209485(VEGF, Vascular endothelial growth factor), GeneBank accession No: AB096256(UNC5B, Unc-5 homolog B(C. elegans)), GeneBank accession No: AB007960(SH3GLB1, SH3-domain GRB2-like endophilin B1), GeneBank accession No: X06374(PDGFA, Platelet-derived growth factor alpha polypeptide), GeneBank accession No: S62138(DDIT3, DNA-damage-inducible transcript 3), GeneBank accession No: NM_078487(CDKN2B, Cyclin-dependent kinase inhibitor 2B(p15, inhibits CDK4)), GeneBank accession No: NM_012127(CIZ1, CDKN1A interacting zinc finger protein 1), GeneBank accession No: NM_005883(APC2, Adenomatosis polyposis coli 2), GeneBank accession No: NM_004196(CDKL1, Cyclin-dependent kinase-like 1(CDC2-related kinase)), GeneBank

accession No: NM_003236(TGFA, Transforming growth factor,
 alpha), GeneBank accession No: NM_001261(CDK9, Cyclin-
 dependent kinase 9(CDC2-related kinase)), GeneBank
 accession No: NM_001007271(DUSP13, Dual specificity
 5 phosphatase 13), GeneBank accession No: CR749511(PARC, P53-
 associated parkin-like cytoplasmic protein), GeneBank
 accession No: CR623038(ID2, Inhibitor of DNA binding 2,
 dominant negative helix-loop-helix protein), GeneBank
 accession No: CR618371(EGFR, Epidermal growth factor
 10 receptor(erythroblastic leukemia viral(v-erb-b) oncogene
 homolog, avian)), GeneBank accession No: BF965144(IFITM1,
 Interferon induced transmembrane protein 1(9-27)), GeneBank
 accession No: AK127679(DUSP1, Dual specificity phosphatase
 1), GeneBank accession No: AK096276(CCND3, Cyclin D3),
 15 GeneBank accession No: AB209586(MAPK13, Mitogen-activated
 protein kinase 13), GeneBank accession No: AB209465(PCTK1,
 PCTAIRE protein kinase 1), GeneBank accession No:
 Z19588(SKIL, SKI-like), GeneBank accession No:
 NM_020429(SMURF1, SMAD specific E3 ubiquitin protein ligase
 20 1), GeneBank accession No: NM_014767(SPOCK2,
 Sparc/osteonectin, cwcw and kazal-like domains
 proteoglycan(testican) 2), GeneBank accession No:
 NM_005979(S100A13, S100 calcium binding protein A13),
 GeneBank accession No: NM_005187(CBFA2T3, Core-binding
 25 factor, runt domain, alpha subunit 2; translocated to, 3),

GeneBank accession No: NM_004364(CEBPA, CCAAT/enhancer binding protein(C/EBP), alpha), GeneBank accession No: NM_001769(CD9, CD9 antigen(p24)), GeneBank accession No: NM_001718(BMP6, Bone morphogenetic protein 6), GeneBank
5 accession No: NM_000641(IL11, Interleukin 11), GeneBank accession No: BX647459(SERPINE2, Serpin peptidase inhibitor, clade E(nexin, plasminogen activator inhibitor type 1), member 2), GeneBank accession No: BQ066037(RPS19, Ribosomal protein S19), GeneBank accession No: BE791300(EDF1,
10 Endothelial differentiation-related factor 1), GeneBank accession No: BC038504(SNF1LK, SNF1-like kinase), GeneBank accession No: AL832287(ZAP70, Zeta-chain(TCR) associated protein kinase 70kDa), GeneBank accession No: AK125742(PCGF1, Polycomb group ring finger 1), GeneBank
15 accession No: AK124709(NDRG1, N-myc downstream regulated gene 1), GeneBank accession No: AB011157(PTDSR, Phosphatidylserine receptor), GeneBank accession No: NM_013255(MKLN1, Muskelin 1, intracellular mediator containing kelch motifs), GeneBank accession No:
20 NM_006572(GNA13, Guanine nucleotide binding protein(G protein), alpha 13), GeneBank accession No: NM_002211(ITGB1, Integrin, beta 1(fibronectin receptor, beta polypeptide, antigen CD29 includes MDF2, MSK12)), GeneBank accession No: CR601067(PLAUR, Plasminogen activator, urokinase receptor),
25 GeneBank accession No: BC050456(THBS4, Thrombospondin 4),

GeneBank accession No: AK027389(CXCL16, Chemokine(C-X-C motif) ligand 16), GeneBank accession No: AJ132099(VNN1, Vanin 1), GeneBank accession No: XM_371354(FLJ10157, Hypothetical protein FLJ10157), GeneBank accession No: XM_208313(TPM3, Similar to tropomyosin 4), GeneBank accession No: XM_208270(ACR, Acrosin-like protease), GeneBank accession No: NM_203353(PDLIM7, PDZ and LIM domain 7(enigma)), GeneBank accession No: NM_201382(PLEC1, Plectin 1, intermediate filament binding protein 500kDa), GeneBank accession No: NM_182961(SYNE1, Spectrin repeat containing, nuclear envelope 1), GeneBank accession No: NM_181826(NF2, Neurofibromin 2(bilateral acoustic neuroma)), GeneBank accession No: NM_172069(PLEKHH2, Pleckstrin homology domain containing, family H(with MyTH4 domain) member 2), GeneBank accession No: NM_022648(TNS, Tensin 1), GeneBank accession No: NM_017556(FBLP-1, Filamin binding LIM protein 1), GeneBank accession No: NM_016081(KIAA0992, Palladin, cytoskeletal associated protein), GeneBank accession No: NM_006617(NES, Nestin), GeneBank accession No: NM_006262(PRPB, Peripherin), GeneBank accession No: NM_005100(AKAP12, A kinase(PRKA) anchor protein(gravin) 12), GeneBank accession No: NM_004368(CNN2, Calponin 2), GeneBank accession No: NM_003388(CYLN2, Cytoplasmic linker 2), GeneBank accession No: NM_003370(VASP, Vasodilator-stimulated phosphoprotein), GeneBank accession No:

NM_003128(SPTBN1, Spectrin, beta, non-erythrocytic 1),
 GeneBank accession No: NM_002705(PPL, Periplakin), GeneBank
 accession No: NM_002475(MLC1SA, Myosin light chain 1 slow
 a), GeneBank accession No: NM_002018(FLII, Flightless I
 5 homolog(Drosophila)), GeneBank accession No: NM_001465(FYB,
 FYN binding protein(FYB-120/130)), GeneBank accession No:
 NM_001069(TUBB2, Tubulin, beta 2A), GeneBank accession No:
 CR625172(MGC8685, Tubulin, beta 2B), GeneBank accession No:
 CR616919(KRT18, Keratin 18), GeneBank accession No:
 10 CR606241(ACTG1, Actin, gamma 1), GeneBank accession No:
 CB240572(MYH11, Myosin, heavy polypeptide 11, smooth
 muscle), GeneBank accession No: BX648253(PTPN3, Protein
 tyrosine phosphatase, non-receptor type 3), GeneBank
 accession No: BX648190(WDR1, WD repeat domain 1), GeneBank
 15 accession No: BX641076(ACTN1, Actinin, alpha 1), GeneBank
 accession No: BX537978(EPB41L1, Erythrocyte membrane
 protein band 4.1-like 1), GeneBank accession No:
 BG121847(NUDC, Nuclear distribution gene C homolog(A.
 nidulans)), GeneBank accession No: BC068013(MYO1C, Myosin
 20 IC), GeneBank accession No: BC065499(MAST2, Microtubule
 associated serine/threonine kinase 2), GeneBank accession
 No: BC051890(TUBG2, Tubulin, gamma 2), GeneBank accession
 No: BC041874(MAP1LC3B, Microtubule-associated protein 1
 light chain 3 beta), GeneBank accession No: BC012597(ACTA1,
 25 Actin, alpha 1, skeletal muscle), GeneBank accession No:

AY484427(KIF17, Kinesin family member 17), GeneBank
accession No: AK130546(STOML2, Stomatin(EPB72)-like 2),
GeneBank accession No: AK124711(CORO2B, Coronin, actin
binding protein, 2B), GeneBank accession No: AK123974(MYL5,
5 Myosin, light polypeptide 5, regulatory), GeneBank
accession No: AK092792(LOC389833, Similar to hypothetical
protein MGC27019), GeneBank accession No: AK026518(MYOHD1,
Myosin head domain containing 1), GeneBank accession No:
AK024500(NICAL, Microtubule associated monooxygenase,
10 calponin and LIM domain containing 1), GeneBank accession
No: AF085886(FLJ46675, Ribosomal protein L29 pseudogene 2),
GeneBank accession No: AB209997(MYO9B, Myosin IXB),
GeneBank accession No: Y12692(WNT11, Wingless-type MMTV
integration site family, member 11), GeneBank accession No:
15 Y11307(CYR61, Cysteine-rich, angiogenic inducer, 61),
GeneBank accession No: X17033(ITGA2, Integrin, alpha
2(CD49B, alpha 2 subunit of VLA-2 receptor)), GeneBank
accession No: U41763(CLTCL1, Clathrin, heavy polypeptide-
like 1), GeneBank accession No: NM_153609(TMPRSS6,
20 Transmembrane protease, serine 6), GeneBank accession No:
NM_031483(ITCH, Itchy homolog E3 ubiquitin protein
ligase(mouse)), GeneBank accession No: NM_024342(GRLF1,
Glucocorticoid receptor DNA binding factor 1), GeneBank
accession No: NM_017555(EGLN2, Egl nine homolog 2(C.
25 elegans)), GeneBank accession No: NM_016569(TBX3, T-box

3(ulnar mammary syndrome)), GeneBank accession No:
 NM_004148(NINJ1, Ninjurin 1), GeneBank accession No:
 NM_003377(VEGFB, Vascular endothelial growth factor B),
 GeneBank accession No: NM_001983(ERCC1, Excision repair
 5 cross-complementing rodent repair deficiency,
 complementation group 1(includes overlapping antisense
 sequence)), GeneBank accession No: NM_001552(IGFBP4,
 Insulin-like growth factor binding protein 4), GeneBank
 accession No: NM_001430(EPAS1, Endothelial PAS domain
 10 protein 1), GeneBank accession No: NM_001300(KLF6, Kruppel-
 like factor 6), GeneBank accession No: NM_001012661(SLC3A2,
 Solute carrier family 3(activators of dibasic and neutral
 amino acid transport), member 2), GeneBank accession No:
 NM_000596(IGFBP1, Insulin-like growth factor binding
 15 protein 1), GeneBank accession No: NM_000474(TWIST1, Twist
 homolog 1(acrocephalosyndactyly 3; Saethre-Chotzen
 syndrome)(Drosophila)), GeneBank accession No:
 BX649103(ChGn, Chondroitin beta1,4 N-
 acetylgalactosaminyltransferase), GeneBank accession No:
 20 BM913048(TIMPI, TIMP metalloproteinase inhibitor 1),
 GeneBank accession No: BM904612(S100A6, S100 calcium
 binding protein A6(calcyclin)), GeneBank accession No:
 BM556279(EMP3, Epithelial membrane protein 3), GeneBank
 accession No: BC015041(VAT1, Family with sequence
 25 similarity 82, member C), GeneBank accession No:

AY258066(OKL38, Pregnancy-induced growth inhibitor),
 GeneBank accession No: AK126729(NDRG4, NDRG family member
 4), GeneBank accession No: AK090459(NFE2L1, Nuclear
 factor(erythroid-derived 2)-like 1), GeneBank accession No:
 5 AK074163(ROBO4, Roundabout homolog 4, magic
 roundabout(Drosophila)), GeneBank accession No:
 AK024680(FLJ21027 fis, CDNA: FLJ21027 fis, clone CAE07110),
 GeneBank accession No: AF176422(HEY1, Hairy/enhancer-of-
 split related with YRPW motif 1), GeneBank accession No:
 10 AF003837(JAG1, Jagged 1(Alagille syndrome)), GeneBank
 accession No: AB209322(SEMA3B, Sema domain, immunoglobulin
 domain(Ig), short basic domain, secreted,(semaphorin) 3B),
 GeneBank accession No: AB011150(NRXN1, Neurexin 1),
 GeneBank accession No: NM_201589(MAFA, V-maf
 15 musculoaponeurotic fibrosarcoma oncogene homolog A(avian)),
 GeneBank accession No: NM_052999(CKLFSF1, CKLF-like MARVEL
 transmembrane domain containing 1), GeneBank accession No:
 NM_006644(HSPH1, Heat shock 105kDa/110kDa protein 1),
 GeneBank accession No: NM_005438(FOSL1, FOS-like antigen 1),
 20 GeneBank accession No: NM_004996(ABCC1, ATP-binding
 cassette, sub-family C(CFTR/MRP), member 1), GeneBank
 accession No: NM_002658(PLAU, Plasminogen activator,
 urokinase), GeneBank accession No: NM_001353(AKR1C1, Aldo-
 keto reductase family 1, member C1(dihydrodiol
 25 dehydrogenase 1; 20-alpha(3-alpha)-hydroxysteroid

dehydrogenase)), GeneBank accession No: H18681(C20orf139, Sulfiredoxin 1 homolog(*S. cerevisiae*)), GeneBank accession No: DR004094(HAMP, Hepcidin antimicrobial peptide), GeneBank accession No: BC082272(KCNMB3, Potassium large

5 conductance calcium-activated channel, subfamily M beta member 3), GeneBank accession No: BC040494(DNAJB2, DnaJ(Hsp40) homolog, subfamily B, member 2), GeneBank accession No: BC018064(ATF6, Activating transcription factor 6), GeneBank accession No: BC006523(SGK2,

10 Serum/glucocorticoid regulated kinase 2), GeneBank accession No: AK090482(CXCL12, Chemokine(C-X-C motif) ligand 12(stromal cell-derived factor 1)), GeneBank accession No: AF219946(TULP4, Tubby like protein 4), GeneBank accession No: AB209112(SLC2A8, Solute carrier

15 family 2,(facilitated glucose transporter) member 8), GeneBank accession No: NM_005242(F2RL1, Coagulation factor II(thrombin) receptor-like 1), GeneBank accession No: NM_001002029(C4A, Complement component 4B, telomeric), GeneBank accession No: NM_000539(RHO, Rhodopsin(opsin 2, rod pigment)(retinitis pigmentosa 4, autosomal dominant)),

20 GeneBank accession No: BX649164(PAI, serpin peptidase inhibitor, clade E(nexin, plasminogen activator inhibitor type 1), member 1), GeneBank accession No: BM918324(LY96, Lymphocyte antigen 96), GeneBank accession No:

25 AB209647(NCF2, Neutrophil cytosolic factor 2(65kDa, chronic

granulomatous disease, autosomal 2)), GeneBank accession
 No: NM_152221(CSNK1E, Casein kinase 1, epsilon), GeneBank
 accession No: NM_017999(RNF31, Ring finger protein 31),
 GeneBank accession No: NM_016819(OGG1, 8-oxoguanine DNA
 5 glycosylase), GeneBank accession No: NM_016816(OAS1, 2',5'-
 oligoadenylate synthetase 1, 40/46kDa), GeneBank accession
 No: NM_012235(SCAP, SREBP cleavage-activating protein),
 GeneBank accession No: NM_006384(CIB1, Calcium and integrin
 binding 1(calmyrin)), GeneBank accession No: NM_001779(CD58,
 10 CD58 antigen,(lymphocyte function-associated antigen 3)),
 GeneBank accession No: CB055213(ICOSLG, Inducible T-cell
 co-stimulator ligand), GeneBank accession No:
 BX641029(MASP1, Mannan-binding lectin serine peptidase
 1(C4/C2 activating component of Ra-reactive factor)),
 15 GeneBank accession No: BQ053419(BATF, Basic leucine zipper
 transcription factor, ATF-like), GeneBank accession No:
 BC039299(STIP1, Stress-induced-phosphoprotein
 1(Hsp70/Hsp90-organizing protein)), GeneBank accession No:
 AY055760(DAF, Decay accelerating factor for complement(CD55,
 20 Cromer blood group system)), GeneBank accession No:
 AK130188(FGR, Gardner-Rasheed feline sarcoma viral(v-fgr)
 oncogene homolog), GeneBank accession No: AK095326(MUS81,
 MUS81 endonuclease homolog(yeast)), GeneBank accession No:
 NM_017670(OTUB1, OTU domain, ubiquitin aldehyde binding 1),
 25 GeneBank accession No: NM_003004(SECTM1, Secreted and

transmembrane 1), GeneBank accession No: NM_002309(LIF,
 Hypothetical protein MGC20647), GeneBank accession No:
 NM_001421(ELF4, E74-like factor 4(ets domain transcription
 factor)), GeneBank accession No: NM_000418(IL4R,
 5 Interleukin 4 receptor), GeneBank accession No:
 BI909222(FCER1G, Fc fragment of IgE, high affinity I,
 receptor for; gamma polypeptide), GeneBank accession No:
 BF569086(NK4, Interleukin 32), GeneBank accession No:
 BC014470(AZGP1, Alpha-2-glycoprotein 1, zinc), GeneBank
 10 accession No: BC020744(AKR1C4, Aldo-keto reductase family 1,
 member C4(chlordecone reductase; 3-alpha hydroxysteroid
 dehydrogenase, type I; dihydrodiol),dehydrogenase 4),
 GeneBank accession No: BQ939577(AKR1C3, Aldo-keto reductase
 family 1, member C3(3-alpha hydroxysteroid dehydrogenase,
 15 type II)), GeneBank accession No: NM_000499(CYP1A1,
 Cytochrome P450, family 1, subfamily A, polypeptide 1),
 GeneBank accession No: NM_030622(CYP2S1, Cytochrome P450,
 family 2, subfamily S, polypeptide 1), GeneBank accession
 No: NM_184041(ALDOA, Aldolase A, fructose-bisphosphate),
 20 GeneBank accession No: NM_024307(MGC4171, Hypothetical
 protein LOC283901), GeneBank accession No: NM_005336(HDLBP,
 High density lipoprotein binding protein(vigilin)),
 GeneBank accession No: NM_002627(PFKP, Phosphofructokinase,
 platelet), GeneBank accession No: BX648281(LDLR, Low
 25 density lipoprotein receptor(familial

hypercholesterolemia)), GeneBank accession No:
 BC069201(FLJ22761, Hexokinase domain containing 1),
 GeneBank accession No: BC030207(NR0B2, Nuclear receptor
 subfamily 0, group B, member 2), GeneBank accession No:
 5 AL833069(KIAA1434, Hypothetical protein KIAA1434), GeneBank
 accession No: AK124656(ENO2, Enolase 2(gamma, neuronal)),
 GeneBank accession No: AK094474(RHOC, Ras homolog gene
 family, member C), GeneBank accession No: AK093461(ISYNA1,
 Myo-inositol 1-phosphate synthase A1), GeneBank accession
 10 No: AB053232(GAL3ST3, Galactose-3-O-sulfotransferase 3),
 GeneBank accession No: AB045292(TMEM8, Transmembrane
 protein 8(five membrane-spanning domains)), GeneBank
 accession No: NM_004753(DHRS3, Dehydrogenase/reductase(SDR
 family) member 3), GeneBank accession No: NM_002900(RBP3,
 15 Retinol binding protein 3, interstitial), GeneBank
 accession No: NM_001995(ACSL1, Acyl-CoA synthetase long-
 chain family member 1), GeneBank accession No:
 NM_000018(ACADVL, Acyl-Coenzyme A dehydrogenase, very long
 chain), GeneBank accession No: BC094756(CRA, Myotubularin
 20 related protein 11), GeneBank accession No: BC050553(NTE,
 Neuropathy target esterase), GeneBank accession No:
 BC033110(HSD17B1, Hydroxysteroid(17-beta) dehydrogenase 1),
 GeneBank accession No: AY268890(TPP1, Tripeptidyl peptidase
 I), GeneBank accession No: AK172798(CPT1A, Carnitine
 25 palmitoyltransferase 1A(liver)), GeneBank accession No:

AK096809(CYP4F8, Cytochrome P450, family 4, subfamily F, polypeptide 8), GeneBank accession No: AK000600(SIAT7D, ST6(alpha-N-acetyl-neuraminy1-2,3-beta- galactosyl-1,3)-N-acetylgalactosaminide alpha-2,6-sialyltransferase 4),

5 GeneBank accession No: AB002454(CYP4F3, Cytochrome P450, family 4, subfamily F, polypeptide 3), GeneBank accession No: Z29093(DDR1, Discoidin domain receptor family, member 1), GeneBank accession No: Z25424(MKNK2, MAP kinase interacting serine/threonine kinase 2), GeneBank accession

10 No: XM_291277(DKFZp761P0423, Hypothetical protein DKFZp761P0423), GeneBank accession No: XM_038150(MAST3, Microtubule associated serine/threonine kinase 3), GeneBank accession No: U88357(ERBB3, V-erb-b2 erythroblastic leukemia viral oncogene homolog 3(avian)), GeneBank

15 accession No: NM_025195(TRIB1, Tribbles homolog 1(Drosophila)), GeneBank accession No: NM_020639(RIPK4, Receptor-interacting serine-threonine kinase 4), GeneBank accession No: NM_014172(PHPT1, Phosphohistidine phosphatase 1), GeneBank accession No: NM_006254(PRKCD, Protein kinase C, delta), GeneBank accession No: NM_005415(SLC20A1, Solute carrier family 20(phosphate transporter), member 1), GeneBank accession No: NM_005026(PIK3CD, Phosphoinositide-3-kinase, catalytic, delta polypeptide), GeneBank accession

20 No: NM_004431(EPHA2, EPH receptor A2), GeneBank accession

25 No: NM_004419(DUSP5, Dual specificity phosphatase 5),

GeneBank accession No: NM_004327(BCR, Breakpoint cluster region), GeneBank accession No: NM_004231(ATP6V1F, ATPase, H⁺ transporting, lysosomal 14kDa, V1 subunit F), GeneBank accession No: NM_004090(DUSP3, Dual specificity phosphatase 3(vaccinia virus phosphatase VH1-related)), GeneBank accession No: NM_002843(PTPRJ, Protein tyrosine phosphatase, receptor type, J), GeneBank accession No: NM_002496(NDUFS8, NADH dehydrogenase(ubiquinone) Fe-S protein 8, 23kDa(NADH-coenzyme Q reductase)), GeneBank accession No: NM_001001852(PIM3, Pim-3 oncogene), GeneBank accession No: L76191(IRAK1, Interleukin-1 receptor-associated kinase 1), GeneBank accession No: D15049(PTPRH, Protein tyrosine phosphatase, receptor type, H), GeneBank accession No: BC065207(ATP6V0D2, ATPase, H⁺ transporting, lysosomal 38kDa, V0 subunit d isoform 2), GeneBank accession No: BC035578(STK24, Serine/threonine kinase 24(STE20 homolog, yeast)), GeneBank accession No: BC028724(DUSP18, Dual specificity phosphatase 18), GeneBank accession No: AL117482(ULK3, Unc-51-like kinase 3(C. elegans)), GeneBank accession No: AK126879(PCTK3, PCTAIRE protein kinase 3), GeneBank accession No: AB209416(ILK, Integrin-linked kinase-2), GeneBank accession No: NM_000782(CYP24A1, Cytochrome P450, family 24, subfamily A, polypeptide 1), GeneBank accession No: CR597101(ZFP36, Zinc finger protein 36, C3H type, homolog(mouse)), GeneBank accession No:

CR936799(FHL2, Four and a half LIM domains 2), GeneBank
 accession No: M24898(NR1D1, Nuclear receptor subfamily 1,
 group D, member 1), GeneBank accession No: AF132818(KLF5,
 Kruppel-like factor 5(intestinal)), GeneBank accession No:
 5 AK055337(ZNF213, Zinc finger protein 213), GeneBank
 accession No: BC008834(PHF1, PHD finger protein 1),
 GeneBank accession No: AK126918(GLIS2, GLIS family zinc
 finger 2), GeneBank accession No: BC042692(CTL2, Solute
 carrier family 44, member 2), GeneBank accession No:
 10 NM_002224(ITPR3, Inositol 1,4,5-triphosphate receptor, type
 3), GeneBank accession No: AK095363(AQP3, Aquaporin 3),
 GeneBank accession No: NM_174953(ATP2A3, ATPase, Ca++
 transporting, ubiquitous), GeneBank accession No:
 BC042390(VTI1B, Vesicle transport through interaction with
 15 t-SNAREs homolog 1B(yeast)), GeneBank accession No:
 NM_016113(TRPV2, Transient receptor potential cation
 channel, subfamily V, member 2), GeneBank accession No:
 BM926478(RBP1, Retinol binding protein 1, cellular),
 GeneBank accession No: NM_000069(CACNA1S, Calcium channel,
 20 voltage-dependent, L type, alpha 1S subunit), GeneBank
 accession No: AK002107(RAB3B, RAB3B, member RAS oncogene
 family), GeneBank accession No: NM_013321(SNX8, Sorting
 nexin 8), GeneBank accession No: AK125026(SLC6A12, Solute
 carrier family 6(neurotransmitter transporter,
 25 betaine/GABA), member 12), GeneBank accession No:

NM_005843(STAM2, Signal transducing adaptor molecule(SH3 domain and ITAM motif) 2), GeneBank accession No: AK092512(SLC16A5, Solute carrier family 16(monocarboxylic acid transporters), member 5), GeneBank accession No:

5 U49248(ABCC2, ATP-binding cassette, sub-family C(CFTR/MRP), member 2), GeneBank accession No: AK172792(SCNN1A, Sodium channel, nonvoltage-gated 1 alpha), GeneBank accession No: BC044656(CASC3, Cancer susceptibility candidate 3), GeneBank accession No: NM_203403(C9orf150, Chromosome 9

10 open reading frame 150), GeneBank accession No: NM_080388(S100A16, S100 calcium binding protein A16), GeneBank accession No: NM_031286(SH3BGRL3, SH3 domain binding glutamic acid-rich protein like 3), GeneBank accession No: NM_022153(PP2135, Chromosome 10 open reading

15 frame 54), GeneBank accession No: NM_004864(GDF15, Growth differentiation factor 15), GeneBank accession No: NM_003330(TXNRD1, Thioredoxin reductase 1), GeneBank accession No: NM_001013632(LOC343521, Similar to hypothetical protein 4833401D15), GeneBank accession No:

20 BX537968(LOC51149, Hypothetical LOC51149), GeneBank accession No: BU945318(MT2A, Hypothetical gene supported by X97260; BC070289), GeneBank accession No: BQ683841(S100A11, S100 calcium binding protein A11(calgizzarin)), GeneBank accession No: BQ276852(TMSB10, Thymosin, beta 10), GeneBank

25 accession No: AK126182(KIAA1949, KIAA1949), GeneBank

accession No: AK124751(CAPN2, Calpain 2,(m/II) large
subunit), GeneBank accession No: AK095079(RGC32, Response
gene to complement 32), GeneBank accession No:
AB075871(FLJ42654, Golgi transport 1 homolog A(S.
5 cerevisiae)).

【Claim 14】

The method according to claim 12, wherein the below
genes are down-regulated by exposure to phenanthrene:

10 GeneBank accession No: AK125150(MAPK8, Mitogen-
activated protein kinase 8), GeneBank accession No:
NM_002758(MAP2K6, Mitogen-activated protein kinase kinase
6), GeneBank accession No: NM_004612(TGFBR1, Transforming
growth factor, beta receptor I(activin A receptor type II-
15 like kinase, 53kDa)), GeneBank accession No:
NM_145686(MAP4K4, Mitogen-activated protein kinase kinase
kinase kinase 4), GeneBank accession No: XM_042066(MAP3K1,
Mitogen-activated protein kinase kinase kinase 1), GeneBank
accession No: AB011123(TNIK, TRAF2 and NCK interacting
20 kinase), GeneBank accession No: AB209031(C5, Complement
component 5), GeneBank accession No: NM_022740(HIPK2,
Homeodomain interacting protein kinase 2), GeneBank
accession No: NM_148957(TNFRSF19, Tumor necrosis factor
receptor superfamily, member 19), GeneBank accession No:
25 AB208909(ITGB2, Integrin, beta 2(antigen CD18(p95),

lymphocyte function-associated antigen 1; macrophage
 antigen 1(mac-1) beta subunit)), GeneBank accession No:
 AB209211(TIA1, TIA1 cytotoxic granule-associated RNA
 binding protein), GeneBank accession No: AB209613(DNASE1L3,
 5 Deoxyribonuclease I-like 3), GeneBank accession No:
 AK122825(HMGB1, High-mobility group box 1), GeneBank
 accession No: AK127326(PHF17, PHD finger protein 17),
 GeneBank accession No: AK223503(CASP1, Caspase 1,
 apoptosis-related cysteine peptidase(interleukin 1, beta,
 10 convertase)), GeneBank accession No: BC013326(GAS2, Growth
 arrest-specific 2), GeneBank accession No: BC047698(IL7,
 Interleukin 7), GeneBank accession No: D79987(ESPL1, Extra
 spindle poles like 1(*S. cerevisiae*)), GeneBank accession
 No: NM_000893(KNG1, Kininogen 1), GeneBank accession No:
 15 NM_001012271(BIRC5, Effector cell peptidase receptor 1),
 GeneBank accession No: NM_004938(DAPK1, Death-associated
 protein kinase 1), GeneBank accession No: NM_005879(TRIP,
 TRAF interacting protein), GeneBank accession No:
 NM_014739(BCLAF1, BCL2-associated transcription factor 1),
 20 GeneBank accession No: NM_018947(CYCS, Cytochrome c,
 somatic), GeneBank accession No: AB033337(MPHOSPH1, M-phase
 phosphoprotein 1), GeneBank accession No: AB209179(PLK1,
 Polo-like kinase 1(*Drosophila*)), GeneBank accession No:
 AB209337(CDC7, CDC7 cell division cycle 7(*S. cerevisiae*)),
 25 GeneBank accession No: AF053305(BUB1, BUB1 budding

uninhibited by benzimidazoles 1 homolog(yeast)), GeneBank
accession No: AF053306(BUB1B, BUB1 budding uninhibited by
benzimidazoles 1 homolog beta(yeast)), GeneBank accession
No: AF345347(SPAG5, Sperm associated antigen 5), GeneBank
5 accession No: AK092638(CCNG2, Cyclin G2), GeneBank
accession No: AK222819(NUSAP1, Nucleolar and spindle
associated protein 1), GeneBank accession No:
AL833191(SMC2L1, SMC2 structural maintenance of chromosomes
2-like 1(yeast)), GeneBank accession No: AY257469(CIT,
10 Citron(rho-interacting, serine/threonine kinase 21)),
GeneBank accession No: AY367065(ASPM, Asp(abnormal
spindle)-like, microcephaly associated(Drosophila)),
GeneBank accession No: BC011000(CDCA5, Cell division cycle
associated 5), GeneBank accession No: BC032677(UBE2C,
15 Ubiquitin-conjugating enzyme E2C), GeneBank accession No:
BC043502(NEK2, NIMA(never in mitosis gene a)-related kinase
2), GeneBank accession No: BU675073(PTTG1, Pituitary tumor-
transforming 1), GeneBank accession No: BX647885(STMN1,
Stathmin 1/oncoprotein 18), GeneBank accession No:
20 CR592757(BRRN1, Barren homolog 1(Drosophila)), GeneBank
accession No: CR597075(MAPRE2, Microtubule-associated
protein, RP/EB family, member 2), GeneBank accession No:
CR604810(CCNA2, Cyclin A2), GeneBank accession No:
CR933728(CDC2, Cell division cycle 2, G1 to S and G2 to M),
25 GeneBank accession No: NM_000919(PAM, Peptidylglycine

alpha-amidating monooxygenase), GeneBank accession No:
NM_001790(CDC25C, Cell division cycle 25C), GeneBank
accession No: NM_001798(CDK2, Cyclin-dependent kinase 2),
GeneBank accession No: NM_001813(CENPE, Centromere protein
5 E, 312kDa), GeneBank accession No: NM_003318(TTK, TTK
protein kinase), GeneBank accession No: NM_003981(PRC1,
Protein regulator of cytokinesis 1), GeneBank accession No:
NM_004523(KIF11, Kinesin family member 11), GeneBank
accession No: NM_004701(CCNB2, Cyclin B2), GeneBank
10 accession No: NM_005983(SKP2, S-phase kinase-associated
protein 2(p45)), GeneBank accession No: NM_006101(KNTC2,
Kinetochore associated 2), GeneBank accession No:
NM_006845(KIF2C, Kinesin family member 2C), GeneBank
accession No: NM_007375(TARDBP, TAR DNA binding protein),
15 GeneBank accession No: NM_012112(TPX2, TPX2, microtubule-
associated, homolog(Xenopus laevis)), GeneBank accession
No: NM_014750(DLG7, Discs, large homolog 7(Drosophila)),
GeneBank accession No: NM_015097(CLASP2, Cytoplasmic linker
associated protein 2), GeneBank accession No:
20 NM_016343(CENPF, Centromere protein F, 350/400ka(mitosis)),
GeneBank accession No: NM_016426(GTSE1, G-2 and S-phase
expressed 1), GeneBank accession No: NM_018492(PBK, PDZ
binding kinase), GeneBank accession No: NM_018685(ANLN,
Anillin, actin binding protein(scraps homolog, Drosophila)),
25 GeneBank accession No: NM_020242(KNSL7, Kinesin family

member 15), GeneBank accession No: NM_031966(CCNB1, Cyclin B1), GeneBank accession No: NM_138555(KIF23, Kinesin family member 23), GeneBank accession No: U65410(MAD2L1, MAD2 mitotic arrest deficient-like 1(yeast)), GeneBank accession

5 No: AB020656(CYLD, Cyldromatosis(turban tumor syndrome)), GeneBank accession No: AF033122(SESNI, Sestrin 1), GeneBank accession No: AK074377(UHRF1, Chromosome 19 open reading frame 31), GeneBank accession No: AK091170(CDKN2C, Cyclin-dependent kinase inhibitor 2C(p18, inhibits CDK4)),

10 GeneBank accession No: AK094323(NFYC, Nuclear transcription factor Y, gamma), GeneBank accession No: AY366508(LOH11CR2A, Loss of heterozygosity, 11, chromosomal region 2, gene A), GeneBank accession No: BC033086(TCF19, Transcription factor 19(SC1)), GeneBank accession No: BC040303(PTP4A1, Protein

15 tyrosine phosphatase type IVA, member 1), GeneBank accession No: BC040991(TFDP2, Transcription factor Dp-2(E2F dimerization partner 2)), GeneBank accession No: BC092412(SGOL2, Shugoshin-like 2(S. pombe)), GeneBank accession No: BQ278454(CKS1B, CDC28 protein kinase

20 regulatory subunit 1B), GeneBank accession No: BX649128(SESNI, Sestrin 3), GeneBank accession No: CD049340(AURKB, Aurora kinase B), GeneBank accession No: M89914(NF1, Neurofibromin 1(neurofibromatosis, von Recklinghausen disease, Watson disease)), GeneBank

25 accession No: NM_001005414(ZWINT, ZW10 interactor

antisense), GeneBank accession No: NM_001008491(Sep 2, Septin 2), GeneBank accession No: NM_001274(CHEK1, CHK1 checkpoint homolog(*S. pombe*)), GeneBank accession No: NM_002105(H2AFX, H2A histone family, member X), GeneBank
5 accession No: NM_002388(MCM3, MCM3 minichromosome maintenance deficient 3(*S. cerevisiae*)), GeneBank accession No: NM_002417(MKI67, Antigen identified by monoclonal antibody Ki-67), GeneBank accession No: NM_002875(RAD51, RAD51 homolog(RecA homolog, *E. coli*)(*S. cerevisiae*)),
10 GeneBank accession No: NM_003884(PCAF, P300/CBP-associated factor), GeneBank accession No: NM_004526(MCM2, MCM2 minichromosome maintenance deficient 2, mitotin(*S. cerevisiae*)), GeneBank accession No: NM_004847(AIF1, Allograft inflammatory factor 1), GeneBank accession No:
15 NM_005915(MCM6, MCM6 minichromosome maintenance deficient 6(MIS5 homolog, *S. pombe*)(*S. cerevisiae*)), GeneBank accession No: NM_012090(MACF1, Microtubule-actin crosslinking factor 1), GeneBank accession No: NM_012415(RAD54B, RAD54 homolog B(*S. cerevisiae*)), GeneBank
20 accession No: NM_014264(PLK4, Polo-like kinase 4(*Drosophila*)), GeneBank accession No: NM_015714(G0S2, G0/G1switch 2), GeneBank accession No: NM_024680(FLJ23311, E2F transcription factor 8), GeneBank accession No: XM_034274(MYBL1, V-myb myeloblastosis viral oncogene
25 homolog(avian)-like 1), GeneBank accession No:

AK001720(FLJ10858, Nei endonuclease VIII-like 3(*E. coli*)),
 GeneBank accession No: AY032677(POLQ, Polymerase(DNA
 directed), theta), GeneBank accession No: BC034480(BLM,
 Bloom syndrome), GeneBank accession No: BC073161(RAD51C,
 5 RAD51 homolog C(*S. cerevisiae*)), GeneBank accession No:
 CR600021(HMGB2, High-mobility group box 2), GeneBank
 accession No: CR625391(RAD51AP1, RAD51 associated protein
 1), GeneBank accession No: CR936783(FLJ40869, Hypothetical
 protein LOC284952), GeneBank accession No:
 10 DQ140356(KIAA1596, Fanconi anemia, complementation group M),
 GeneBank accession No: NM_001067(TOP2A, Topoisomerase(DNA)
 II alpha 170kDa), GeneBank accession No: NM_001618(PARP1,
 Poly(ADP-ribose) polymerase family, member 1), GeneBank
 accession No: NM_003362(UNG, Uracil-DNA glycosylase),
 15 GeneBank accession No: NM_006904(PRKDC, Protein kinase,
 DNA-activated, catalytic polypeptide), GeneBank accession
 No: NM_130398(EXO1, Exonuclease 1), GeneBank accession No:
 AB020807(TLR6, Toll-like receptor 6), GeneBank accession
 No: AB032980(DCDC2, Doublecortin domain containing 2),
 20 GeneBank accession No: AB209866(TFPI, Tissue factor pathway
 inhibitor(lipoprotein-associated coagulation inhibitor)),
 GeneBank accession No: AK057015(HSPA4, Heat shock 70kDa
 protein 4), GeneBank accession No: AK095515(IFIT1,
 Interferon-induced protein with tetratricopeptide repeats
 25 1), GeneBank accession No: AK122686(IF, I

factor(complement)), GeneBank accession No: AK123010(RRM2, Ribonucleotide reductase M2 polypeptide), GeneBank accession No: BC035582(TRIM22, Tripartite motif-containing 22), GeneBank accession No: BX537894(LOC493869, Similar to
5 RIKEN cDNA 2310016C16), GeneBank accession No: M14338(PROS1, Protein S(alpha)), GeneBank accession No: NM_000821(GGCX, Gamma-glutamyl carboxylase), GeneBank accession No: NM_000963(PTGS2, Prostaglandin-endoperoxide synthase 2(prostaglandin G/H synthase and cyclooxygenase)), GeneBank
10 accession No: NM_001001547(CD36, CD36 antigen(collagen type I receptor, thrombospondin receptor)), GeneBank accession No: NM_001512(GSTA4, Glutathione S-transferase A4), GeneBank accession No: NM_001629(ALOX5AP, Arachidonate 5-lipoxygenase-activating protein), GeneBank accession No:
15 NM_001752(CAT, Catalase), GeneBank accession No: NM_001837(CCR3, Chemokine(C-C motif) receptor 3), GeneBank accession No: NM_001979(EPHX2, Epoxide hydrolase 2, cytoplasmic), GeneBank accession No: NM_001994(F13B, Coagulation factor XIII, B polypeptide), GeneBank accession
20 No: NM_002182(IL1RAP, Interleukin 1 receptor accessory protein), GeneBank accession No: NM_006120(HLA-DMA, Major histocompatibility complex, class II, DM alpha), GeneBank accession No: NM_173216(SIAT1, ST6 beta-galactosamide alpha-2,6-sialyltransferase 1), GeneBank accession No:
25 NM_202002(FOXM1, Forkhead box M1), GeneBank accession No:

AB163917(LRAP, Leukocyte-derived arginine aminopeptidase),
 GeneBank accession No: BC027881(AFP, Alpha-fetoprotein),
 GeneBank accession No: NM_015915(SPG3A, Spastic paraplegia
 3A(autosomal dominant)), GeneBank accession No:
 5 NM_000671(ADH5, Alcohol dehydrogenase 5(class III), chi
 polypeptide), GeneBank accession No: J05428(UGT2B7, UDP
 glucuronosyltransferase 2 family, polypeptide B7), GeneBank
 accession No: NM_000672(ADH6, Alcohol dehydrogenase 6(class
 V)), GeneBank accession No: M15943(ADH4, Alcohol
 10 dehydrogenase 4(class II), pi polypeptide), GeneBank
 accession No: AK223395(FBP1, Fructose-1,6-bisphosphatase 1),
 GeneBank accession No: NM_000151(G6PC, Glucose-6-
 phosphatase, catalytic(glycogen storage disease type I, von
 Gierke disease)), GeneBank accession No: XM_113962(KIAA0650,
 15 Structural maintenance of chromosomes flexible hinge domain
 containing 1), GeneBank accession No: AB020644(ACSL6, Acyl-
 CoA synthetase long-chain family member 6), GeneBank
 accession No: AB209907(PLD1, Phospholipase D1,
 phophatidylcholine-specific), GeneBank accession No:
 20 AF285167(ABCA1, ATP-binding cassette, sub-family A(ABC1),
 member 1), GeneBank accession No: AF297872(TRERF1,
 Transcriptional regulating factor 1), GeneBank accession
 No: AF303134(ALDH8A1, Aldehyde dehydrogenase 8 family,
 member A1), GeneBank accession No: AF339053(PLA2G12B,
 25 Phospholipase A2, group XIIB), GeneBank accession No:

AK096018(HADHSC, L-3-hydroxyacyl-Coenzyme A dehydrogenase, short chain), GeneBank accession No: AK124635(PCSK9, Proprotein convertase subtilisin/kexin type 9), GeneBank accession No: AK127346(SIAT9, ST3 beta-galactoside alpha-
5 2,3-sialyltransferase 5), GeneBank accession No: AL359559(AGPS, Alkylglycerone phosphate synthase), GeneBank accession No: AY691170(PLCL3, Phospholipase C-like 3), GeneBank accession No: BG567934(APOM, Apolipoprotein M), GeneBank accession No: BX538214(C6orf167, Chromosome 6 open
10 reading frame 167), GeneBank accession No: BX640945(FADS2, Fatty acid desaturase 2), GeneBank accession No: BX648473(PIGK, Phosphatidylinositol glycan, class K), GeneBank accession No: BX648557(HSD17B2, Hydroxysteroid(17-beta) dehydrogenase 2), GeneBank accession No:
15 CR749601(ETNK1, Death-associated protein kinase 3), GeneBank accession No: NM_000859(HMGCR, 3-hydroxy-3-methylglutaryl-Coenzyme A reductase), GeneBank accession No: NM_001443(FABP1, Fatty acid binding protein 1, liver), GeneBank accession No: NM_002130(HMGCS1, 3-hydroxy-3-methylglutaryl-Coenzyme A synthase 1(soluble)), GeneBank
20 accession No: NM_003725(RODH, Hydroxysteroid(17-beta) dehydrogenase 6), GeneBank accession No: NM_004845(PCYT1B, Phosphate cytidylyltransferase 1, choline, beta), GeneBank accession No: NM_014762(DHCR24, 24-dehydrocholesterol reductase), GeneBank accession No: NM_020139(DHRS6,
25

Dehydrogenase/reductase(SDR family) member 6), GeneBank
 accession No: NM_020918(GPAM, Glycerol-3-phosphate
 acyltransferase, mitochondrial), GeneBank accession No:
 NM_032523(OSBPL6, Oxysterol binding protein-like 6),
 5 GeneBank accession No: NM_033505(SELI, Selenoprotein I),
 GeneBank accession No: Z28339(AKR1D1, Aldo-keto reductase
 family 1, member D1(delta 4-3-ketosteroid-5-beta-
 reductase)), GeneBank accession No: AK024899(ENPP3,
 Ectonucleotide pyrophosphatase/ phosphodiesterase 3),
 10 GeneBank accession No: AK025546(PTPN4, Protein tyrosine
 phosphatase, non-receptor type 4(megakaryocyte)), GeneBank
 accession No: AK124910(ENPP2, Ectonucleotide
 pyrophosphatase/phosphodiesterase 2(autotaxin)), GeneBank
 accession No: BC035116(FLJ35059 fis, CDNA FLJ30761 fis,
 15 clone FEBRA2000538), GeneBank accession No: BC050565(PASK,
 PAS domain containing serine/threonine kinase), GeneBank
 accession No: L13436(NPR2, Natriuretic peptide receptor
 B/guanylate cyclase B(atrionatriuretic peptide receptor B)),
 GeneBank accession No: NM_001005862(ERBB2, V-erb-b2
 20 erythroblastic leukemia viral oncogene homolog 2,
 neuro/glioblastoma derived oncogene homolog(avian)),
 GeneBank accession No: NM_005012(ROR1, Receptor tyrosine
 kinase-like orphan receptor 1), GeneBank accession No:
 NM_006035(CDC42BPB, CDC42 binding protein kinase beta(DMPK-
 25 like)), GeneBank accession No: NM_014791(MELK, Maternal

embryonic leucine zipper kinase), GeneBank accession No:
 NM_023028(FGFR2, Fibroblast growth factor receptor
 2(bacteria-expressed kinase, keratinocyte growth factor
 receptor, craniofacial dysostosis 1, Crouzon syndrome,
 5 Pfeiffer syndrome, Jackson-Weiss syndrome)), GeneBank
 accession No: NM_080836(STK35, Serine/threonine kinase 35),
 GeneBank accession No: AF419331(FUSIP1, FUS interacting
 protein(serine/arginine-rich) 1), GeneBank accession No:
 AK091927(SFRS3, Splicing factor, arginine/serine-rich 3),
 10 GeneBank accession No: BC010266(HNRNPA1, Heterogeneous
 nuclear ribonucleoprotein A1), GeneBank accession No:
 BC012360(CTAGE5, CTAGE family, member 5), GeneBank
 accession No: BC036046(PLRG1, Pleiotropic regulator 1(PRL1
 homolog, Arabidopsis)), GeneBank accession No:
 15 BC065384(PCF11, PCF11, cleavage and polyadenylation factor
 subunit, homolog(S. cerevisiae)), GeneBank accession No:
 BX537360(CPSF5, Nudix(nucleoside diphosphate linked moiety
 X)-type motif 21), GeneBank accession No: BX537494(HNRPA2B1,
 Heterogeneous nuclear ribonucleoprotein A2/B1), GeneBank
 20 accession No: BX647784(HNRPR, Heterogeneous nuclear
 ribonucleoprotein R), GeneBank accession No: CA455267(PPIH,
 Peptidyl prolyl isomerase H(cyclophilin H)), GeneBank
 accession No: CR596214(HNRPA0, Heterogeneous nuclear
 ribonucleoprotein A0), GeneBank accession No:
 25 NM_001326(CSTF3, Hypothetical protein LOC283267), GeneBank

accession No: NM_004640(BAT1, HLA-B associated transcript
 1), GeneBank accession No: NM_005463(HNRPDL, Heterogeneous
 nuclear ribonucleoprotein D-like), GeneBank accession No:
 NM_006924(SFRS1, Splicing factor, arginine/serine-rich
 5 1(splicing factor 2, alternate splicing factor)), GeneBank
 accession No: NM_012426(SF3B3, Splicing factor 3b, subunit
 3, 130kDa), GeneBank accession No: NM_018048(FLJ10292,
 Mago-nashi homolog), GeneBank accession No:
 NM_030919(C20orf129, Chromosome 20 open reading frame 129),
 10 GeneBank accession No: NM_031370(HNRPD, Heterogeneous
 nuclear ribonucleoprotein D(AU-rich element RNA binding
 protein 1, 37kDa)), GeneBank accession No: NM_138933(ACF,
 Apobec-1 complementation factor), GeneBank accession No:
 AB193259(ACE2, Angiotensin I converting enzyme(peptidyl-
 15 dipeptidase A) 2), GeneBank accession No: BX648769(EWSR1,
 Ewing sarcoma breakpoint region 1), GeneBank accession No:
 AB023154(DTX4, Deltex 4 homolog(Drosophila)), GeneBank
 accession No: AL543755(VAV3, Vav 3 oncogene), GeneBank
 accession No: M75106(CPB2, Carboxypeptidase B2(plasma,
 20 carboxypeptidase U)), GeneBank accession No:
 NM_021045(ZNF248, Zinc finger protein 248), GeneBank
 accession No: AB209194(B4GALT6, UDP-Gal:betaGlcNAc beta
 1,4- galactosyltransferase, polypeptide 6), GeneBank
 accession No: AF279145(ANTXR1, Anthrax toxin receptor 1),
 25 GeneBank accession No: NM_025074(FRAS1, Fraser syndrome 1),

GeneBank accession No: AK025790(KIF20A, Kinesin family member 20A), GeneBank accession No: NM_006152(LRMP, Lymphoid-restricted membrane protein), GeneBank accession No: NM_000340(SLC2A2, Solute carrier family 2(facilitated glucose transporter), member 2), GeneBank accession No: 5 AF071592(KIF4A, Kinesin family member 4A), GeneBank accession No: NM_013277(RACGAP1, Rac GTPase activating protein 1), GeneBank accession No: AY043484(SCN1A, Sodium channel, voltage-gated, type I, alpha), GeneBank accession 10 No: AY791349(KIF18A, Kinesin family member 18A), GeneBank accession No: NM_018018(SLC38A4, Solute carrier family 38, member 4), GeneBank accession No: AK094603(FLJ37284 fis, unnamed protein product; Homo sapiens cDNA FLJ37284 fis, clone BRAMY2013590.), GeneBank accession No: 15 NM_021069(ARGBP2, Sorbin and SH3 domain containing 2), GeneBank accession No: NM_001005747(CACNB4, Calcium channel, voltage-dependent, beta 4 subunit), GeneBank accession No: AJ496568(SLC25A12, Solute carrier family 25(mitochondrial carrier, Aralar), member 12), GeneBank accession No: 20 NM_030641(APOL6, Apolipoprotein L, 6), GeneBank accession No: NM_173512(FLJ39822, Hypothetical protein FLJ39822), GeneBank accession No: NM_000037(ANK1, Ankyrin 1, erythrocytic), GeneBank accession No: NM_001011554(SLC13A3, Solute carrier family 13(sodium-dependent dicarboxylate 25 transporter), member 3), GeneBank accession No:

AB091343(C10orf3, Centrosomal protein 55kDa), GeneBank
 accession No: AK000643(ASB9, Ankyrin repeat and SOCS box-
 containing 9), GeneBank accession No: AK055221(FBX05, F-box
 protein 5), GeneBank accession No: AK075271(SPTLC2L, Serine
 5 palmitoyltransferase, long chain base subunit 2-
 like(aminotransferase 2)), GeneBank accession No:
 AK122685(GLUD1, Glutamate dehydrogenase 1), GeneBank
 accession No: AK127098(FLJ10706, Chromosome 1 open reading
 frame 112), GeneBank accession No: AL133031(MLR1,
 10 Transcription factor MLR1), GeneBank accession No:
 AY007723(MAL2, Mal, T-cell differentiation protein 2),
 GeneBank accession No: BC022255(Spc25, Spindle pole body
 component 25 homolog(*S. cerevisiae*)), GeneBank accession
 No: BC041882(ATF7IP2, Activating transcription factor 7
 15 interacting protein 2), GeneBank accession No:
 BC052951(LMNB1, Lamin B1), GeneBank accession No:
 BC098313(FLJ20641, Hypothetical protein FLJ20641), GeneBank
 accession No: NM_001809(CENPA, Centromere protein A, 17kDa),
 GeneBank accession No: NM_145061(C13orf3, Chromosome 13
 20 open reading frame 3), GeneBank accession No:
 XM_372695(LOC390859, PREDICTED: Homo sapiens similar to
 Chain A, Crystal Structure Of The R463a Mutant Of Human
 Glutamate Dehydrogenase(LOC390859), mRNA).

25 **【Claim 15】**

The method according to claim 12, wherein the human somatic cell of step 1) is originated from human liver or liver cancer cells or tissues.

5 **【Claim 16】**

The method according to claim 15, wherein the human liver cancer cell is HepG2.

【Claim 17】

10 The method according to claim 12, wherein the fluorescent material of step 3) is selected from the group consisting of Cy3, Cy5, FITC (poly L-lysine-fluorescein isothiocyanate), RITC (rhodamine-B-isothiocyanate) and rhodamine.

15

【Claim 18】

A method for detecting the below genes for the identification of exposure to phenanthrene, comprising the following steps:

20 1) extracting RNAs from the experimental group human somatic cells and the control group human somatic cells;

2) performing real-time RT-PCR (reverse transcript polymerase chain reaction) with the RNAs of step 1) using a primer set capable of amplifying a gene selected from the group consisting of the genes below; and

25

3) determining exposure to phenanthrene by comparing gene expressions, precisely if the gene expression in the experimental group exposed to phenanthrene is significantly changed, compared with that of the control group, it is judged that the gene is exposed to phenanthrene.

GeneBank accession No: NM_004420(DUSP8, Dual specificity phosphatase 8), GeneBank accession No: L11329(DUSP2, Dual specificity phosphatase 2), GeneBank accession No: BC094766(PKN1, Protein kinase N1), GeneBank accession No: AY247738(TRIB3, Tribbles homolog 3(Drosophila)), GeneBank accession No: AK129595(GADD45B, Growth arrest and DNA-damage-inducible, beta), GeneBank accession No: AB208849(SHC1, SHC(Src homology 2 domain containing) transforming protein 1), GeneBank accession No: X02812(TGFB1, Transforming growth factor, beta 1(Camurati-Engelmann disease)), GeneBank accession No: NM_198951(TGM2, Transglutaminase 2(C polypeptide, protein-glutamine-gamma-glutamyltransferase)), GeneBank accession No: NM_147780(CTSB, Cathepsin B), GeneBank accession No: NM_078467(CDKN1A, Cyclin-dependent kinase inhibitor 1A(p21, Cip1)), GeneBank accession No: NM_033027(AXUD1, AXIN1 up-regulated 1), GeneBank accession No: NM_032797(AMID, Apoptosis-inducing factor(AIF)-like mitochondrion-associated inducer of death), GeneBank accession No: NM_021960(MCL1, Myeloid cell leukemia sequence 1(BCL2-

related)), GeneBank accession No: NM_016639(TNFRSF12A, Tumor necrosis factor receptor superfamily, member 12A), GeneBank accession No: NM_016222(DDX41, DEAD(Asp-Glu-Ala-Asp) box polypeptide 41), GeneBank accession No: NM_013246(CLC, Cardiotrophin-like cytokine factor 1), GeneBank accession No: NM_004401(DFFA, DNA fragmentation factor, 45kDa, alpha polypeptide), GeneBank accession No: NM_004281(BAG3, BCL2-associated athanogene 3), GeneBank accession No: NM_003897(IER3, Immediate early response 3), GeneBank accession No: NM_003806(HRK, Harakiri, BCL2 interacting protein(contains only BH3 domain)), GeneBank accession No: NM_003639(IKBKG, Inhibitor of kappa light polypeptide gene enhancer in B-cells, kinase gamma), GeneBank accession No: NM_003311(PHLDA2, Pleckstrin homology-like domain, family A, member 2), GeneBank accession No: NM_002737(PRKCA, Protein kinase C, alpha), GeneBank accession No: NM_002648(PIM1, Pim-1 oncogene), GeneBank accession No: NM_002507(NGFR, Nerve growth factor receptor(TNFR superfamily, member 16)), GeneBank accession No: NM_002305(LGALS1, Lectin, galactoside-binding, soluble, 1(galectin 1)), GeneBank accession No: NM_001013398(IGFBP3, Insulin-like growth factor binding protein 3), GeneBank accession No: BX640923(MDM4, Mdm4, transformed 3T3 cell double minute 4, p53 binding protein(mouse)), GeneBank accession No: BX537586(STK17A, Serine/threonine kinase

17a(apoptosis-inducing)), GeneBank accession No:
 BG284742(P8, P8 protein(candidate of metastasis 1)),
 GeneBank accession No: BE903247(PDCD6IP, Programmed cell
 death 6 interacting protein), GeneBank accession No:
 5 BC027949(P2RX1, Purinergic receptor P2X, ligand-gated ion
 channel, 1), GeneBank accession No: BC006365(PSEN2,
 Presenilin 2(Alzheimer disease 4)), GeneBank accession No:
 AY869712(PPP1R13L, Protein phosphatase 1,
 regulatory(inhibitor) subunit 13 like), GeneBank accession
 10 No: AY028896(CARD10, Caspase recruitment domain family,
 member 10), GeneBank accession No: AK122614(PPARD,
 Peroxisome proliferative activated receptor, delta),
 GeneBank accession No: AK092872(ERCC2, Excision repair
 cross-complementing rodent repair deficiency,
 15 complementation group 2(xeroderma pigmentosum D)), GeneBank
 accession No: AK092808(RRAGC, Ras-related GTP binding C),
 GeneBank accession No: AJ001898(GDNF, Glial cell derived
 neurotrophic factor), GeneBank accession No:
 AF220656(PHLDA1, Pleckstrin homology-like domain, family A,
 20 member 1), GeneBank accession No: AF055634(UNC5C, Unc-5
 homolog C(C. elegans)), GeneBank accession No:
 AB209485(VEGF, Vascular endothelial growth factor),
 GeneBank accession No: AB096256(UNC5B, Unc-5 homolog B(C.
 elegans)), GeneBank accession No: AB007960(SH3GLB1, SH3-
 25 domain GRB2-like endophilin B1), GeneBank accession No:

X06374(PDGFA, Platelet-derived growth factor alpha polypeptide), GeneBank accession No: S62138(DDIT3, DNA-damage-inducible transcript 3), GeneBank accession No: NM_078487(CDKN2B, Cyclin-dependent kinase inhibitor 2B(p15, inhibits CDK4)), GeneBank accession No: NM_012127(CIZ1, CDKN1A interacting zinc finger protein 1), GeneBank accession No: NM_005883(APC2, Adenomatosis polyposis coli 2), GeneBank accession No: NM_004196(CDKL1, Cyclin-dependent kinase-like 1(CDC2-related kinase)), GeneBank accession No: NM_003236(TGFA, Transforming growth factor, alpha), GeneBank accession No: NM_001261(CDK9, Cyclin-dependent kinase 9(CDC2-related kinase)), GeneBank accession No: NM_001007271(DUSP13, Dual specificity phosphatase 13), GeneBank accession No: CR749511(PARC, P53-associated parkin-like cytoplasmic protein), GeneBank accession No: CR623038(ID2, Inhibitor of DNA binding 2, dominant negative helix-loop-helix protein), GeneBank accession No: CR618371(EGFR, Epidermal growth factor receptor(erythroblastic leukemia viral(v-erb-b) oncogene homolog, avian)), GeneBank accession No: BF965144(IFITM1, Interferon induced transmembrane protein 1(9-27)), GeneBank accession No: AK127679(DUSP1, Dual specificity phosphatase 1), GeneBank accession No: AK096276(CCND3, Cyclin D3), GeneBank accession No: AB209586(MAPK13, Mitogen-activated protein kinase 13), GeneBank accession No: AB209465(PCTK1,

PCTAIRE protein kinase 1), GeneBank accession No:
 Z19588(SKIL, SKI-like), GeneBank accession No:
 NM_020429(SMURF1, SMAD specific E3 ubiquitin protein ligase
 1), GeneBank accession No: NM_014767(SPOCK2,
 5 Sparc/osteonectin, cwcw and kazal-like domains
 proteoglycan(testican) 2), GeneBank accession No:
 NM_005979(S100A13, S100 calcium binding protein A13),
 GeneBank accession No: NM_005187(CBFA2T3, Core-binding
 factor, runt domain, alpha subunit 2; translocated to, 3),
 10 GeneBank accession No: NM_004364(CEBPA, CCAAT/enhancer
 binding protein(C/EBP), alpha), GeneBank accession No:
 NM_001769(CD9, CD9 antigen(p24)), GeneBank accession No:
 NM_001718(BMP6, Bone morphogenetic protein 6), GeneBank
 accession No: NM_000641(IL11, Interleukin 11), GeneBank
 15 accession No: BX647459(SERPINE2, Serpin peptidase inhibitor,
 clade E(nexin, plasminogen activator inhibitor type 1),
 member 2), GeneBank accession No: BQ066037(RPS19, Ribosomal
 protein S19), GeneBank accession No: BE791300(EDF1,
 Endothelial differentiation-related factor 1), GeneBank
 20 accession No: BC038504(SNF1LK, SNF1-like kinase), GeneBank
 accession No: AL832287(ZAP70, Zeta-chain(TCR) associated
 protein kinase 70kDa), GeneBank accession No:
 AK125742(PCGF1, Polycomb group ring finger 1), GeneBank
 accession No: AK124709(NDRG1, N-myc downstream regulated
 25 gene 1), GeneBank accession No: AB011157(PTDSR,

Phosphatidylserine receptor), GeneBank accession No: NM_013255(MKLN1, Muskelein 1, intracellular mediator containing kelch motifs), GeneBank accession No: NM_006572(GNA13, Guanine nucleotide binding protein(G protein), alpha 13), GeneBank accession No: NM_002211(ITGB1, Integrin, beta 1(fibronectin receptor, beta polypeptide, antigen CD29 includes MDF2, MSK12)), GeneBank accession No: CR601067(PLAUR, Plasminogen activator, urokinase receptor), GeneBank accession No: BC050456(THBS4, Thrombospondin 4), GeneBank accession No: AK027389(CXCL16, Chemokine(C-X-C motif) ligand 16), GeneBank accession No: AJ132099(VNN1, Vanin 1), GeneBank accession No: XM_371354(FLJ10157, Hypothetical protein FLJ10157), GeneBank accession No: XM_208313(TPM3, Similar to tropomyosin 4), GeneBank accession No: XM_208270(ACR, Acrosin-like protease), GeneBank accession No: NM_203353(PDLIM7, PDZ and LIM domain 7(enigma)), GeneBank accession No: NM_201382(PLEC1, Plectin 1, intermediate filament binding protein 500kDa), GeneBank accession No: NM_182961(SYNE1, Spectrin repeat containing, nuclear envelope 1), GeneBank accession No: NM_181826(NF2, Neurofibromin 2(bilateral acoustic neuroma)), GeneBank accession No: NM_172069(PLEKHH2, Pleckstrin homology domain containing, family H(with MyTH4 domain) member 2), GeneBank accession No: NM_022648(TNS, Tensin 1), GeneBank accession No: NM_017556(FBLP-1, Filamin binding LIM protein 1),

GeneBank accession No: NM_016081(KIAA0992, Palladin, cytoskeletal associated protein), GeneBank accession No: NM_006617(NES, Nestin), GeneBank accession No: NM_006262(PRPH, Peripherin), GeneBank accession No: 5 NM_005100(AKAP12, A kinase(PRKA) anchor protein(gravin) 12), GeneBank accession No: NM_004368(CNN2, Calponin 2), GeneBank accession No: NM_003388(CYLN2, Cytoplasmic linker 2), GeneBank accession No: NM_003370(VASP, Vasodilator-stimulated phosphoprotein), GeneBank accession No: 10 NM_003128(SPTBN1, Spectrin, beta, non-erythrocytic 1), GeneBank accession No: NM_002705(PPL, Periplakin), GeneBank accession No: NM_002475(MLC1SA, Myosin light chain 1 slow a), GeneBank accession No: NM_002018(FLII, Flightless I homolog(Drosophila)), GeneBank accession No: NM_001465(FYB, 15 FYN binding protein(FYB-120/130)), GeneBank accession No: NM_001069(TUBB2, Tubulin, beta 2A), GeneBank accession No: CR625172(MGC8685, Tubulin, beta 2B), GeneBank accession No: CR616919(KRT18, Keratin 18), GeneBank accession No: CR606241(ACTG1, Actin, gamma 1), GeneBank accession No: 20 CB240572(MYH11, Myosin, heavy polypeptide 11, smooth muscle), GeneBank accession No: BX648253(PTPN3, Protein tyrosine phosphatase, non-receptor type 3), GeneBank accession No: BX648190(WDR1, WD repeat domain 1), GeneBank accession No: BX641076(ACTN1, Actinin, alpha 1), GeneBank 25 accession No: BX537978(EPB41L1, Erythrocyte membrane

protein band 4.1-like 1), GeneBank accession No: BG121847(NUDC, Nuclear distribution gene C homolog(A. nidulans)), GeneBank accession No: BC068013(MYO1C, Myosin IC), GeneBank accession No: BC065499(MAST2, Microtubule associated serine/threonine kinase 2), GeneBank accession No: BC051890(TUBG2, Tubulin, gamma 2), GeneBank accession No: BC041874(MAP1LC3B, Microtubule-associated protein 1 light chain 3 beta), GeneBank accession No: BC012597(ACTA1, Actin, alpha 1, skeletal muscle), GeneBank accession No: 10 AY484427(KIF17, Kinesin family member 17), GeneBank accession No: AK130546(STOML2, Stomatin(EPB72)-like 2), GeneBank accession No: AK124711(CORO2B, Coronin, actin binding protein, 2B), GeneBank accession No: AK123974(MYL5, Myosin, light polypeptide 5, regulatory), GeneBank 15 accession No: AK092792(LOC389833, Similar to hypothetical protein MGC27019), GeneBank accession No: AK026518(MYOHD1, Myosin head domain containing 1), GeneBank accession No: AK024500(NICAL, Microtubule associated monooxygenase, calponin and LIM domain containing 1), GeneBank accession 20 No: AF085886(FLJ46675, Ribosomal protein L29 pseudogene 2), GeneBank accession No: AB209997(MYO9B, Myosin IXB), GeneBank accession No: Y12692(WNT11, Wingless-type MMTV integration site family, member 11), GeneBank accession No: Y11307(CYR61, Cysteine-rich, angiogenic inducer, 61), 25 GeneBank accession No: X17033(ITGA2, Integrin, alpha

2(CD49B, alpha 2 subunit of VLA-2 receptor)), GeneBank
 accession No: U41763(CLTCL1, Clathrin, heavy polypeptide-
 like 1), GeneBank accession No: NM_153609(TMPRSS6,
 Transmembrane protease, serine 6), GeneBank accession No:
 5 NM_031483(ITCH, Itchy homolog E3 ubiquitin protein
 ligase(mouse)), GeneBank accession No: NM_024342(GRLF1,
 Glucocorticoid receptor DNA binding factor 1), GeneBank
 accession No: NM_017555(EGLN2, Egl nine homolog 2(C.
 elegans)), GeneBank accession No: NM_016569(TBX3, T-box
 10 3(ulnar mammary syndrome)), GeneBank accession No:
 NM_004148(NINJ1, Ninjurin 1), GeneBank accession No:
 NM_003377(VEGFB, Vascular endothelial growth factor B),
 GeneBank accession No: NM_001983(ERCC1, Excision repair
 cross-complementing rodent repair deficiency,
 15 complementation group 1(includes overlapping antisense
 sequence)), GeneBank accession No: NM_001552(IGFBP4,
 Insulin-like growth factor binding protein 4), GeneBank
 accession No: NM_001430(EPAS1, Endothelial PAS domain
 protein 1), GeneBank accession No: NM_001300(KLF6, Kruppel-
 20 like factor 6), GeneBank accession No: NM_001012661(SLC3A2,
 Solute carrier family 3(activators of dibasic and neutral
 amino acid transport), member 2), GeneBank accession No:
 NM_000596(IGFBP1, Insulin-like growth factor binding
 protein 1), GeneBank accession No: NM_000474(TWIST1, Twist
 25 homolog 1(acrocephalosyndactyly 3; Saethre-Chotzen

syndrome)(Drosophila)), GeneBank accession No:
 BX649103(ChGn, Chondroitin beta1,4 N-
 acetylgalactosaminyltransferase), GeneBank accession No:
 BM913048(TIMP1, TIMP metalloproteinase inhibitor 1),
 5 GeneBank accession No: BM904612(S100A6, S100 calcium
 binding protein A6(calcyclin)), GeneBank accession No:
 BM556279(EMP3, Epithelial membrane protein 3), GeneBank
 accession No: BC015041(VAT1, Family with sequence
 similarity 82, member C), GeneBank accession No:
 10 AY258066(OKL38, Pregnancy-induced growth inhibitor),
 GeneBank accession No: AK126729(NDRG4, NDRG family member
 4), GeneBank accession No: AK090459(NFE2L1, Nuclear
 factor(erythroid-derived 2)-like 1), GeneBank accession No:
 AK074163(ROBO4, Roundabout homolog 4, magic
 15 roundabout(Drosophila)), GeneBank accession No:
 AK024680(FLJ21027 fis, CDNA: FLJ21027 fis, clone CAE07110),
 GeneBank accession No: AF176422(HEY1, Hairy/enhancer-of-
 split related with YRPW motif 1), GeneBank accession No:
 AF003837(JAG1, Jagged 1(Alagille syndrome)), GeneBank
 20 accession No: AB209322(SEMA3B, Sema domain, immunoglobulin
 domain(Ig), short basic domain, secreted,(semaphorin) 3B),
 GeneBank accession No: AB011150(NRXN1, Neurexin 1),
 GeneBank accession No: NM_201589(MAFA, V-maf
 musculoaponeurotic fibrosarcoma oncogene homolog A(avian)),
 25 GeneBank accession No: NM_052999(CKLF1, CKLF-like MARVEL

transmembrane domain containing 1), GeneBank accession No: NM_006644(HSPH1, Heat shock 105kDa/110kDa protein 1), GeneBank accession No: NM_005438(FOSL1, FOS-like antigen 1), GeneBank accession No: NM_004996(ABCC1, ATP-binding cassette, sub-family C(CFTR/MRP), member 1), GeneBank accession No: NM_002658(PLAU, Plasminogen activator, urokinase), GeneBank accession No: NM_001353(AKR1C1, Aldo-keto reductase family 1, member C1(dihydrodiol dehydrogenase 1; 20-alpha(3-alpha)-hydroxysteroid dehydrogenase)), GeneBank accession No: H18681(C20orf139, Sulfiredoxin 1 homolog(*S. cerevisiae*)), GeneBank accession No: DR004094(HAMP, Hepcidin antimicrobial peptide), GeneBank accession No: BC082272(KCNMB3, Potassium large conductance calcium-activated channel, subfamily M beta member 3), GeneBank accession No: BC040494(DNAJB2, DnaJ(Hsp40) homolog, subfamily B, member 2), GeneBank accession No: BC018064(ATF6, Activating transcription factor 6), GeneBank accession No: BC006523(SGK2, Serum/glucocorticoid regulated kinase 2), GeneBank accession No: AK090482(CXCL12, Chemokine(C-X-C motif) ligand 12(stromal cell-derived factor 1)), GeneBank accession No: AF219946(TULP4, Tubby like protein 4), GeneBank accession No: AB209112(SLC2A8, Solute carrier family 2,(facilitated glucose transporter) member 8), GeneBank accession No: NM_005242(F2RL1, Coagulation factor

II(thrombin) receptor-like 1), GeneBank accession No:
 NM_001002029(C4A, Complement component 4B, telomeric),
 GeneBank accession No: NM_000539(RHO, Rhodopsin(opsin 2,
 rod pigment)(retinitis pigmentosa 4, autosomal dominant)),
 5 GeneBank accession No: BX649164(PAI, serpin peptidase
 inhibitor, clade E(nexin, plasminogen activator inhibitor
 type 1), member 1), GeneBank accession No: BM918324(LY96,
 Lymphocyte antigen 96), GeneBank accession No:
 AB209647(NCF2, Neutrophil cytosolic factor 2(65kDa, chronic
 10 granulomatous disease, autosomal 2)), GeneBank accession
 No: NM_152221(CSNK1E, Casein kinase 1, epsilon), GeneBank
 accession No: NM_017999(RNF31, Ring finger protein 31),
 GeneBank accession No: NM_016819(OGG1, 8-oxoguanine DNA
 glycosylase), GeneBank accession No: NM_016816(OAS1, 2',5'-
 15 oligoadenylate synthetase 1, 40/46kDa), GeneBank accession
 No: NM_012235(SCAP, SREBP cleavage-activating protein),
 GeneBank accession No: NM_006384(CIB1, Calcium and integrin
 binding 1(calmyrin)), GeneBank accession No: NM_001779(CD58,
 CD58 antigen,(lymphocyte function-associated antigen 3)),
 20 GeneBank accession No: CB055213(ICOSLG, Inducible T-cell
 co-stimulator ligand), GeneBank accession No:
 BX641029(MASP1, Mannan-binding lectin serine peptidase
 1(C4/C2 activating component of Ra-reactive factor)),
 GeneBank accession No: BQ053419(BATF, Basic leucine zipper
 25 transcription factor, ATF-like), GeneBank accession No:

BC039299(STIP1, Stress-induced-phosphoprotein
 1(Hsp70/Hsp90-organizing protein)), GeneBank accession No:
 AY055760(DAF, Decay accelerating factor for complement(CD55,
 Cromer blood group system)), GeneBank accession No:
 5 AK130188(FGR, Gardner-Rasheed feline sarcoma viral(v-fgr)
 oncogene homolog), GeneBank accession No: AK095326(MUS81,
 MUS81 endonuclease homolog(yeast)), GeneBank accession No:
 NM_017670(OTUB1, OTU domain, ubiquitin aldehyde binding 1),
 GeneBank accession No: NM_003004(SECTM1, Secreted and
 10 transmembrane 1), GeneBank accession No: NM_002309(LIF,
 Hypothetical protein MGC20647), GeneBank accession No:
 NM_001421(ELF4, E74-like factor 4(ets domain transcription
 factor)), GeneBank accession No: NM_000418(IL4R,
 Interleukin 4 receptor), GeneBank accession No:
 15 BI909222(FCER1G, Fc fragment of IgE, high affinity I,
 receptor for; gamma polypeptide), GeneBank accession No:
 BF569086(NK4, Interleukin 32), GeneBank accession No:
 BC014470(AZGP1, Alpha-2-glycoprotein 1, zinc), GeneBank
 accession No: BC020744(AKR1C4, Aldo-keto reductase family 1,
 20 member C4(chlordecone reductase; 3-alpha hydroxysteroid
 dehydrogenase, type I; dihydrodiol),dehydrogenase 4),
 GeneBank accession No: BQ939577(AKR1C3, Aldo-keto reductase
 family 1, member C3(3-alpha hydroxysteroid dehydrogenase,
 type II)), GeneBank accession No: NM_000499(CYP1A1,
 25 Cytochrome P450, family 1, subfamily A, polypeptide 1),

GeneBank accession No: NM_030622(CYP2S1, Cytochrome P450, family 2, subfamily S, polypeptide 1), GeneBank accession No: NM_184041(ALDOA, Aldolase A, fructose-bisphosphate), GeneBank accession No: NM_024307(MGC4171, Hypothetical protein LOC283901), GeneBank accession No: NM_005336(HDLBP, High density lipoprotein binding protein(vigilin)), GeneBank accession No: NM_002627(PFKP, Phosphofructokinase, platelet), GeneBank accession No: BX648281(LDLR, Low density lipoprotein receptor(familial hypercholesterolemia)), GeneBank accession No: BC069201(FLJ22761, Hexokinase domain containing 1), GeneBank accession No: BC030207(NR0B2, Nuclear receptor subfamily 0, group B, member 2), GeneBank accession No: AL833069(KIAA1434, Hypothetical protein KIAA1434), GeneBank accession No: AK124656(ENO2, Enolase 2(gamma, neuronal)), GeneBank accession No: AK094474(RHOC, Ras homolog gene family, member C), GeneBank accession No: AK093461(ISYNA1, Myo-inositol 1-phosphate synthase A1), GeneBank accession No: AB053232(GAL3ST3, Galactose-3-O-sulfotransferase 3), GeneBank accession No: AB045292(TMEM8, Transmembrane protein 8(five membrane-spanning domains)), GeneBank accession No: NM_004753(DHRS3, Dehydrogenase/reductase(SDR family) member 3), GeneBank accession No: NM_002900(RBP3, Retinol binding protein 3, interstitial), GeneBank accession No: NM_001995(ACSL1, Acyl-CoA synthetase long-

chain family member 1), GeneBank accession No: NM_000018(ACADVL, Acyl-Coenzyme A dehydrogenase, very long chain), GeneBank accession No: BC094756(CRA, Myotubularin related protein 11), GeneBank accession No: BC050553(NTE, Neuropathy target esterase), GeneBank accession No: BC033110(HSD17B1, Hydroxysteroid(17-beta) dehydrogenase 1), GeneBank accession No: AY268890(TPP1, Tripeptidyl peptidase I), GeneBank accession No: AK172798(CPT1A, Carnitine palmitoyltransferase 1A(liver)), GeneBank accession No: AK096809(CYP4F8, Cytochrome P450, family 4, subfamily F, polypeptide 8), GeneBank accession No: AK000600(SIAT7D, ST6(alpha-N-acetyl-neuraminy-2,3-beta-galactosyl-1,3)-N-acetylgalactosaminide alpha-2,6-sialyltransferase 4), GeneBank accession No: AB002454(CYP4F3, Cytochrome P450, family 4, subfamily F, polypeptide 3), GeneBank accession No: Z29093(DDR1, Discoidin domain receptor family, member 1), GeneBank accession No: Z25424(MKNK2, MAP kinase interacting serine/threonine kinase 2), GeneBank accession No: XM_291277(DKFZp761P0423, Hypothetical protein DKFZp761P0423), GeneBank accession No: XM_038150(MAST3, Microtubule associated serine/threonine kinase 3), GeneBank accession No: U88357(ERBB3, V-erb-b2 erythroblastic leukemia viral oncogene homolog 3(avian)), GeneBank accession No: NM_025195(TRIB1, Tribbles homolog 1(Drosophila)), GeneBank accession No: NM_020639(RIPK4,

Receptor-interacting serine-threonine kinase 4), GeneBank
accession No: NM_014172(PHPT1, Phosphohistidine phosphatase
1), GeneBank accession No: NM_006254(PRKCD, Protein kinase
C, delta), GeneBank accession No: NM_005415(SLC20A1, Solute
5 carrier family 20(phosphate transporter), member 1),
GeneBank accession No: NM_005026(PIK3CD, Phosphoinositide-
3-kinase, catalytic, delta polypeptide), GeneBank accession
No: NM_004431(EPHA2, EPH receptor A2), GeneBank accession
No: NM_004419(DUSP5, Dual specificity phosphatase 5),
10 GeneBank accession No: NM_004327(BCR, Breakpoint cluster
region), GeneBank accession No: NM_004231(ATP6V1F, ATPase,
H⁺ transporting, lysosomal 14kDa, V1 subunit F), GeneBank
accession No: NM_004090(DUSP3, Dual specificity phosphatase
3(vaccinia virus phosphatase VH1-related)), GeneBank
15 accession No: NM_002843(PTPRJ, Protein tyrosine phosphatase,
receptor type, J), GeneBank accession No: NM_002496(NDUFS8,
NADH dehydrogenase(ubiquinone) Fe-S protein 8, 23kDa(NADH-
coenzyme Q reductase)), GeneBank accession No:
NM_001001852(PIM3, Pim-3 oncogene), GeneBank accession No:
20 L76191(IRAK1, Interleukin-1 receptor-associated kinase 1),
GeneBank accession No: D15049(PTPRH, Protein tyrosine
phosphatase, receptor type, H), GeneBank accession No:
BC065207(ATP6V0D2, ATPase, H⁺ transporting, lysosomal 38kDa,
V0 subunit d isoform 2), GeneBank accession No:
25 BC035578(STK24, Serine/threonine kinase 24(STE20 homolog,

yeast)), GeneBank accession No: BC028724(DUSP18, Dual
specificity phosphatase 18), GeneBank accession No:
AL117482(ULK3, Unc-51-like kinase 3(C. elegans)), GeneBank
accession No: AK126879(PCTK3, PCTAIRE protein kinase 3),
5 GeneBank accession No: AB209416(ILK, Integrin-linked
kinase-2), GeneBank accession No: NM_000782(CYP24A1,
Cytochrome P450, family 24, subfamily A, polypeptide 1),
GeneBank accession No: CR597101(ZFP36, Zinc finger protein
36, C3H type, homolog(mouse)), GeneBank accession No:
10 CR936799(FHL2, Four and a half LIM domains 2), GeneBank
accession No: M24898(NR1D1, Nuclear receptor subfamily 1,
group D, member 1), GeneBank accession No: AF132818(KLF5,
Kruppel-like factor 5(intestinal)), GeneBank accession No:
AK055337(ZNF213, Zinc finger protein 213), GeneBank
15 accession No: BC008834(PHF1, PHD finger protein 1),
GeneBank accession No: AK126918(GLIS2, GLIS family zinc
finger 2), GeneBank accession No: BC042692(CTL2, Solute
carrier family 44, member 2), GeneBank accession No:
NM_002224(ITPR3, Inositol 1,4,5-triphosphate receptor, type
20 3), GeneBank accession No: AK095363(AQP3, Aquaporin 3),
GeneBank accession No: NM_174953(ATP2A3, ATPase, Ca++
transporting, ubiquitous), GeneBank accession No:
BC042390(VTI1B, Vesicle transport through interaction with
t-SNAREs homolog 1B(yeast)), GeneBank accession No:
25 NM_016113(TRPV2, Transient receptor potential cation

channel, subfamily V, member 2), GeneBank accession No:
BM926478(RBP1, Retinol binding protein 1, cellular),
GeneBank accession No: NM_000069(CACNA1S, Calcium channel,
voltage-dependent, L type, alpha 1S subunit), GeneBank
5 accession No: AK002107(RAB3B, RAB3B, member RAS oncogene
family), GeneBank accession No: NM_013321(SNX8, Sorting
nexin 8), GeneBank accession No: AK125026(SLC6A12, Solute
carrier family 6(neurotransmitter transporter,
betaine/GABA), member 12), GeneBank accession No:
10 NM_005843(STAM2, Signal transducing adaptor molecule(SH3
domain and ITAM motif) 2), GeneBank accession No:
AK092512(SLC16A5, Solute carrier family 16(monocarboxylic
acid transporters), member 5), GeneBank accession No:
U49248(ABCC2, ATP-binding cassette, sub-family C(CFTR/MRP),
15 member 2), GeneBank accession No: AK172792(SCNN1A, Sodium
channel, nonvoltage-gated 1 alpha), GeneBank accession No:
BC044656(CASC3, Cancer susceptibility candidate 3),
GeneBank accession No: NM_203403(C9orf150, Chromosome 9
open reading frame 150), GeneBank accession No:
20 NM_080388(S100A16, S100 calcium binding protein A16),
GeneBank accession No: NM_031286(SH3BGRL3, SH3 domain
binding glutamic acid-rich protein like 3), GeneBank
accession No: NM_022153(PP2135, Chromosome 10 open reading
frame 54), GeneBank accession No: NM_004864(GDF15, Growth
25 differentiation factor 15), GeneBank accession No:

NM_003330(TXNRD1, Thioredoxin reductase 1), GeneBank
 accession No: NM_001013632(LOC343521, Similar to
 hypothetical protein 4833401D15), GeneBank accession No:
 BX537968(LOC51149, Hypothetical LOC51149), GeneBank
 5 accession No: BU945318(MT2A, Hypothetical gene supported by
 X97260; BC070289), GeneBank accession No: BQ683841(S100A11,
 S100 calcium binding protein A11(calgizzarin)), GeneBank
 accession No: BQ276852(TMSB10, Thymosin, beta 10), GeneBank
 accession No: AK126182(KIAA1949, KIAA1949), GeneBank
 10 accession No: AK124751(CAPN2, Calpain 2,(m/II) large
 subunit), GeneBank accession No: AK095079(RGC32, Response
 gene to complement 32), GeneBank accession No:
 AB075871(FLJ42654, Golgi transport 1 homolog A(S.
 cerevisiae)), GeneBank accession No: AK125150(MAPK8,
 15 Mitogen-activated protein kinase 8), GeneBank accession No:
 NM_002758(MAP2K6, Mitogen-activated protein kinase kinase
 6), GeneBank accession No: NM_004612(TGFBR1, Transforming
 growth factor, beta receptor I(activin A receptor type II-
 like kinase, 53kDa)), GeneBank accession No:
 20 NM_145686(MAP4K4, Mitogen-activated protein kinase kinase
 kinase kinase 4), GeneBank accession No: XM_042066(MAP3K1,
 Mitogen-activated protein kinase kinase kinase 1), GeneBank
 accession No: AB011123(TNIK, TRAF2 and NCK interacting
 kinase), GeneBank accession No: AB209031(C5, Complement
 25 component 5), GeneBank accession No: NM_022740(HIPK2,

Homeodomain interacting protein kinase 2), GeneBank
accession No: NM_148957(TNFRSF19, Tumor necrosis factor
receptor superfamily, member 19), GeneBank accession No:
AB208909(ITGB2, Integrin, beta 2(antigen CD18(p95),
5 lymphocyte function-associated antigen 1; macrophage
antigen 1(mac-1) beta subunit)), GeneBank accession No:
AB209211(TIA1, TIA1 cytotoxic granule-associated RNA
binding protein), GeneBank accession No: AB209613(DNASE1L3,
Deoxyribonuclease I-like 3), GeneBank accession No:
10 AK122825(HMGB1, High-mobility group box 1), GeneBank
accession No: AK127326(PHF17, PHD finger protein 17),
GeneBank accession No: AK223503(CASP1, Caspase 1,
apoptosis-related cysteine peptidase(interleukin 1, beta,
convertase)), GeneBank accession No: BC013326(GAS2, Growth
15 arrest-specific 2), GeneBank accession No: BC047698(IL7,
Interleukin 7), GeneBank accession No: D79987(ESPL1, Extra
spindle poles like 1(*S. cerevisiae*)), GeneBank accession
No: NM_000893(KNG1, Kininogen 1), GeneBank accession No:
NM_001012271(BIRC5, Effector cell peptidase receptor 1),
20 GeneBank accession No: NM_004938(DAPK1, Death-associated
protein kinase 1), GeneBank accession No: NM_005879(TRIP,
TRAF interacting protein), GeneBank accession No:
NM_014739(BCLAF1, BCL2-associated transcription factor 1),
GeneBank accession No: NM_018947(CYCS, Cytochrome c,
25 somatic), GeneBank accession No: AB033337(MPHOSPH1, M-phase

phosphoprotein 1), GeneBank accession No: AB209179(PLK1, Polo-like kinase 1(Drosophila)), GeneBank accession No: AB209337(CDC7, CDC7 cell division cycle 7(S. cerevisiae)), GeneBank accession No: AF053305(BUB1, BUB1 budding uninhibited by benzimidazoles 1 homolog(yeast)), GeneBank accession No: AF053306(BUB1B, BUB1 budding uninhibited by benzimidazoles 1 homolog beta(yeast)), GeneBank accession No: AF345347(SPAG5, Sperm associated antigen 5), GeneBank accession No: AK092638(CCNG2, Cyclin G2), GeneBank accession No: AK222819(NUSAP1, Nucleolar and spindle associated protein 1), GeneBank accession No: AL833191(SMC2L1, SMC2 structural maintenance of chromosomes 2-like 1(yeast)), GeneBank accession No: AY257469(CIT, Citron(rho-interacting, serine/threonine kinase 21)), GeneBank accession No: AY367065(ASPM, Asp(abnormal spindle)-like, microcephaly associated(Drosophila)), GeneBank accession No: BC011000(CDCA5, Cell division cycle associated 5), GeneBank accession No: BC032677(UBE2C, Ubiquitin-conjugating enzyme E2C), GeneBank accession No: BC043502(NEK2, NIMA(never in mitosis gene a)-related kinase 2), GeneBank accession No: BU675073(PTTG1, Pituitary tumor-transforming 1), GeneBank accession No: BX647885(STMN1, Stathmin 1/oncoprotein 18), GeneBank accession No: CR592757(BRRN1, Barren homolog 1(Drosophila)), GeneBank accession No: CR597075(MAPRE2, Microtubule-associated

protein, RP/EB family, member 2), GeneBank accession No:
 CR604810(CCNA2, Cyclin A2), GeneBank accession No:
 CR933728(CDC2, Cell division cycle 2, G1 to S and G2 to M),
 GeneBank accession No: NM_000919(PAM, Peptidylglycine
 5 alpha-amidating monooxygenase), GeneBank accession No:
 NM_001790(CDC25C, Cell division cycle 25C), GeneBank
 accession No: NM_001798(CDK2, Cyclin-dependent kinase 2),
 GeneBank accession No: NM_001813(CENPE, Centromere protein
 E, 312kDa), GeneBank accession No: NM_003318(TTK, TTK
 10 protein kinase), GeneBank accession No: NM_003981(PRC1,
 Protein regulator of cytokinesis 1), GeneBank accession No:
 NM_004523(KIF11, Kinesin family member 11), GeneBank
 accession No: NM_004701(CCNB2, Cyclin B2), GeneBank
 accession No: NM_005983(SKP2, S-phase kinase-associated
 15 protein 2(p45)), GeneBank accession No: NM_006101(KNTC2,
 Kinetochore associated 2), GeneBank accession No:
 NM_006845(KIF2C, Kinesin family member 2C), GeneBank
 accession No: NM_007375(TARDBP, TAR DNA binding protein),
 GeneBank accession No: NM_012112(TPX2, TPX2, microtubule-
 20 associated, homolog(Xenopus laevis)), GeneBank accession
 No: NM_014750(DLG7, Discs, large homolog 7(Drosophila)),
 GeneBank accession No: NM_015097(CLASP2, Cytoplasmic linker
 associated protein 2), GeneBank accession No:
 NM_016343(CENPF, Centromere protein F, 350/400ka(mitosis)),
 25 GeneBank accession No: NM_016426(GTSE1, G-2 and S-phase

expressed 1), GeneBank accession No: NM_018492(PBK, PDZ binding kinase), GeneBank accession No: NM_018685(ANLN, Anillin, actin binding protein(scraps homolog, Drosophila)), GeneBank accession No: NM_020242(KNSL7, Kinesin family member 15), GeneBank accession No: NM_031966(CCNB1, Cyclin B1), GeneBank accession No: NM_138555(KIF23, Kinesin family member 23), GeneBank accession No: U65410(MAD2L1, MAD2 mitotic arrest deficient-like 1(yeast)), GeneBank accession No: AB020656(CYLD, Cyldromatosis(turban tumor syndrome)), GeneBank accession No: AF033122(SESNI, Sestrin 1), GeneBank accession No: AK074377(UHRF1, Chromosome 19 open reading frame 31), GeneBank accession No: AK091170(CDKN2C, Cyclin-dependent kinase inhibitor 2C(p18, inhibits CDK4)), GeneBank accession No: AK094323(NFYC, Nuclear transcription factor Y, gamma), GeneBank accession No: AY366508(LOH11CR2A, Loss of heterozygosity, 11, chromosomal region 2, gene A), GeneBank accession No: BC033086(TCF19, Transcription factor 19(SC1)), GeneBank accession No: BC040303(PTP4A1, Protein tyrosine phosphatase type IVA, member 1), GeneBank accession No: BC040991(TFDP2, Transcription factor Dp-2(E2F dimerization partner 2)), GeneBank accession No: BC092412(SGOL2, Shugoshin-like 2(S. pombe)), GeneBank accession No: BQ278454(CKS1B, CDC28 protein kinase regulatory subunit 1B), GeneBank accession No: BX649128(SESNI, Sestrin 3), GeneBank accession No:

CD049340(AURKB, Aurora kinase B), GeneBank accession No:
 M89914(NF1, Neurofibromin 1(neurofibromatosis, von
 Recklinghausen disease, Watson disease)), GeneBank
 accession No: NM_001005414(ZWINT, ZW10 interactor
 5 antisense), GeneBank accession No: NM_001008491(Sep 2,
 Septin 2), GeneBank accession No: NM_001274(CHEK1, CHK1
 checkpoint homolog(*S. pombe*)), GeneBank accession No:
 NM_002105(H2AFX, H2A histone family, member X), GeneBank
 accession No: NM_002388(MCM3, MCM3 minichromosome
 10 maintenance deficient 3(*S. cerevisiae*)), GeneBank accession
 No: NM_002417(MKI67, Antigen identified by monoclonal
 antibody Ki-67), GeneBank accession No: NM_002875(RAD51,
 RAD51 homolog(RecA homolog, *E. coli*)(*S. cerevisiae*)),
 GeneBank accession No: NM_003884(PCAF, P300/CBP-associated
 15 factor), GeneBank accession No: NM_004526(MCM2, MCM2
 minichromosome maintenance deficient 2, mitotin(*S.*
cerevisiae)), GeneBank accession No: NM_004847(AIF1,
 Allograft inflammatory factor 1), GeneBank accession No:
 NM_005915(MCM6, MCM6 minichromosome maintenance deficient
 20 6(MIS5 homolog, *S. pombe*)(*S. cerevisiae*)), GeneBank
 accession No: NM_012090(MACF1, Microtubule-actin
 crosslinking factor 1), GeneBank accession No:
 NM_012415(RAD54B, RAD54 homolog B(*S. cerevisiae*)), GeneBank
 accession No: NM_014264(PLK4, Polo-like kinase
 25 4(*Drosophila*)), GeneBank accession No: NM_015714(G0S2,

G0/G1switch 2), GeneBank accession No: NM_024680(FLJ23311, E2F transcription factor 8), GeneBank accession No: XM_034274(MYBL1, V-myb myeloblastosis viral oncogene homolog(avian)-like 1), GeneBank accession No: AK001720(FLJ10858, Nei endonuclease VIII-like 3(E. coli)), GeneBank accession No: AY032677(POLQ, Polymerase(DNA directed), theta), GeneBank accession No: BC034480(BLM, Bloom syndrome), GeneBank accession No: BC073161(RAD51C, RAD51 homolog C(S. cerevisiae)), GeneBank accession No: CR600021(HMGB2, High-mobility group box 2), GeneBank accession No: CR625391(RAD51AP1, RAD51 associated protein 1), GeneBank accession No: CR936783(FLJ40869, Hypothetical protein LOC284952), GeneBank accession No: DQ140356(KIAA1596, Fanconi anemia, complementation group M), GeneBank accession No: NM_001067(TOP2A, Topoisomerase(DNA) II alpha 170kDa), GeneBank accession No: NM_001618(PARP1, Poly(ADP-ribose) polymerase family, member 1), GeneBank accession No: NM_003362(UNG, Uracil-DNA glycosylase), GeneBank accession No: NM_006904(PRKDC, Protein kinase, DNA-activated, catalytic polypeptide), GeneBank accession No: NM_130398(EXO1, Exonuclease 1), GeneBank accession No: AB020807(TLR6, Toll-like receptor 6), GeneBank accession No: AB032980(DCDC2, Doublecortin domain containing 2), GeneBank accession No: AB209866(TFPI, Tissue factor pathway inhibitor(lipoprotein-associated coagulation inhibitor)),

GeneBank accession No: AK057015(HSPA4, Heat shock 70kDa protein 4), GeneBank accession No: AK095515(IFIT1, Interferon-induced protein with tetratricopeptide repeats 1), GeneBank accession No: AK122686(IF, I factor(complement)), GeneBank accession No: AK123010(RRM2, Ribonucleotide reductase M2 polypeptide), GeneBank accession No: BC035582(TRIM22, Tripartite motif-containing 22), GeneBank accession No: BX537894(LOC493869, Similar to RIKEN cDNA 2310016C16), GeneBank accession No: M14338(PROS1, Protein S(alpha)), GeneBank accession No: NM_000821(GGCX, Gamma-glutamyl carboxylase), GeneBank accession No: NM_000963(PTGS2, Prostaglandin-endoperoxide synthase 2(prostaglandin G/H synthase and cyclooxygenase)), GeneBank accession No: NM_001001547(CD36, CD36 antigen(collagen type I receptor, thrombospondin receptor)), GeneBank accession No: NM_001512(GSTA4, Glutathione S-transferase A4), GeneBank accession No: NM_001629(ALOX5AP, Arachidonate 5-lipoxygenase-activating protein), GeneBank accession No: NM_001752(CAT, Catalase), GeneBank accession No: NM_001837(CCR3, Chemokine(C-C motif) receptor 3), GeneBank accession No: NM_001979(EPHX2, Epoxide hydrolase 2, cytoplasmic), GeneBank accession No: NM_001994(F13B, Coagulation factor XIII, B polypeptide), GeneBank accession No: NM_002182(IL1RAP, Interleukin 1 receptor accessory protein), GeneBank accession No: NM_006120(HLA-DMA, Major

histocompatibility complex, class II, DM alpha), GeneBank
 accession No: NM_173216(SIAT1, ST6 beta-galactosamide
 alpha-2,6-sialyltransferase 1), GeneBank accession No:
 NM_202002(FOXM1, Forkhead box M1), GeneBank accession No:
 5 AB163917(LRAP, Leukocyte-derived arginine aminopeptidase),
 GeneBank accession No: BC027881(AFP, Alpha-fetoprotein),
 GeneBank accession No: NM_015915(SPG3A, Spastic paraplegia
 3A(autosomal dominant)), GeneBank accession No:
 NM_000671(ADH5, Alcohol dehydrogenase 5(class III), chi
 10 polypeptide), GeneBank accession No: J05428(UGT2B7, UDP
 glucuronosyltransferase 2 family, polypeptide B7), GeneBank
 accession No: NM_000672(ADH6, Alcohol dehydrogenase 6(class
 V)), GeneBank accession No: M15943(ADH4, Alcohol
 dehydrogenase 4(class II), pi polypeptide), GeneBank
 15 accession No: AK223395(FBP1, Fructose-1,6-bisphosphatase 1),
 GeneBank accession No: NM_000151(G6PC, Glucose-6-
 phosphatase, catalytic(glycogen storage disease type I, von
 Gierke disease)), GeneBank accession No: XM_113962(KIAA0650,
 Structural maintenance of chromosomes flexible hinge domain
 20 containing 1), GeneBank accession No: AB020644(ACSL6, Acyl-
 CoA synthetase long-chain family member 6), GeneBank
 accession No: AB209907(PLD1, Phospholipase D1,
 phosphatidylcholine-specific), GeneBank accession No:
 AF285167(ABCA1, ATP-binding cassette, sub-family A(ABC1),
 25 member 1), GeneBank accession No: AF297872(TREMF1,

Transcriptional regulating factor 1), GeneBank accession
 No: AF303134(ALDH8A1, Aldehyde dehydrogenase 8 family,
 member A1), GeneBank accession No: AF339053(PLA2G12B,
 Phospholipase A2, group XIIB), GeneBank accession No:
 5 AK096018(HADHSC, L-3-hydroxyacyl-Coenzyme A dehydrogenase,
 short chain), GeneBank accession No: AK124635(PCSK9,
 Proprotein convertase subtilisin/kexin type 9), GeneBank
 accession No: AK127346(SIAT9, ST3 beta-galactoside alpha-
 2,3-sialyltransferase 5), GeneBank accession No:
 10 AL359559(AGPS, Alkylglycerone phosphate synthase), GeneBank
 accession No: AY691170(PLCL3, Phospholipase C-like 3),
 GeneBank accession No: BG567934(APOM, Apolipoprotein M),
 GeneBank accession No: BX538214(C6orf167, Chromosome 6 open
 reading frame 167), GeneBank accession No: BX640945(FADS2,
 15 Fatty acid desaturase 2), GeneBank accession No:
 BX648473(PIGK, Phosphatidylinositol glycan, class K),
 GeneBank accession No: BX648557(HSD17B2, Hydroxysteroid(17-
 beta) dehydrogenase 2), GeneBank accession No:
 CR749601(ETNK1, Death-associated protein kinase 3),
 20 GeneBank accession No: NM_000859(HMGCR, 3-hydroxy-3-
 methylglutaryl-Coenzyme A reductase), GeneBank accession
 No: NM_001443(FABP1, Fatty acid binding protein 1, liver),
 GeneBank accession No: NM_002130(HMGCS1, 3-hydroxy-3-
 methylglutaryl-Coenzyme A synthase 1(soluble)), GeneBank
 25 accession No: NM_003725(RODH, Hydroxysteroid(17-beta)

dehydrogenase 6), GeneBank accession No: NM_004845(PCYT1B,
 Phosphate cytidylyltransferase 1, choline, beta), GeneBank
 accession No: NM_014762(DHCR24, 24-dehydrocholesterol
 reductase), GeneBank accession No: NM_020139(DHRS6,
 5 Dehydrogenase/reductase(SDR family) member 6), GeneBank
 accession No: NM_020918(GPAM, Glycerol-3-phosphate
 acyltransferase, mitochondrial), GeneBank accession No:
 NM_032523(OSBPL6, Oxysterol binding protein-like 6),
 GeneBank accession No: NM_033505(SELI, Selenoprotein I),
 10 GeneBank accession No: Z28339(AKR1D1, Aldo-keto reductase
 family 1, member D1(delta 4-3-ketosteroid-5-beta-
 reductase)), GeneBank accession No: AK024899(ENPP3,
 Ectonucleotide pyrophosphatase/phosphodiesterase 3),
 GeneBank accession No: AK025546(PTPN4, Protein tyrosine
 15 phosphatase, non-receptor type 4(megakaryocyte)), GeneBank
 accession No: AK124910(ENPP2, Ectonucleotide
 pyrophosphatase/phosphodiesterase 2(autotaxin)), GeneBank
 accession No: BC035116(FLJ35059 fis, CDNA FLJ30761 fis,
 clone FEBRA2000538), GeneBank accession No: BC050565(PASK,
 20 PAS domain containing serine/threonine kinase), GeneBank
 accession No: L13436(NPR2, Natriuretic peptide receptor
 B/guanylate cyclase B(atrionatriuretic peptide receptor B)),
 GeneBank accession No: NM_001005862(ERBB2, V-erb-b2
 erythroblastic leukemia viral oncogene homolog 2,
 25 neuro/glioblastoma derived oncogene homolog(avian)),

GeneBank accession No: NM_005012(ROR1, Receptor tyrosine kinase-like orphan receptor 1), GeneBank accession No: NM_006035(CDC42BPB, CDC42 binding protein kinase beta(DMPK-like)), GeneBank accession No: NM_014791(MELK, Maternal embryonic leucine zipper kinase), GeneBank accession No: NM_023028(FGFR2, Fibroblast growth factor receptor 2(bacteria-expressed kinase, keratinocyte growth factor receptor, craniofacial dysostosis 1, Crouzon syndrome, Pfeiffer syndrome, Jackson-Weiss syndrome)), GeneBank accession No: NM_080836(STK35, Serine/threonine kinase 35), GeneBank accession No: AF419331(FUSIP1, FUS interacting protein(serine/arginine-rich) 1), GeneBank accession No: AK091927(SFRS3, Splicing factor, arginine/serine-rich 3), GeneBank accession No: BC010266(HNRNPA1, Heterogeneous nuclear ribonucleoprotein A1), GeneBank accession No: BC012360(CTAGE5, CTAGE family, member 5), GeneBank accession No: BC036046(PLRG1, Pleiotropic regulator 1(PRL1 homolog, Arabidopsis)), GeneBank accession No: BC065384(PCF11, PCF11, cleavage and polyadenylation factor subunit, homolog(S. cerevisiae)), GeneBank accession No: BX537360(CPSF5, Nudix(nucleoside diphosphate linked moiety X)-type motif 21), GeneBank accession No: BX537494(HNRPA2B1, Heterogeneous nuclear ribonucleoprotein A2/B1), GeneBank accession No: BX647784(HNRPR, Heterogeneous nuclear ribonucleoprotein R), GeneBank accession No: CA455267(PPIH,

Peptidyl prolyl isomerase H(cyclophilin H)), GeneBank
 accession No: CR596214(HNRPA0, Heterogeneous nuclear
 ribonucleoprotein A0), GeneBank accession No:
 NM_001326(CSTF3, Hypothetical protein LOC283267), GeneBank
 5 accession No: NM_004640(BAT1, HLA-B associated transcript
 1), GeneBank accession No: NM_005463(HNRPDL, Heterogeneous
 nuclear ribonucleoprotein D-like), GeneBank accession No:
 NM_006924(SFRS1, Splicing factor, arginine/serine-rich
 1(splicing factor 2, alternate splicing factor)), GeneBank
 10 accession No: NM_012426(SF3B3, Splicing factor 3b, subunit
 3, 130kDa), GeneBank accession No: NM_018048(FLJ10292,
 Mago-nashi homolog), GeneBank accession No:
 NM_030919(C20orf129, Chromosome 20 open reading frame 129),
 GeneBank accession No: NM_031370(HNRPD, Heterogeneous
 15 nuclear ribonucleoprotein D(AU-rich element RNA binding
 protein 1, 37kDa)), GeneBank accession No: NM_138933(ACF,
 Apobec-1 complementation factor), GeneBank accession No:
 AB193259(ACE2, Angiotensin I converting enzyme(peptidyl-
 dipeptidase A) 2), GeneBank accession No: BX648769(EWSR1,
 20 Ewing sarcoma breakpoint region 1), GeneBank accession No:
 AB023154(DTX4, Deltex 4 homolog(Drosophila)), GeneBank
 accession No: AL543755(VAV3, Vav 3 oncogene), GeneBank
 accession No: M75106(CPB2, Carboxypeptidase B2(plasma,
 carboxypeptidase U)), GeneBank accession No:
 25 NM_021045(ZNF248, Zinc finger protein 248), GeneBank

accession No: AB209194(B4GALT6, UDP-Gal:betaGlcNAc beta
1,4- galactosyltransferase, polypeptide 6), GeneBank
accession No: AF279145(ANTXR1, Anthrax toxin receptor 1),
GeneBank accession No: NM_025074(FRAS1, Fraser syndrome 1),
5 GeneBank accession No: AK025790(KIF20A, Kinesin family
member 20A), GeneBank accession No: NM_006152(LRMP,
Lymphoid-restricted membrane protein), GeneBank accession
No: NM_000340(SLC2A2, Solute carrier family 2(facilitated
glucose transporter), member 2), GeneBank accession No:
10 AF071592(KIF4A, Kinesin family member 4A), GeneBank
accession No: NM_013277(RACGAP1, Rac GTPase activating
protein 1), GeneBank accession No: AY043484(SCN1A, Sodium
channel, voltage-gated, type I, alpha), GeneBank accession
No: AY791349(KIF18A, Kinesin family member 18A), GeneBank
15 accession No: NM_018018(SLC38A4, Solute carrier family 38,
member 4), GeneBank accession No: AK094603(FLJ37284 fis,
unnamed protein product; Homo sapiens cDNA FLJ37284 fis,
clone BRAMY2013590.), GeneBank accession No:
NM_021069(ARGBP2, Sorbin and SH3 domain containing 2),
20 GeneBank accession No: NM_001005747(CACNB4, Calcium channel,
voltage-dependent, beta 4 subunit), GeneBank accession No:
AJ496568(SLC25A12, Solute carrier family 25(mitochondrial
carrier, Aralar), member 12), GeneBank accession No:
NM_030641(APOL6, Apolipoprotein L, 6), GeneBank accession
25 No: NM_173512(FLJ39822, Hypothetical protein FLJ39822),

GeneBank accession No: NM_000037(ANK1, Ankyrin 1, erythrocytic), GeneBank accession No: NM_001011554(SLC13A3, Solute carrier family 13(sodium-dependent dicarboxylate transporter), member 3), GeneBank accession No:

5 AB091343(C10orf3, Centrosomal protein 55kDa), GeneBank accession No: AK000643(ASB9, Ankyrin repeat and SOCS box-containing 9), GeneBank accession No: AK055221(FBXO5, F-box protein 5), GeneBank accession No: AK075271(SPTLC2L, Serine palmitoyltransferase, long chain base subunit 2-

10 like(aminotransferase 2)), GeneBank accession No: AK122685(GLUD1, Glutamate dehydrogenase 1), GeneBank accession No: AK127098(FLJ10706, Chromosome 1 open reading frame 112), GeneBank accession No: AL133031(MLR1, Transcription factor MLR1), GeneBank accession No:

15 AY007723(MAL2, Mal, T-cell differentiation protein 2), GeneBank accession No: BC022255(Spc25, Spindle pole body component 25 homolog(*S. cerevisiae*)), GeneBank accession No: BC041882(ATF7IP2, Activating transcription factor 7 interacting protein 2), GeneBank accession No:

20 BC052951(LMNB1, Lamin B1), GeneBank accession No: BC098313(FLJ20641, Hypothetical protein FLJ20641), GeneBank accession No: NM_001809(CENPA, Centromere protein A, 17kDa), GeneBank accession No: NM_145061(C13orf3, Chromosome 13 open reading frame 3), GeneBank accession No:

25 XM_372695(LOC390859, PREDICTED: Homo sapiens similar to

Chain A, Crystal Structure Of The R463a Mutant Of Human Glutamate Dehydrogenase(LOC390859), mRNA).

【Claim 19】

5 The method according to claim 18, wherein the below genes are up-regulated by exposure to phenanthrene:

 GeneBank accession No: NM_004420(DUSP8, Dual
specificity phosphatase 8), GeneBank accession No:
L11329(DUSP2, Dual specificity phosphatase 2), GeneBank
10 accession No: BC094766(PKN1, Protein kinase N1), GeneBank
accession No: AY247738(TRIB3, Tribbles homolog
3(Drosophila)), GeneBank accession No: AK129595(GADD45B,
Growth arrest and DNA-damage-inducible, beta), GeneBank
accession No: AB208849(SHC1, SHC(Src homology 2 domain
15 containing) transforming protein 1), GeneBank accession No:
X02812(TGFB1, Transforming growth factor, beta 1(Camurati-
Engelmann disease)),GeneBank accession No: NM_198951(TGM2,
Transglutaminase 2(C polypeptide, protein-glutamine-gamma-
glutamyltransferase)), GeneBank accession No:
20 NM_147780(CTSB, Cathepsin B), GeneBank accession No:
NM_078467(CDKN1A, Cyclin-dependent kinase inhibitor 1A(p21,
Cip1)), GeneBank accession No: NM_033027(AXUD1, AXIN1 up-
regulated 1), GeneBank accession No: NM_032797(AMID,
Apoptosis-inducing factor(AIF)-like mitochondrion-
25 associated inducer of death), GeneBank accession No:

NM_021960(MCL1, Myeloid cell leukemia sequence 1(BCL2-related)), GeneBank accession No: NM_016639(TNFRSF12A, Tumor necrosis factor receptor superfamily, member 12A), GeneBank accession No: NM_016222(DDX41, DEAD(Asp-Glu-Ala-Asp) box polypeptide 41), GeneBank accession No: NM_013246(CLC, Cardiotrophin-like cytokine factor 1), GeneBank accession No: NM_004401(DFFA, DNA fragmentation factor, 45kDa, alpha polypeptide), GeneBank accession No: NM_004281(BAG3, BCL2-associated athanogene 3), GeneBank accession No: NM_003897(IER3, Immediate early response 3), GeneBank accession No: NM_003806(HRK, Harakiri, BCL2 interacting protein(contains only BH3 domain)), GeneBank accession No: NM_003639(IKBKG, Inhibitor of kappa light polypeptide gene enhancer in B-cells, kinase gamma), GeneBank accession No: NM_003311(PHLDA2, Pleckstrin homology-like domain, family A, member 2), GeneBank accession No: NM_002737(PRKCA, Protein kinase C, alpha), GeneBank accession No: NM_002648(PIM1, Pim-1 oncogene), GeneBank accession No: NM_002507(NGFR, Nerve growth factor receptor(TNFR superfamily, member 16)), GeneBank accession No: NM_002305(LGALS1, Lectin, galactoside-binding, soluble, 1(galectin 1)), GeneBank accession No: NM_001013398(IGFBP3, Insulin-like growth factor binding protein 3), GeneBank accession No: BX640923(MDM4, Mdm4, transformed 3T3 cell double minute 4, p53 binding protein(mouse)), GeneBank

accession No: BX537586(STK17A, Serine/threonine kinase
 17a(apoptosis-inducing)), GeneBank accession No:
 BG284742(P8, P8 protein(candidate of metastasis 1)),
 GeneBank accession No: BE903247(PDCD6IP, Programmed cell
 5 death 6 interacting protein), GeneBank accession No:
 BC027949(P2RX1, Purinergic receptor P2X, ligand-gated ion
 channel, 1), GeneBank accession No: BC006365(PSEN2,
 Presenilin 2(Alzheimer disease 4)), GeneBank accession No:
 AY869712(PPP1R13L, Protein phosphatase 1,
 10 regulatory(inhibitor) subunit 13 like), GeneBank accession
 No: AY028896(CARD10, Caspase recruitment domain family,
 member 10), GeneBank accession No: AK122614(PPARD,
 Peroxisome proliferative activated receptor, delta),
 GeneBank accession No: AK092872(ERCC2, Excision repair
 15 cross-complementing rodent repair deficiency,
 complementation group 2(xeroderma pigmentosum D)), GeneBank
 accession No: AK092808(RRAGC, Ras-related GTP binding C),
 GeneBank accession No: AJ001898(GDNF, Glial cell derived
 neurotrophic factor), GeneBank accession No:
 20 AF220656(PHLDA1, Pleckstrin homology-like domain, family A,
 member 1), GeneBank accession No: AF055634(UNC5C, Unc-5
 homolog C(C. elegans)), GeneBank accession No:
 AB209485(VEGF, Vascular endothelial growth factor),
 GeneBank accession No: AB096256(UNC5B, Unc-5 homolog B(C.
 25 elegans)), GeneBank accession No: AB007960(SH3GLB1, SH3-

domain GRB2-like endophilin B1), GeneBank accession No:
X06374(PDGFA, Platelet-derived growth factor alpha
polypeptide), GeneBank accession No: S62138(DDIT3, DNA-
damage-inducible transcript 3), GeneBank accession No:
5 NM_078487(CDKN2B, Cyclin-dependent kinase inhibitor 2B(p15,
inhibits CDK4)), GeneBank accession No: NM_012127(CIZ1,
CDKN1A interacting zinc finger protein 1), GeneBank
accession No: NM_005883(APC2, Adenomatosis polyposis coli
2), GeneBank accession No: NM_004196(CDKL1, Cyclin-
10 dependent kinase-like 1(CDC2-related kinase)), GeneBank
accession No: NM_003236(TGFA, Transforming growth factor,
alpha), GeneBank accession No: NM_001261(CDK9, Cyclin-
dependent kinase 9(CDC2-related kinase)), GeneBank
accession No: NM_001007271(DUSP13, Dual specificity
15 phosphatase 13), GeneBank accession No: CR749511(PARC, P53-
associated parkin-like cytoplasmic protein), GeneBank
accession No: CR623038(ID2, Inhibitor of DNA binding 2,
dominant negative helix-loop-helix protein), GeneBank
accession No: CR618371(EGFR, Epidermal growth factor
20 receptor(erythroblastic leukemia viral(v-erb-b) oncogene
homolog, avian)), GeneBank accession No: BF965144(IFITM1,
Interferon induced transmembrane protein 1(9-27)), GeneBank
accession No: AK127679(DUSP1, Dual specificity phosphatase
1), GeneBank accession No: AK096276(CCND3, Cyclin D3),
25 GeneBank accession No: AB209586(MAPK13, Mitogen-activated

protein kinase 13), GeneBank accession No: AB209465(PCTK1,
 PCTAIRE protein kinase 1), GeneBank accession No:
 Z19588(SKIL, SKI-like), GeneBank accession No:
 NM_020429(SMURF1, SMAD specific E3 ubiquitin protein ligase
 5 1), GeneBank accession No: NM_014767(SPOCK2,
 Sparc/osteonectin, cwcvc and kazal-like domains
 proteoglycan(testican) 2), GeneBank accession No:
 NM_005979(S100A13, S100 calcium binding protein A13),
 GeneBank accession No: NM_005187(CBFA2T3, Core-binding
 10 factor, runt domain, alpha subunit 2; translocated to, 3),
 GeneBank accession No: NM_004364(CEBPA, CCAAT/enhancer
 binding protein(C/EBP), alpha), GeneBank accession No:
 NM_001769(CD9, CD9 antigen(p24)), GeneBank accession No:
 NM_001718(BMP6, Bone morphogenetic protein 6), GeneBank
 15 accession No: NM_000641(IL11, Interleukin 11), GeneBank
 accession No: BX647459(SERPINE2, Serpin peptidase inhibitor,
 clade E(nexin, plasminogen activator inhibitor type 1),
 member 2), GeneBank accession No: BQ066037(RPS19, Ribosomal
 protein S19), GeneBank accession No: BE791300(EDF1,
 20 Endothelial differentiation-related factor 1), GeneBank
 accession No: BC038504(SNF1LK, SNF1-like kinase), GeneBank
 accession No: AL832287(ZAP70, Zeta-chain(TCR) associated
 protein kinase 70kDa), GeneBank accession No:
 AK125742(PCGF1, Polycomb group ring finger 1), GeneBank
 25 accession No: AK124709(NDRG1, N-myc downstream regulated

gene 1), GeneBank accession No: AB011157(PTDSR, Phosphatidylserine receptor), GeneBank accession No: NM_013255(MKLN1, Muskelein 1, intracellular mediator containing kelch motifs), GeneBank accession No:

5 NM_006572(GNA13, Guanine nucleotide binding protein(G protein), alpha 13), GeneBank accession No: NM_002211(ITGB1, Integrin, beta 1(fibronectin receptor, beta polypeptide, antigen CD29 includes MDF2, MSK12)), GeneBank accession No: CR601067(PLAUR, Plasminogen activator, urokinase receptor),

10 GeneBank accession No: BC050456(THBS4, Thrombospondin 4), GeneBank accession No: AK027389(CXCL16, Chemokine(C-X-C motif) ligand 16), GeneBank accession No: AJ132099(VNN1, Vanin 1), GeneBank accession No: XM_371354(FLJ10157, Hypothetical protein FLJ10157), GeneBank accession No:

15 XM_208313(TPM3, Similar to tropomyosin 4), GeneBank accession No: XM_208270(ACR, Acrosin-like protease), GeneBank accession No: NM_203353(PDLIM7, PDZ and LIM domain 7(enigma)), GeneBank accession No: NM_201382(PLEC1, Plectin 1, intermediate filament binding protein 500kDa), GeneBank

20 accession No: NM_182961(SYNE1, Spectrin repeat containing, nuclear envelope 1), GeneBank accession No: NM_181826(NF2, Neurofibromin 2(bilateral acoustic neuroma)), GeneBank accession No: NM_172069(PLEKHH2, Pleckstrin homology domain containing, family H(with MyTH4 domain) member 2), GeneBank

25 accession No: NM_022648(TNS, Tensin 1), GeneBank accession

No: NM_017556(FBLP-1, Filamin binding LIM protein 1),
 GeneBank accession No: NM_016081(KIAA0992, Palladin,
 cytoskeletal associated protein), GeneBank accession No:
 NM_006617(NES, Nestin), GeneBank accession No:
 5 NM_006262(PRPH, Peripherin), GeneBank accession No:
 NM_005100(AKAP12, A kinase(PRKA) anchor protein(gravin) 12),
 GeneBank accession No: NM_004368(CNN2, Calponin 2),
 GeneBank accession No: NM_003388(CYLN2, Cytoplasmic linker
 2), GeneBank accession No: NM_003370(VASP, Vasodilator-
 10 stimulated phosphoprotein), GeneBank accession No:
 NM_003128(SPTBN1, Spectrin, beta, non-erythrocytic 1),
 GeneBank accession No: NM_002705(PPL, Periplakin), GeneBank
 accession No: NM_002475(MLC1SA, Myosin light chain 1 slow
 a), GeneBank accession No: NM_002018(FLII, Flightless I
 15 homolog(Drosophila)), GeneBank accession No: NM_001465(FYB,
 FYN binding protein(FYB-120/130)), GeneBank accession No:
 NM_001069(TUBB2, Tubulin, beta 2A), GeneBank accession No:
 CR625172(MGC8685, Tubulin, beta 2B), GeneBank accession No:
 CR616919(KRT18, Keratin 18), GeneBank accession No:
 20 CR606241(ACTG1, Actin, gamma 1), GeneBank accession No:
 CB240572(MYH11, Myosin, heavy polypeptide 11, smooth
 muscle), GeneBank accession No: BX648253(PTPN3, Protein
 tyrosine phosphatase, non-receptor type 3), GeneBank
 accession No: BX648190(WDR1, WD repeat domain 1), GeneBank
 25 accession No: BX641076(ACTN1, Actinin, alpha 1), GeneBank

accession No: BX537978(EPB41L1, Erythrocyte membrane
 protein band 4.1-like 1), GeneBank accession No:
 BG121847(NUDC, Nuclear distribution gene C homolog(A.
 nidulans)), GeneBank accession No: BC068013(MYO1C, Myosin
 5 IC), GeneBank accession No: BC065499(MAST2, Microtubule
 associated serine/threonine kinase 2), GeneBank accession
 No: BC051890(TUBG2, Tubulin, gamma 2), GeneBank accession
 No: BC041874(MAP1LC3B, Microtubule-associated protein 1
 light chain 3 beta), GeneBank accession No: BC012597(ACTA1,
 10 Actin, alpha 1, skeletal muscle), GeneBank accession No:
 AY484427(KIF17, Kinesin family member 17), GeneBank
 accession No: AK130546(STOML2, Stomatin(EPB72)-like 2),
 GeneBank accession No: AK124711(CORO2B, Coronin, actin
 binding protein, 2B), GeneBank accession No: AK123974(MYL5,
 15 Myosin, light polypeptide 5, regulatory), GeneBank
 accession No: AK092792(LOC389833, Similar to hypothetical
 protein MGC27019), GeneBank accession No: AK026518(MYOHD1,
 Myosin head domain containing 1), GeneBank accession No:
 AK024500(NICAL, Microtubule associated monooxygenase,
 20 calponin and LIM domain containing 1), GeneBank accession
 No: AF085886(FLJ46675, Ribosomal protein L29 pseudogene 2),
 GeneBank accession No: AB209997(MYO9B, Myosin IXB),
 GeneBank accession No: Y12692(WNT11, Wingless-type MMTV
 integration site family, member 11), GeneBank accession No:
 25 Y11307(CYR61, Cysteine-rich, angiogenic inducer, 61),

GeneBank accession No: X17033(ITGA2, Integrin, alpha
2(CD49B, alpha 2 subunit of VLA-2 receptor)), GeneBank
accession No: U41763(CLTCL1, Clathrin, heavy polypeptide-
like 1), GeneBank accession No: NM_153609(TMPPRSS6,
5 Transmembrane protease, serine 6), GeneBank accession No:
NM_031483(ITCH, Itchy homolog E3 ubiquitin protein
ligase(mouse)), GeneBank accession No: NM_024342(GRLF1,
Glucocorticoid receptor DNA binding factor 1), GeneBank
accession No: NM_017555(EGLN2, Egl nine homolog 2(C.
10 elegans)), GeneBank accession No: NM_016569(TBX3, T-box
3(ulnar mammary syndrome)), GeneBank accession No:
NM_004148(NINJ1, Ninjurin 1), GeneBank accession No:
NM_003377(VEGFB, Vascular endothelial growth factor B),
GeneBank accession No: NM_001983(ERCC1, Excision repair
15 cross-complementing rodent repair deficiency,
complementation group 1(includes overlapping antisense
sequence)), GeneBank accession No: NM_001552(IGFBP4,
Insulin-like growth factor binding protein 4), GeneBank
accession No: NM_001430(EPAS1, Endothelial PAS domain
20 protein 1), GeneBank accession No: NM_001300(KLF6, Kruppel-
like factor 6), GeneBank accession No: NM_001012661(SLC3A2,
Solute carrier family 3(activators of dibasic and neutral
amino acid transport), member 2), GeneBank accession No:
NM_000596(IGFBP1, Insulin-like growth factor binding
25 protein 1), GeneBank accession No: NM_000474(TWIST1, Twist

homolog 1(acrocephalosyndactyly 3; Saethre-Chotzen syndrome)(Drosophila)), GeneBank accession No: BX649103(ChGn, Chondroitin beta1,4 N-acetylgalactosaminyltransferase), GeneBank accession No: 5 BM913048(TIMP1, TIMP metalloproteinase inhibitor 1), GeneBank accession No: BM904612(S100A6, S100 calcium binding protein A6(calycyclin)), GeneBank accession No: BM556279(EMP3, Epithelial membrane protein 3), GeneBank accession No: BC015041(VAT1, Family with sequence 10 similarity 82, member C), GeneBank accession No: AY258066(OKL38, Pregnancy-induced growth inhibitor), GeneBank accession No: AK126729(NDRG4, NDRG family member 4), GeneBank accession No: AK090459(NFE2L1, Nuclear factor(erythroid-derived 2)-like 1), GeneBank accession No: 15 AK074163(ROBO4, Roundabout homolog 4, magic roundabout(Drosophila)), GeneBank accession No: AK024680(FLJ21027 fis, CDNA: FLJ21027 fis, clone CAE07110), GeneBank accession No: AF176422(HEY1, Hairy/enhancer-of-split related with YRPW motif 1), GeneBank accession No: 20 AF003837(JAG1, Jagged 1(Alagille syndrome)), GeneBank accession No: AB209322(SEMA3B, Sema domain, immunoglobulin domain(Ig), short basic domain, secreted,(semaphorin) 3B), GeneBank accession No: AB011150(NRXN1, Neurexin 1), GeneBank accession No: NM_201589(MAFA, V-maf 25 musculoaponeurotic fibrosarcoma oncogene homolog A(avian)),

GeneBank accession No: NM_052999(CKLFSF1, CKLF-like MARVEL transmembrane domain containing 1), GeneBank accession No: NM_006644(HSPH1, Heat shock 105kDa/110kDa protein 1), GeneBank accession No: NM_005438(FOSL1, FOS-like antigen 1),

5 GeneBank accession No: NM_004996(ABCC1, ATP-binding cassette, sub-family C(CFTR/MRP), member 1), GeneBank accession No: NM_002658(PLAU, Plasminogen activator, urokinase), GeneBank accession No: NM_001353(AKR1C1, Aldo-keto reductase family 1, member C1(dihydrodiol

10 dehydrogenase 1; 20-alpha(3-alpha)-hydroxysteroid dehydrogenase)), GeneBank accession No: H18681(C20orf139, Sulfiredoxin 1 homolog(*S. cerevisiae*)), GeneBank accession No: DR004094(HAMP, Hepcidin antimicrobial peptide), GeneBank accession No: BC082272(KCNMB3, Potassium large

15 conductance calcium-activated channel, subfamily M beta member 3), GeneBank accession No: BC040494(DNAJB2, DnaJ(Hsp40) homolog, subfamily B, member 2), GeneBank accession No: BC018064(ATF6, Activating transcription factor 6), GeneBank accession No: BC006523(SGK2, Serum/glucocorticoid regulated kinase 2), GeneBank

20 accession No: AK090482(CXCL12, Chemokine(C-X-C motif) ligand 12(stromal cell-derived factor 1)), GeneBank accession No: AF219946(TULP4, Tubby like protein 4), GeneBank accession No: AB209112(SLC2A8, Solute carrier

25 family 2,(facilitated glucose transporter) member 8),

GeneBank accession No: NM_005242(F2RL1, Coagulation factor II(thrombin) receptor-like 1), GeneBank accession No: NM_001002029(C4A, Complement component 4B, telomeric), GeneBank accession No: NM_000539(RHO, Rhodopsin(opsin 2, rod pigment)(retinitis pigmentosa 4, autosomal dominant)),
5 GeneBank accession No: BX649164(PAI, serpin peptidase inhibitor, clade E(nexin, plasminogen activator inhibitor type 1), member 1), GeneBank accession No: BM918324(LY96, Lymphocyte antigen 96), GeneBank accession No: AB209647(NCF2, Neutrophil cytosolic factor 2(65kDa, chronic granulomatous disease, autosomal 2)), GeneBank accession No: NM_152221(CSNK1E, Casein kinase 1, epsilon), GeneBank accession No: NM_017999(RNF31, Ring finger protein 31), GeneBank accession No: NM_016819(OGG1, 8-oxoguanine DNA glycosylase), GeneBank accession No: NM_016816(OAS1, 2',5'-oligoadenylate synthetase 1, 40/46kDa), GeneBank accession No: NM_012235(SCAP, SREBP cleavage-activating protein), GeneBank accession No: NM_006384(CIB1, Calcium and integrin binding 1(calmyrin)), GeneBank accession No: NM_001779(CD58, CD58 antigen,(lymphocyte function-associated antigen 3)),
20 GeneBank accession No: CB055213(ICOSLG, Inducible T-cell co-stimulator ligand), GeneBank accession No: BX641029(MASP1, Mannan-binding lectin serine peptidase 1(C4/C2 activating component of Ra-reactive factor)),
25 GeneBank accession No: BQ053419(BATF, Basic leucine zipper

transcription factor, ATF-like), GeneBank accession No: BC039299(STIP1, Stress-induced-phosphoprotein 1(Hsp70/Hsp90-organizing protein)), GeneBank accession No: AY055760(DAF, Decay accelerating factor for complement(CD55, Cromer blood group system)), GeneBank accession No: AK130188(FGR, Gardner-Rasheed feline sarcoma viral(v-fgr) oncogene homolog), GeneBank accession No: AK095326(MUS81, MUS81 endonuclease homolog(yeast)), GeneBank accession No: NM_017670(OTUB1, OTU domain, ubiquitin aldehyde binding 1), GeneBank accession No: NM_003004(SECTM1, Secreted and transmembrane 1), GeneBank accession No: NM_002309(LIF, Hypothetical protein MGC20647), GeneBank accession No: NM_001421(ELF4, E74-like factor 4(ets domain transcription factor)), GeneBank accession No: NM_000418(IL4R, Interleukin 4 receptor), GeneBank accession No: BI909222(FCER1G, Fc fragment of IgE, high affinity I, receptor for; gamma polypeptide), GeneBank accession No: BF569086(NK4, Interleukin 32), GeneBank accession No: BC014470(AZGP1, Alpha-2-glycoprotein 1, zinc), GeneBank accession No: BC020744(AKR1C4, Aldo-keto reductase family 1, member C4(chlordecone reductase; 3-alpha hydroxysteroid dehydrogenase, type I; dihydrodiol),dehydrogenase 4), GeneBank accession No: BQ939577(AKR1C3, Aldo-keto reductase family 1, member C3(3-alpha hydroxysteroid dehydrogenase, type II)), GeneBank accession No: NM_000499(CYP1A1,

Cytochrome P450, family 1, subfamily A, polypeptide 1),
 GeneBank accession No: NM_030622(CYP2S1, Cytochrome P450,
 family 2, subfamily S, polypeptide 1), GeneBank accession
 No: NM_184041(ALDOA, Aldolase A, fructose-bisphosphate),
 5 GeneBank accession No: NM_024307(MGC4171, Hypothetical
 protein LOC283901), GeneBank accession No: NM_005336(HDLBP,
 High density lipoprotein binding protein(vigilin)),
 GeneBank accession No: NM_002627(PFKP, Phosphofructokinase,
 platelet), GeneBank accession No: BX648281(LDLR, Low
 10 density lipoprotein receptor(familial
 hypercholesterolemia)), GeneBank accession No:
 BC069201(FLJ22761, Hexokinase domain containing 1),
 GeneBank accession No: BC030207(NR0B2, Nuclear receptor
 subfamily 0, group B, member 2), GeneBank accession No:
 15 AL833069(KIAA1434, Hypothetical protein KIAA1434), GeneBank
 accession No: AK124656(ENO2, Enolase 2(gamma, neuronal)),
 GeneBank accession No: AK094474(RHOC, Ras homolog gene
 family, member C), GeneBank accession No: AK093461(ISYNA1,
 Myo-inositol 1-phosphate synthase A1), GeneBank accession
 20 No: AB053232(GAL3ST3, Galactose-3-O-sulfotransferase 3),
 GeneBank accession No: AB045292(TMEN8, Transmembrane
 protein 8(five membrane-spanning domains)), GeneBank
 accession No: NM_004753(DHRS3, Dehydrogenase/reductase(SDR
 family) member 3), GeneBank accession No: NM_002900(RBP3,
 25 Retinol binding protein 3, interstitial), GeneBank

accession No: NM_001995(ACSL1, Acyl-CoA synthetase long-
 chain family member 1), GeneBank accession No:
 NM_000018(ACADVL, Acyl-Coenzyme A dehydrogenase, very long
 chain), GeneBank accession No: BC094756(CRA, Myotubularin
 5 related protein 11), GeneBank accession No: BC050553(NTE,
 Neuropathy target esterase), GeneBank accession No:
 BC033110(HSD17B1, Hydroxysteroid(17-beta) dehydrogenase 1),
 GeneBank accession No: AY268890(TPP1, Tripeptidyl peptidase
 I), GeneBank accession No: AK172798(CPT1A, Carnitine
 10 palmitoyltransferase 1A(liver)), GeneBank accession No:
 AK096809(CYP4F8, Cytochrome P450, family 4, subfamily F,
 polypeptide 8), GeneBank accession No: AK000600(SIAT7D,
 ST6(alpha-N-acetyl-neuraminy-2,3-beta- galactosyl-1,3)-N-
 acetylgalactosaminide alpha-2,6-sialyltransferase 4),
 15 GeneBank accession No: AB002454(CYP4F3, Cytochrome P450,
 family 4, subfamily F, polypeptide 3), GeneBank accession
 No: Z29093(DDR1, Discoidin domain receptor family, member
 1), GeneBank accession No: Z25424(MKMK2, MAP kinase
 interacting serine/threonine kinase 2), GeneBank accession
 20 No: XM_291277(DKFZp761P0423, Hypothetical protein
 DKFZp761P0423), GeneBank accession No: XM_038150(MAST3,
 Microtubule associated serine/threonine kinase 3), GeneBank
 accession No: U88357(ERBB3, V-erb-b2 erythroblastic
 leukemia viral oncogene homolog 3(avian)), GeneBank
 25 accession No: NM_025195(TRIB1, Tribbles homolog

1(Drosophila)), GeneBank accession No: NM_020639(RIPK4, Receptor-interacting serine-threonine kinase 4), GeneBank accession No: NM_014172(PHPT1, Phosphohistidine phosphatase 1), GeneBank accession No: NM_006254(PRKCD, Protein kinase C, delta), GeneBank accession No: NM_005415(SLC20A1, Solute carrier family 20(phosphate transporter), member 1), GeneBank accession No: NM_005026(PIK3CD, Phosphoinositide-3-kinase, catalytic, delta polypeptide), GeneBank accession No: NM_004431(EPHA2, EPH receptor A2), GeneBank accession No: NM_004419(DUSP5, Dual specificity phosphatase 5), GeneBank accession No: NM_004327(BCR, Breakpoint cluster region), GeneBank accession No: NM_004231(ATP6V1F, ATPase, H⁺ transporting, lysosomal 14kDa, V1 subunit F), GeneBank accession No: NM_004090(DUSP3, Dual specificity phosphatase 3(vaccinia virus phosphatase VH1-related)), GeneBank accession No: NM_002843(PTPRJ, Protein tyrosine phosphatase, receptor type, J), GeneBank accession No: NM_002496(NDUFS8, NADH dehydrogenase(ubiquinone) Fe-S protein 8, 23kDa(NADH-coenzyme Q reductase)), GeneBank accession No: NM_001001852(PIM3, Pim-3 oncogene), GeneBank accession No: L76191(IRAK1, Interleukin-1 receptor-associated kinase 1), GeneBank accession No: D15049(PTPRH, Protein tyrosine phosphatase, receptor type, H), GeneBank accession No: BC065207(ATP6V0D2, ATPase, H⁺ transporting, lysosomal 38kDa, V0 subunit d isoform 2), GeneBank accession No:

BC035578(STK24, Serine/threonine kinase 24(STE20 homolog, yeast)), GeneBank accession No: BC028724(DUSP18, Dual specificity phosphatase 18), GeneBank accession No: AL117482(ULK3, Unc-51-like kinase 3(C. elegans)), GeneBank
5 accession No: AK126879(PCTK3, PCTAIRE protein kinase 3), GeneBank accession No: AB209416(ILK, Integrin-linked kinase-2), GeneBank accession No: NM_000782(CYP24A1, Cytochrome P450, family 24, subfamily A, polypeptide 1), GeneBank accession No: CR597101(ZFP36, Zinc finger protein
10 36, C3H type, homolog(mouse)), GeneBank accession No: CR936799(FHL2, Four and a half LIM domains 2), GeneBank accession No: M24898(NR1D1, Nuclear receptor subfamily 1, group D, member 1), GeneBank accession No: AF132818(KLF5, Kruppel-like factor 5(intestinal)), GeneBank accession No:
15 AK055337(ZNF213, Zinc finger protein 213), GeneBank accession No: BC008834(PHF1, PHD finger protein 1), GeneBank accession No: AK126918(GLIS2, GLIS family zinc finger 2), GeneBank accession No: BC042692(CTL2, Solute carrier family 44, member 2), GeneBank accession No:
20 NM_002224(ITPR3, Inositol 1,4,5-triphosphate receptor, type 3), GeneBank accession No: AK095363(AQP3, Aquaporin 3), GeneBank accession No: NM_174953(ATP2A3, ATPase, Ca++ transporting, ubiquitous), GeneBank accession No: BC042390(VTI1B, Vesicle transport through interaction with
25 t-SNAREs homolog 1B(yeast)), GeneBank accession No:

NM_016113(TRPV2, Transient receptor potential cation channel, subfamily V, member 2), GeneBank accession No: BM926478(RBP1, Retinol binding protein 1, cellular), GeneBank accession No: NM_000069(CACNA1S, Calcium channel, voltage-dependent, L type, alpha 1S subunit), GeneBank accession No: AK002107(RAB3B, RAB3B, member RAS oncogene family), GeneBank accession No: NM_013321(SNX8, Sorting nexin 8), GeneBank accession No: AK125026(SLC6A12, Solute carrier family 6(neurotransmitter transporter, betaine/GABA), member 12), GeneBank accession No: NM_005843(STAM2, Signal transducing adaptor molecule(SH3 domain and ITAM motif) 2), GeneBank accession No: AK092512(SLC16A5, Solute carrier family 16(monocarboxylic acid transporters), member 5), GeneBank accession No: U49248(ABCC2, ATP-binding cassette, sub-family C(CFTR/MRP), member 2), GeneBank accession No: AK172792(SCNN1A, Sodium channel, nonvoltage-gated 1 alpha), GeneBank accession No: BC044656(CASC3, Cancer susceptibility candidate 3), GeneBank accession No: NM_203403(C9orf150, Chromosome 9 open reading frame 150), GeneBank accession No: NM_080388(S100A16, S100 calcium binding protein A16), GeneBank accession No: NM_031286(SH3BGRL3, SH3 domain binding glutamic acid-rich protein like 3), GeneBank accession No: NM_022153(PP2135, Chromosome 10 open reading frame 54), GeneBank accession No: NM_004864(GDF15, Growth

differentiation factor 15), GeneBank accession No:
 NM_003330(TXNRD1, Thioredoxin reductase 1), GeneBank
 accession No: NM_001013632(LOC343521, Similar to
 hypothetical protein 4833401D15), GeneBank accession No:
 5 BX537968(LOC51149, Hypothetical LOC51149), GeneBank
 accession No: BU945318(MT2A, Hypothetical gene supported by
 X97260; BC070289), GeneBank accession No: BQ683841(S100A11,
 S100 calcium binding protein A11(calgizzarin)), GeneBank
 accession No: BQ276852(TMSB10, Thymosin, beta 10), GeneBank
 10 accession No: AK126182(KIAA1949, KIAA1949), GeneBank
 accession No: AK124751(CAPN2, Calpain 2,(m/II) large
 subunit), GeneBank accession No: AK095079(RGC32, Response
 gene to complement 32), GeneBank accession No:
 AB075871(FLJ42654, Golgi transport 1 homolog A(S.
 15 cerevisiae)).

【Claim 20】

The method according to claim 18, wherein the below
 genes are down-regulated by exposure to phenanthrene:

20 GeneBank accession No: AK125150(MAPK8, Mitogen-
 activated protein kinase 8), GeneBank accession No:
 NM_002758(MAP2K6, Mitogen-activated protein kinase kinase
 6), GeneBank accession No: NM_004612(TGFBR1, Transforming
 growth factor, beta receptor I(activin A receptor type II-
 25 like kinase, 53kDa)), GeneBank accession No:

NM_145686(MAP4K4, Mitogen-activated protein kinase kinase kinase kinase 4), GeneBank accession No: XM_042066(MAP3K1, Mitogen-activated protein kinase kinase kinase 1), GeneBank accession No: AB011123(TNIK, TRAF2 and NCK interacting kinase), GeneBank accession No: AB209031(C5, Complement component 5), GeneBank accession No: NM_022740(HIPK2, Homeodomain interacting protein kinase 2), GeneBank accession No: NM_148957(TNFRSF19, Tumor necrosis factor receptor superfamily, member 19), GeneBank accession No: AB208909(ITGB2, Integrin, beta 2(antigen CD18(p95), lymphocyte function-associated antigen 1; macrophage antigen 1(mac-1) beta subunit)), GeneBank accession No: AB209211(TIA1, TIA1 cytotoxic granule-associated RNA binding protein), GeneBank accession No: AB209613(DNASE1L3, Deoxyribonuclease I-like 3), GeneBank accession No: AK122825(HMGB1, High-mobility group box 1), GeneBank accession No: AK127326(PHF17, PHD finger protein 17), GeneBank accession No: AK223503(CASP1, Caspase 1, apoptosis-related cysteine peptidase(interleukin 1, beta, convertase)), GeneBank accession No: BC013326(GAS2, Growth arrest-specific 2), GeneBank accession No: BC047698(IL7, Interleukin 7), GeneBank accession No: D79987(ESPL1, Extra spindle poles like 1(S. cerevisiae)), GeneBank accession No: NM_000893(KNG1, Kininogen 1), GeneBank accession No: NM_001012271(BIRC5, Effector cell peptidase receptor 1),

GeneBank accession No: NM_004938(DAPK1, Death-associated protein kinase 1), GeneBank accession No: NM_005879(TRIP, TRAF interacting protein), GeneBank accession No: NM_014739(BCLAF1, BCL2-associated transcription factor 1),

5 GeneBank accession No: NM_018947(CYCS, Cytochrome c, somatic), GeneBank accession No: AB033337(MPHOSPH1, M-phase phosphoprotein 1), GeneBank accession No: AB209179(PLK1, Polo-like kinase 1(Drosophila)), GeneBank accession No: AB209337(CDC7, CDC7 cell division cycle 7(S. cerevisiae)),

10 GeneBank accession No: AF053305(BUB1, BUB1 budding uninhibited by benzimidazoles 1 homolog(yeast)), GeneBank accession No: AF053306(BUB1B, BUB1 budding uninhibited by benzimidazoles 1 homolog beta(yeast)), GeneBank accession No: AF345347(SPAG5, Sperm associated antigen 5), GeneBank

15 accession No: AK092638(CCNG2, Cyclin G2), GeneBank accession No: AK222819(NUSAP1, Nucleolar and spindle associated protein 1), GeneBank accession No: AL833191(SMC2L1, SMC2 structural maintenance of chromosomes 2-like 1(yeast)), GeneBank accession No: AY257469(CIT, Citron(rho-interacting, serine/threonine kinase 21)),

20 GeneBank accession No: AY367065(ASPM, Asp(abnormal spindle)-like, microcephaly associated(Drosophila)), GeneBank accession No: BC011000(CDCA5, Cell division cycle associated 5), GeneBank accession No: BC032677(UBE2C, Ubiquitin-conjugating enzyme E2C),

25 GeneBank accession No:

BC043502(NEK2, NIMA(never in mitosis gene a)-related kinase 2), GeneBank accession No: BU675073(PTTG1, Pituitary tumor-transforming 1), GeneBank accession No: BX647885(STMN1, Stathmin 1/oncoprotein 18), GeneBank accession No: CR592757(BRRN1, Barren homolog 1(Drosophila)), GeneBank accession No: CR597075(MAPRE2, Microtubule-associated protein, RP/EB family, member 2), GeneBank accession No: CR604810(CCNA2, Cyclin A2), GeneBank accession No: CR933728(CDC2, Cell division cycle 2, G1 to S and G2 to M), GeneBank accession No: NM_000919(PAM, Peptidylglycine alpha-amidating monooxygenase), GeneBank accession No: NM_001790(CDC25C, Cell division cycle 25C), GeneBank accession No: NM_001798(CDK2, Cyclin-dependent kinase 2), GeneBank accession No: NM_001813(CENPE, Centromere protein E, 312kDa), GeneBank accession No: NM_003318(TTK, TTK protein kinase), GeneBank accession No: NM_003981(PRC1, Protein regulator of cytokinesis 1), GeneBank accession No: NM_004523(KIF11, Kinesin family member 11), GeneBank accession No: NM_004701(CCNB2, Cyclin B2), GeneBank accession No: NM_005983(SKP2, S-phase kinase-associated protein 2(p45)), GeneBank accession No: NM_006101(KNTC2, Kinetochore associated 2), GeneBank accession No: NM_006845(KIF2C, Kinesin family member 2C), GeneBank accession No: NM_007375(TARDBP, TAR DNA binding protein), GeneBank accession No: NM_012112(TPX2, TPX2, microtubule-

associated, homolog(*Xenopus laevis*)), GeneBank accession
 No: NM_014750(DLG7, Discs, large homolog 7(*Drosophila*)),
 GeneBank accession No: NM_015097(CLASP2, Cytoplasmic linker
 associated protein 2), GeneBank accession No:
 5 NM_016343(CENPF, Centromere protein F, 350/400ka(mitosis)),
 GeneBank accession No: NM_016426(GTSE1, G-2 and S-phase
 expressed 1), GeneBank accession No: NM_018492(PBK, PDZ
 binding kinase), GeneBank accession No: NM_018685(ANLN,
 Anillin, actin binding protein(scrap homolog, *Drosophila*)),
 10 GeneBank accession No: NM_020242(KNSL7, Kinesin family
 member 15), GeneBank accession No: NM_031966(CCNB1, Cyclin
 B1), GeneBank accession No: NM_138555(KIF23, Kinesin family
 member 23), GeneBank accession No: U65410(MAD2L1, MAD2
 mitotic arrest deficient-like 1(yeast)), GeneBank accession
 15 No: AB020656(CYLD, Cyldromatosis(turban tumor syndrome)),
 GeneBank accession No: AF033122(SESNI, Sestrin 1), GeneBank
 accession No: AK074377(UHRF1, Chromosome 19 open reading
 frame 31), GeneBank accession No: AK091170(CDKN2C, Cyclin-
 dependent kinase inhibitor 2C(p18, inhibits CDK4)),
 20 GeneBank accession No: AK094323(NFYC, Nuclear transcription
 factor Y, gamma), GeneBank accession No: AY366508(LOH11CR2A,
 Loss of heterozygosity, 11, chromosomal region 2, gene A),
 GeneBank accession No: BC033086(TCF19, Transcription factor
 19(SC1)), GeneBank accession No: BC040303(PTP4A1, Protein
 25 tyrosine phosphatase type IVA, member 1), GeneBank

accession No: BC040991(TFDP2, Transcription factor Dp-2(E2F
 dimerization partner 2)), GeneBank accession No:
 BC092412(SGOL2, Shugoshin-like 2(S. pombe)), GeneBank
 accession No: BQ278454(CKS1B, CDC28 protein kinase
 5 regulatory subunit 1B), GeneBank accession No:
 BX649128(SESN3, Sestrin 3), GeneBank accession No:
 CD049340(AURKB, Aurora kinase B), GeneBank accession No:
 M89914(NF1, Neurofibromin 1(neurofibromatosis, von
 Recklinghausen disease, Watson disease)), GeneBank
 10 accession No: NM_001005414(ZWINT, ZW10 interactor
 antisense), GeneBank accession No: NM_001008491(Sep 2,
 Septin 2), GeneBank accession No: NM_001274(CHEK1, CHK1
 checkpoint homolog(S. pombe)), GeneBank accession No:
 NM_002105(H2AFX, H2A histone family, member X), GeneBank
 15 accession No: NM_002388(MCM3, MCM3 minichromosome
 maintenance deficient 3(S. cerevisiae)), GeneBank accession
 No: NM_002417(MKI67, Antigen identified by monoclonal
 antibody Ki-67), GeneBank accession No: NM_002875(RAD51,
 RAD51 homolog(RecA homolog, E. coli)(S. cerevisiae)),
 20 GeneBank accession No: NM_003884(PCAF, P300/CBP-associated
 factor), GeneBank accession No: NM_004526(MCM2, MCM2
 minichromosome maintenance deficient 2, mitotin(S.
 cerevisiae)), GeneBank accession No: NM_004847(AIF1,
 Allograft inflammatory factor 1), GeneBank accession No:
 25 NM_005915(MCM6, MCM6 minichromosome maintenance deficient

6(MIS5 homolog, *S. pombe*)(*S. cerevisiae*)), GeneBank
 accession No: NM_012090(MACF1, Microtubule-actin
 crosslinking factor 1), GeneBank accession No:
 NM_012415(RAD54B, RAD54 homolog B(*S. cerevisiae*)), GeneBank
 5 accession No: NM_014264(PLK4, Polo-like kinase
 4(*Drosophila*)), GeneBank accession No: NM_015714(G0S2,
 G0/G1switch 2), GeneBank accession No: NM_024680(FLJ23311,
 E2F transcription factor 8), GeneBank accession No:
 XM_034274(MYBL1, V-myb myeloblastosis viral oncogene
 10 homolog(avian)-like 1), GeneBank accession No:
 AK001720(FLJ10858, Nei endonuclease VIII-like 3(*E. coli*)),
 GeneBank accession No: AY032677(POLQ, Polymerase(DNA
 directed), theta), GeneBank accession No: BC034480(BLM,
 Bloom syndrome), GeneBank accession No: BC073161(RAD51C,
 15 RAD51 homolog C(*S. cerevisiae*)), GeneBank accession No:
 CR600021(HMGB2, High-mobility group box 2), GeneBank
 accession No: CR625391(RAD51AP1, RAD51 associated protein
 1), GeneBank accession No: CR936783(FLJ40869, Hypothetical
 protein LOC284952), GeneBank accession No:
 20 DQ140356(KIAA1596, Fanconi anemia, complementation group M),
 GeneBank accession No: NM_001067(TOP2A, Topoisomerase(DNA)
 II alpha 170kDa), GeneBank accession No: NM_001618(PARP1,
 Poly(ADP-ribose) polymerase family, member 1), GeneBank
 accession No: NM_003362(UNG, Uracil-DNA glycosylase),
 25 GeneBank accession No: NM_006904(PRKDC, Protein kinase,

DNA-activated, catalytic polypeptide), GeneBank accession
 No: NM_130398(EXO1, Exonuclease 1), GeneBank accession No:
 AB020807(TLR6, Toll-like receptor 6), GeneBank accession
 No: AB032980(DCDC2, Doublecortin domain containing 2),
 5 GeneBank accession No: AB209866(TFPI, Tissue factor pathway
 inhibitor(lipoprotein-associated coagulation inhibitor)),
 GeneBank accession No: AK057015(HSPA4, Heat shock 70kDa
 protein 4), GeneBank accession No: AK095515(IFIT1,
 Interferon-induced protein with tetratricopeptide repeats
 10 1), GeneBank accession No: AK122686(IF, I
 factor(complement)), GeneBank accession No: AK123010(RRM2,
 Ribonucleotide reductase M2 polypeptide), GeneBank
 accession No: BC035582(TRIM22, Tripartite motif-containing
 22), GeneBank accession No: BX537894(LOC493869, Similar to
 15 RIKEN cDNA 2310016C16), GeneBank accession No: M14338(PROS1,
 Protein S(alpha)), GeneBank accession No: NM_000821(GGCX,
 Gamma-glutamyl carboxylase), GeneBank accession No:
 NM_000963(PTGS2, Prostaglandin-endoperoxide synthase
 2(prostaglandin G/H synthase and cyclooxygenase)), GeneBank
 20 accession No: NM_001001547(CD36, CD36 antigen(collagen type
 I receptor, thrombospondin receptor)), GeneBank accession
 No: NM_001512(GSTA4, Glutathione S-transferase A4),
 GeneBank accession No: NM_001629(ALOX5AP, Arachidonate 5-
 lipoxygenase-activating protein), GeneBank accession No:
 25 NM_001752(CAT, Catalase), GeneBank accession No:

NM_001837(CCR3, Chemokine(C-C motif) receptor 3), GeneBank
 accession No: NM_001979(EPHX2, Epoxide hydrolase 2,
 cytoplasmic), GeneBank accession No: NM_001994(F13B,
 Coagulation factor XIII, B polypeptide), GeneBank accession
 5 No: NM_002182(IL1RAP, Interleukin 1 receptor accessory
 protein), GeneBank accession No: NM_006120(HLA-DMA, Major
 histocompatibility complex, class II, DM alpha), GeneBank
 accession No: NM_173216(SIAT1, ST6 beta-galactosamide
 alpha-2,6-sialyltransferase 1), GeneBank accession No:
 10 NM_202002(FOXM1, Forkhead box M1), GeneBank accession No:
 AB163917(LRAP, Leukocyte-derived arginine aminopeptidase),
 GeneBank accession No: BC027881(AFP, Alpha-fetoprotein),
 GeneBank accession No: NM_015915(SPG3A, Spastic paraplegia
 3A(autosomal dominant)), GeneBank accession No:
 15 NM_000671(ADH5, Alcohol dehydrogenase 5(class III), chi
 polypeptide), GeneBank accession No: J05428(UGT2B7, UDP
 glucuronosyltransferase 2 family, polypeptide B7), GeneBank
 accession No: NM_000672(ADH6, Alcohol dehydrogenase 6(class
 V)), GeneBank accession No: M15943(ADH4, Alcohol
 20 dehydrogenase 4(class II), pi polypeptide), GeneBank
 accession No: AK223395(FBP1, Fructose-1,6-bisphosphatase 1),
 GeneBank accession No: NM_000151(G6PC, Glucose-6-
 phosphatase, catalytic(glycogen storage disease type I, von
 Gierke disease)), GeneBank accession No: XM_113962(KIAA0650,
 25 Structural maintenance of chromosomes flexible hinge domain

containing 1), GeneBank accession No: AB020644(ACSL6, Acyl-CoA synthetase long-chain family member 6), GeneBank accession No: AB209907(PLD1, Phospholipase D1, phosphatidylcholine-specific), GeneBank accession No: 5 AF285167(ABCA1, ATP-binding cassette, sub-family A(ABC1), member 1), GeneBank accession No: AF297872(TRERF1, Transcriptional regulating factor 1), GeneBank accession No: AF303134(ALDH8A1, Aldehyde dehydrogenase 8 family, member A1), GeneBank accession No: AF339053(PLA2G12B, 10 Phospholipase A2, group XIIB), GeneBank accession No: AK096018(HADHSC, L-3-hydroxyacyl-Coenzyme A dehydrogenase, short chain), GeneBank accession No: AK124635(PCSK9, Proprotein convertase subtilisin/kexin type 9), GeneBank accession No: AK127346(SIAT9, ST3 beta-galactoside alpha- 15 2,3-sialyltransferase 5), GeneBank accession No: AL359559(AGPS, Alkylglycerone phosphate synthase), GeneBank accession No: AY691170(PLCL3, Phospholipase C-like 3), GeneBank accession No: BG567934(APOM, Apolipoprotein M), GeneBank accession No: BX538214(C6orf167, Chromosome 6 open 20 reading frame 167), GeneBank accession No: BX640945(FADS2, Fatty acid desaturase 2), GeneBank accession No: BX648473(PIGK, Phosphatidylinositol glycan, class K), GeneBank accession No: BX648557(HSD17B2, Hydroxysteroid(17-beta) dehydrogenase 2), GeneBank accession No: 25 CR749601(ETNK1, Death-associated protein kinase 3),

GeneBank accession No: NM_000859(HMGCR, 3-hydroxy-3-methylglutaryl-Coenzyme A reductase), GeneBank accession No: NM_001443(FABP1, Fatty acid binding protein 1, liver), GeneBank accession No: NM_002130(HMGCS1, 3-hydroxy-3-methylglutaryl-Coenzyme A synthase 1(soluble)), GeneBank accession No: NM_003725(RODH, Hydroxysteroid(17-beta) dehydrogenase 6), GeneBank accession No: NM_004845(PCYT1B, Phosphate cytidylyltransferase 1, choline, beta), GeneBank accession No: NM_014762(DHCR24, 24-dehydrocholesterol reductase), GeneBank accession No: NM_020139(DHRS6, Dehydrogenase/reductase(SDR family) member 6), GeneBank accession No: NM_020918(GPAM, Glycerol-3-phosphate acyltransferase, mitochondrial), GeneBank accession No: NM_032523(OSBPL6, Oxysterol binding protein-like 6), GeneBank accession No: NM_033505(SELI, Selenoprotein I), GeneBank accession No: Z28339(AKR1D1, Aldo-keto reductase family 1, member D1(delta 4-3-ketosteroid-5-beta-reductase)), GeneBank accession No: AK024899(ENPP3, Ectonucleotide pyrophosphatase/ phosphodiesterase 3), GeneBank accession No: AK025546(PTPN4, Protein tyrosine phosphatase, non-receptor type 4(megakaryocyte)), GeneBank accession No: AK124910(ENPP2, Ectonucleotide pyrophosphatase/phosphodiesterase 2(autotaxin)), GeneBank accession No: BC035116(FLJ35059 fis, CDNA FLJ30761 fis, clone FEBRA2000538), GeneBank accession No: BC050565(PASK,

PAS domain containing serine/threonine kinase), GeneBank
 accession No: L13436(NPR2, Natriuretic peptide receptor
 B/guanylate cyclase B(atrionatriuretic peptide receptor B)),
 GeneBank accession No: NM_001005862(ERBB2, V-erb-b2
 5 erythroblastic leukemia viral oncogene homolog 2,
 neuro/glioblastoma derived oncogene homolog(avian)),
 GeneBank accession No: NM_005012(ROR1, Receptor tyrosine
 kinase-like orphan receptor 1), GeneBank accession No:
 NM_006035(CDC42BPB, CDC42 binding protein kinase beta(DMPK-
 10 like)), GeneBank accession No: NM_014791(MELK, Maternal
 embryonic leucine zipper kinase), GeneBank accession No:
 NM_023028(FGFR2, Fibroblast growth factor receptor
 2(bacteria-expressed kinase, keratinocyte growth factor
 receptor, craniofacial dysostosis 1, Crouzon syndrome,
 15 Pfeiffer yndrome, Jackson-Weiss syndrome)), GeneBank
 accession No: NM_080836(STK35, Serine/threonine kinase 35),
 GeneBank accession No: AF419331(FUSIP1, FUS interacting
 protein(serine/arginine-rich) 1), GeneBank accession No:
 AK091927(SFRS3, Splicing factor, arginine/serine-rich 3),
 20 GeneBank accession No: BC010266(HNRNPA1, Heterogeneous
 nuclear ribonucleoprotein A1), GeneBank accession No:
 BC012360(CTAGE5, CTAGE family, member 5), GeneBank
 accession No: BC036046(PLRG1, Pleiotropic regulator 1(PRL1
 homolog, Arabidopsis)), GeneBank accession No:
 25 BC065384(PCF11, PCF11, cleavage and polyadenylation factor

subunit, homolog(*S. cerevisiae*)), GeneBank accession No: BX537360(CPSF5, Nudix(nucleoside diphosphate linked moiety X)-type motif 21), GeneBank accession No: BX537494(HNRPA2B1, Heterogeneous nuclear ribonucleoprotein A2/B1), GeneBank
5 accession No: BX647784(HNRPR, Heterogeneous nuclear ribonucleoprotein R), GeneBank accession No: CA455267(PPIH, Peptidyl prolyl isomerase H(cyclophilin H)), GeneBank accession No: CR596214(HNRPA0, Heterogeneous nuclear ribonucleoprotein A0), GeneBank accession No:
10 NM_001326(CSTF3, Hypothetical protein LOC283267), GeneBank accession No: NM_004640(BAT1, HLA-B associated transcript 1), GeneBank accession No: NM_005463(HNRPDL, Heterogeneous nuclear ribonucleoprotein D-like), GeneBank accession No: NM_006924(SFRS1, Splicing factor, arginine/serine-rich
15 1(splicing factor 2, alternate splicing factor)), GeneBank accession No: NM_012426(SF3B3, Splicing factor 3b, subunit 3, 130kDa), GeneBank accession No: NM_018048(FLJ10292, Mago-nashi homolog), GeneBank accession No: NM_030919(C20orf129, Chromosome 20 open reading frame 129),
20 GeneBank accession No: NM_031370(HNRPD, Heterogeneous nuclear ribonucleoprotein D(AU-rich element RNA binding protein 1, 37kDa)), GeneBank accession No: NM_138933(ACF, Apobec-1 complementation factor), GeneBank accession No: AB193259(ACE2, Angiotensin I converting enzyme(peptidyl-
25 dipeptidase A) 2), GeneBank accession No: BX648769(EWSR1,

Ewing sarcoma breakpoint region 1), GeneBank accession No: AB023154(DTX4, Deltex 4 homolog(Drosophila)), GeneBank accession No: AL543755(VAV3, Vav 3 oncogene), GeneBank accession No: M75106(CPB2, Carboxypeptidase B2(plasma, carboxypeptidase U)), GeneBank accession No: NM_021045(ZNF248, Zinc finger protein 248), GeneBank accession No: AB209194(B4GALT6, UDP-Gal:betaGlcNAc beta 1,4- galactosyltransferase, polypeptide 6), GeneBank accession No: AF279145(ANTXR1, Anthrax toxin receptor 1), GeneBank accession No: NM_025074(FRAS1, Fraser syndrome 1), GeneBank accession No: AK025790(KIF20A, Kinesin family member 20A), GeneBank accession No: NM_006152(LRMP, Lymphoid-restricted membrane protein), GeneBank accession No: NM_000340(SLC2A2, Solute carrier family 2(facilitated glucose transporter), member 2), GeneBank accession No: AF071592(KIF4A, Kinesin family member 4A), GeneBank accession No: NM_013277(RACGAP1, Rac GTPase activating protein 1), GeneBank accession No: AY043484(SCN1A, Sodium channel, voltage-gated, type I, alpha), GeneBank accession No: AY791349(KIF18A, Kinesin family member 18A), GeneBank accession No: NM_018018(SLC38A4, Solute carrier family 38, member 4), GeneBank accession No: AK094603(FLJ37284 fis, unnamed protein product; Homo sapiens cDNA FLJ37284 fis, clone BRAMY2013590.), GeneBank accession No: NM_021069(ARGBP2, Sorbin and SH3 domain containing 2),

GeneBank accession No: NM_001005747(CACNB4, Calcium channel, voltage-dependent, beta 4 subunit), GeneBank accession No: AJ496568(SLC25A12, Solute carrier family 25(mitochondrial carrier, Aralar), member 12), GeneBank accession No: 5 NM_030641(APOL6, Apolipoprotein L, 6), GeneBank accession No: NM_173512(FLJ39822, Hypothetical protein FLJ39822), GeneBank accession No: NM_000037(ANK1, Ankyrin 1, erythrocytic), GeneBank accession No: NM_001011554(SLC13A3, Solute carrier family 13(sodium-dependent dicarboxylate 10 transporter), member 3), GeneBank accession No: AB091343(C10orf3, Centrosomal protein 55kDa), GeneBank accession No: AK000643(ASB9, Ankyrin repeat and SOCS box-containing 9), GeneBank accession No: AK055221(FBXO5, F-box protein 5), GeneBank accession No: AK075271(SPTLC2L, Serine 15 palmitoyltransferase, long chain base subunit 2-like(aminotransferase 2)), GeneBank accession No: AK122685(GLUD1, Glutamate dehydrogenase 1), GeneBank accession No: AK127098(FLJ10706, Chromosome 1 open reading frame 112), GeneBank accession No: AL133031(MLR1, 20 Transcription factor MLR1), GeneBank accession No: AY007723(MAL2, Mal, T-cell differentiation protein 2), GeneBank accession No: BC022255(Spc25, Spindle pole body component 25 homolog(*S. cerevisiae*)), GeneBank accession No: BC041882(ATF7IP2, Activating transcription factor 7 25 interacting protein 2), GeneBank accession No:

BC052951(LMNB1, Lamin B1), GeneBank accession No:
BC098313(FLJ20641, Hypothetical protein FLJ20641), GeneBank
accession No: NM_001809(CENPA, Centromere protein A, 17kDa),
GeneBank accession No: NM_145061(C13orf3, Chromosome 13
5 open reading frame 3), GeneBank accession No:
XM_372695(LOC390859, PREDICTED: Homo sapiens similar to
Chain A, Crystal Structure Of The R463a Mutant Of Human
Glutamate Dehydrogenase(LOC390859), mRNA).

10 **【Claim 21】**

The method according to claim 18, wherein the human
somatic cell of step 1) is originated from human liver or
liver cancer cells or tissues.

15 **【Claim 22】**

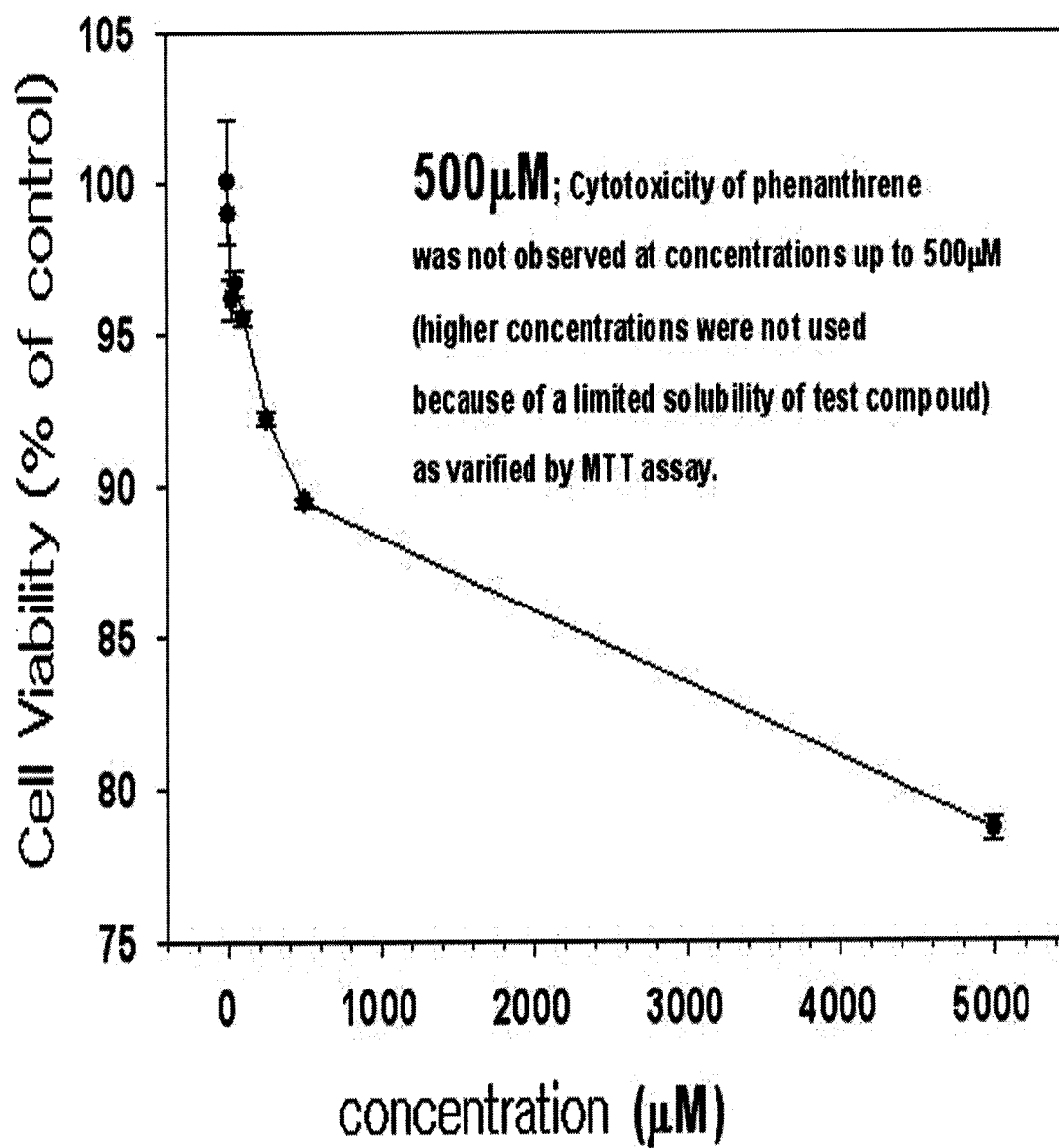
The method according to claim 21, wherein the human
liver cancer cell is HepG2.

【Claim 23】

20 The method according to claim 18, wherein the primer
set of step 2) is composed of at least 2 forward primers
and reverse primers selected from the group consisting of
sequences represented by SEQ. ID. NO: 1 -NO: 56.

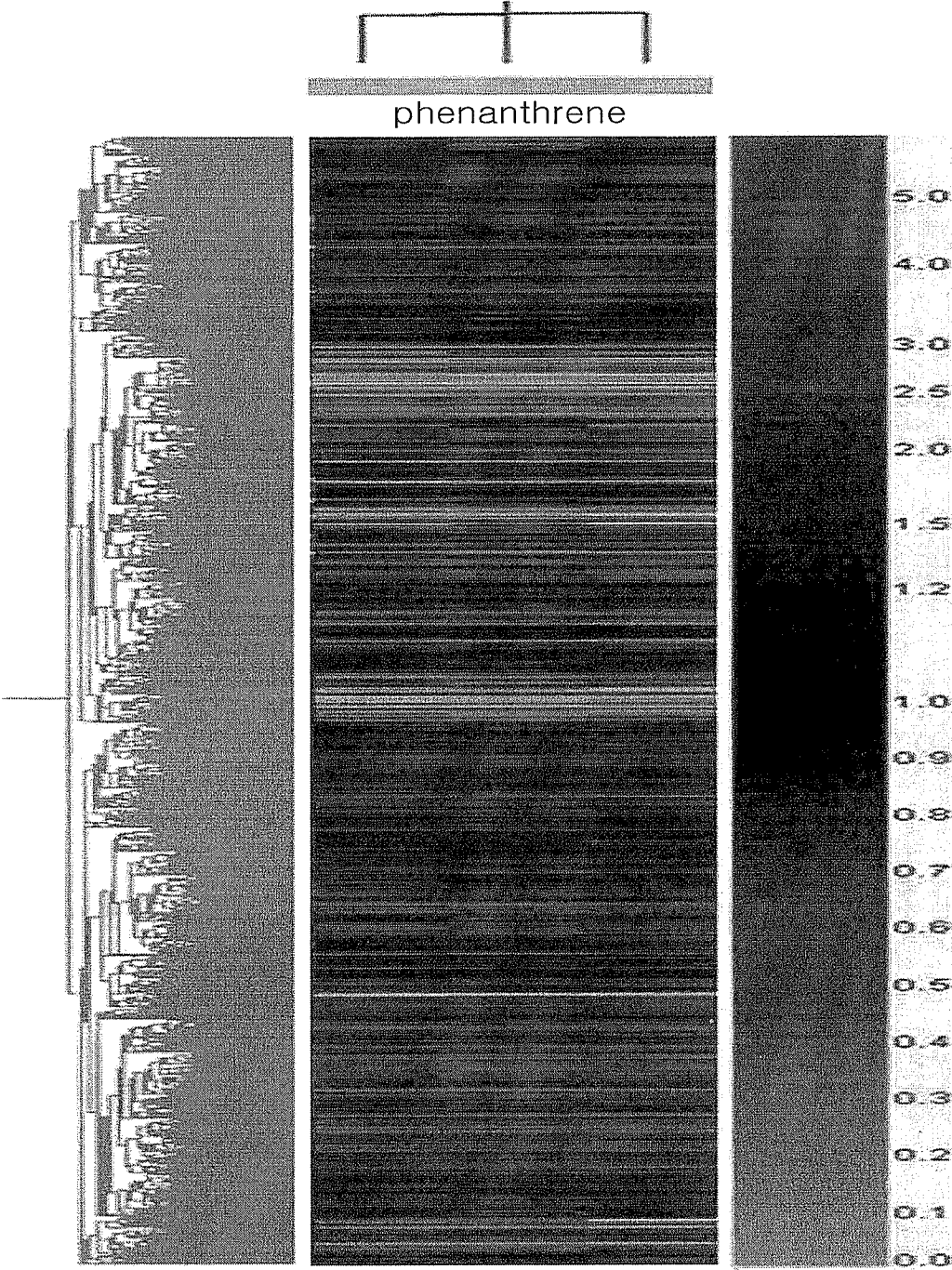
1/2

[Fig. 1]



2/2

[Fig. 2]



PATENT COOPERATION TREATY

PCT

DECLARATION OF NON-ESTABLISHMENT OF INTERNATIONAL SEARCH REPORT
(PCT Article 17(2)(a), Rules 13ter.1(c) and (d) and 39)

Applicant's or agent's file reference 8fpo-07-21	IMPORTANT DECLARATION	Date of mailing (<i>day/month/year</i>) 28 APRIL 2009 (28.04.2009)
International application No. PCT/KR2008/005022	International filing date (<i>day/month/year</i>) 27 AUGUST 2008 (27.08.2008)	(Earliest) Priority date (<i>day/month/year</i>) 06 AUGUST 2008 (06.08.2008)
International Patent Classification (IPC) or both national classification and IPC <i>C12N 15/10(2006.01)i</i>		
Applicant KOREA INSTITUTE OF SCIENCE AND TECHNOLOGY et al		

This International Searching Authority hereby declares, according to Article 17(2)(a), that **no international search report will be established** on the international application for the reasons indicated below.

- ☒ The subject matter of the international application relates to:
 - ☐ scientific theories.
 - ☐ mathematical theories.
 - ☐ plant varieties.
 - ☐ animal varieties.
 - ☐ essentially biological processes for the production of plants and animals, other than microbiological processes and the products of such processes.
 - ☐ schemes, rules or methods of doing business.
 - ☐ schemes, rules or methods of performing purely mental acts.
 - ☐ schemes, rules or methods of playing games.
 - ☐ methods for treatment of the human body by surgery or therapy.
 - ☐ methods for treatment of the animal body by surgery or therapy.
 - ☒ diagnostic methods practised on the human or animal body.
 - ☐ mere presentation of information.
 - ☐ computer programs for which this International Searching Authority is not equipped to search prior art.
- ☒ The failure of the following parts of the international application to comply with prescribed requirements prevents a meaningful search from being carried out:

☐ the description
 ☒ the claims
 ☐ the drawings
- ☐ A meaningful search could not be carried out without the sequence listing; the applicant did not, within the prescribed time limit:

☐ furnish a sequence listing on paper complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Searching Authority in a form and manner acceptable to it.
☐ furnish a sequence listing in electronic form complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Searching Authority in a form and manner acceptable to it.
☐ pay the required late furnishing fee for the furnishing of a sequence listing in response to an invitation under Rule 13ter.1(a) or (b)
- ☐ A meaningful search could not be carried out without the tables related to the sequence listings; the applicant did not, within the prescribed time limit, furnish such tables in electronic form complying with the technical requirements provided for in Annex C-bis of the Administrative Instructions, and such tables were not available to the International Searching Authority in a form and manner acceptable to it.
- Further comments:

Name and mailing address of ISA/KR  Korean Intellectual Property Office Government Complex-Daejeon, 139 Seonsa-ro, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer JEONG Eui Jun Telephone No. 82-42-481-5549 