

Fig 1-III-3-11 Inflammatory Cytokines & Receptors 遺伝子
Scatter Plot (direct) *Aldh2* genotype 曝露前後比較

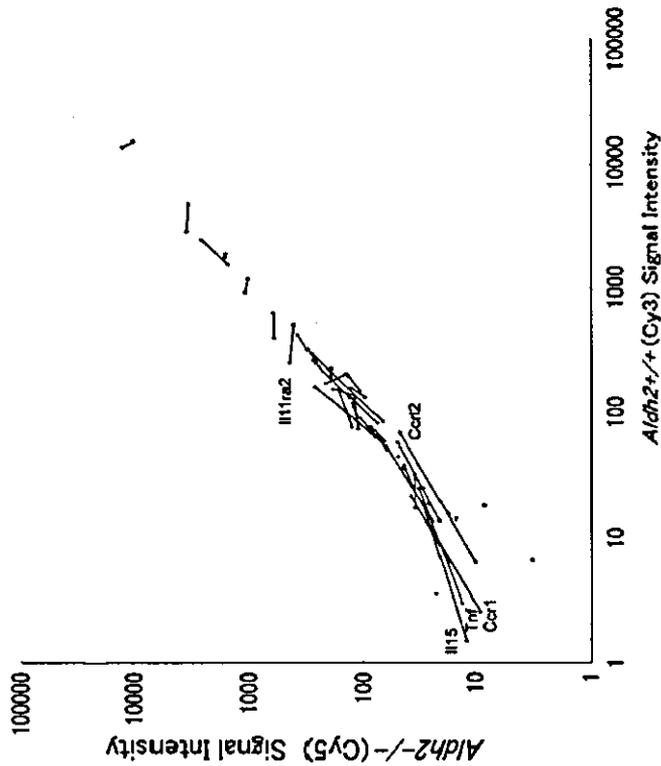


Table 1-III-3-11 Inflammatory Cytokines & Receptors 遺伝子

Gene Bank Accession	Description	Gene Name
NM_011331	Chemokine (C-C motif) ligand 12	Ccl12
NM_011332	Chemokine (C-C motif) ligand 17	Ccl17
NM_011888	Chemokine (C-C motif) ligand 19	Ccl19
NM_016960	Chemokine (C-C motif) ligand 20	Ccl20
NM_009137	Chemokine (C-C motif) ligand 22	Ccl22
NM_019577	Chemokine (C-C motif) ligand 24	Ccl24
NM_009138	Chemokine (C-C motif) ligand 25	Ccl25
NM_013652	Chemokine (C-C motif) ligand 4	Ccl4
NM_013654	Chemokine (C-C motif) ligand 7	Ccl7
NM_021443	Chemokine (C-C motif) ligand 8	Ccl8
NM_009912	Chemokine (C-C motif) receptor 1	Ccr1
NM_009916	Chemokine (C-C motif) receptor 4	Ccr4
NM_009913	Chemokine (C-C motif) receptor 9	Ccr9

NM_017466	Chemokine (C-C motif) receptor-like 2	Cxcl13
NM_009914	Chemokine (C-C) receptor_3	Ccr3
NM_013655	Chemokine (C-X-C motif) ligand 12	Cxcl12
NM_019568	Chemokine (C-X-C motif) ligand 14	Cxcl14
NM_011333	Chemokine (C-X-C motif) ligand 15	Cxcl15
NM_008599	Chemokine (C-X-C motif) ligand 9	Cxcl9
NM_009910	Chemokine (C-X-C motif) receptor_3	Cxcr3
NM_030712	Chemokine (C-X-C motif) receptor_6	Cxcr6
NM_134103	Interleukin 1 receptor accessory protein	Il1rap
NM_010555	Interleukin 1 receptor, type II	Il1r2
NM_008349	Interleukin 10 receptor, beta	Il10rb
NM_008350	Interleukin 11	Il11
NM_010549	Interleukin 11 receptor, alpha chain 1	Il11ra1
NM_010550	Interleukin 11 receptor, alpha chain 2	Il11ra2
NM_008357	Interleukin 15	Il15
NM_008359	Interleukin 17 receptor	Il17r
NM_010531	Interleukin 18 binding protein	Il18bp
NM_021887	Interleukin 21 receptor	Il21r
NM_016971	Interleukin 22	Il22
NM_031252	Interleukin 23, alpha subunit p19	Il23a
NM_010557	Interleukin 4 receptor, alpha	Il4ra
NM_010561	Interleukin enhancer binding factor 3	Il3
NM_010736	Lymphotxin B receptor	Ltbr
NM_010798	Macrophage migration inhibitory factor	Mif
NM_009143	Stromal cell derived factor 2	Sdf2
NM_031199	Transforming growth factor alpha	Tgfa
NM_009367	Transforming growth factor, beta 2	Tgfb2
NM_009368	Transforming growth factor, beta 3	Tgfb3
NM_013693	Tumor necrosis factor	Tnf
NM_008764	Tumor necrosis factor receptor superfamily, member 11b (osteoprotegerin)	Tnfr11b
NM_028075	Tumor necrosis factor receptor superfamily, member 13c	Tnfr13c
NM_011606	Tumor necrosis factor receptor superfamily, member 17	Tnfr17
NM_013869	Tumor necrosis factor receptor superfamily, member 19	Tnfr19
NM_052975	Tumor necrosis factor receptor superfamily, member 21	Tnfr21
NM_011659	Tumor necrosis factor receptor superfamily, member 4	Tnfr4

Fig 1-III-3-12 Th1-Th2-Th3 関連遺伝子

Scatter Plot (direct) Aldh2 genotype 曝露前後比較

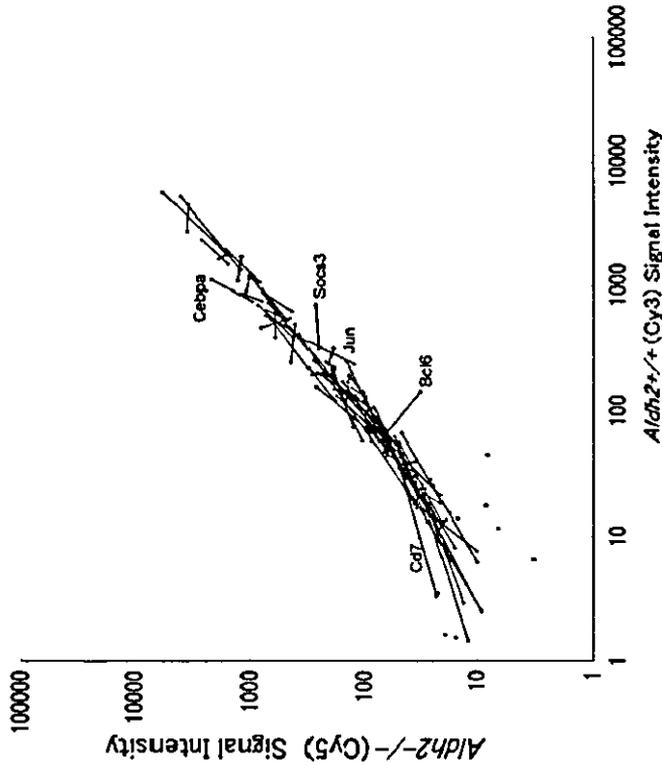


Table 1-III-3-12 Th1-Th2-Th3 関連遺伝子

Gene Bank Accession	Description	Gene Name
NM_009740	B-cell leukemia/lymphoma 10	Bcl10
NM_009741	B-cell leukemia/lymphoma 2	Bcl2
NM_009744	B-cell leukemia/lymphoma 6	Bcl6
NM_021399	B-cell lymphoma/leukaemia 11B	Bcl11b
NM_007530	B-cell receptor-associated protein 29	Bcap29
NM_012060	B-cell receptor-associated protein 31	Bcap31
NM_007531	B-cell receptor-associated protein 37	Bcap37
NM_007678	CCAAT/enhancer binding protein (C/EBP), alpha	Cebpa
NM_009841	CD14 antigen	Cd14
NM_053094	CD163 antigen	Cd163
NM_016898	CD164 antigen	Cd164
NM_007640	CD1d2 antigen	Cd1d2
NM_027353	CD2 antigen (cytoplasmic tail) binding protein 2	Cd2bp2

NM_026972	CD209b antigen	Cd209b
NM_009846	CD24a antigen	Cd24a
NM_013929	Cd27 binding protein (Hindu God of destruction)	Siva
NM_007648	CD3 antigen, epsilon polypeptide	Cd3e
NM_031162	CD3 antigen, zeta polypeptide	Cd3z
NM_007643	CD36 antigen	Cd36
NM_013706	CD52 antigen	Cd52
NM_007652	CD59a antigen	Cd59a
NM_009852	CD6 antigen	Cd6
NM_009853	CD68 antigen	Cd7
NM_009854	CD7 antigen	Cd79b
NM_008339	CD79B antigen	Cd83
NM_009856	CD83 antigen	Cd8b
NM_007657	CD9 antigen	Cd9
NM_011331	Chemokine (C-C motif) ligand 12	Ccl12
NM_011332	Chemokine (C-C motif) ligand 17	Ccl17
NM_011898	Chemokine (C-C motif) ligand 19	Ccl19
NM_016960	Chemokine (C-C motif) ligand 20	Ccl20
NM_009137	Chemokine (C-C motif) ligand 22	Ccl22
NM_019577	Chemokine (C-C motif) ligand 24	Ccl24
NM_009138	Chemokine (C-C motif) ligand 25	Ccl25
NM_013652	Chemokine (C-C motif) ligand 4	Ccl4
NM_013654	Chemokine (C-C motif) ligand 7	Ccl7
NM_021443	Chemokine (C-C motif) ligand 8	Ccl8
NM_009912	Chemokine (C-C motif) receptor 1	Ccr1
NM_009916	Chemokine (C-C motif) receptor 4	Ccr4
NM_009913	Chemokine (C-C motif) receptor 9	Ccr9
NM_017466	Chemokine (C-C motif) receptor-like 2	Ccr12
NM_009914	Chemokine (C-C) receptor 3	Ccr3
NM_013655	Chemokine (C-X-C motif) ligand 12	Cxcl12
NM_019568	Chemokine (C-X-C motif) ligand 14	Cxcl14
NM_011339	Chemokine (C-X-C motif) ligand 15	Cxcl15
NM_008599	Chemokine (C-X-C motif) ligand 9	Cxcl9
NM_009910	Chemokine (C-X-C motif) receptor 3	Cxcr3
NM_030712	Chemokine (C-X-C motif) receptor 6	Cxcr6
NM_007778	Colony stimulating factor 1 (macrophage)	Csf1
NM_007780	Colony stimulating factor 2 receptor, beta 1, low-affinity (granulocyte-macrophage)	Csf1rb1
NM_007781	Colony stimulating factor 2 receptor, beta 2, low-affinity (granulocyte-macrophage)	Csf1rb2
NM_009971	Colony stimulating factor 3 (granulocyte)	Csf3
NM_011565	Cytotoxic granule-associated RNA binding protein 1	Tar1
NM_007796	Cytotoxic T lymphocyte-associated protein 2 alpha	Ctla2a
NM_007948	Excision repair cross-complementing rodent repair deficiency, complementation group 1	Ercc1
NM_015769	Excision repair cross-complementing rodent repair deficiency, complementation group 4	Ercc4

	Excision repair cross-complementing rodent repair deficiency, complementation group 5	Erc5
NM_011729	Excision repair cross-complementing rodent repair deficiency, complementation group 5	Erc5
NM_010234	FB1 osteosarcoma oncogene	Fos
NM_008037	Fos-like antigen 2	FosL2
NM_008157	G protein-coupled receptor 19	Gpr19
NM_010195	G protein-coupled receptor 49	Gpr49
NM_018882	G protein-coupled receptor 56	Gpr56
NM_010287	G protein-coupled receptor 83	Gpr83
NM_030726	G protein-coupled receptor 90	Gpr90
NM_008090	GATA binding protein 2	Gata2
NM_008091	GATA binding protein 3	Gata3
NM_008093	GATA binding protein 5	Gata5
NM_018770	Immunoglobulin superfamily, member 4	Igsf4a
NM_008391	Interferon regulatory factor 2	Ir2
NM_016949	Interferon regulatory factor 3	Ir3
NM_134103	Interleukin 1 receptor accessory protein	Il1rap
NM_010555	Interleukin 1 receptor, type II	Il1r2
NM_008249	Interleukin 10 receptor, beta	Il10r2
NM_008350	Interleukin 11	Il11
NM_010549	Interleukin 11 receptor, alpha chain 1	Il11ra1
NM_010550	Interleukin 11 receptor, alpha chain 2	Il11ra2
NM_008357	Interleukin 15	Il15
NM_008359	Interleukin 17 receptor	Il17r
NM_010531	Interleukin 18 binding protein	Il18bp
NM_021887	Interleukin 21 receptor	Il21r
NM_016971	Interleukin 22	Il22
NM_031252	Interleukin 23, alpha subunit p19	Il23a
NM_010557	Interleukin 4 receptor, alpha	Il4ra
NM_010561	Interleukin enhancer binding factor 3	Ilf3
NM_008413	Janus kinase 2	Jak2
NM_010591	Jun oncogene	Jun
NM_006507	Linker of T-cell receptor pathways	Lnk
NM_009158	Mitogen activated protein kinase 10	Mapk10
NM_011951	Mitogen activated protein kinase 14	Mapk14
NM_016700	Mitogen activated protein kinase 8	Mapk8
NM_016961	Mitogen activated protein kinase 9	Mapk9
NM_011941	Mitogen activated protein kinase binding protein 1	Mapkbp1
NM_008927	Mitogen activated protein kinase kinase 1	Map2k1
NM_011840	Mitogen activated protein kinase kinase 5	Map2k5
NM_009582	Mitogen activated protein kinase kinase 12	Map3k12
NM_011948	Mitogen activated protein kinase kinase 4	Map3k4
NM_008580	Mitogen activated protein kinase kinase 5	Map3k5
NM_009006	Mitogen activated protein kinase kinase 2	Mep4k2
NM_011841	Mitogen-activated protein kinase 7	Mapk7
NM_021921	Mitogen-activated protein kinase 8 interacting protein 2	Mak8ip2
NM_013931	Mitogen-activated protein kinase 8 interacting protein 3	Map8ip3
NM_019920	Mitogen-activated protein kinase 1 interacting protein 1	Map2k1ip1

NM_016896	Mitogen-activated protein kinase kinase 14	Map3k14
NM_016713	Mitogen-activated protein kinase kinase kinase 6	Map4k6
NM_011210	Protein tyrosine phosphatase, receptor type, C	Ptprc
NM_009762	SET and MYND domain containing 1	Smyd1
NM_019963	Signal transducer and activator of transcription 2	Stat2
NM_011487	Signal transducer and activator of transcription 4	Stat4
NM_011489	Signal transducer and activator of transcription 5B	Stat5b
NM_007706	Suppressor of cytokine signaling 2	Socs2
NM_007707	Suppressor of cytokine signaling 3	Socs3
NM_019654	Suppressor of cytokine signaling 5	Socs5
NM_019507	T-box 21	Tbx21
NM_009368	Transforming growth factor, beta 3	Tgfb3
NM_013693	Tumor necrosis factor	Tnf
NM_052975	Tumor necrosis factor receptor superfamily, member 21	Tnfrsf21
NM_011659	Tumor necrosis factor receptor superfamily, member 4	Tnfrsf4
NM_018793	Tyrosine kinase 2	Tyk2

Fig 1-III-3-13 Dehydrogenase 酵素遺伝子

Scatter Plot (direct) Aldh2 genotype 曝露前後比較

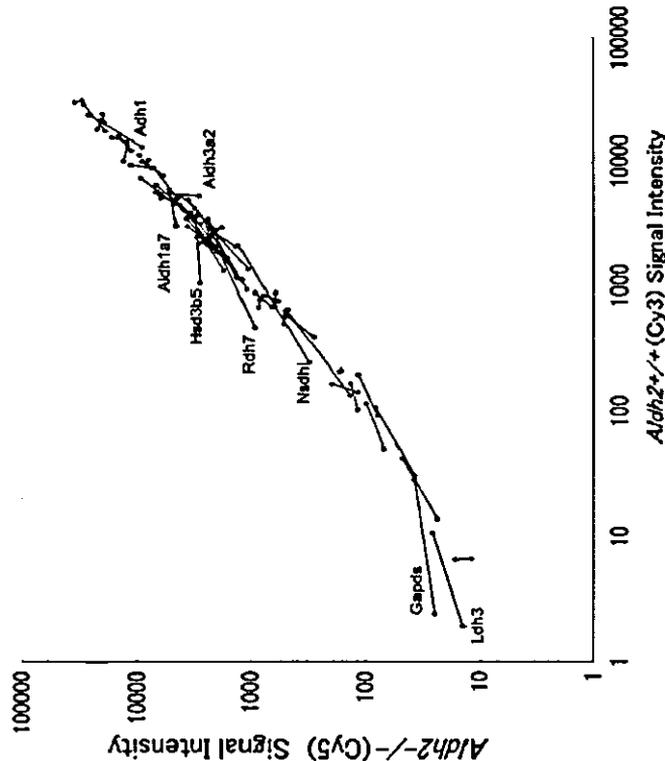


Table 1-III-3-13 Dehydrogenase 酵素遺伝子

GeneBank Accession	Description	Gene name
NM_007381	Acetyl-Coenzyme A dehydrogenase, long-chain	Acadl
NM_007382	Acetyl-Coenzyme A dehydrogenase, medium chain	Acadm
NM_007383	Acetyl-Coenzyme A dehydrogenase, short chain	Acads
NM_025826	Acetyl-Coenzyme A dehydrogenase, short/branched chain	Acadsb
NM_025337	Alko-keto reductase family 7, member A5 (eftia toxin aldehyde reductase)	Akr7a5
NM_007409	Alcohol dehydrogenase 1 (class I)	Adh1
NM_011986	Alcohol dehydrogenase 4 (class II), pi polypeptide	Adh4
NM_007410	Alcohol dehydrogenase 5 (class III), chi polypeptide	Adh5
NM_019993	Aldehyde dehydrogenase 9, subfamily A1	Adh9a1
NM_013467	Aldehyde dehydrogenase family 1, subfamily A1	Aldh1a1
NM_009022	Aldehyde dehydrogenase family 1, subfamily A2	Aldh1a2
NM_053080	Aldehyde dehydrogenase family 1, subfamily A3	Aldh1a3
NM_011921	Aldehyde dehydrogenase family 1, subfamily A7	Aldh1a7

NM_007437	Aldehyde dehydrogenase family 3, subfamily A2	Aldh3a2
NM_019977	Aldehyde reductase (alkose reductase)-like 6	Aldr6
NM_021473	Alde-keto reductase family 1, member A4 (aldehyde reductase)	Akr1a4
NM_007533	Branched chain ketoacid dehydrogenase E1, alpha polypeptide	Bckdha
NM_009739	Branched chain ketoacid dehydrogenase kinase	Bckdhk
NM_007861	Dihydropyrimidine dehydrogenase	Dld
NM_020046	Dihydroorotate dehydrogenase	Dhodh
NM_008062	Glucose-6-phosphate dehydrogenase X-linked	G6pdx
NM_008133	Glutamate dehydrogenase	Glud1
NM_008097	Glutaryl-Coenzyme A dehydrogenase	Gcdh
NM_008085	Glycerolaldehyde-3-phosphate dehydrogenase, spermatogenic	Gapds
NM_010271	Glycerol phosphate dehydrogenase 1, cytoplasmic adult	Gpd1
NM_018763	Hydroxyacyl-Coenzyme A dehydrogenase type II	Hadh2
NM_008278	Hydroxyprostaglandin dehydrogenase 15 (NAD)	Hpgd
NM_019657	Hydroxysteroid (17-beta) dehydrogenase 12	Hsd17b3
NM_008291	Hydroxysteroid (17-beta) dehydrogenase 3	Hsd17b7
NM_010476	Hydroxysteroid (17-beta) dehydrogenase 7	Hsd11b1
NM_008288	Hydroxysteroid 11-beta dehydrogenase 1	Hsd3b1
NM_008293	Hydroxysteroid dehydrogenase-1, deltaϵ-3-beta	Hsd3b5
NM_008295	Hydroxysteroid dehydrogenase-5, deltaϵ-3-beta	Impdh2
NM_011830	Inosine 5-phosphate dehydrogenase 2	Ihh1
NM_010497	Isocitrate dehydrogenase 1 (NADP+), soluble	Ihd2
NM_006322	Isocitrate dehydrogenase 2 (NADP+), mitochondrial	Ihd3g
NM_008323	Isocitrate dehydrogenase 3 (NAD+), gamma	Ihd3a
NM_029573	Isocitrate dehydrogenase 3 (NAD+) alpha	Ihd
NM_019826	Isovaleryl coenzyme A dehydrogenase	Ihdsc
NM_006212	L-3-hydroxyacyl-Coenzyme A dehydrogenase, short chain	Ldh1
NM_010699	Lactate dehydrogenase 1, A chain	Ldh2
NM_008492	Lactate dehydrogenase 2, B chain	Ldh3
NM_013580	Lactate dehydrogenase 3, C chain, sperm specific	Aass
NM_013930	aminoadipate-semialdehyde synthase	Mdh1
NM_008618	Malate dehydrogenase, soluble	Mdh2
NM_008638	Methylenetetrahydrofolate dehydrogenase (NAD+ dependent), methylenetetrahydrofolate cyclohydrolase	Mthfd1
NM_138745	Methylenetetrahydrofolate dehydrogenase (NADP+ dependent), methylenetetrahydrofolate cyclohydrolase, formyltetrahydrofolate synthase	Mthfd1
NM_010941	NAD(P) dependent steroid dehydrogenase-like	Nsdh1
NM_008706	NAD(P)H dehydrogenase, quinone 1	Npq1
NM_025523	NADH dehydrogenase (ubiquinone) 1, subcomplex unknown, 1	Ndufc1
NM_019443	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 1	Ndufa1
NM_010685	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 2	Ndufa2
NM_025987	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 6 (14kD, B14)	Ndufa6
NM_023202	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 7 (14.5kD, B14.5a)	Ndufa7
NM_025316	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 5	Ndufb5
NM_010887	NADH dehydrogenase (ubiquinone) Fe-S protein 4	Ndufs4
NM_011172	Prolina dehydrogenase	Prodh
NM_019546	Prolina dehydrogenase (oxidase) 2	Prodh2

NM_024221	Pyruvate dehydrogenase (lipoamide) beta	Pdhb
NM_013743	Pyruvate dehydrogenase kinase, isoenzyme 4	Pdk4
NM_011303	Dehydrogenase/reductase (SDR family) member 3	Dhrs3
NM_017473	Retinol dehydrogenase 7	Rdh7
NM_009466	UDP-glucose dehydrogenase	Ugdh
NM_011723	Xanthine dehydrogenase	Xdh

Fig 1-III-3-14 Metal Transport と Homeostasis に関連する遺伝子
Scatter Plot (direct) Aldh2 genotype 曝露前後比較

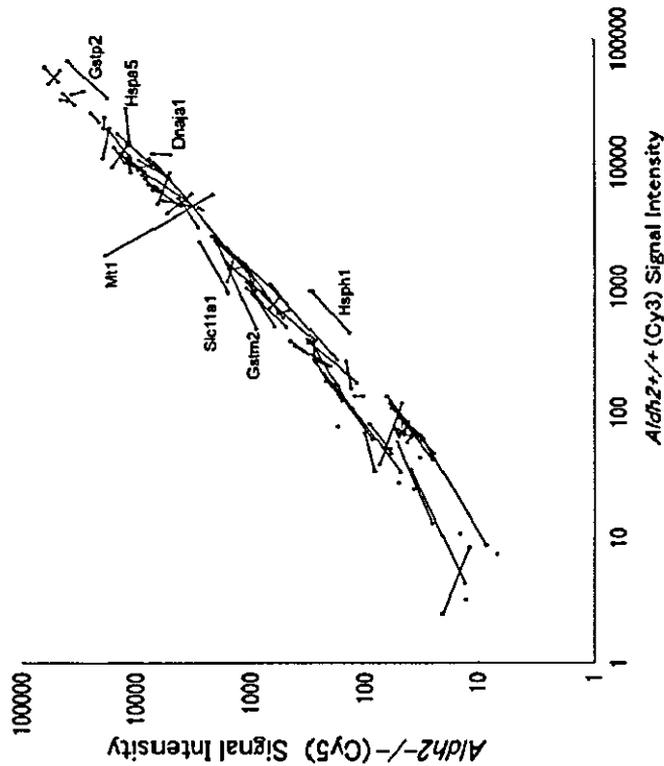


Table 1-III-3-14 Metal Transport と Homeostasis に関連する遺伝子

GeneBank Accession	Description	Gene Name
NM_007511	ATPase, Cu ⁺⁺ transporting, beta polypeptide	Atp7b
NM_019552	ATP-binding cassette, sub-family B (MDR/TAP), member 10	Abcb10
NM_009720	ATX1 (antioxidant protein 1) homolog 1 (yeast)	Atpx1
NM_009735	Beta-2 microglobulin	B2m
NM_007591	Calreticulin	Calr
NM_009804	Catalase 1	Cat
NM_053094	CD163 antigen	Cd163
NM_007752	Ceruloplasmin	Cp
NM_010050	Ce1od1nase, iodothyronine, type II	Dio2
NM_008298	Dnaj (Hsp40) homolog, subfamily A, member 1	Dnaj1
NM_007913	Early growth response 1	Egr1
NM_010239	Ferritin heavy chain	Fth1
NM_026286	Ferritin heavy chain 3	Fth3

NM_010240	Ferritin light chain 1	Fth1
NM_007998	Ferrochelatase	Fech
NM_008030	Flavin containing monooxygenase 3	Fmo3
NM_008044	Friedreich ataxia	Frida
NM_008160	Glutathione peroxidase 1	Gpx1
NM_030677	Glutathione peroxidase 2	Gpx2
NM_008161	Glutathione peroxidase 3	Gpx3
NM_008162	Glutathione peroxidase 4	Gpx4
NM_010344	Glutathione reductase 1	Gsr
NM_008181	Glutathione S-transferase, alpha 1 (Yc)	Gsta1
NM_008183	Glutathione S-transferase, mu 2	Gstm2
NM_010360	Glutathione S-transferase, mu 5	Gstm5
NM_008184	Glutathione S-transferase, mu 6	Gstm6
NM_013541	Glutathione S-transferase, pi 2	Gstp2
NM_008180	Glutathione synthetase	Gss
NM_008086	Growth arrest specific 1	Gas1
NM_008303	Heat shock 10 kDa protein 1 (chaperonin 10)	Hsp1
NM_022310	Heat shock 70kD protein 5 (glucose-regulated protein, 78kD)	Hspa5
NM_013559	Heat shock protein, 105 kDa	Hsp11
NM_010442	Heme oxygenase (decycling) 1	Hmox1
NM_010443	Heme oxygenase (decycling) 2	Hmox2
NM_010424	Hemochromatosis	Hfe
NM_008220	Hemoglobin, beta adult major chain	Hbb-b1
NM_016956	Hemoglobin, beta adult minor chain	Hbb-b2
NM_032541	Hepcidin antimicrobial peptide	Hamp
NM_016768	Huntingtin interacting protein 2	Hip2
NM_010404	Huntingtin-associated protein 1	hip1
NM_010431	Hypoxia inducible factor 1, alpha subunit	Hif1a
NM_008522	Lactoferrin	Lf
NM_013602	Metallothionein 1	Mt1
NM_010841	Metallothionein-like 5, testis-specific (testin)	Mt5
NM_011638	Transferrin receptor (Tfr)	Tfr
NM_015799	Transferrin receptor 2 (Tfr2)	Tfr2
NM_008712	Nitric oxide synthase 1, neuronal	Nos1
NM_008898	P450 (cytochrome) oxidoreductase	Por
NM_011034	Peroxiredoxin 1	Prdx1
NM_011563	Peroxiredoxin 2	Prdx2
NM_007452	Peroxiredoxin 3	Prdx3
NM_016764	Peroxiredoxin 4	Prdx4
NM_012021	Peroxiredoxin 5	Prdx5
NM_009268	Selenophosphate synthetase 2	Septis2
NM_009155	Selenoprotein P, plasma, 1	Sepp1
NM_013759	Selenoprotein R	Sepr
NM_009156	Selenoprotein W, muscle 1	Seprw1
NM_053196	Sideroflexin 2	Skn2
NM_053197	Sideroflexin 3	Skn3

NM_053198	Sideroflexin 4		Sfxn4
NM_013612	Solute carrier family 11 (proton-coupled divalent metal ion transporters), member 1		Slc11a1
NM_008732	Solute carrier family 11 (proton-coupled divalent metal ion transporters), member 2		Slc11a2
NM_011773	Solute carrier family 30 (zinc transporter), member 3		Slc30a3
NM_022885	Solute carrier family 30 (zinc transporter), member 5		Slc30a5
NM_025286	Solute carrier family 31, member 2		Slc31a2
NM_016917	Solute carrier family 39 (iron-regulated transporter), member 1		Slc39a1
NM_013671	Superoxide dismutase 2, mitochondrial		Sod2
NM_015762	T		Tnfrd1
NM_013711	Thioredoxin reductase 2		Tnfrd2
NM_021297	Toll-like receptor 4		Tlr4
NM_009377	Tyrosine hydroxylase		Th
NM_009461	Ubiquitin protein ligase E3 component n-recognin 1		Ubr1
NM_009505	Vascular endothelial growth factor A		Vegfa
NM_011697	Vascular endothelial growth factor B		Vegfb
NM_009506	Vascular endothelial growth factor C		Vegfc

Fig 1-III-3-15 Ubiquitin 関連遺伝子

Scatter Plot (direct) Aldh2 genotype 曝露前後比較

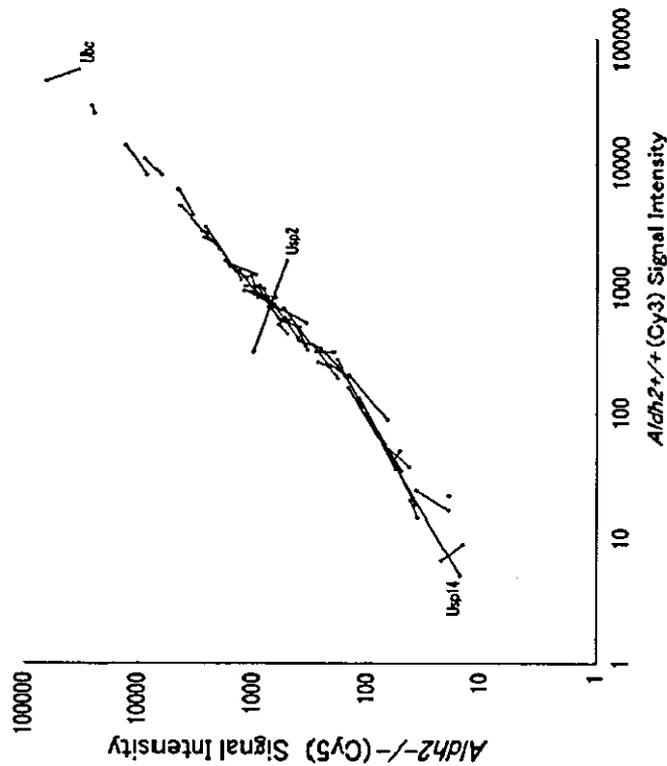


Table 1-III-3-15 Ubiquitin 関連遺伝子

Gene Bank Accession	Description	Gene name
NM_022331	Homocysteine-inducible, endoplasmic reticulum stress-inducible, ubiquitin-like domain member 1	Harpud1
NM_009460	SMT3 suppressor of mit two 3 homolog 1 (yeast)	Sumo1
NM_011432	U1 small nuclear ribonucleoprotein 1C	Snrp1c
NM_011663	U2 small nuclear ribonucleoprotein auxiliary factor (U2AF), 35 kDa, related sequence 1	U2af1+rs1
NM_009453	U2 small nuclear ribonucleoprotein auxiliary factor (U2AF), 35 kDa, related sequence 2	U2af1+rs2
NM_024187	U2 small nuclear ribonucleoprotein auxiliary factor (U2AF), 35 kDa	U2af1
NM_026842	Ubiquitin 1	Ubqn1
NM_018798	Ubiquitin 2	Ubqn2
NM_033526	Ubiquitin 4	Ubqn4
NM_025407	Ubiquitin-cytochrome c reductase core protein 1	Ubcrc1

NM_011664	Ubiquitin B	Ubb
NM_019639	Ubiquitin C	Ubc
NM_016723	Ubiquitin carboxyl-terminal esterase L3 (ubiquitin thiolesterase)	UchL3
NM_019562	Ubiquitin carboxyl-terminal esterase L5	UchL5
NM_011670	Ubiquitin carboxyl-terminal hydrolase L1	UchL1
NM_019705	Ubiquitin conjugating enzyme 7 interacting protein 3	Ube7ip3
NM_080563	Ubiquitin conjugating enzyme 7 interacting protein 4	Ube7ip4
NM_011672	Ubiquitin fusion degradation 1 like	Ufd1l
NM_009461	Ubiquitin protein ligase E3 component n-recogin 1	Ubr1
NM_009462	Ubiquitin specific protease 10	Usp10
NM_021522	Ubiquitin specific protease 14	Usp14
NM_024258	Ubiquitin specific protease 16	Usp16
NM_011909	Ubiquitin specific protease 1B	Usp18
NM_016808	Ubiquitin specific protease 2	Usp2
NM_013919	Ubiquitin specific protease 21	Usp21
NM_013918	Ubiquitin specific protease 25	Usp25
NM_031388	Ubiquitin specific protease 26	Usp26
NM_021323	Ubiquitin specific protease 29	Usp29
NM_011678	Ubiquitin specific protease 4 (proto-oncogene)	Usp4
NM_013700	Ubiquitin specific protease 5 (isopeptidase T)	Usp5
NM_009481	Ubiquitin specific protease 9, X chromosome	Usp9
NM_009457	Ubiquitin-activating enzyme E1, Chr X	Ube1x
NM_011658	Ubiquitin-activating enzyme E1C	Ube1c
NM_023305	Ubiquitin-associated protein 1	Ubaip1
NM_022022	Ubiquitination factor E4B, UFD2 homolog (S. cerevisiae)	Ube4b
NM_023585	Ubiquitin-conjugating enzyme E2 variant 2	Ube2v2
NM_021402	Ubiquitin-conjugating enzyme E2, J2 homolog (yeast)	Ube2j2
NM_019658	Ubiquitin-conjugating enzyme E2A, RAD6 homolog (S. cerevisiae)	Ube2a
NM_009458	Ubiquitin-conjugating enzyme E2B, RAD6 homolog (S. cerevisiae)	Ube2b
NM_019912	Ubiquitin-conjugating enzyme E2D 2	Ube2d2
NM_009455	Ubiquitin-conjugating enzyme E2E 1, UBC4/5 homolog (yeast)	Ube2e1
NM_009459	Ubiquitin-conjugating enzyme E2H	Ube2h
NM_011665	Ubiquitin-conjugating enzyme E2I	Ube2i
NM_009456	Ubiquitin-conjugating enzyme E2L 3	Ube2l3
NM_019949	Ubiquitin-conjugating enzyme E2L 6	Ube2l6
NM_080560	Ubiquitin-conjugating enzyme E2N	Ube2n
NM_016682	Ubiquitin-like 1 (sentrin) activating enzyme E1B	Ubie1b
NM_011908	Ubiquitin-like 3	Ubi3
NM_025401	Ubiquitin-like 5	Ubi5

Fig 1-III-3-16 CardioVascularDiseaseに関連する Biomarker 遺伝子
Scatter Plot (direct) Aldh2 genotype 曝露前後比較

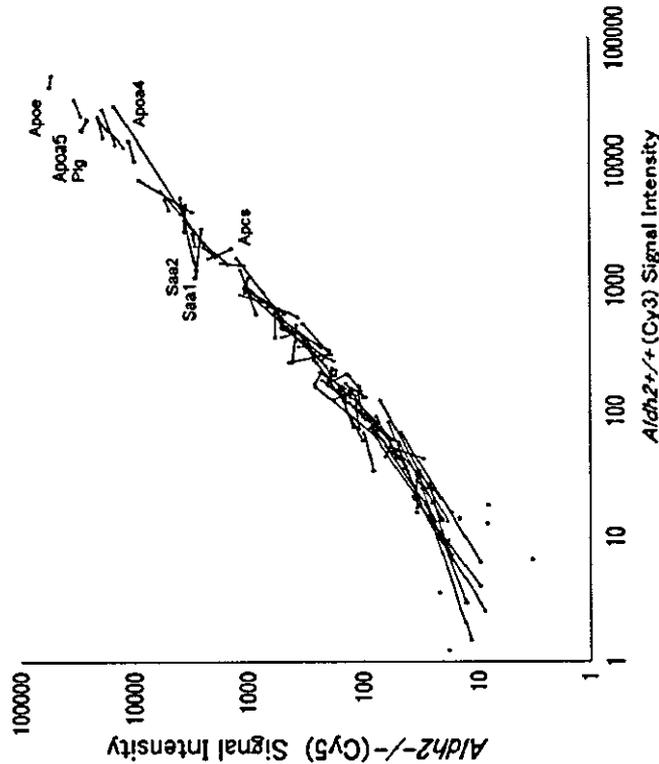


Table 1-III-3-16 CardioVascularDiseaseに関連する Biomarker 遺伝子

Gene Bank Accession	Description	Gene Name
NM_007468	Apolipoprotein A-IV	ApoA4
NM_080434	Apolipoprotein A-V	ApoA5
NM_005695	Apolipoprotein C-II	ApoC2
NM_023114	Apolipoprotein C-III	ApoC3
NM_007385	Apolipoprotein C-IV	ApoC4
NM_007470	Apolipoprotein D	ApoD
NM_006696	Apolipoprotein E	ApoE
NM_013475	Apolipoprotein H	ApoH
NM_018818	Apolipoprotein M	ApoM
NM_010581	CD47 antigen (Rb-related antigen, integrin-associated signal transducer)	CD47
NM_011331	Chemokine (C-C motif) ligand 12	Ccl12
NM_011332	Chemokine (C-C motif) ligand 17	Ccl17

NM_011888	Chemokine (C-C motif) ligand 19	Ccl19
NM_016960	Chemokine (C-C motif) ligand 20	Ccl20
NM_009137	Chemokine (C-C motif) ligand 22	Ccl22
NM_019577	Chemokine (C-C motif) ligand 24	Ccl24
NM_009138	Chemokine (C-C motif) ligand 25	Ccl25
NM_013652	Chemokine (C-C motif) ligand 4	Ccl4
NM_013654	Chemokine (C-C motif) ligand 7	Ccl7
NM_021443	Chemokine (C-C motif) ligand 8	Ccl8
NM_009912	Chemokine (C-C motif) receptor 1	Ccr1
NM_009916	Chemokine (C-C motif) receptor 4	Ccr4
NM_009913	Chemokine (C-C motif) receptor 9	Ccr9
NM_017466	Chemokine (C-C motif) receptor-like 2	Ccr2
NM_009914	Chemokine (C-C) receptor 3	Ccr3
NM_013655	Chemokine (C-X-C motif) ligand 12	Cxcl12
NM_019568	Chemokine (C-X-C motif) ligand 14	Cxcl14
NM_011339	Chemokine (C-X-C motif) ligand 15	Cxcl15
NM_008589	Chemokine (C-X-C motif) ligand 9	Cxcl9
NM_009910	Chemokine (C-X-C motif) receptor 3	Cxcr3
NM_030712	Chemokine (C-X-C motif) receptor 6	Cxcr6
NM_010168	Coagulation factor II	F2
NM_010169	Coagulation factor II (thrombin) receptor	F2r
NM_010170	Coagulation factor II (thrombin) receptor-like 2	F2r2
NM_007976	Coagulation factor V	F5
NM_010172	Coagulation factor VII	F7
NM_007972	Coagulation factor X	F10
NM_021489	Coagulation factor XII (Hageman factor)	F12
NM_031164	Coagulation factor XIII, beta subunit	F13b
NM_007768	C-reactive protein, pectin related	Crp
NM_008997	Creatine kinase, mitochondrial 1, ubiquitous	Ckm1
NM_018776	Cytokine receptor-like factor 3	Crlf3
NM_008013	Fibrinogen-like protein 2	Fglb2
NM_030701	G protein-coupled receptor 109B	Gpr109b
NM_009149	Golgi apparatus protein 1	Selel
NM_010442	Heme oxygenase (decycling) 1	Hmox1
NM_010443	Heme oxygenase (decycling) 2	Hmox2
NM_008398	Integrin alpha 2	Iiga2
NM_010576	Integrin alpha 4	Iiga4
NM_008397	Integrin alpha 6	Iiga6
NM_008401	Integrin alpha M	Iigam
NM_021334	Integrin alpha X	Iigax
NM_008403	Integrin beta 1 binding protein 1	Irgb1bp1
NM_008404	Integrin beta 2	Irgb2
NM_010580	Integrin beta 5	Irgb5
NM_010494	Intracellular adhesion molecule 2	Icam2
NM_010508	Interferon (alpha and beta) receptor 1	Inf1r1
NM_010509	Interferon (alpha and beta) receptor 2	Inf1r2

NM_008327	Interferon activated gene 202A	Ifi202a
NM_008329	Interferon activated gene204	Ifi204
NM_022329	Interferon alpha responsive gene, 15 kDa	Ifig15
NM_008394	Interferon dependent positive acting transcription factor 3 gamma	Isg3g
NM_008330	Interferon gamma inducible protein, 47 kDa	Ifi47
NM_010511	Interferon gamma receptor	Ifngr1
NM_008338	Interferon gamma receptor2	Ifngr2
NM_019440	Interferon inducible GTPase 2	Igp2
NM_008326	Interferon inducible protein 1	Ifi1
NM_008381	Interferon regulatory factor 2	Irf2
NM_018849	Interferon regulatory factor 3	Irf3
NM_015783	Interferon, alpha-inducible protein	G1p2
NM_008331	Interferon-induced protein with tetratricopeptide repeats 1	Ifi1
NM_008332	Interferon-induced protein with tetratricopeptide repeats 2	Ifi2
NM_020583	Interferon-stimulated protein (20 kDa)	Isg20
NM_134103	Interleukin 1 receptor accessory protein	Ilt1rap
NM_010555	Interleukin 1 receptor, type II	Ilf2
NM_008349	Interleukin 10 receptor, beta	Ilf0b
NM_008350	Interleukin 11	Ilf1
NM_010549	Interleukin 11 receptor, alpha chain 1	Ilf1ra1
NM_010550	Interleukin 11 receptor, alpha chain 2	Ilf1ra2
NM_008357	Interleukin 15	Ilf5
NM_008358	Interleukin 17 receptor	Ilf7r
NM_010531	Interleukin 18 binding protein	Ilf8bp
NM_021887	Interleukin 21 receptor	Ilf21r
NM_016871	Interleukin 22	Ilf22
NM_031252	Interleukin 23, alpha subunit p19	Ilf23a
NM_010557	Interleukin 4 receptor, alpha	Ilf4a
NM_010561	Interleukin enhancer binding factor 3	Ilf3
NM_010736	Lymphotoxin B receptor	Iltr
NM_008606	Matrix metalloproteinase 11	Mmp11
NM_008605	Matrix metalloproteinase 12	Mmp12
NM_008608	Matrix metalloproteinase 14 (membrane-inserted)	Mmp14
NM_008609	Matrix metalloproteinase 15	Mmp15
NM_011846	Matrix metalloproteinase 17	Mmp17
NM_008610	Matrix metalloproteinase 2	Mmp2
NM_010609	Matrix metalloproteinase 3	Mmp3
NM_008726	Matrilysin peptide precursor type B	Bmp
NM_008712	Nitric oxide synthase 1, neuronal	Nos1
NM_008713	Nitric oxide synthase 3, endothelial cell	Nos3
NM_011146	Peroxisome proliferator activated receptor gamma	Pparg
NM_013737	Phospholipase A2 group VII (platelet-activating factor acetylhydrolase, plasma)	Pla2g7
NM_008877	Plasminogen	Pli
NM_008816	Platelet/endothelial cell adhesion molecule	Pecam1
NM_011346	Selectin, lymphocyte	Sell
NM_011347	Selectin, platelet	Seip

NM_009117	Serum amyloid A 1	Saa1
NM_011314	Serum amyloid A 2	Saa2
NM_011315	Serum amyloid A 3	Saa3
NM_011318	Serum amyloid A 4	Saa4
NM_011318	Serum amyloid P-component	Apc
NM_011594	Tissue inhibitor of metalloproteinase 2	Timp2
NM_011595	Tissue inhibitor of metalloproteinase 3	Timp3
NM_008639	Tissue inhibitor of metalloproteinase 4	Timp4
NM_009393	Troponin C, cardiac/slow skeletal	Tnnc
NM_009406	Troponin I, cardiac	Tnni3
NM_011619	Troponin T2, cardiac	Tnnt2
NM_013693	Tumor necrosis factor	Tnf
NM_011613	Tumor necrosis factor (ligand) superfamily, member 11	Tnfrsf11
NM_023517	Tumor necrosis factor (ligand) superfamily, member 13	Tnfrsf13
NM_009403	Tumor necrosis factor (ligand) superfamily, member 8	Tnfrsf8
NM_008764	Tumor necrosis factor receptor superfamily, member 11b (osteoprotegerin)	Tnfrsf11b
NM_028075	Tumor necrosis factor receptor superfamily, member 13c	Tnfrsf13c
NM_011608	Tumor necrosis factor receptor superfamily, member 17	Tnfrsf17
NM_013869	Tumor necrosis factor receptor superfamily, member 19	Tnfrsf19
NM_052975	Tumor necrosis factor receptor superfamily, member 21	Tnfrsf21
NM_011859	Tumor necrosis factor receptor superfamily, member 4	Tnfrsf4
NM_009395	Tumor necrosis factor, alpha-induced protein 1 (endothelial)	Tnfrsf1
NM_011693	Vascular cell adhesion molecule 1	Vcam1

Fig 1-III-3-17 Diabetesに関連する遺伝子

Scatter Plot (direct) Aldh2 genotype 曝露前後比較

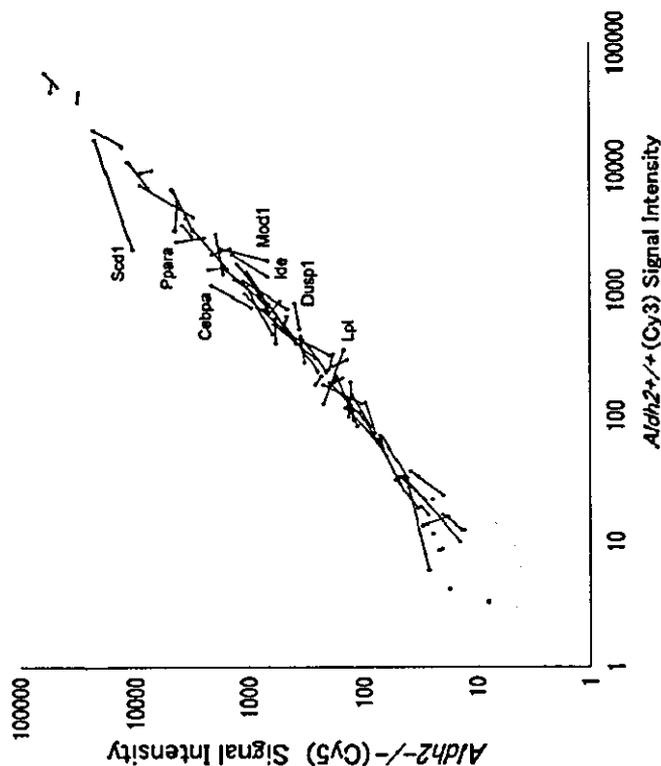


Table 1-III-3-17 Diabetesに関連する遺伝子

Gene Bank Accession	Description	Gene Name
NM_007415	ADP-ribosyltransferase (NAD+: poly (ADP-ribose) polymerase) 1	Adprt1
NM_007428	Angiotensinogen	Agt
NM_009696	Apolipoprotein E	ApoE
NM_009465	AXL receptor tyrosine kinase	Axl
NM_009741	B-cell leukemia/lymphoma 2	Bcl2
NM_009735	Beta-2 microglobulin	B2m
NM_007678	CCAAT/enhancer binding protein (C/EBP) alpha	Cebpa
NM_013642	Dual specificity phosphatase 1	Dusp1
NM_013849	Dual specificity phosphatase 13	Dusp13
NM_019819	Dual specificity phosphatase 14	Dusp14
NM_130447	Dual specificity phosphatase 16	Dusp16
NM_024438	Dual specificity phosphatase 19	Dusp19
NM_026268	Dual specificity phosphatase 6	Dusp6

NM_015744	Ectonucleotide pyrophosphatase/phosphodiesterase 2	Enpp2
NM_032003	Ectonucleotide pyrophosphatase/phosphodiesterase 5	Enpp5
NM_010446	Forkhead box A2	Foxa2
NM_008260	Forkhead box A3	Foxa3
NM_013519	Forkhead box C2	Foxc2
NM_010426	Forkhead box F1a	Foxf1a
NM_008241	Forkhead box G1	Foxg1
NM_009021	Forkhead box M1	Foxm1
NM_053202	Forkhead box P1	Foxp1
NM_019395	Fructose biphosphatase 1	Fbp1
NM_008101	Glucagon receptor	Gcgr
NM_021332	Glucagon-like peptide 1 receptor	Glp1r
NM_010292	Glucokinase	Gck
NM_019827	Glyceral phosphate dehydrogenase 1, cytoplasmic adult	Gpd1
NM_013755	Glycogen synthase kinase 3 beta	Gsk3b
NM_010442	Heme oxygenase (decycling) 1	Hmox1
NM_010443	Heme oxygenase (decycling) 2	Hmox2
NM_008261	Hepatic nuclear factor 4	Hnf4
NM_010381	Histocompatibility 2, class II antigen E alpha	Hmox1
NM_133232	Inducible 6-phosphofructo-2-kinase	Ikbkg
NM_010547	Inhibitor of kappaB kinase gamma	Ibbp1
NM_008384	Inositol polyphosphate-1-phosphatase	Ide
NM_031156	Insulin degrading enzyme	Ins1
NM_008386	Insulin I	Ins2
NM_008387	Insulin II	Ins2
NM_011832	Insulin receptor-related receptor	Insr
NM_010518	Insulin-like growth factor binding protein 5	Igfbp5
NM_010494	Intercellular adhesion molecule 2	Icam2
NM_010557	Interleukin 4 receptor, alpha	Il4ra
NM_008509	Lipoprotein lipase	Lpl
NM_133198	Liver glycogen phosphorylase	Pygl
NM_008615	Malic enzyme, supernatant	Mod1
NM_011951	Mitogen activated protein kinase 14	Mapk14
NM_018700	Mitogen activated protein kinase 8	Mapk8
NM_008740	N-ethylmaleimide sensitive fusion protein	Nsf
NM_009717	Neurogenic differentiation 6	Neuro6
NM_008713	Nitric oxide synthase 3, endothelial cell	Nos3
NM_013627	Paired box gene 6	Pax6
NM_011040	Paired box gene B	Pax8
NM_011144	Peroxisome proliferator activated receptor alpha	Ppara
NM_134027	Peroxisome proliferator activated receptor binding protein	Pparbp
NM_011146	Peroxisome proliferator activated receptor gamma	Pparg
NM_011044	Phosphoenolpyruvate carboxykinase 1, cytosolic	Pck1
NM_009003	RAB4A, member RAS oncogene family	Rab4a
NM_024277	Ribosomal protein S27a	Rps27a
NM_017346	Selectin, lymphocyte	Sell
NM_028122	Solute carrier family 14 (urea transporter), member 1	Slc14a1
NM_031197	Solute carrier family 2 (facilitated glucose transporter), member 2	Slc2a2
NM_009127	Stearoyl-Coenzyme A desaturase 1	Scd1
NM_013671	Superoxide dismutase 2, mitochondrial	Sod2
NM_009222	Synapsosomal-associated protein, 23kD	Snap23

NM_133854	Synaptoosomal-associated protein, 25 kDa, binding protein	Snap25
NM_009295	Syntaxin binding protein 1	Sx1bp1
NM_011503	Syntaxin binding protein 2	Sx1bp2
NM_011504	Syntaxin binding protein 3	Sx1bp3
NM_009562	Thymoma viral proto-oncogene 1	AK1
NM_007434	Thymoma viral proto-oncogene 2	AK2
NM_011785	Thymoma viral proto-oncogene 3	AK3
NM_009367	Transforming growth factor, beta 2	Tgfb2
NM_009368	Transforming growth factor, beta 3	Tgfb3
NM_009464	Uncoupling protein 3, mitochondrial	Ucp3
NM_009505	Vascular endothelial growth factor A	Vegfa
NM_009496	Vesicle-associated membrane protein 1	Vamp1
NM_009497	Vesicle-associated membrane protein 2	Vamp2
NM_016796	Vesicle-associated membrane protein 4	Vamp4
NM_016872	Vesicle-associated membrane protein 5	Vamp5
NM_013933	Vesicle-associated membrane protein, associated protein A, (33 kDa)	VapA
NM_019806	Vesicle-associated membrane protein, associated protein B and C	VapB

Fig 1-IV-2-1 戻し交配の際の染色体

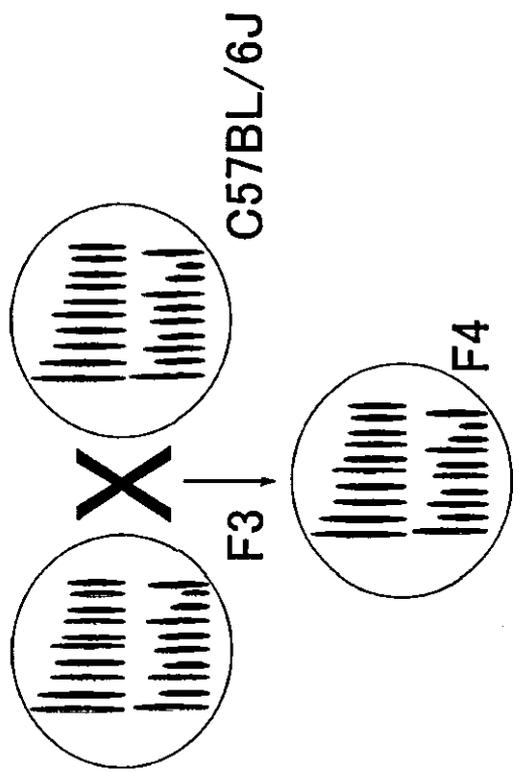


Fig 1-IV-2-2 戻し交配の際に生じる相同組み換え

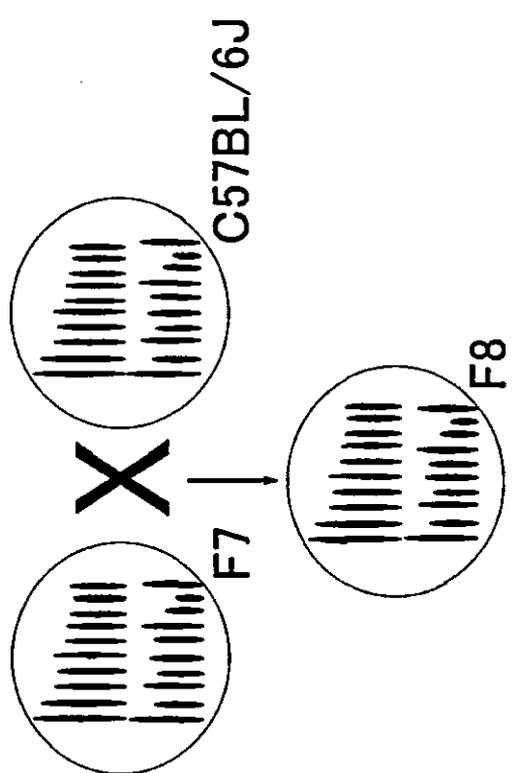
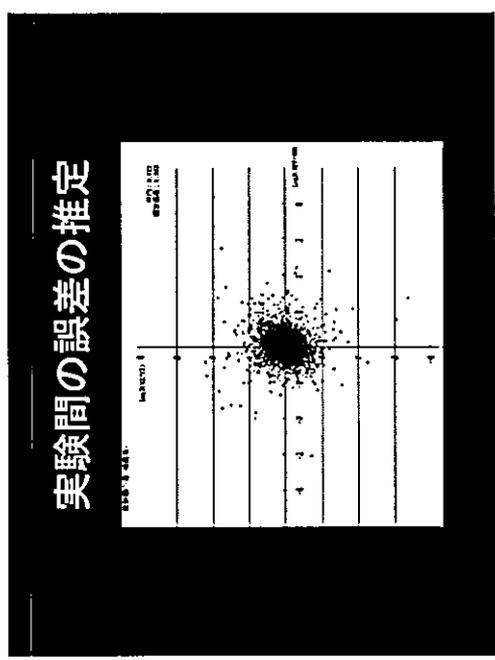


Fig 1-IV-4 実験誤差の推定



x 軸：非曝露群の $Aldh2^{+/+}$ と $Aldh2^{-/-}$ の発現差

$$\log_2 \frac{x_1}{x_2}$$

y 軸：500ppm 曝露群の $Aldh2^{+/+}$ と $Aldh2^{-/-}$ の発現差

$$\log_2 \frac{y_1}{y_2}$$

資料 2

2) アセトアルデヒド吸入曝露による酸化ストレスの検討

- *Aldh2*^{+/+}と *Aldh2*^{-/-}のアセトアルデヒド2週間吸入曝露における比較-

【方法】

尿中 8-ヒドロキシグアニン (8-OHdG) 測定するため、曝露前、曝露 6 日目、曝露 12 日目の同一時刻に各個体からスポット採尿を行い、8-OHdG ELISA キット (日本老化制御研究所) を用いて尿中 8-OHdG 濃度を測定した。なお尿濃度補正のためクレアチニン補正を行った。また、血漿中マロンジアルデヒド (MDA) を測定するため、2 週間の吸入曝露終了後、直ちに心臓からヘパリンコートシリンジで採血し、採血後直ちに遠心分離し血漿を採取した。過酸化脂質比色定量キット (Oxis) にて血漿中の MDA 濃度を測定した。

【結果】

・尿中 8-OHdG 濃度について

Aldh2^{+/+}の尿中 8-OHdG は、125ppm 曝露群では曝露前と曝露 6 日目および 12 日目の比較において、尿中 8-OHdG 濃度の明らかな変化は認められなかった。500ppm 曝露群は、曝露 6 日目、12 日目ともに曝露前に比べ尿中 8-OHdG 濃度の有意な上昇を認めた (Fig.2-1)。125ppm 曝露群の *Aldh2*^{-/-}は、曝露 12 日目では曝露前に比べ、尿中 8-OHdG 濃度が約 1.6 倍高値であった。また、500ppm 曝露群は、6 日目、12 日目ともに曝露前に比べ尿中 8-OHdG 濃度が有意に高値を示した (Fig.2-1)。

・血漿中 MDA 濃度について

非曝露群、125ppm 曝露群、および 500ppm 曝露群の比較で血漿中 MDA 濃度は有意な変化は認めなかった (Fig.2-2)が、曝露濃度の上昇に伴い血漿中 MDA 濃度が上昇の傾向を認めた。各群の *Aldh2*^{+/+}および *Aldh2*^{-/-}間の比較において有意差は認められなかった (Fig.2-2)。

【考察】

Aldh2^{-/-}ではアセトアルデヒドの代謝速度が *Aldh2*^{+/+}に比べ小さいため、血中アセトアルデヒド濃度が高値を示す。そのためアセトアルデヒドの吸入曝露の結果、*Aldh2*^{+/+}に比べ酸化的 DNA 損傷が増加する傾向にあると考えられた。

【結論】

ALDH2 不活性型のヒトのモデル動物である *Aldh2*^{-/-}で上記の結果が示されたことから、日本人の約半数を占める ALDH2 不活性型のヒトでは低濃度のアセトアルデヒドでも酸化的 DNA 損傷が増加する可能性が示された。

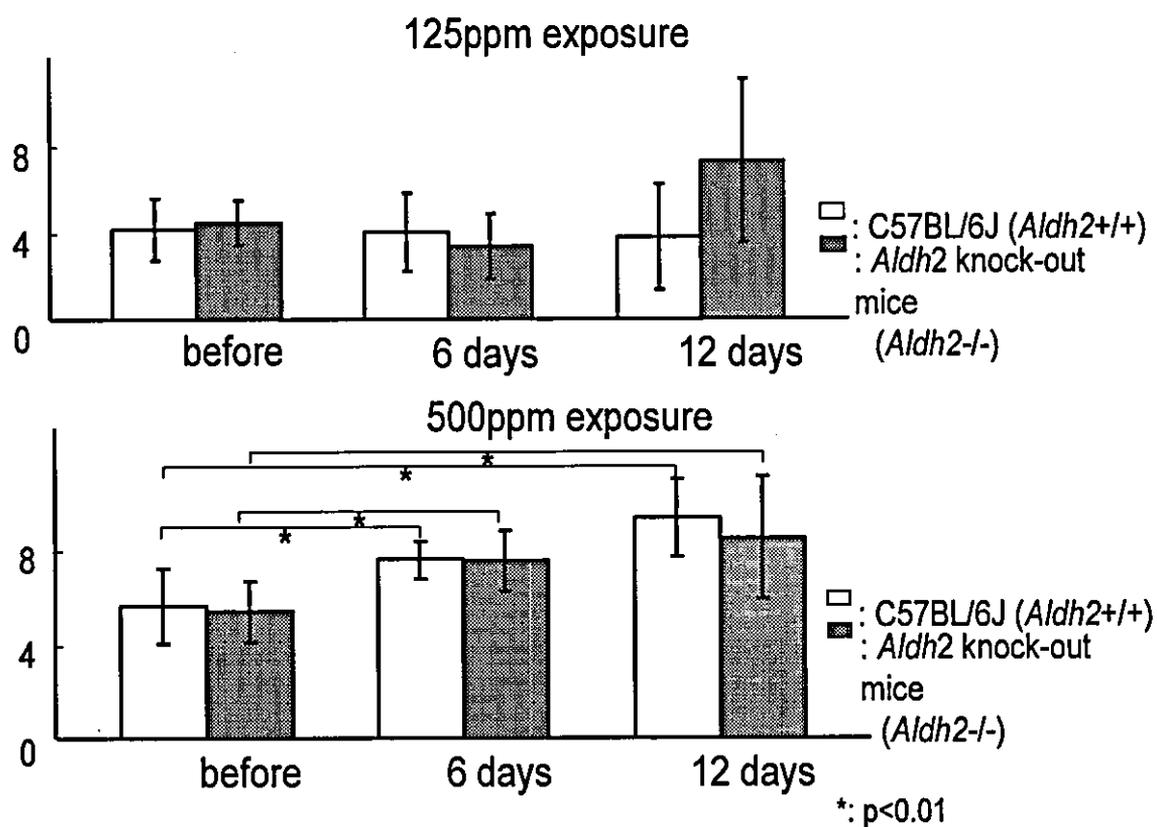


Fig.2—1. Urinary 8-OHdG levels under 125ppm and 500ppm acetaldehyde exposure.

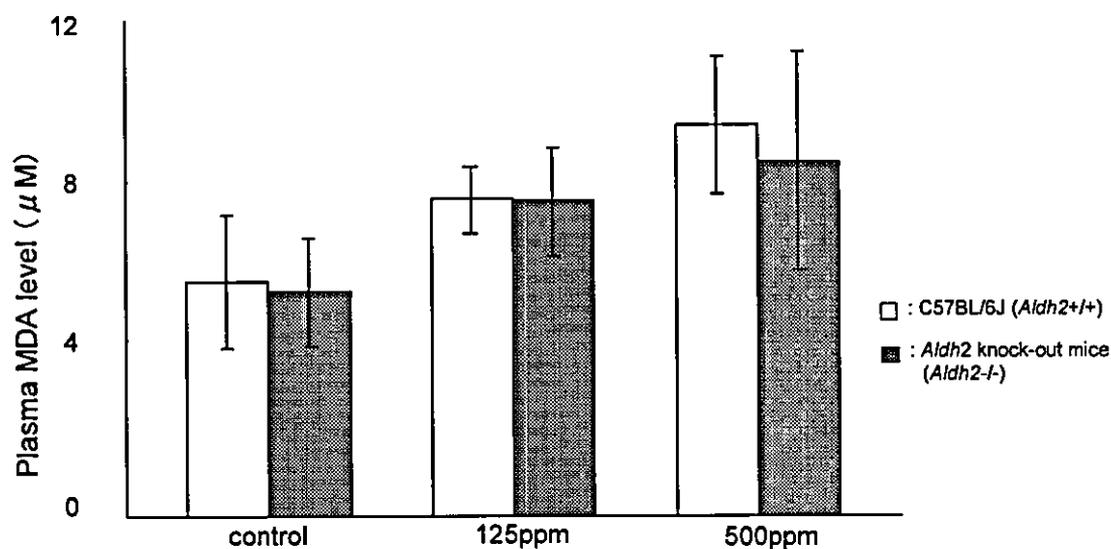


Fig.2—2. Plasma MDA levels under 125ppm and 500ppm acetaldehyde exposure.

There was no significant difference between each group.

資料 3

3-I) アセトアルデヒド皮下投与による表皮内 Aldh2・Cyp2e1 発現の変動

— Aldh2^{+/+}と Aldh2^{-/-}の比較—

【対象】

10 週齢雄の Aldh2^{+/+}および Aldh2^{-/-}を対象とした。2 週と 4 週の間には生理食塩水 0.9mL/匹/日の量で Aldh2^{+/+}・Aldh2^{-/-}に皮下投与してコントロール群とした (各群 n=4)。一方、2 週と 4 週の間には生理食塩水で調節した 0.5%アセトアルデヒドを 0.9mL/匹/日をそれぞれ 4 匹ずつの Aldh2^{+/+}・Aldh2^{-/-}に皮下投与してアセトアルデヒド皮下投与群とした (各群 n=4)。

【方法】

コントロール群・アセトアルデヒド皮下投与群ともに背部を 3cm×3cm 以上の範囲で剃毛し、皮下投与部位が互いに 1cm 間隔となるように 3 行×3 列に 0.1mL ずつ計 0.9mL/匹皮下投与した (Figure3-I-1-A)。アセトアルデヒド皮下投与群では実験終了時に 2 週間と 4 週間皮下投与したマウス背部表皮を皮下投与部位が中央に含まれるように 2.5cm×2.5cm の範囲で切除した (Figure 3-I-1-B)。切除した表皮の中央部矢状断による標本より Hematoxylin-Eosin (HE) 染色による表皮の病理標本を作成して背部表皮の 2 週間・4 週間アセトアルデヒド皮下投与による病理学的変化を検討し、免疫組織化学染色法 (IHC) により Aldh2、Cyp2e1 の発現も検出した (Figure3-I-1-C)。また、4 週間のアセトアルデヒド皮下投与の後、切除表皮よりそれぞれミトコンドリア分画とミクロソーム分画を抽出して、ミトコンドリア分画から Aldh2 発現をウェスタンブロット法 (WB) により検出し、ミクロソーム分画から Cyp2e1 の発現を WB により検出した。

【結果】

Aldh2^{+/+}におけるアセトアルデヒド皮下投与による病理学的所見を示す (Figure3-I-2)。2 週間のアセトアルデヒド皮下投与の後には表皮下の浮腫を認め、4 週間の投与の後には表皮下の脂肪細胞の集簇を認めた。Aldh2 の発現は投与開始 2 週間後には減少していたが、4 週間後にはコントロール群に比べ明らかに増加していた。Cyp2e1 の発現は投与開始 2 週間後から 4 週間後にかけてコントロール群に比べ増加していた。Aldh2^{-/-}におけるアセトアルデヒド皮下投与による病理学的所見を示す (Figure3-I-3)。アセトアルデヒド皮下投与 2 週間後には表皮下の浮腫を認め、4 週間後には表皮において軽度の細胞異型を認めた。また、Aldh2 の発現は認めず、Cyp2e1 の発現は投与開始 2 週間後から 4 週間後にかけてコントロール群に比べ増加していた。アセトアルデヒド皮下投与開始 4 週間後の表皮のウェスタンブロット法による解析には、各群 2 匹ずつ使用した。2 回の Aldh2・Cyp2e1 発現結果を示す (Figure3-I-4)。ミトコンドリア分画による Aldh2 発現では Aldh2^{-/-}で認めず、Aldh2^{+/+}においてアセトアルデヒド皮下投与開始 4 週間後にはコントロール群に比べ Aldh2 発現は減少していた。Aldh2^{+/+}においてアセトアルデヒド皮下投与開始 4 週間後にはコントロール群に比べミクロソーム分画による Cyp2e1 発現は増加していた。コントロール群の Aldh2^{+/+}に比べ Aldh2^{-/-}における Cyp2e1 発現は明らかに増加しており、コントロール群に比べア