Integrating Murine Gene Expression Studies to Understand Obstructive Lung Disease due to Chronic Inhaled Endotoxin

Full Title Integrating murine gene expression studies to understand obstructive lung disease due to chronic inhaled endotoxin

Short Title Lung disease due to chronic endotoxin exposure

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Abstract

RATIONALE: Endotoxin is a near ubiquitous environmental exposure that that has been associated with both asthma and chronic obstructive pulmonary disease (COPD). These obstructive lung diseases have a complex pathophysiology, making them difficult to study comprehensively in the context of endotoxin. Genome-wide gene expression studies have been used to identify a molecular snapshot of the response to environmental exposures. Identification of differentially expressed genes shared across all published murine models of chronic inhaled endotoxin will provide insight into the biology underlying endotoxin-associated lung disease.

METHODS: We identified three published murine models with gene expression profiling after repeated low-dose inhaled endotoxin. All array data from these experiments were re-analyzed, annotated consistently, and tested for shared genes found to be differentially expressed. Additional functional comparison was conducted by testing for significant enrichment of differentially expressed genes in known pathways. The importance of this gene signature in smoking-related lung disease was assessed using hierarchical clustering in an independent experiment where mice were exposed to endotoxin, smoke, and endotoxin plus smoke.

RESULTS: A 101-gene signature was detected in three murine models, more than expected by chance. The three model systems exhibit additional similarity beyond shared genes when compared at the pathway level, with increasing enrichment of inflammatory pathways associated with longer duration of endotoxin exposure. Genes and pathways important in both asthma and COPD were shared across all endotoxin models. Mice exposed to endotoxin, smoke, and smoke plus endotoxin were accurately classified with the endotoxin gene signature.

CONCLUSIONS: Despite the differences in laboratory, duration of exposure, and strain of mouse used in three experimental models of chronic inhaled endotoxin, surprising similarities in gene expression were observed. The endotoxin component of tobacco smoke may play an important role in disease development.

Introduction

Endotoxin (or lipopolysaccharide, LPS) is a cell-wall component of gram-negative bacteria and is ubiquitous in the environment. Endotoxin has been detected in household dust at low or moderate concentrations[1], and at much higher concentrations in occupational settings such as in swine farms, poultry houses, sewage treatment plants, humidified buildings, and processing of organic materials - in particular cotton[2]. The relationship between endotoxin exposure and the development of asthma is conflicting, with studies suggesting a protective effect of endotoxin in early childhood exposure on the development of asthma [3] while later exposure suggest that endotoxin exposure is associated with both asthma diagnosis and severity [1]. Studies in cotton textile workers have demonstrated the development of an asthma-like syndrome with reversible airflow obstruction termed byssinosis after several years of exposure, while longitudinal studies have demonstrated that with decades of exposure there is an accelerated decline in lung function consistent with chronic obstructive lung disease (COPD), even in the absence of cigarette smoke exposure[4]. More broadly, exposure to biomass fuel has been cited as a major cause of non-tobacco related obstructive lung disease, with roughly 3 billion people exposed worldwide[5,6]. While prior studies on biomass fuel and COPD have focused on the role of particulate matter a recent study noted high levels of airborne endotoxin (up to 365 EU/m^3) in homes burning biomass fuel, with higher endotoxin levels noted in less processed solid fuels such as dried animal dung[7]. Intriguingly, bioactive LPS has also been detected in cigarette smoke, and it has been estimated that the amount of endotoxin delivered from smoking one pack of cigarettes a day is equivalent to that experienced daily by cotton textile workers at risk for byssinosis[8].

The mechanisms whereby endotoxin might protect against, or lead to obstructive lung disease remain unclear, and the phenotype of obstructive lung disease (reversible airflow obstruction in asthma vs. irreversible airflow obstruction in COPD) related to inhaled endotoxin has not been well characterized. A poorly understood and understudied overlap syndrome between asthma and COPD is seen in clinical practice, where patients at times may exhibit reversible airflow obstruction but at other times might present with irreversible airflow obstruction[9].

While most animal models of COPD utilize inhaled endotoxin as a model for acute COPD exacerbations rather than for the development of chronic COPD over longitudinal exposure [10], several experimental animal models have demonstrated that long-term exposure to inhaled endotoxin leads to increased airways resistance and hyper-reactivity to methacholine challenge [11-14] as well as histologic evidence of emphysema [15,16] and airway narrowing associated with fibroproliferation[17]. Several groups have used microarray technology to characterize the pulmonary gene expression profile associated with chronic inhaled endotoxin. Airflow obstruction has been noted in these models [15,17-19], and pulmonary gene expression profiling has demonstrated over-expression of genes such as serum amyloid A 3(Saa3), matrix metalloproteinase 12 (MMP-12), and lymphocyte antigen 6 complex locus I (Ly6i), a cell surface marker with unknown function found on the surface of T and immature B cells.

However, to date no studies have examined the agreement between model systems at the gene or pathway level. Microarray data generated in different laboratories may vary greatly based on strain of mouse and endotoxin used, different exposure protocols, and different array platforms [20,21]. In these situations, confirmation of findings based on

agreement between results from other groups represents an important method of validation[22].

In this study we hypothesized that a combined analysis of gene expression microarray data sets from all available experimental murine models of chronic inhaled endotoxin would identify a shared, robust signature at both the gene and pathway level. We further hypothesized that this signature would yield biologic insight into the phenotype of endotoxin-related obstructive lung disease as well as potential dysregulated pathways. Finally, to assess the biological significance of this endotoxin signature in complex endotoxin containing exposures such as cigarette smoke, we used the endotoxin signature that we identified to accurately classify mice exposed to either smoke alone, endotoxin alone, or smoke and endotoxin.

Materials and Methods

Please refer to **Supplementary Figure 1** for an overview of the methods.

Identification of studies for inclusion

A murine model of chronic exposure to inhaled endotoxin was developed in our laboratory [23]. A thorough literature search was conducted in order to identify all additional published studies where the study design included murine models of repeated inhaled endotoxin exposure with extraction of RNA from lung homogenate for microarray analysis. A computer search of PubMed with the following search terms "Gene Expression Profiling"[Mesh]) AND "Lipopolysaccharides"[Mesh] AND "Lung"[Mesh] to identify candidate studies and also hand-searched references in the articles. Four

experimental models of endotoxin exposure from three distinct laboratories were identified, two from the same laboratory[18,19,23]. The raw gene expression data was obtained from authors through written correspondence.

Normalization and Data Analysis

To ensure consistent processing and annotation of results, re-analysis of all samples was performed using BioConductor/R version 2.13 (www.bioconductor.org) for Affymetrix arrays and the TM4 Microarray Software Suite (http://www.tm4.org/) for Agilent arrays.

For arrays performed on the Affymetrix platform, the quality of the microarray analysis was confirmed using the arrayQualityMetrics package [24]. Background adjustment, quantile normalization, and summarization was performed with RMA using the simpleaffy package [25]. Using the siggenes package, pairwise analysis was performed with significance analysis of microarrays (SAM) [26] to identify statistically significant changes in gene expression. The delta was chosen to limit the output gene list to a false discovery rate (FDR) of less than 5%.

Identification and validation of gene signature

The gene signature for chronic inhaled endotoxin was defined by a common intersect of differentially regulated genes across 3 experiments. As the genes interrogated by each platform differed, each probeset from each platform was mapped to both common MGI gene symbols and common Entrez gene identifiers in order to identify a common intersect of both differentially expressed genes as well as genes interrogated by each microarray platform to identify a common background distribution of genes. As there is no readily available implementation for 3-way hypergeometric tests, 2-way

hypergeometric tests were performed to test for the statistical significance of the overlap between any two studies.

Comparison of studies at the gene and pathway level

Annotation of each gene in the gene signature was performed. For each study, genes with significant differential expression were tested for enrichment in pathways from KEGG [27], WikiPathways [28], Reactome [29], and Netpath[30] using a hypergeometric test ($p \leq 0.05$). The twenty most significant GO terms from each study were merged into a single representation as long as they reached significance in at least one study and visualized as a functional network using Cytoscape [31]. To identify other experimental studies that have differentially expressed genes highly correlated with the identified endotoxin gene signature, we used Nextbio. Nextbio is a proprietary software program that aggregates all publicly available high-throughput microarray data from repositories such as Gene Expression Omnibus (GEO), and performs quality control and significance testing to identify differentially expressed genes.

The system supports the calculation of pairwise gene signature correlation scores using rank-based enrichment statistics between a user-provided input gene signature and ranked gene lists generated from the public data sets within the NextBio corpus[32]. We identified the top 20 experimental conditions with the highest enrichment scores based on the endotoxin gene signature.

Interrogating biological significance of endotoxin gene signature in tobacco exposure

Consensus clustering[33] using expression probe intensity values was used to assess the role of the endotoxin-associated gene signature in smoking related lung disease. In

a study in which mice were exposed to air (as a control), LPS alone, smoke alone, and smoke as well as LPS, consensus clustering was performed by subsampling the gene signature (80% of the gene signature, repeated 1000 times) and assessing pairwise consensus values, the proportion that two items occupied the same cluster out of the number of times they occurred in the same subsample. The consensus values were compared to the mean consensus clustering value of 1000 random gene signatures of the same size.

Results

Four studies from three different investigators were identified from our literature search[18,19,23]. Characteristics of each study are as detailed in **Table 1**. There were differences between these studies in the strain of LPS and mouse used as well as the exposure protocol, microarray platform, and lab where the study was conducted. Using a FDR cutoff of 5%, 578, 3083, and 2256 genes were found to be differentially expressed for the Lai (5 day), Meng, and Brass datasets, respectively.

101 genes were found to be differentially expressed in common across all three studies (**Figure 1a, Supplementary Table 1**). Comparison of the genes mapped by each array revealed that 11,194 genes were present in the array platform across all three studies (**Figure 1b**). As there is no readily available method to implement 3-way hypergeometric tests, 2-way hypergeometric tests were performed to detect the statistical significance of the overlap between differentially expressed genes in each study. P-values were less than 4.1×10^{-27}, 1.8×10^{-24}, and 4.4×10^{-75} when comparing Brass vs Meng, Brass vs Lai, and Meng vs Lai (**Figure 1c**).

The genes present in the 101-gene signature are as listed in **Table 2**. As internal validation, we looked for the presence of proteins encoded by genes present in the well described LPS signaling pathway [34]. Both *lbp* (LPS binding protein) and *cd14* (cluster of differentiation 14) are present, although *tlr4* (Toll-like receptor 4) and *ly96* (lymphocyte antigen 96, which codes for the protein MD-2) were not. Further validation of the gene signature was performed by confirming that these 101 genes could accurately classify a separate 4th endotoxin and control PBS exposed murine experiment (Lai 8 week model, **Supplementary Figure 2**).

Functional evaluation of the 101-gene signature was performed. First, annotation of the 101 genes by querying PubMed to determine an association between these genes and published manuscripts on asthma and COPD revealed a significant amount of overlap, with 1024 asthma related publications and 437 COPD related publications (**Supplementary Tables 2 and 3**). Gene enrichment analysis was performed using DAVID. The Gene Ontology Biological Processes most enriched were response to wounding, inflammatory response, and acute inflammatory response. Using a repository of published experimental results (NextBio [35]), the 101 gene signature was found in a high frequency of murine asthma experiments (**Table 3**).

A pathway based comparison of the 3 experiments was performed using all known pathways present in Netpath, Wikipathways, Kegg, and Reactome. We used hypergeometric tests to determine pathway enrichment from each experiment and visualized the results with Cytoscape (**Fig 2**). Multiple similarities at the pathway level were noted, including in the complement, coagulation, and cell adhesion pathways. Within the same experimental model[23], longer duration of LPS exposure (Lai et al 5

day vs. 8 week) was associated with an increased enrichment of inflammatory pathways (**Fig 2a** vs. **Fig 2b**).

Finally, endotoxin is rarely if ever present as an environmental exposure alone but rather is typically present in conjunction with other exposures. Endotoxin is a known component of tobacco smoke[8], and so we sought to determine whether the key genes involved in the response to endotoxin are also important in the response to tobacco smoke. In experiments performed at a single laboratory where mice were exposed to air (as control), endotoxin, tobacco, and endotoxin with tobacco[19] (**Table 4**), and gene expression profiling was performed on lung homogenate, the 101 gene signature accurately classified endotoxin vs. smoke vs. endotoxin plus smoke exposed mice (**Supplementary Figure 3**). To assess the stability of the classification as well as to determine whether accurate classification was likely due to chance, we used consensus clustering where the ability of the endotoxin gene signature to accurately classify 1000 bootstrapped samples from the data was compared to a randomly chosen gene signature of equal size. Consensus clustering by the gene signature accurately classified air vs. endotoxin vs smoke vs smoke plus endotoxin exposed groups 99.97% of the time based on 1000 randomly chosen subsamples of probes from all arrays, vs. 78.15% of the time using an equal number of randomly chosen genes (**Figure 3**). This suggests that the ability of the endotoxin gene signature to classify between these subgroups is better than a random selection of genes.

Discussion

In this study, we made a number of novel observations. First, we identified a common set of 101 genes that was differentially regulated in endotoxin exposed vs. control (PBS

or air exposed) mice across all published models of recurrent endotoxin exposure. A number of genes previously identified as being important in either the pathogenesis or severity of COPD and asthma were present in the signature. In addition, there are a number of other genes identified not previously associated with obstructive lung disease, and may represent candidate genes for further investigation. Of particular interest is the ability of this 101 gene signature to accurately classify endotoxin, smoke, and endotoxin plus smoke exposed mice. While there appear to be some similarities in differential gene expression in response to endotoxin, to cigarette smoke, or to cigarette smoke in conjunction with endotoxin, whether this translates into a similar phenotype of obstructive lung disease cannot be concluded from this observation.

Comparison of these studies at the pathway level revealed additional similarities across these experiments. Notably, when looking within the same experimental model, longer duration of endotoxin exposure led to increased enrichment of inflammatory pathways, which is in contrast to prior studies suggesting that endotoxin tolerance develops in response to repeated endotoxin challenge[36]. While development of tolerance may be related to a number of factors such as the method or route of exposure, it deserves further study as chronic inflammation is thought to play an important role in both asthma and COPD.

While the 101 genes identified represents a small number of genes that are differentially expressed across experimental models as compared to the number of genes differentially expressed within any of the identified experimental models, factors that have previously been identified as being important in the biological response to endotoxin and likely contributed to the heterogeneity in response include significant differences in strain of endotoxin, strain of mouse, exposure protocol, and local practices

of each lab, and likely contributed to differentially expressed genes that were not conserved across experimental models[37,38]. We evaluated the significance of these 101 genes on a number of levels. First, using hypergeometric tests, we demonstrated that this common intersect is highly unlikely due to chance alone. Second, examination of the 101 genes revealed the presence of *lbp and cd14,* which are well described components of the endotoxin signaling pathway, thus affirming the biologic relevance of this gene signature. Third, this gene signature was able to accurately classify between endotoxin and phosphate buffered saline exposed mice in a distinct experiment not used to generate the gene signature. Finally, at the pathway level, we observed that increasing duration of endotoxin exposure led to increasing enrichment of inflammatory pathways; this was confirmed in a recent publication from our group [23], where increasing duration of inhaled endotoxin exposure was associated with increased IL-6 and decreased IL-10 concentrations in lung homogenate, consistent with a persistent pro-inflammatory profile. The increase in inflammation with prolonged endotoxin exposure was associated with and potentially mediated by an expansion of lung dendritic cells and a reduction in macrophages; thus it was not surprising to see that within the 101 gene signature, there were a number of genes important in antigen presentation that were differentially expressed (such as *h2ab-1* which encodes for MHC class II, myeloid chemokines such as *ccl6* and *ccl9,* cathepsins such as *ctsz, ctss, ctsb,* and *psa,* and C-type leptin-like receptors such as *clec4a2, clec4n,* and *clec7a*). Recent human studies have demonstrated the accumulation of dendritic cells in COPD, with an association between disease severity and level of dendritic cell accumulation.[39,40]On examination of the genes present in the 101 gene signature (**Supplementary Tables 1 and 2**), a number of asthma associated genes were present, including *chi3l1*, which was identified in one of the first genome-wide association (GWAS) studies of asthma[41], and *il33*,

which has been shown in a number of experiments to be important in asthma development[42,43] and asthma severity[43]. Interestingly, interleukin-33 has also been found to enhance the endotoxin response of macrophages[44]. Several COPD associated genes were present, including *mmp-12,* which has been identified in both murine studies as being associated with the development of emphysema [45] as well as in human studies as being associated with the risk of COPD development in smokers [46]. Of further interest was the identification of *fpr2 and saa3*. Serum amyloid protein (SAA) has previously been considered solely an acute phase reactant, and while *saa1* and *saa2* are expressed primarily in liver and kidney [47], *saa3* is expressed in the lung and has only recently been identified as important in the pathogenesis of glucocorticoid refractory COPD by opposing organ protective signaling by lipoxins at the ALX/FPR2 receptors [48].

While inhaled endotoxin exposure as a model for de novo COPD development rather than COPD exacerbations has received little attention, from epidemiologic studies it is clear that between a quarter to a half of patients with COPD have never smoked [5]. The phenotype of non-tobacco induced COPD as compared to tobacco-related COPD remains poorly studied. The third National Health and Nutrition Examination Survey (NHANES III) has suggested that non-smokers account for 24.9% of COPD cases in the United States [49]; in this study many subjects with non-tobacco COPD previously had a physician diagnosis of asthma. The multi-center, international BOLD study [50] confirms these findings, estimating that between a quarter to a fifth of all patients with COPD are nonsmokers. Indoor biomass fuel exposure and occupational exposure to biologic or organic dusts in the workplace, both of which has been associated with high levels of endotoxin exposure, were associated with non-tobacco COPD. As in the NHANES

study, self-reported physician diagnosis of asthma was a strong predictor of non-tobacco COPD. While this may represent disease misclassification by physicians, as the existence of non-tobacco COPD is not widely appreciated, it is also possible that this may relate to the underlying phenotype of non-tobacco COPD that is different from tobacco-related COPD.

The ability of the 101 gene signature to accurately classify between endotoxin, smoke, and endotoxin plus smoke exposed mice, and not just mice exposed to air vs. mice exposed to any endotoxin (whether as endotoxin alone, tobacco smoke [which contains endotoxin], or endotoxin in addition to tobacco smoke) is intriguing. It suggests that genes selected for differential expression between endotoxin and control also play an important role in differential expression between various endotoxin containing exposures. Further examination of expression patterns of the 101 gene signature in this comparison indicate that (**Supplementary Figure 3**) *chi3l1*, which is associated with asthma, was upregulated only in endotoxin exposed mice. Conversely, *mmp12* was significantly upregulated in all exposure groups although average $\log_2$ fold change for smoke vs. control was 4.76, for LPS vs. control was 2.05, and for smoke + LPS vs. control was 2.33.. MMP-12 does not appear to have an important role in endotoxin induced inflammation[51], but the interaction between smoke and endotoxin has not been well studied. Of note *mmp12* has been associated with the emphysema subtype of COPD[45]. If these gene expression changes are reflected in human exposures and affect downstream clinical phenotypes, it is possible that endotoxin-related COPD has a phenotype more consistent with small airways disease rather than parenchymal disease as seen in tobacco-related emphysema. A further potential implication of the observed differences in *mmp12* expression is that smokers who have recurrent bacterial infections

(and thus are exposed recurrently to endotoxin) may be more likely to develop a predominantly airways disease subphenotype of COPD rather than a predominantly emphysema subphenotype of COPD[52].

Strengths of this work include the approach to identify the consistency of gene expression across experimental models, the use of consensus clustering to validate the importance of the identified gene signature against a randomly picked set of genes, and the potential biological applications of the gene signature. This is the first paper to assess the importance of the endotoxin component of cigarette smoke as an exposure using genomic techniques.

We acknowledge that there are several limitations to this work. These studies were performed in murine models and may not be translatable to human disease. Additionally, all of these studies were performed on lung homogenates, and it is difficult to distinguish which cell population contributed to the gene expression signature. Differences between duration of endotoxin exposure were not explicitly addressed as we were looking for agreement across studies; prior work has demonstrated that there are changes in short term vs. long term exposure.[23] Finally, to verify the biologic importance of any one of the identified genes, additional functional work is needed.

To date all treatment trials of COPD have required prior significant tobacco use as an inclusion criteria, and thus we know little about the efficacy of COPD therapies in non-tobacco related COPD. While our work suggests that the endotoxin component of cigarette smoke may be important in disease development, the effect of additional endotoxin in conjunction with tobacco exposure leads to different gene expression changes compared to endotoxin alone. The differentially expressed genes in response

to repeated endotoxin exposure that we identified have been implicated in both asthma and COPD, and based on our pathway analysis, chronic inflammation plays a significant role. There may be other biologically-targeted therapies that may have additional benefit in endotoxin-related obstructive lung disease. Prognosis and treatment implications of this disease may or may not differ from tobacco-related COPD, and deserves further study.

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Tables

Table 1. Description of all included studies including differences by endotoxin strain, mouse strain, exposure protocol, and microarray platform used.

Investigator	Endotoxin strain	Mouse strain	Exposure protocol	Microarray platform
Brass et al[18]	*Escherichia coli* serotype 0111:B4	C57BL/6	• 5 µg/m^3 atomized LPS with air as control • 4 hrs/day, 5 days/week • 1 week duration • N=8 per exposure group[a]	Agilent 20K customized mouse array
Meng et al[19]	*Escherichia coli* serotype O55:B5	AKR/J	• 0.5 µg /L nebulized LPS with air as control • 1 h/day, 2x/week • 3 week duration • N=6 for air exposure, N=5 for LPS exposure	Affymetrix mouse genome 430 2.0 array
Lai et al[23]	*Pseudomonas aeruginosa* serotype 10	C57BL/6	• 2mg/day nebulized LPS with nebulized phosphate buffered saline (PBS) as control • 15 min/day, 5 days/week • 5 day duration[b] • N=4 per exposure group	Affymetrix mouse genome 430a 2.0 array
			• 2mg/day nebulized LPS with nebulized phosphate buffered saline (PBS) as control • 15 min/day, 5 days/week • 8 week duration* • N=4 per exposure group	

[a] In this study, 24 mice were exposed to each condition, with RNA was pooled 3 mice per array, for a total of 8 arrays per experimental condition,

[b] 5 day duration used as part of training set to identify common gene signature, 8 week duration used as test set to determine if gene signature can accurately classify between endotoxin and control phosphate buffered saline (PBS) exposed mice

Table 2. Mouse genome identifier (MGI) gene symbols for all genes identified in the 101 gene signature.

1100001G20Rik	Ch25h	Fn1	Ly6i	Rab32
Acp2	Chi3l1	Fpr2	Matn4	Reg3g
Atp6ap2	Chi3l3	Gatm	Mmp12	Rmcs2
B4galnt1	Clec4a2	Grn	Ms4a6d	Saa3
Bcl2a1a	Clec4n	H2-Ab1	Ms4a7	Sirpa
Bcl2a1b	Clec7a	Havcr2	Mtm1	Slc26a4
Bcl2a1d	Clu	Hvcn1	Muc1	Slc3a2
Bst1	Cp	Id2	Naip1-rs1	Slc6a20a
C1qb	Csf2rb2	Ifi30	Naip2	Smpdl3b
C1ra	Ctsb	Ifit3	Olfm1	Snx10
C1rb	Ctsk	Igf1	Olr1	Tgfbi
C2	Ctss	Il1rn	Orm1	Tgfbr1
C3	Ctsz	Il33	Orm2	Tifa
Capg	Cxcl17	Itgax	Per3	Tlr7
Ccl6	Cxcl2	Itgb2	Pigr	Tmem106a
Ccl9	Cyba	Itih4	Pon1	U46068
Cd14	Cybb	Lair1	Prkcd	Vnn1
Cd1d1	Dab2	Laptm5	Procr	
Cd200r1	Dbp	Lbp	Psap	
Cd68	Emr1	Lgals3bp	Ptgs1	
Cfb	F10	Lrg1	Rab20	

Table 3. Identifying other studies with similar expression of 101 gene signature in the context of the public corpus of gene expression studies using NextBio. The top 20 experiments with gene signatures present in the NextBio database that have the highest enrichment scores for the 101 gene signature are listed below. Multiple murine asthma studies demonstrate similar gene expression patterns to the 101 gene signature.

Study Name	GEO ID
Lung gene expression profiles in a mouse model of IL-13-induced allergic airway inflammation	GSE35979
Lungs of BALB/c wildtype or Rag deficient mice exposed to ovalbumin as an experimental asthma model	GSE6858
Murine pulmonary responses to ambient Baltimore particulate matter	GSE9465
Lungs from IFNg-/-, IRF1-/-, or WT mice infected with M. avium	GSE11809
Effect of a disease-associated human IL-4 receptor allele in experimental asthma	GSE18010
Hookworm-Induced Persistent Changes to the Immunological Environment of the Lung	GSE5555
Virus-Induced Airway Disease in Mice	GSE10964
The effect of IL-13 and dust mites on gene expression in murine model of asthma	GSE1301
Lungs of BAL/C mice sensitized with ovalbumin (OVA) and exposed to diesel exhaust particles (DEP)	GSE22357
Lungs of C57BL6 mice infected with a low dose of M. tuberculosis for 30 and 70 days	E-MEXP-1899
Lungs from mice in time course infection study of pandemic H1N1 influenza A isolate A/CA/4/2009	GSE37569
Murine Airway Hyperresponsiveness	GSE3184
Hyperlipidemic aorta atherosclerosis in ApoE null mice	GSE21419
Immune response to Pneumocystis Infection in WT and CD40 Ligand Deficient Mice	GSE11005
Lung expression in Foxa3 knock-out and wildtype mice challenged with allergen	GSE13382
Plasma cell tumor progression	GSE34078
Lungs from mice exposed to bleomycin	GSE16846
Ovalbumen sensitized and challenged A/J mice	GSE450
Lung gene expression in ovalbumin (OVA)-induced experimental asthma	GSE11911
Mndal suppresses cell growth and may modify plasmacytoma susceptibility	GSE17297

Table 4. Description of exposure protocol used in comparing endotoxin, cigarette smoke, and endotoxin plus cigarette smoke exposed mice.

Investigator	Endotoxin strain	Mouse strain	Exposure protocol	Microarray platform
Meng et al	*Escherichia coli* serotype O55:B5	AKR/J	**Air only (Control)** • HEPA-filtered air • 3 weeks • N=6	Affymetrix mouse genome 430 2.0 array
			LPS only • 0.5 µg LPS/L nebulized LPS • 1 h/day, 2x/week • 3 weeks • N=5	
			Smoke only • 2R4F cigarettes (250 µg WTPM) • 5 h/day, 5x/week • 3 weeks • N=6	
			LPS + smoke • Smoke protocol (5x/week) with concurrent LPS protocol (2x/week) • 3 weeks • N=5	

Figure legends

Figure 1. Comparison of 3 identified studies of murine inhaled endotoxin exposure used to generate gene signature. **1a.** Common intersect of differentially regulated genes (endotoxin vs. control exposure) identifies a gene signature for endotoxin exposure. **1b**. Common intersect of arrays used in each studies represents a background distribution to identify the statistical significance of the gene signature. **1c**. 2-way hypergeometric tests to identify statistical significance of gene signature.

Figure 2. Comparison of all 4 identified studies at the pathway level. Pathway enrichment calculated using hypergeometric tests with all known pathways present in Netpath, Wikipathways, Kegg, and Reactome, with Cytoscape for visualization. **2a.** Lai et al, 5 day exposure. **2b**. Lai et al, 8 week exposure. **2c**. Meng et al, 3 week exposure. **2d**. Brass et al, 1 week exposure.

Figure 3. Consensus clustering of air, endotoxin, smoke, and endotoxin plus smoke exposed mice using endotoxin gene signature and random gene signature. The endotoxin gene signature accurately clusters the different exposure groups 99.97% of the time as compared to a randomly chosen gene signature which accurately clusters the different exposure groups 78.15% of the time.

Figure 1.


A
Lai et al
(5 day)
Brass et al
(1 week)
187
43
1035
101
142
280
1266
Meng et al
(3 week)
B
Affymetrix
430a 2.0
Agilent custom
array
0
0
3777
11194
3442
2974
4743
Affymetrix 430 2.0
C
Studies compared
Probability of
selecting common
genes
Brass et al
1078
381
1408
Meng et al
p < 4.1 e-27
Brass et al
1315
144
329
Lai et al
p < 1.8 e-24
Meng et al
1546
243
230
Lai et al
p < 4.4 e-75

Figure 2.

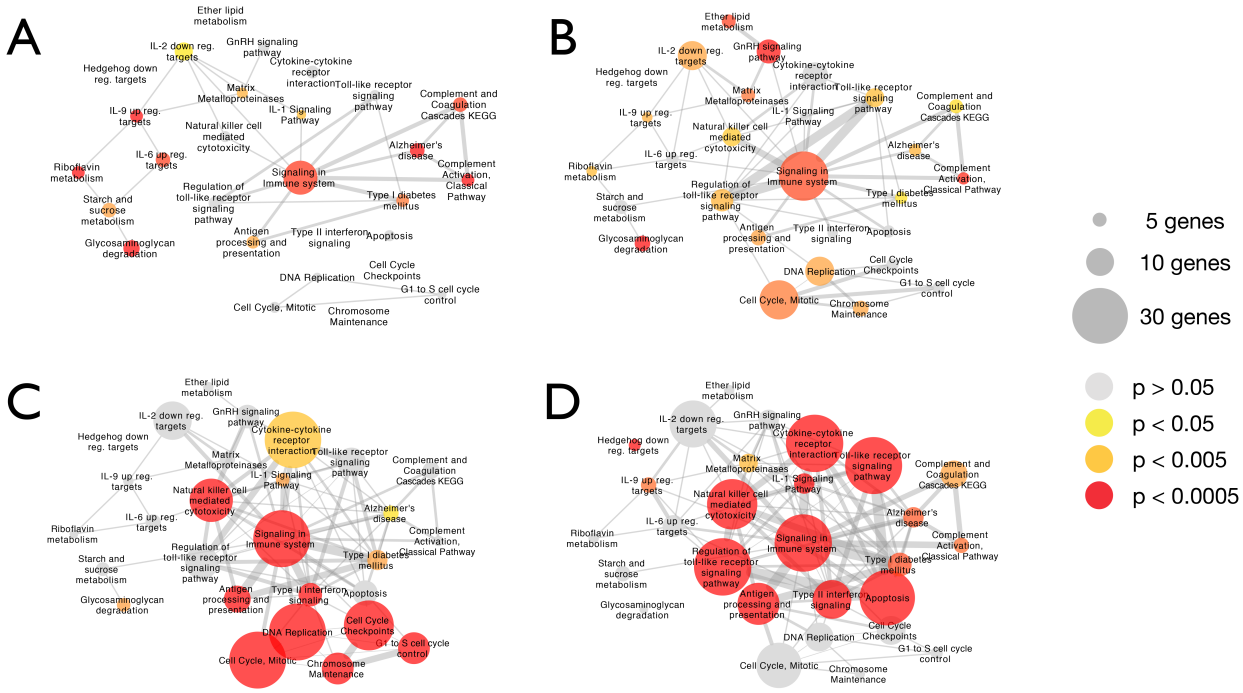
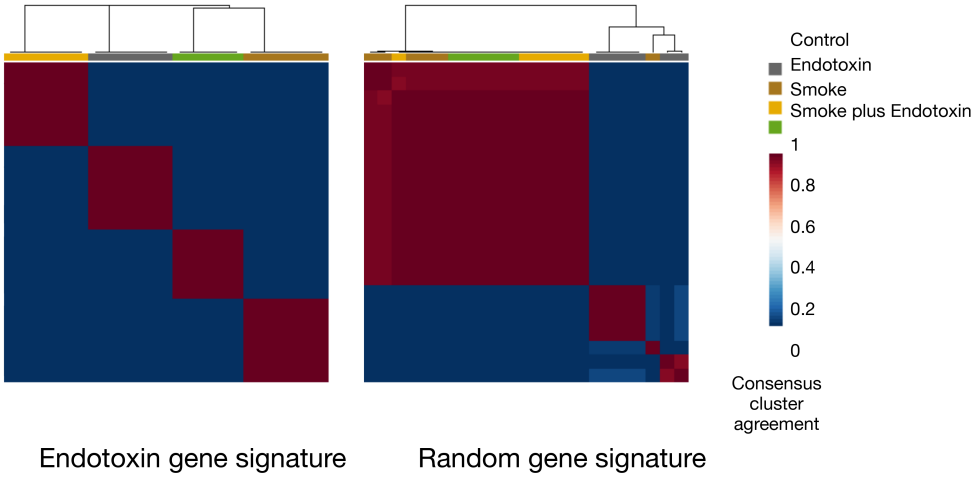
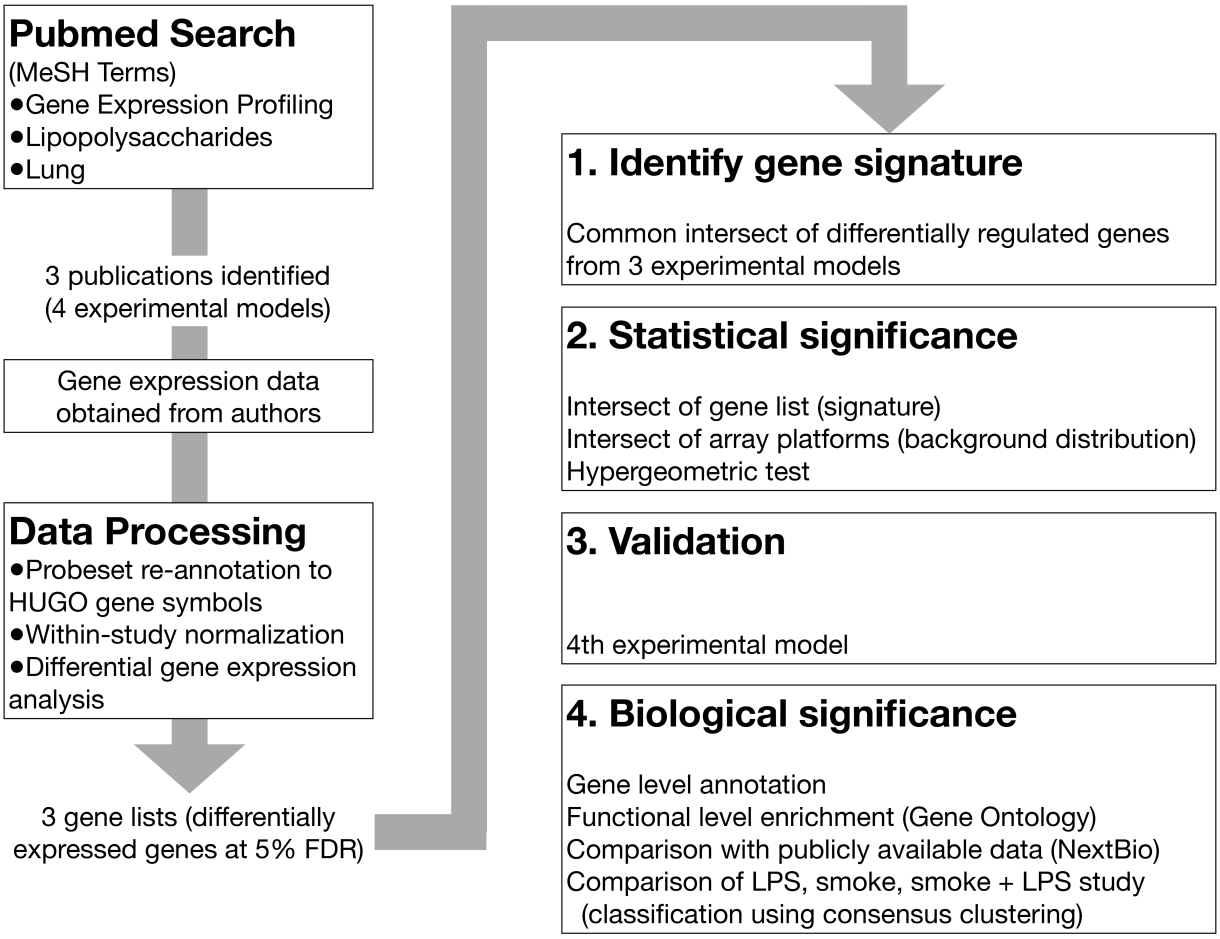

A
B
C
D
Ether lipid metabolism
IL-2 down reg. targets
GnRH signaling pathway
Cytokine-cytokine receptor interaction
Hedgehog down reg. targets
Matrix Metalloproteinases
Toll-like receptor signaling pathway
Complement and Coagulation Cascades KEGG
IL-9 up reg. targets
IL-1 Signaling Pathway
Natural killer cell mediated cytotoxicity
Alzheimer's disease
IL-6 up reg. targets
Riboflavin metabolism
Signaling in Immune system
Complement Activation, Classical Pathway
Regulation of toll-like receptor signaling pathway
Type I diabetes mellitus
Starch and sucrose metabolism
Antigen processing and presentation
Type II interferon signaling
Apoptosis
Glycosaminoglycan degradation
Cell Cycle Checkpoints
DNA Replication
G1 to S cell cycle control
Cell Cycle, Mitotic
Chromosome Maintenance
5 genes
10 genes
30 genes
p > 0.05
p < 0.05
p < 0.005
p < 0.0005

Figure 3.

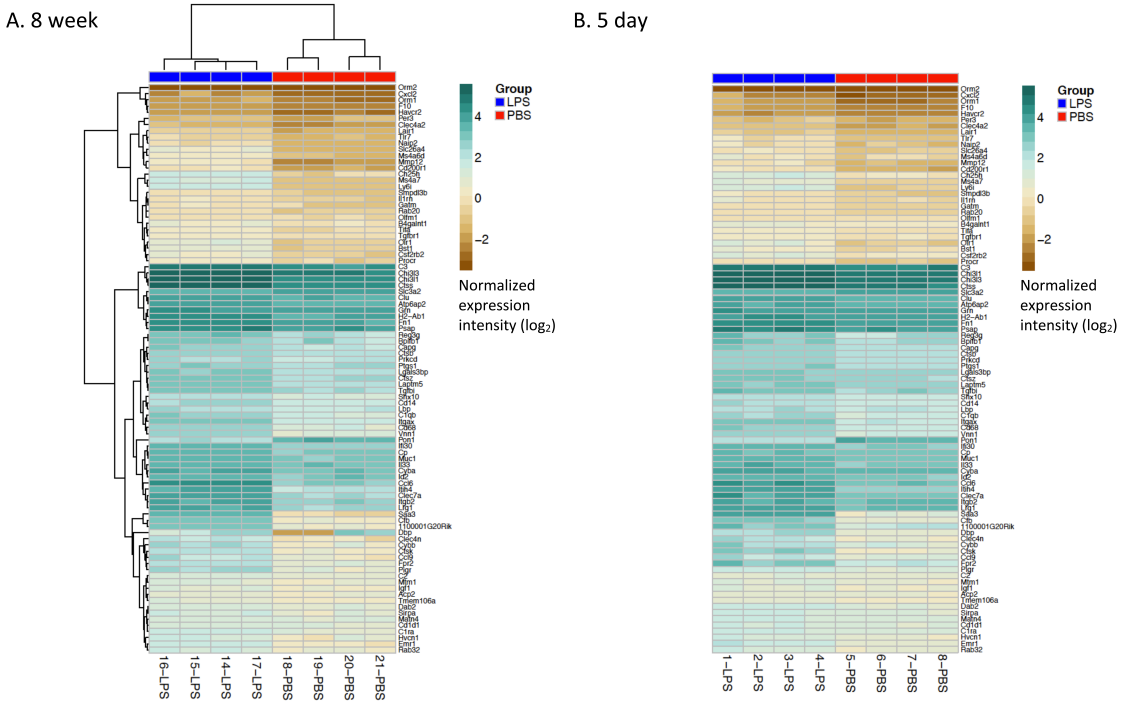

Control
Endotoxin
Smoke
Smoke plus Endotoxin
1
0.8
0.6
0.4
0.2
0
Consensus cluster agreement
Endotoxin gene signature
Random gene signature

Supplementary figures and tables

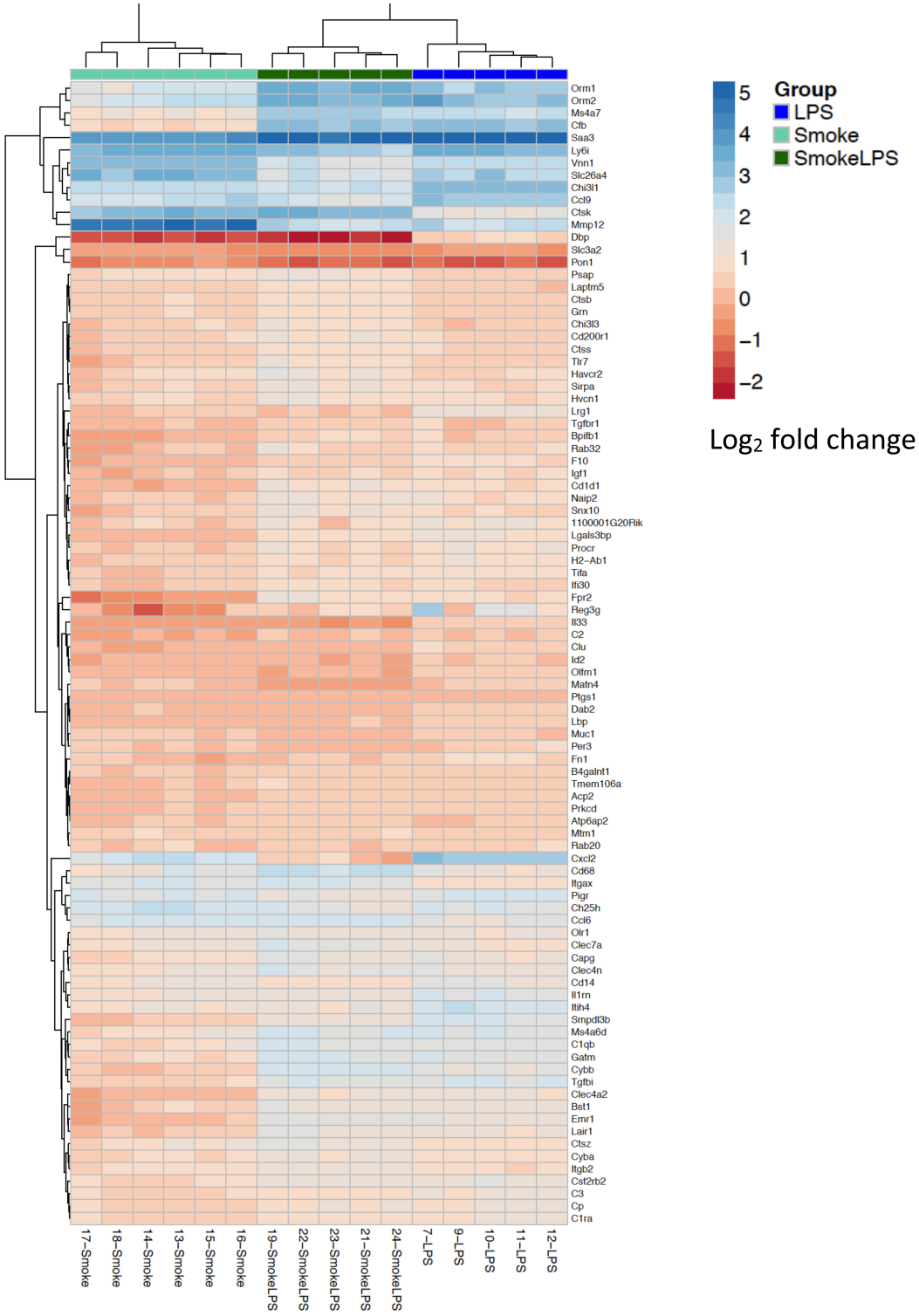
Supplementary Figure 1. Overview of methods.



Supplementary Figure 2. Heatmap based on normalized expression intensity of 101 genes in gene signature between endotoxin and control phosphate buffered saline exposed mice. Normalized expression intensities been centered to a mean expression of zero across each gene. 2a. Gene signature accurately classifies between endotoxin (LPS) and control (PBS) exposed mice at 8 weeks. 2b. Expression patterns for the 101 genes at 5 days are concordant with those observed at 8 weeks.



Supplementary Figure 3. Heatmap based on log_2 fold change of 101 genes in gene signature in smoke, endotoxin, and smoke plus endotoxin exposed mice as compared to air exposed (control) mice. Gene signature accurately classifies between these groups.



Supplementary Table 1. Annotation of 101 gene signature with gene name and MGI identifier.

MGI symbol	MGI Description	MGI ID
1100001G20Rik	RIKEN cDNA 1100001G20 gene Gene	MGI:1913357
Acp2	acid phosphatase 2, lysosomal Gene	MGI:87882
Atp6ap2	ATPase, H+ transporting, lysosomal accessory protein 2 Gene	MGI:1917745
B4galnt1	beta-1,4-N-acetyl-galactosaminyl transferase 1 Gene	MGI:1342057
Bcl2a1a	B-cell leukemia/lymphoma 2 related protein A1a Gene	MGI:102687
Bcl2a1b	B-cell leukemia/lymphoma 2 related protein A1b Gene	MGI:1278326
Bcl2a1d	B-cell leukemia/lymphoma 2 related protein A1d Gene	MGI:1278325
Bst1	bone marrow stromal cell antigen 1 Gene	MGI:105370
C1qb	complement component 1, q subcomponent, beta polypeptide Gene	MGI:88224
C1ra	complement component 1, r subcomponent A Gene	MGI:1355313
C1rb	complement component 1, r subcomponent B Gene	MGI:3779804
C2	complement component 2 (within H-2S) Gene	MGI:88226
C3	complement component 3 Gene	MGI:88227
Capg	capping protein (actin filament), gelsolin-like Gene	MGI:1098259
Ccl6	chemokine (C-C motif) ligand 6 Gene	MGI:98263
Ccl9	chemokine (C-C motif) ligand 9 Gene	MGI:104533
Cd14	CD14 antigen Gene	MGI:88318
Cd1d1	CD1d1 antigen Gene	MGI:107674
Cd200r1	CD200 receptor 1 Gene	MGI:1889024
Cd68	CD68 antigen Gene	MGI:88342
Cfb	complement factor B Gene	MGI:105975
Ch25h	cholesterol 25-hydroxylase Gene	MGI:1333869
Chi3l1	chitinase 3-like 1 Gene	MGI:1340899
Chi3l3	chitinase 3-like 3 Gene	MGI:1330860
Clec4a2	C-type lectin domain family 4, member a2 Gene	MGI:1349412
Clec4n	C-type lectin domain family 4, member n Gene	MGI:1861231
Clec7a	C-type lectin domain family 7, member a Gene	MGI:1861431
Clu	clusterin Gene	MGI:88423
Cp	ceruloplasmin Gene	MGI:88476
Csf2rb2	colony stimulating factor 2 receptor, beta 2, low-affinity (granulocyte-macrophage) Gene	MGI:1339760
Ctsb	cathepsin B Gene	MGI:88561
Ctsk	cathepsin K Gene	MGI:107823
Ctss	cathepsin S Gene	MGI:107341
Ctsz	cathepsin Z Gene	MGI:1891190
Cxcl17	chemokine (C-X-C motif) ligand 17 Gene	MGI:2387642
Cxcl2	chemokine (C-X-C motif) ligand 2 Gene	MGI:1340094
Cyba	cytochrome b-245, alpha polypeptide Gene	MGI:1316658

Cybb	cytochrome b-245, beta polypeptide Gene	MGI:88574
Dab2	disabled homolog 2 (Drosophila) Gene	MGI:109175
Dbp	D site albumin promoter binding protein Gene	MGI:94866
Emr1	EGF-like module containing, mucin-like, hormone receptor-like sequence 1 Gene	MGI:106912
F10	coagulation factor X Gene	MGI:103107
Fn1	fibronectin 1 Gene	MGI:95566
Fpr2	formyl peptide receptor 2 Gene	MGI:1278319
Gatm	glycine amidinotransferase (L-arginine:glycine amidinotransferase) Gene	MGI:1914342
Grn	granulin Gene	MGI:95832
H2-Ab1	histocompatibility 2, class II antigen A, beta 1 Gene	MGI:103070
Havcr2	hepatitis A virus cellular receptor 2 Gene	MGI:2159682
Hvcn1	hydrogen voltage-gated channel 1 Gene	MGI:1921346
Id2	inhibitor of DNA binding 2 Gene	MGI:96397
Ifi30	interferon gamma inducible protein 30 Gene	MGI:2137648
Ifit3	interferon-induced protein with tetratricopeptide repeats 3 Gene	MGI:1101055
Igf1	insulin-like growth factor 1 Gene	MGI:96432
Il1rn	interleukin 1 receptor antagonist Gene	MGI:96547
Il33	interleukin 33 Gene	MGI:1924375
Itgax	integrin alpha X Gene	MGI:96609
Itgb2	integrin beta 2 Gene	MGI:96611
Itih4	inter alpha-trypsin inhibitor, heavy chain 4 Gene	MGI:109536
Lair1	leukocyte-associated Ig-like receptor 1 Gene	MGI:105492
Laptm5	lysosomal-associated protein transmembrane 5 Gene	MGI:108046
Lbp	lipopolysaccharide binding protein Gene	MGI:1098776
Lgals3bp	lectin, galactoside-binding, soluble, 3 binding protein Gene	MGI:99554
Lrg1	leucine-rich alpha-2-glycoprotein 1 Gene	MGI:1924155
Ly6i	lymphocyte antigen 6 complex, locus I Gene	MGI:1888480
Matn4	matrilin 4 Gene	MGI:1328314
Mmp12	matrix metallopeptidase 12 Gene	MGI:97005
Ms4a6d	membrane-spanning 4-domains, subfamily A, member 6D Gene	MGI:1916024
Ms4a7	membrane-spanning 4-domains, subfamily A, member 7 Gene	MGI:1918846
Mtm1	X-linked myotubular myopathy gene 1 Gene	MGI:1099452
Muc1	mucin 1, transmembrane Gene	MGI:97231
Naip1-rs1	NLR family, apoptosis inhibitory protein 1, related sequence 1 Pseudogene	MGI:109439
Naip2	NLR family, apoptosis inhibitory protein 2 Gene	MGI:1298226
Olfm1	olfactomedin 1 Gene	MGI:1860437
Olr1	oxidized low density lipoprotein (lectin-like) receptor 1 Gene	MGI:1261434
Orm1	orosomucoid 1 Gene	MGI:97443
Orm2	orosomucoid 2 Gene	MGI:97444
Per3	period homolog 3 (Drosophila) Gene	MGI:1277134

Pigr	polymeric immunoglobulin receptor Gene	MGI:103080
Pon1	paraoxonase 1 Gene	MGI:103295
Prkcd	protein kinase C, delta Gene	MGI:97598
Procr	protein C receptor, endothelial Gene	MGI:104596
Psap	prosaposin Gene	MGI:97783
Ptgs1	prostaglandin-endoperoxide synthase 1 Gene	MGI:97797
Rab20	RAB20, member RAS oncogene family Gene	MGI:102789
Rab32	RAB32, member RAS oncogene family Gene	MGI:1915094
Reg3g	regenerating islet-derived 3 gamma Gene	MGI:109406
Rmcs2	response to metastatic cancers 2 Gene	MGI:1890697
Saa3	serum amyloid A 3 Gene	MGI:98223
Sirpa	signal-regulatory protein alpha Gene	MGI:108563
Slc26a4	solute carrier family 26, member 4 Gene	MGI:1346029
Slc3a2	solute carrier family 3 (activators of dibasic and neutral amino acid transport), member 2 Gene	MGI:96955
Slc6a20a	solute carrier family 6 (neurotransmitter transporter), member 20A Gene	MGI:2143217
Smpdl3b	sphingomyelin phosphodiesterase, acid-like 3B Gene	MGI:1916022
Snx10	sorting nexin 10 Gene	MGI:1919232
Tgfbi	transforming growth factor, beta induced Gene	MGI:99959
Tgfbr1	transforming growth factor, beta receptor I Gene	MGI:98728
Tifa	TRAF-interacting protein with forkhead-associated domain Gene	MGI:2182965
Tlr7	toll-like receptor 7 Gene	MGI:2176882
Tmem106a	transmembrane protein 106A Gene	MGI:1922056
U46068	cDNA sequence U46068 Gene	MGI:2137431
Vnn1	vanin 1 Gene	MGI:108395

Supplementary Table 2. Pubmed search of genes present in gene signature previously reported to be associated with asthma.

symbol	count	pmid	year	journal
Tgfbi	0	0		
Matn4	0	0		
Clec7a	0	0		
Olr1	1	22611474	2012	American journal of translational research
Ctsz	0	0		
Mmp12	12	23075521	2012	International archives of allergy and immunology
Mmp12	12	22837640	2012	Biomarker insights
Mmp12	12	22305682	2012	The Journal of allergy and clinical immunology
Mmp12	12	22216879	2012	Clinical and molecular allergy : CMA
Mmp12	12	20546881	2010	The Journal of allergy and clinical immunology
Mmp12	12	20133923	2010	American journal of respiratory and critical care medicine
Mmp12	12	20018959	2009	The New England journal of medicine

Mmp12	12	19028979	2009	American journal of physiology. Lung cellular and molecular physiology
Mmp12	12	16359550	2005	Respiratory research
Mmp12	12	16166618	2005	American journal of respiratory and critical care medicine
Mmp12	12	15474460	2004	Biochemical and biophysical research communications
Mmp12	12	11893658	2002	Chest
Per3	0	0		
Dab2	0	0		
Slc3a2	0	0		
Cyba	6	19459419	2009	TerapevticheskiÄ arkhiv
Cyba	6	18716406	2009	International archives of allergy and immunology
Cyba	6	18672803	2008	Genetika
Cyba	6	16608528	2006	Journal of negative results in biomedicine
Cyba	6	12594296	2003	Journal of immunology (Baltimore, Md. : 1950)
Cyba	6	11940577	2002	The Journal of biological chemistry
Fpr2	9	22410002	2012	Biochemical pharmacology
Fpr2	9	22377711	2012	Journal of human genetics
Fpr2	9	22297737	2012	Archives of pharmacal research
Fpr2	9	21095183	2011	Biochemical pharmacology
Fpr2	9	18583575	2008	American journal of respiratory and critical care medicine
Fpr2	9	17046755	2006	FEBS letters
Fpr2	9	12205450	2002	Nature medicine
Fpr2	9	12172542	2002	Nature medicine
Fpr2	9	12088274	2002	Cellular and molecular life sciences : CMLS
Ctsk	1	17311556	2007	Current pharmaceutical design
Ctss	1	22170489	2012	The Journal of investigative dermatology
Dbp	12	23026126	2012	Water research
Dbp	12	22234043	2012	European journal of clinical nutrition
Dbp	12	21429484	2011	Environmental research
Dbp	12	21370925	2011	Journal of agricultural and food chemistry
Dbp	12	19740346	2009	Immunology
Dbp	12	18528597	NA	Revista portuguesa de pneumologia
Dbp	12	17969688	2007	Environmental science & technology
Dbp	12	16236340	2005	Water research
Dbp	12	15103311	2004	Journal of human hypertension
Dbp	12	9055100	1996	Indian journal of physiology and pharmacology
Dbp	12	1279289	1992	Journal of cardiovascular pharmacology
Dbp	12	6507943	1984	Angiology
Ctsb	0	0		
Laptm5	0	0		
Cxcl2	30	22355409	2012	PloS one
Cxcl2	30	21961642	2011	Journal of environmental science and health

Cxcl2	30	21356202	2011	Chemico-biological interactions
Cxcl2	30	19864593	2009	Journal of immunology (Baltimore, Md. : 1950)
Cxcl2	30	19785013	2009	Stem cells (Dayton, Ohio)
Cxcl2	30	19744573	2009	Pulmonary pharmacology & therapeutics
Cxcl2	30	19671179	2009	Virology journal
Cxcl2	30	19560456	2009	European journal of pharmacology
Cxcl2	30	19050257	2008	Journal of immunology (Baltimore, Md. : 1950)
Cxcl2	30	18787777	2008	Inflammation research
Cxcl2	30	18774390	2008	The Journal of allergy and clinical immunology
Cxcl2	30	18292580	2008	Journal of immunology (Baltimore, Md. : 1950)
Cxcl2	30	18021431	2007	Respiratory research
Cxcl2	30	18007984	2007	Environmental health perspectives
Cxcl2	30	17980417	2008	The Journal of allergy and clinical immunology
Cxcl2	30	17641782	2007	The Journal of clinical investigation
Cxcl2	30	17014439	2006	Clinical and experimental allergy
Cxcl2	30	16929007	2006	Toxicological sciences : an official journal of the Society of Toxicology
Cxcl2	30	16290175	2005	Cytokine
Cxcl2	30	16202497	2006	Toxicology
Cxcl2	30	16122864	2005	Toxicology
Cxcl2	30	15885264	2005	Toxicology and applied pharmacology
Cxcl2	30	15668323	2005	American journal of respiratory cell and molecular biology
Cxcl2	30	15585884	2004	Journal of immunology (Baltimore, Md. : 1950)
Cxcl2	30	14976461	2004	Medical science monitor
Cxcl2	30	12476359	2003	Inhalation toxicology
Cxcl2	30	11766995	2001	Inflammation research
Cxcl2	30	11726396	2001	American journal of respiratory cell and molecular biology
Cxcl2	30	9847020	1998	Veterinary immunology and immunopathology
Cxcl2	30	9490662	1998	American journal of respiratory cell and molecular biology
Saa3	3	22174454	2012	Journal of immunology (Baltimore, Md. : 1950)
Saa3	3	21622869	2011	Journal of immunology (Baltimore, Md. : 1950)
Saa3	3	16973978	2006	American journal of respiratory and critical care medicine
Tmem106a	0	0		
Prkcd	5	15536414	2004	The Journal of allergy and clinical immunology
Prkcd	5	12759450	2003	Journal of immunology (Baltimore, Md. : 1950)
Prkcd	5	12529321	2003	The Journal of biological chemistry
Prkcd	5	11748588	2001	Journal of cellular physiology
Prkcd	5	9478929	1998	The Journal of biological chemistry
Clu	1	10842440	NA	BoletÃn de la AsociaciÃ³n MÃ©dica de Puerto Rico
Smpdl3b	0	0		
Lair1	0	0		
Itih4	0	0		

Grn	0	0		
Tgfbr1	0	0		
Lrg1	0	0		
Cd1d1	2	20083656	2010	Journal of immunology (Baltimore, Md. : 1950)
Cd1d1	2	9927517	1999	The Journal of experimental medicine
C3	143	23113211	2012	Iranian journal of public health
C3	143	22997700	NA	Bioorganicheskaia khimiia
C3	143	22734375	2012	Zhongguo zhen jiu = Chinese acupuncture & moxibustion
C3	143	22567103	2012	PloS one
C3	143	22372350	2012	Clinical laboratory
C3	143	22367138	2012	Medical science monitor
C3	143	22361510	2012	Allergology international
C3	143	22246175	2012	American journal of respiratory and critical care medicine
C3	143	22211906	2012	Clinical and experimental allergy
C3	143	22149063	2012	Journal of aerosol medicine and pulmonary drug delivery
C3	143	22065014	NA	Jornal de pediatria
C3	143	21846943	2011	Disease markers
C3	143	21801245	2012	Clinical and experimental allergy
C3	143	21620804	2011	Biochemical pharmacology
C3	143	21480785	2011	Journal of alternative and complementary medicine (New York, N.Y.)
C3	143	21462136	2011	Chinese journal of medical genetics
C3	143	21210563	2004	
C3	143	20696559	2010	Phytomedicine
C3	143	20600518	2010	Food and chemical toxicology
C3	143	20589464	2010	Indian journal of pediatrics
C3	143	20538303	2010	Journal of the neurological sciences
C3	143	20511342	2010	American journal of physiology. Lung cellular and molecular physiology
C3	143	20402389	2010	Expert review of clinical immunology
C3	143	20395963	2010	Journal of human genetics
C3	143	20029843	2010	Proteomics
C3	143	19684087	2009	Journal of immunology (Baltimore, Md. : 1950)
C3	143	22557323	2009	Ancient science of life
C3	143	18566738	2008	Journal of human genetics
C3	143	18424754	2008	Journal of immunology (Baltimore, Md. : 1950)
C3	143	19823661	2008	Indian journal of orthopaedics
C3	143	17418355	NA	Neurophysiologie clinique = Clinical neurophysiology
C3	143	17082579	2006	Journal of immunology (Baltimore, Md. : 1950)
C3	143	17002917	2006	Translational research : the journal of laboratory and clinical medicine
C3	143	16913666	2006	Rinsho byori. The Japanese journal of clinical pathology
C3	143	16879240	2006	Clinical and experimental immunology
C3	143	16858009	2006	American journal of respiratory cell and molecular biology

C3	143	16574942	2006	American journal of respiratory cell and molecular biology
C3	143	16439722	2006	American journal of respiratory and critical care medicine
C3	143	16355111	2006	Genes and immunity
C3	143	16312927	2005	Zhongguo zhen jiu = Chinese acupuncture & moxibustion
C3	143	16293803	2006	American journal of respiratory and critical care medicine
C3	143	16186675	2005	Indian journal of pediatrics
C3	143	16113417	2004	Proceedings of the American Thoracic Society
C3	143	16091207	2005	Current allergy and asthma reports
C3	143	15655303	2004	Journal of smooth muscle research
C3	143	15638941	2005	Respiratory research
C3	143	15338393	2004	Pediatric nephrology (Berlin, Germany)
C3	143	15278436	2004	Human genetics
C3	143	12097289	2002	Cancer research
C3	143	12096683	2002	Central European journal of public health
C3	143	11980156	2002	Klinicheskaia meditsina
C3	143	11979168	2002	Spine
C3	143	11591733	2001	Journal of immunology (Baltimore, Md. : 1950)
C3	143	11510804	2001	The European respiratory journal
C3	143	11477893	1998	Chinese journal of tuberculosis and respiratory diseases
C3	143	11189891	2000	Handchirurgie, Mikrochirurgie, plastische Chirurgie
C3	143	10826222	2000	Hukuoka acta medica
C3	143	10660972	NA	Romanian journal of internal medicine
C3	143	10553582	1999	Nihon yakurigaku zasshi. Folia pharmacologica Japonica
C3	143	10594541	1999	Clinical and experimental allergy
C3	143	9538632	1998	The Korean journal of internal medicine
C3	143	9440942	1997	Meditsina truda i promyshlennaia ekologiia
C3	143	8843003	1996	Journal of Korean medical science
C3	143	8563490	1996	International archives of allergy and immunology
C3	143	8520733	1995	American journal of respiratory and critical care medicine
C3	143	7752082	1995	The Journal of pharmacology and experimental therapeutics
C3	143	7950448	NA	Pneumoftiziologia]
C3	143	8443468	1993	International archives of allergy and immunology
C3	143	8428161	1993	International archives of allergy and immunology
C3	143	1558328	1992	Annals of allergy
C3	143	1548406	1992	Journal of immunological methods
C3	143	1476040	1992	Acta dermato-venereologica. Supplementum
C3	143	1345603	1992	Bulletin of the Institute of Maritime and Tropical Medicine in Gdynia
C3	143	1659436	1991	British journal of clinical pharmacology
C3	143	1772350	1991	ArerugÄ« = [Allergy]
C3	143	1953911	1991	The European respiratory journal. Supplement
C3	143	1773456	1991	Chinese journal of modern developments in traditional medicine

C3	143	1669567	1991	Journal of investigational allergology & clinical immunology
C3	143	1809688	1991	International archives of allergy and applied immunology
C3	143	2221489	1990	Annals of allergy
C3	143	2129476	NA	Archivos de investigaciÃ³n mÃ©dica
C3	143	2802267	1989	Annals of allergy
C3	143	2721280	1989	Chest
C3	143	2526632	1989	Asian Pacific journal of allergy and immunology
C3	143	3272988	NA	Zhonghua Minguo xiao er ke yi xue hui za zhi [Journal]
C3	143	3258826	1988	The European respiratory journal
C3	143	3545262	1987	Archives of otolaryngology--head & neck surgery
C3	143	3506436	1987	Bulletin of the Institute of Maritime and Tropical Medicine in Gdynia
C3	143	3491553	1986	Annals of allergy
C3	143	3717764	1986	The American review of respiratory disease
C3	143	2951829	1986	Respiration; international review of thoracic diseases
C3	143	4050221	1985	Zhurnal mikrobiologii, epidemiologii, i immunobiologii
C3	143	4033033	1985	Klinicheskaia meditsina
C3	143	3893231	1985	Annals of allergy
C3	143	4029967	1985	Human heredity
C3	143	6442583	1984	Asian Pacific journal of allergy and immunology
C3	143	6210004	1984	The American review of respiratory disease
C3	143	6528951	NA	AlergÃa
C3	143	6085153	1984	Pneumonologia polska
C3	143	6499053	1984	CeskoslovenskÃ¡ pediatrie
C3	143	6465480	1984	Allergy
C3	143	6429229	1984	The Journal of allergy and clinical immunology
C3	143	6201833	1984	Pneumonologia polska
C3	143	6719352	1984	TerapevticheskiÄ arkhiv
C3	143	6627619	1983	Clinical allergy
C3	143	6544421	NA	La Pediatria medica e chirurgica
C3	143	6342165	1983	South African medical journal
C3	143	6878777	1983	Revista clÃnica espaÃ±ola
C3	143	6194517	1983	Pneumonologia polska
C3	143	6831684	1983	Clinical allergy
C3	143	6924864	1982	Clinical allergy
C3	143	6919393	NA	Allergologia et immunopathologia
C3	143	6797794	1982	Chest
C3	143	6975678	1981	Clinical and experimental immunology
C3	143	6781385	1981	Annals of allergy
C3	143	6975491	1981	Respiration; international review of thoracic diseases
C3	143	7444701	1980	South African medical journal
C3	143	6768786	1980	The Journal of allergy and clinical immunology

C3	143	539520	NA	Allergologia et immunopathologia
C3	143	382104	1979	La Nouvelle presse mÃ©dicale
C3	143	156917	1979	Praxis und Klinik der Pneumologie
C3	143	445782	1979	Clinical allergy
C3	143	115071	NA	Revue franÃ§aise des maladies respiratoires
C3	143	162027	1979	Allergie und Immunologie
C3	143	752256	NA	Allergologia et immunopathologia
C3	143	373930	1978	Clinical and experimental immunology
C3	143	709794	1978	Clinical allergy
C3	143	686507	1978	Annals of allergy
C3	143	677979	1978	Archives of internal medicine
C3	143	308809	1978	British journal of diseases of the chest
C3	143	309715	NA	Allergologia et immunopathologia
C3	143	652026	1978	Mycopathologia
C3	143	627043	1978	Clinical allergy
C3	143	846785	1977	Pediatric research
C3	143	324512	1977	The British journal of dermatology
C3	143	67566	1977	Nature
C3	143	872357	1977	Clinical allergy
C3	143	988767	1976	The American review of respiratory disease
C3	143	968799	1976	Thorax
C3	143	56632	1976	Lancet
C3	143	58741	1976	Clinical allergy
C3	143	1099944	1975	Annals of allergy
C3	143	1100092	1975	The British journal of dermatology
LOC100048759	0	0		
Fn1	1	19710636	2010	Mucosal immunology
Emr1	1	20625511	2010	PloS one
Chi3l3	7	22014099	2011	BMC immunology
Chi3l3	7	21530272	2011	Bioorganic & medicinal chemistry
Chi3l3	7	21469115	2011	European journal of immunology
Chi3l3	7	18758056	2008	Biological & pharmaceutical bulletin
Chi3l3	7	18087596	2007	Environmental health perspectives
Chi3l3	7	17082650	2006	Journal of immunology (Baltimore, Md. : 1950)
Chi3l3	7	11553626	2001	The Journal of biological chemistry
Acp2	0	0		
H2-Ab1	0	0		
Havcr2	18	21623966	2011	Clinical and experimental allergy
Havcr2	18	21575348	2011	Chinese journal of contemporary pediatrics
Havcr2	18	21470319	2011	Clinical and experimental allergy
Havcr2	18	20536563	2010	Immunological reviews

Havcr2	18	20083673	2010	Journal of immunology (Baltimore, Md. : 1950)
Havcr2	18	19905911	2009	The Journal of asthma
Havcr2	18	19566956	2009	BMC medical genetics
Havcr2	18	19494522	2009	International archives of allergy and immunology
Havcr2	18	18785518	2008	Chinese journal of tuberculosis and respiratory diseases
Havcr2	18	18727494	2008	Current topics in microbiology and immunology
Havcr2	18	16456792	2006	Chinese journal of medical genetics
Havcr2	18	16002337	2005	Trends in molecular medicine
Havcr2	18	15867855	2005	The Journal of allergy and clinical immunology
Havcr2	18	15603868	2004	Human immunology
Havcr2	18	15272240	2004	Experimental & molecular medicine
Havcr2	18	14999428	2004	Springer seminars in immunopathology
Havcr2	18	14508299	2003	Current opinion in pediatrics
Havcr2	18	11725301	2001	Nature immunology
Cfb	0	0		
C2	43	22826050	2013	Advances in experimental medicine and biology
C2	43	22458856	2012	Journal of environmental science and health
C2	43	22142423	2012	Journal of medicinal chemistry
C2	43	22094623	2012	Respiration; international review of thoracic diseases
C2	43	21889615	2011	Journal of biomedical informatics
C2	43	20600518	2010	Food and chemical toxicology
C2	43	20368027	2010	Chinese journal of tuberculosis and respiratory diseases
C2	43	19651244	2009	Respiratory physiology & neurobiology
C2	43	18842290	2008	The Journal of allergy and clinical immunology
C2	43	17379851	2007	American journal of respiratory and critical care medicine
C2	43	17305324	2007	Journal of medicinal chemistry
C2	43	16843616	2006	Medical hypotheses
C2	43	16840383	2006	Chest
C2	43	16061704	2005	Thorax
C2	43	15853649	2005	Current protein & peptide science
C2	43	15805998	2005	The Journal of allergy and clinical immunology
C2	43	15135092	2004	Journal of chromatography.
C2	43	14642800	2003	Clinical therapeutics
C2	43	12872723	2003	Nihon Jibiinkoka Gakkai kaiho
C2	43	12693800	2003	Respiratory medicine
C2	43	12495964	2003	Archives of disease in childhood
C2	43	12184862	2002	Journal of aerosol medicine
C2	43	12153960	2002	American journal of respiratory and critical care medicine
C2	43	11979168	2002	Spine
C2	43	11964752	2002	Current opinion in allergy and clinical immunology
C2	43	11477893	1998	Chinese journal of tuberculosis and respiratory diseases

C2	43	11049743	2000	Protein expression and purification
C2	43	11042185	2001	The Journal of biological chemistry
C2	43	10780759	2000	The European respiratory journal
C2	43	10350223	1999	The Journal of asthma
C2	43	10319815	1999	Cell
C2	43	9751271	1998	Cancer letters
C2	43	9592812	1998	No shinkei geka. Neurological surgery
C2	43	8613071	1996	Gastroenterology
C2	43	1444832	1992	ArerugÄ« = [Allergy]
C2	43	1348480	1992	The European respiratory journal
C2	43	2221489	1990	Annals of allergy
C2	43	3041356	1988	The Pediatric infectious disease journal
C2	43	3773900	1986	Monographs in allergy
C2	43	6788213	1981	British medical journal (Clinical research ed.)
C2	43	7438416	1980	Clinical allergy
C2	43	710825	1978	Gastroenterologia Japonica
C2	43	62112	1976	Lancet
Cp	105	23091170	2012	Toxicological sciences
Cp	105	22823210	2012	Respiratory research
Cp	105	22685462	2012	International journal of otolaryngology
Cp	105	22678519	2012	Indian journal of pediatrics
Cp	105	22545149	2012	PloS one
Cp	105	22329284	2011	CasopÃs lÃ©karÌ†Å¯ cÌ†eskÃ½ch
Cp	105	22300433	2012	Pediatric allergy and immunology
Cp	105	21695198	2011	PloS one
Cp	105	21573487	2011	International journal of molecular medicine
Cp	105	21439045	2011	Biomedical engineering online
Cp	105	21157643	2010	Current opinion in investigational drugs (London, England : 2000)
Cp	105	20190433	2010	Chemical & pharmaceutical bulletin
Cp	105	19998041	2010	Lung
Cp	105	19905928	2009	The Journal of asthma
Cp	105	19768975	NA	Revista alergia Mexico (Tecamachalco, Puebla, Mexico : 1993)
Cp	105	20873055	2009	Revista alergia Mexico (Tecamachalco, Puebla, Mexico : 1993)
Cp	105	19058490	NA	Revista alergia Mexico (Tecamachalco, Puebla, Mexico : 1993)
Cp	105	19052510	2008	ArerugÄ« = [Allergy]
Cp	105	19010996	2009	The European respiratory journal
Cp	105	18693537	NA	Revista alergia Mexico (Tecamachalco, Puebla, Mexico : 1993)
Cp	105	18601933	2008	Life sciences
Cp	105	18397914	2008	American journal of epidemiology
Cp	105	18266975	2008	Journal of cellular and molecular medicine
Cp	105	18259994	NA	The Journal of asthma

Cp	105	18242596	2008	European journal of pharmacology
Cp	105	18188083	2008	Journal of occupational and environmental medicine
Cp	105	19462122	2007	Revista brasileira de anestesiologia
Cp	105	17384874	2007	Singapore medical journal
Cp	105	17287299	2007	Thorax
Cp	105	17251674	2007	Circulation journal
Cp	105	17124849	2006	Equine veterinary journal
Cp	105	17121872	2007	Thorax
Cp	105	16801164	2006	Acta paediatrica (Oslo, Norway : 1992). Supplement
Cp	105	16624877	2006	Proceedings of the National Academy of Sciences of the United States of America
Cp	105	16613702	2006	Chinese journal of contemporary pediatrics
Cp	105	16575135	2006	Georgian medical news
Cp	105	16395708	2006	International journal of cancer. Journal international du cancer
Cp	105	16158778	NA	Revista alergia Mexico (Tecamachalco, Puebla, Mexico : 1993)
Cp	105	15946835	2006	Respiratory medicine
Cp	105	15787872	2005	Pediatric allergy and immunology
Cp	105	15753914	2005	The Journal of allergy and clinical immunology
Cp	105	15659480	2005	BMJ (Clinical research ed.)
Cp	105	15598725	2005	Journal of epidemiology and community health
Cp	105	15575487	2004	TerapevticheskiÄ arkhiv
Cp	105	15565789	2004	Seminars in perinatology
Cp	105	15482516	2004	Pediatric allergy and immunology
Cp	105	15477001	2004	Patient education and counseling
Cp	105	15286255	2004	Pediatrics
Cp	105	15241925	NA	Zeitschrift fÃ¼r Naturforschung. C, Journal of biosciences
Cp	105	15066221	2004	Acta pharmacologica Sinica
Cp	105	14968984	NA	Revista alergia Mexico (Tecamachalco, Puebla, Mexico : 1993)
Cp	105	14964011	2003	SantÃ© publique (Vandoeuvre-lÃ¨s-Nancy, France)
Cp	105	12940106	NA	Revista alergia Mexico (Tecamachalco, Puebla, Mexico : 1993)
Cp	105	12822543	NA	Revista alergia Mexico (Tecamachalco, Puebla, Mexico : 1993)
Cp	105	12822542	NA	Revista alergia Mexico (Tecamachalco, Puebla, Mexico : 1993)
Cp	105	12530578	2002	Pathology, research and practice
Cp	105	12441327	2002	Journal of the National Cancer Institute
Cp	105	12371533	2002	Journal of investigational allergology & clinical immunology
Cp	105	12205810	2002	Archives de pÃ©diatrie
Cp	105	12011732	2002	Revue d'Ã©pidÃ©miologie et de santÃ© publique
Cp	105	11961081	2002	The Journal of pharmacology and experimental therapeutics
Cp	105	11862756	2002	Nihon yakurigaku zasshi. Folia pharmacologica Japonica
Cp	105	11721274	2001	Annals of the Academy of Medicine, Singapore
Cp	105	11668926	2001	Australian health review
Cp	105	11602515	2001	Drug metabolism and disposition: the biological fate of chemicals

Cp	105	11426850	2001	European journal of pharmacology
Cp	105	11401872	2001	American journal of respiratory and critical care medicine
Cp	105	11273793	2001	Pulmonary pharmacology & therapeutics
Cp	105	11171871	2001	International journal of epidemiology
Cp	105	11003986	2000	American journal of physiology. Regulatory, integrative and comparative physiology
Cp	105	10988132	2000	American journal of respiratory and critical care medicine
Cp	105	10903239	2000	American journal of respiratory and critical care medicine
Cp	105	10891017	2000	Archives of pediatrics & adolescent medicine
Cp	105	10710030	2000	Archives of pediatrics & adolescent medicine
Cp	105	10611439	1999	European journal of pharmacology
Cp	105	10468306	1999	British journal of cancer
Cp	105	10235630	1999	Regulatory peptides
Cp	105	9927373	1999	American journal of respiratory and critical care medicine
Cp	105	9723564	1998	Annals of allergy, asthma & immunology
Cp	105	9400681	1997	Respirology (Carlton, Vic.)
Cp	105	9353399	1997	The Journal of pharmacology and experimental therapeutics
Cp	105	11498865	1997	Acta pharmaceutica Sinica
Cp	105	9234081	1997	Journal of autonomic pharmacology
Cp	105	8836335	1996	Allergy
Cp	105	8567958	1996	The Journal of clinical investigation
Cp	105	7663799	1995	American journal of respiratory and critical care medicine
Cp	105	8846432	1995	Canadian journal of physiology and pharmacology
Cp	105	7735167	1995	Nuclear medicine and biology
Cp	105	8121098	1993	Nihon KyÅbu Shikkan Gakkai zasshi
Cp	105	7693493	1993	European journal of pharmacology
Cp	105	7692490	1993	Regulatory peptides
Cp	105	7902346	1993	The Journal of asthma
Cp	105	1525326	1992	Cancer causes & control : CCC
Cp	105	1990954	1991	The American review of respiratory disease
Cp	105	2251634	1990	South African medical journal
Cp	105	2247790	1990	South African medical journal
Cp	105	2339312	1990	South African medical journal
Cp	105	2896105	1988	Chest
Cp	105	3340935	1988	South African medical journal
Cp	105	2443279	1987	Clinica chimica acta
Cp	105	6233230	1984	International journal of immunopharmacology
Cp	105	7065516	1982	The American review of respiratory disease
Cp	105	7129659	1982	International archives of allergy and applied immunology
Cp	105	13094	1977	The Journal of allergy and clinical immunology
Cp	105	993478	1976	The Journal of allergy and clinical immunology
Ly6i	0	0		

Pigr	1	22240167	2012	Biochimica et biophysica acta
C1qb	0	0		
Bst1	0	0		
Muc1	6	21605280	2011	Pediatrics international : official journal of the Japan Pediatric Society
Muc1	6	20348949	2010	Oncogene
Muc1	6	16990615	2007	American journal of respiratory cell and molecular biology
Muc1	6	16630149	2006	Clinical and experimental allergy
Muc1	6	11802251	2002	Pediatric pulmonology
Muc1	6	11062147	2000	American journal of respiratory cell and molecular biology
Lgals3bp	1	15562889	2004	Annals of allergy, asthma & immunology
Hvcn1	1	19958596	NA	American journal of rhinology & allergy
Slc6a20a	0	0		
Orm1	10	23096927	2012	Genetics and molecular research : GMR
Orm1	10	22986918	2012	The pharmacogenomics journal
Orm1	10	22694930	2012	The Journal of allergy and clinical immunology
Orm1	10	22535525	2012	Molecular biology of the cell
Orm1	10	22271045	2012	Human genetics
Orm1	10	22069270	2011	Diabetes/metabolism research and reviews
Orm1	10	22017802	2012	International journal of immunogenetics
Orm1	10	20182505	2010	Nature
Orm1	10	19133921	2009	Allergy
Orm1	10	18155279	2008	The Journal of allergy and clinical immunology
Orm2	2	22535525	2012	Molecular biology of the cell
Orm2	2	20182505	2010	Nature
Bcl2a1d	0	0		
Bcl2a1a	0	0		
Bcl2a1b	0	0		
Csf2rb2	1	21841801	2011	Nature
Tifa	0	0		
Itgax	58	22585735	2012	The Journal of experimental medicine
Itgax	58	22388091	2012	Nature medicine
Itgax	58	22110701	2011	PloS one
Itgax	58	21985360	2011	Clinical and experimental immunology
Itgax	58	21646790	2011	International archives of allergy and immunology
Itgax	58	21634009	2011	EMBO molecular medicine
Itgax	58	21538995	2011	EMBO molecular medicine
Itgax	58	21477339	2011	Respiratory research
Itgax	58	21402950	2011	Proceedings of the National Academy of Sciences of the United States of America
Itgax	58	21274737	2011	Inflammation research
Itgax	58	21268008	2011	European journal of immunology
Itgax	58	21231886	2011	Immunopharmacology and immunotoxicology

Itgax	58	21135031	2011	International immunology
Itgax	58	20819092	2010	Clinical and experimental immunology
Itgax	58	20659336	2010	Respiratory research
Itgax	58	20622891	2010	Cellular & molecular immunology
Itgax	58	20581095	2011	American journal of respiratory cell and molecular biology
Itgax	58	20375632	2010	Journal of innate immunity
Itgax	58	20351460	2010	Journal of infection in developing countries
Itgax	58	20214669	2010	Clinical and experimental allergy
Itgax	58	20194813	2010	American journal of respiratory and critical care medicine
Itgax	58	20179765	2010	PloS one
Itgax	58	20118218	2011	American journal of respiratory cell and molecular biology
Itgax	58	20085598	2009	Clinical and experimental allergy
Itgax	58	20016195	2010	International archives of allergy and immunology
Itgax	58	19933379	2010	American journal of respiratory cell and molecular biology
Itgax	58	19901344	2010	American journal of respiratory cell and molecular biology
Itgax	58	19877020	2009	European journal of immunology
Itgax	58	19828636	2009	Journal of immunology (Baltimore, Md. : 1950)
Itgax	58	19628980	2009	Allergology international
Itgax	58	19553159	2009	Clinical immunology (Orlando, Fla.)
Itgax	58	19494498	2009	International archives of allergy and immunology
Itgax	58	19464382	2009	Pulmonary pharmacology & therapeutics
Itgax	58	19448155	2010	American journal of respiratory cell and molecular biology
Itgax	58	19155511	2009	Journal of immunology (Baltimore, Md. : 1950)
Itgax	58	18835962	2009	Thorax
Itgax	58	18594149	2008	International archives of allergy and immunology
Itgax	58	18498542	2008	Clinical and experimental allergy
Itgax	58	18209085	2008	Journal of immunology (Baltimore, Md. : 1950)
Itgax	58	17977814	2007	International immunology
Itgax	58	17512567	2007	Toxicology and applied pharmacology
Itgax	58	17506035	2007	European journal of immunology
Itgax	58	17460444	2007	Allergology international
Itgax	58	17210044	2007	Clinical and experimental allergy
Itgax	58	16455972	2006	Journal of immunology (Baltimore, Md. : 1950)
Itgax	58	16424176	2006	Journal of immunology (Baltimore, Md. : 1950)
Itgax	58	16314434	2005	The Journal of experimental medicine
Itgax	58	15944318	2005	Journal of immunology (Baltimore, Md. : 1950)
Itgax	58	15781587	2005	The Journal of experimental medicine
Itgax	58	15196283	2004	Clinical and experimental allergy
Itgax	58	15096186	2004	Immunology
Itgax	58	12702544	2003	American journal of respiratory cell and molecular biology
Itgax	58	12603602	2003	Immunology

Itgax	58	12393720	2002	Blood
Itgax	58	11869687	2002	Immunity
Itgax	58	10688435	1999	Allergy
Itgax	58	9450145	1997	Allergy
Itgax	58	7596088	1995	The Kurume medical journal
Il1rn	34	21622869	2011	Journal of immunology (Baltimore, Md. : 1950)
Il1rn	34	21252117	2011	Carcinogenesis
Il1rn	34	20523065	2010	International archives of allergy and immunology
Il1rn	34	19768973	NA	Revista alergia Mexico (Tecamachalco, Puebla, Mexico : 1993)
Il1rn	34	19149188	2008	Chinese journal of biotechnology
Il1rn	34	19087723	2008	Zhonghua yi xue za zhi
Il1rn	34	18959005	2008	Journal of molecular cell biology
Il1rn	34	18926055	NA	Allergy and asthma proceedings
Il1rn	34	18810365	2008	Indian journal of pediatrics
Il1rn	34	17116976	2006	Journal of pharmacological sciences
Il1rn	34	17107994	2007	The European respiratory journal
Il1rn	34	17021861	2006	Immunogenetics
Il1rn	34	16724092	2006	Gene therapy
Il1rn	34	16519819	2006	BMC medical genetics
Il1rn	34	16409203	2006	Allergy
Il1rn	34	15539764	2005	Biology of the neonate
Il1rn	34	15020290	2004	American journal of respiratory and critical care medicine
Il1rn	34	14730914	2003	Yao xue xue bao = Acta pharmaceutica Sinica
Il1rn	34	14519149	2003	Clinical and experimental allergy
Il1rn	34	12938145	2003	Journal of clinical laboratory analysis
Il1rn	34	12663678	2003	International immunology
Il1rn	34	12467523	2002	Mediators of inflammation
Il1rn	34	11360527	1998	Chinese journal of tuberculosis and respiratory diseases
Il1rn	34	11027520	2000	Biochemical and biophysical research communications
Il1rn	34	10843772	2000	Cytokine
Il1rn	34	10667111	NA	ThÃ©rapie
Il1rn	34	10487780	1999	The Journal of clinical investigation
Il1rn	34	9949321	1999	The Journal of allergy and clinical immunology
Il1rn	34	9927362	1999	American journal of respiratory and critical care medicine
Il1rn	34	9811535	1998	Cytokine
Il1rn	34	8887608	1996	American journal of respiratory and critical care medicine
Il1rn	34	8870701	1996	Clinical and experimental immunology
Il1rn	34	7631820	1995	The American journal of physiology
Il1rn	34	8038709	1994	Receptor
Chi3l1	35	23190377	2012	The Journal of asthma
Chi3l1	35	22857879	2012	The Journal of allergy and clinical immunology

Chi3l1	35	22742450	2012	The Biochemical journal
Chi3l1	35	22554524	2012	Biochemical and biophysical research communications
Chi3l1	35	22550243	2012	Proceedings of the American Thoracic Society
Chi3l1	35	22534532	2012	The Journal of allergy and clinical immunology
Chi3l1	35	22480951	2012	Cytokine
Chi3l1	35	22281830	2012	American journal of respiratory and critical care medicine
Chi3l1	35	21968467	2012	Respiration; international review of thoracic diseases
Chi3l1	35	21949714	2011	PloS one
Chi3l1	35	21899483	2011	The Journal of asthma
Chi3l1	35	21530869	2011	Annals of allergy, asthma & immunology
Chi3l1	35	21159721	2011	Multiple sclerosis (Houndmills, Basingstoke, England)
Chi3l1	35	21054166	2011	Annual review of physiology
Chi3l1	35	20650887	2010	The Journal of biological chemistry
Chi3l1	35	20538957	2010	American journal of respiratory and critical care medicine
Chi3l1	35	20356987	2010	The European respiratory journal
Chi3l1	35	20347285	2010	Respiratory medicine
Chi3l1	35	20226308	2010	The Journal of allergy and clinical immunology
Chi3l1	35	20224674	2010	Allergy, asthma & immunology research
Chi3l1	35	19908331	2009	World journal of gastroenterology : WJG
Chi3l1	35	19644363	2009	Current opinion in allergy and clinical immunology
Chi3l1	35	19568425	2009	PloS one
Chi3l1	35	19532094	2009	Current opinion in allergy and clinical immunology
Chi3l1	35	19421404	2009	PloS one
Chi3l1	35	19414556	2009	The Journal of experimental medicine
Chi3l1	35	18769193	2008	Current opinion in allergy and clinical immunology
Chi3l1	35	18498542	2008	Clinical and experimental allergy
Chi3l1	35	18403760	2008	The New England journal of medicine
Chi3l1	35	18403759	2008	The New England journal of medicine
Chi3l1	35	18334164	2008	MÃ©decine sciences : M/S
Chi3l1	35	18322291	2008	The New England journal of medicine
Chi3l1	35	18003958	2007	The New England journal of medicine
Chi3l1	35	17709146	2007	Veterinary immunology and immunopathology
Chi3l1	35	17392594	2007	The Keio journal of medicine
Cd68	55	21943944	2012	The Journal of allergy and clinical immunology
Cd68	55	21681974	2011	Diagnostic cytopathology
Cd68	55	21512269	2011	Experimental animals / Japanese Association for Laboratory Animal Science
Cd68	55	20644177	2010	Journal of immunology (Baltimore, Md. : 1950)
Cd68	55	19961259	2009	Archives of pathology & laboratory medicine
Cd68	55	19490801	NA	American journal of rhinology & allergy
Cd68	55	19191129	2009	The Journal of asthma
Cd68	55	19132974	2009	Allergy

Cd68	55	18681853	2008	Clinical and experimental allergy
Cd68	55	18498542	2008	Clinical and experimental allergy
Cd68	55	18268925	2007	International journal of chronic obstructive pulmonary disease
Cd68	55	18250182	2008	Thorax
Cd68	55	17441790	2007	Allergy
Cd68	55	17272787	2007	American journal of respiratory and critical care medicine
Cd68	55	17075272	2006	Allergology international
Cd68	55	17035437	2006	Chest
Cd68	55	16959617	2006	Journal of the Formosan Medical Association = Taiwan yi zhi
Cd68	55	16899487	2006	The European respiratory journal
Cd68	55	15805998	2005	The Journal of allergy and clinical immunology
Cd68	55	15784110	2005	Clinical and experimental allergy
Cd68	55	15510586	NA	Allergy and asthma proceedings
Cd68	55	14564360	2003	The Journal of allergy and clinical immunology
Cd68	55	12212952	2002	The European respiratory journal
Cd68	55	12149529	2002	Thorax
Cd68	55	12070058	2002	American journal of respiratory and critical care medicine
Cd68	55	12028114	2002	Allergy
Cd68	55	11972605	2002	Clinical and experimental allergy
Cd68	55	11502664	2001	Chest
Cd68	55	11199094	2001	Novartis Foundation symposium
Cd68	55	11182013	2001	Thorax
Cd68	55	11069834	2000	American journal of respiratory and critical care medicine
Cd68	55	11031340	2000	The Journal of allergy and clinical immunology
Cd68	55	10984367	2000	The Journal of allergy and clinical immunology
Cd68	55	10843939	2000	Chest
Cd68	55	10573219	1999	The European respiratory journal
Cd68	55	10570327	1999	Journal of immunology (Baltimore, Md. : 1950)
Cd68	55	10556105	1999	American journal of respiratory and critical care medicine
Cd68	55	10394103	1999	International archives of allergy and immunology
Cd68	55	10362043	1999	The European respiratory journal
Cd68	55	10193369	1998	Thorax
Cd68	55	9257786	1997	The Journal of allergy and clinical immunology
Cd68	55	9155834	1997	The Journal of allergy and clinical immunology
Cd68	55	9150325	1997	The European respiratory journal
Cd68	55	9117016	1997	American journal of respiratory and critical care medicine
Cd68	55	8970374	1996	American journal of respiratory and critical care medicine
Cd68	55	8887608	1996	American journal of respiratory and critical care medicine
Cd68	55	8680684	1996	American journal of respiratory and critical care medicine
Cd68	55	8630259	1996	American journal of respiratory cell and molecular biology
Cd68	55	7668997	1995	ArerugÄ« = [Allergy]

Cd68	55	7742012	1995	American journal of respiratory cell and molecular biology
Cd68	55	7613132	NA	International archives of allergy and immunology
Cd68	55	7874318	NA	Journal of investigational allergology & clinical immunology
Cd68	55	8417755	1993	American journal of respiratory cell and molecular biology
Cd68	55	1489147	1992	The American review of respiratory disease
Cd68	55	1532807	1992	The Journal of allergy and clinical immunology
Gatm	0	0		
Olfm1	0	0		
Sirpa	0	0		
Ptgs1	65	22829846	2012	Journal of allergy
Ptgs1	65	22627848	2012	Allergology international
Ptgs1	65	22484053	2012	Journal of ethnopharmacology
Ptgs1	65	22324934	2012	Expert opinion on therapeutic targets
Ptgs1	65	22132000	2012	Journal of allergy
Ptgs1	65	21331560	2011	Journal of pharmacokinetics and pharmacodynamics
Ptgs1	65	21039786	2010	The Journal of dermatology
Ptgs1	65	20955151	2011	Current drug targets
Ptgs1	65	20656922	2010	Journal of immunology (Baltimore, Md. : 1950)
Ptgs1	65	20633623	2011	Journal of ethnopharmacology
Ptgs1	65	20631417	NA	Pharmacological reports : PR
Ptgs1	65	20519889	2010	Chemical immunology and allergy
Ptgs1	65	19879442	2009	Immunology and allergy clinics of North America
Ptgs1	65	19575683	2009	Annual review of physiology
Ptgs1	65	19251796	2009	The European respiratory journal Physiology
Ptgs1	65	19132974	2009	Allergy
Ptgs1	65	18996575	2009	The Journal of allergy and clinical immunology
Ptgs1	65	18753249	2008	FASEB journal
Ptgs1	65	17609236	2007	The Annals of pharmacotherapy
Ptgs1	65	17508966	2007	Allergy
Ptgs1	65	17454003	2007	DNA sequence
Ptgs1	65	17292954	2007	The Journal of allergy and clinical immunology
Ptgs1	65	16579869	2006	Current allergy and asthma reports
Ptgs1	65	16457808	2006	European journal of pharmacology
Ptgs1	65	16433444	2005	Bulletin de l'AcadÃ©mie nationale de mÃ©decine
Ptgs1	65	16055872	2005	The European respiratory journal
Ptgs1	65	15613671	2004	JAMA : the journal of the American Medical Association
Ptgs1	65	15521369	2004	Annals of allergy, asthma & immunology munology
Ptgs1	65	15480320	2004	The Journal of allergy and clinical immunology
Ptgs1	65	15375155	2004	The Journal of biological chemistry
Ptgs1	65	15242723	2004	Immunology and allergy clinics of North America
Ptgs1	65	15151923	2004	American journal of respiratory and critical care medicine

Ptgs1	65	15100686	2004	The Journal of allergy and clinical immunology
Ptgs1	65	14769263	2004	Current allergy and asthma reports
Ptgs1	65	14680616	2004	Current allergy and asthma reports
Ptgs1	65	14600429	2003	International archives of allergy and immunology
Ptgs1	65	14561202	2002	Current drug targets. Inflammation and allergy
Ptgs1	65	14552699	NA	International journal of immunopathology and pharmacology
Ptgs1	65	12895598	NA	Prostaglandins, leukotrienes, and essential fatty acids
Ptgs1	65	12796206	2003	Chest
Ptgs1	65	12743569	2003	The Journal of allergy and clinical immunology
Ptgs1	65	12668895	2003	Clinical reviews in allergy & immunology
Ptgs1	65	12576199	2003	Journal of ethnopharmacology
Ptgs1	65	12529163	2003	Paediatric drugs
Ptgs1	65	12487218	2002	Annals of allergy, asthma & immunology
Ptgs1	65	12429575	2002	British journal of pharmacology
Ptgs1	65	11952135	2002	Viral immunology
Ptgs1	65	11943670	2002	American journal of physiology. Lung cellular and molecular physiology
Ptgs1	65	11940059	2002	Clinical and experimental allergy
Ptgs1	65	11860351	2002	Current medicinal chemistry
Ptgs1	65	11694451	2001	American journal of respiratory cell and molecular biology
Ptgs1	65	11447381	2001	The Journal of allergy and clinical immunology
Ptgs1	65	11394934	2001	Pharmacological research
Ptgs1	65	11273789	2001	Pulmonary pharmacology & therapeutics
Ptgs1	65	11251623	2001	Clinical and experimental allergy
Ptgs1	65	11251618	2001	Clinical and experimental allergy
Ptgs1	65	11237998	2001	American journal of physiology. Lung cellular and molecular physiology
Ptgs1	65	11152649	2001	American journal of respiratory cell and molecular biology
Ptgs1	65	10992560	2000	Thorax
Ptgs1	65	10400832	1999	The Journal of allergy and clinical immunology
Ptgs1	65	10390414	1999	American journal of respiratory and critical care medicine
Ptgs1	65	9846651	1998	British journal of pharmacology
Ptgs1	65	9761007	1998	Clinical and experimental allergy
Ptgs1	65	9416556	NA	Journal of investigational allergology & clinical immunology
Ptgs1	65	9032211	1997	American journal of respiratory and critical care medicine
Ccl9	4	20622891	2010	Cellular & molecular immunology
Ccl9	4	16339523	2005	Journal of immunology (Baltimore, Md. : 1950)
Ccl9	4	15585884	2004	Journal of immunology (Baltimore, Md. : 1950)
Ccl9	4	15203102	2004	The international journal of biochemistry & cell biology
Ccl6	8	20622891	2010	Cellular & molecular immunology
Ccl6	8	18156208	2008	The American journal of pathology
Ccl6	8	17168792	2006	Inflammation & allergy drug targets
Ccl6	8	16645178	2006	American journal of respiratory cell and molecular biology

Ccl6	8	16607380	2006	Laboratory investigation; a journal of technical methods and pathology
Ccl6	8	16251377	2005	Occupational medicine (Oxford, England)
Ccl6	8	15585884	2004	Journal of immunology (Baltimore, Md. : 1950)
Ccl6	8	15374841	2005	American journal of respiratory and critical care medicine
1100001G20Rik	0	0		
Bpifb1	0	0		
Procr	1	14604971	2004	Blood
Lbp	10	23063165	2012	The Journal of allergy and clinical immunology
Lbp	10	20226507	2010	The Journal of allergy and clinical immunology
Lbp	10	16740168	2006	BMC pulmonary medicine
Lbp	10	16539740	2006	BMC musculoskeletal disorders
Lbp	10	15356561	2004	The Journal of allergy and clinical immunology
Lbp	10	12397021	2002	American journal of respiratory cell and molecular biology
Lbp	10	11181108	2001	Toxicology and applied pharmacology
Lbp	10	11160257	2001	Journal of immunology (Baltimore, Md. : 1950)
Lbp	10	8967507	1996	The American journal of physiology
Lbp	10	8838085	1996	Nihon rinsho. Japanese journal of clinical medicine
Rab20	0	0		
F10	4	22970026	2012	Experimental and therapeutic medicine
F10	4	21892786	2012	Mycopathologia
F10	4	18922934	2008	Cancer research
F10	4	16086832	2005	Respiratory research
Naip2	0	0		
Cd14	179	23194293	2012	Pediatric allergy and immunology
Cd14	179	23101184	2012	Journal of investigational allergology & clinical immunology
Cd14	179	22697010	2012	Journal of investigational allergology & clinical immunology
Cd14	179	22564189	2012	Allergy
Cd14	179	22377711	2012	Journal of human genetics
Cd14	179	22376040	2012	The Journal of asthma
Cd14	179	22356142	2012	Clinical and experimental allergy
Cd14	179	22328887	2011	Archives of medical science : AMS
Cd14	179	22299310	2011	Asian Pacific journal of allergy and immunology
Cd14	179	22032786	2011	International journal of immunopathology and pharmacology
Cd14	179	22015088	2011	Respiratory medicine
Cd14	179	21905503	2011	Journal of investigational allergology & clinical immunology
Cd14	179	21842127	NA	Molecular medicine reports
Cd14	179	21749458	2011	Pediatric allergy and immunology
Cd14	179	21745379	2011	BMC medical genetics
Cd14	179	21646795	2011	International archives of allergy and immunology
Cd14	179	21489615	2011	The Journal of allergy and clinical immunology
Cd14	179	21389010	2011	Occupational and environmental medicine

Cd14	179	21325943	2011	Current opinion in allergy and clinical immunology
Cd14	179	21324477	2011	The Journal of pediatrics
Cd14	179	21274737	2011	Inflammation research
Cd14	179	21079949	2011	Immunogenetics
Cd14	179	21039977	2010	Clinical and experimental allergy
Cd14	179	21039600	2011	Allergy
Cd14	179	20726961	2011	Allergy
Cd14	179	20701615	2010	Clinical and experimental allergy
Cd14	179	20618347	2010	Clinical and experimental allergy
Cd14	179	20608916	2011	Allergy
Cd14	179	20579716	2010	The Journal of allergy and clinical immunology
Cd14	179	20574656	2010	Human genetics
Cd14	179	20536280	2010	The Journal of asthma
Cd14	179	20398919	2010	The Journal of allergy and clinical immunology
Cd14	179	20394509	2010	The Journal of asthma
Cd14	179	20384875	2010	Scandinavian journal of immunology
Cd14	179	20302606	2010	Respiratory research
Cd14	179	20179765	2010	PloS one
Cd14	179	20126925	2009	Jornal brasileiro de pneumologia
Cd14	179	20085599	2009	Clinical and experimental allergy
Cd14	179	20080799	2010	Proceedings of the National Academy of Sciences of the United States of America
Cd14	179	20051845	2010	Current opinion in allergy and clinical immunology
Cd14	179	19968655	2010	Clinical and experimental allergy
Cd14	179	19883332	2009	Expert review of anti-infective therapy
Cd14	179	19825525	2009	European cytokine network
Cd14	179	19796192	2010	Allergy
Cd14	179	19785013	2009	Stem cells (Dayton, Ohio)
Cd14	179	19462345	2009	Pneumonologia i alergologia polska
Cd14	179	19372244	2010	American journal of respiratory cell and molecular biology
Cd14	179	19361972	2009	Respiratory medicine
Cd14	179	19254290	2009	Allergy
Cd14	179	19222419	2009	Allergy
Cd14	179	19191129	2009	The Journal of asthma
Cd14	179	19148143	2009	Genes and immunity
Cd14	179	19119705	2008	Annals of allergy, asthma & immunology
Cd14	179	19109137	2009	Journal of immunology (Baltimore, Md. : 1950)
Cd14	179	19096003	2009	American journal of respiratory and critical care medicine
Cd14	179	18952503	2009	Clinical immunology (Orlando, Fla.)
Cd14	179	18931892	2009	Journal of clinical immunology
Cd14	179	18774388	2008	The Journal of allergy and clinical immunology
Cd14	179	18714537	2008	Journal of investigational allergology & clinical immunology

Cd14	179	18446588	2008	The Journal of asthma : official journal of the Association for the Care of Asthma
Cd14	179	18426139	2008	Annals of allergy, asthma & immunology
Cd14	179	18425216	NA	Jornal de pediatria
Cd14	179	18417506	2008	The European respiratory journal
Cd14	179	18312481	2008	Tissue antigens
Cd14	179	17989521	2007	Current opinion in allergy and clinical immunology
Cd14	179	17954484	2007	Archives of disease in childhood
Cd14	179	17951166	2007	Folia histochemica et cytobiologica
Cd14	179	17919709	2007	The Journal of allergy and clinical immunology
Cd14	179	17910328	2007	Annals of allergy, asthma & immunology
Cd14	179	17877764	2007	Clinical and experimental allergy
Cd14	179	17823973	2007	Human mutation
Cd14	179	17607003	2007	Proceedings of the American Thoracic Society
Cd14	179	17581203	2007	Clinical and experimental allergy
Cd14	179	17574828	2007	Respiratory medicine
Cd14	179	17456337	2007	Zhonghua er ke za zhi. Chinese journal of pediatrics
Cd14	179	17349684	2007	The Journal of allergy and clinical immunology
Cd14	179	17270707	2007	Immunobiology
Cd14	179	17218815	2007	Current opinion in allergy and clinical immunology
Cd14	179	17202288	2007	Proceedings of the American Thoracic Society
Cd14	179	17201240	2006	Annals of allergy, asthma & immunology
Cd14	179	17196641	2007	The Journal of allergy and clinical immunology
Cd14	179	17175987	2006	Pneumonologia i alergologia polska
Cd14	179	17083354	2006	Clinical and experimental allergy
Cd14	179	17075287	2006	Allergology international
Cd14	179	17042137	2006	Annals of allergy, asthma & immunology
Cd14	179	17003960	2006	Journal of human genetics
Cd14	179	16959617	2006	Journal of the Formosan Medical Association
Cd14	179	16954783	2006	Current opinion in allergy and clinical immunology
Cd14	179	16844729	2007	Thorax
Cd14	179	16815140	2006	The Journal of allergy and clinical immunology
Cd14	179	16771785	2006	Pediatric allergy and immunology
Cd14	179	16630939	2006	The Journal of allergy and clinical immunology
Cd14	179	16566859	2006	Current allergy and asthma reports
Cd14	179	16543402	2006	Journal of leukocyte biology
Cd14	179	16505608	2006	Current opinion in allergy and clinical immunology
Cd14	179	16446545	2006	International archives of allergy and immunology
Cd14	179	16446543	2006	International archives of allergy and immunology
Cd14	179	16387800	2006	American journal of respiratory and critical care medicine
Cd14	179	16310521	2006	The Medical clinics of North America
Cd14	179	16266379	2005	Allergy

Cd14	179	16266378	2005	Allergy
Cd14	179	16257634	2005	Immunology and allergy clinics of North America
Cd14	179	16214776	2005	Acta paediatrica (Oslo, Norway : 1992). Supplement
Cd14	179	16202577	2006	Respiratory medicine
Cd14	179	16120082	2005	Clinical and experimental allergy
Cd14	179	15992841	2005	Toxicology and applied pharmacology
Cd14	179	15940135	2005	The Journal of allergy and clinical immunology
Cd14	179	15897161	2005	The Journal of dermatological treatment
Cd14	179	15879416	2005	American journal of respiratory and critical care medicine
Cd14	179	15853738	2005	Current drug targets. Inflammation and allergy
Cd14	179	15753897	2005	The Journal of allergy and clinical immunology
Cd14	179	15741437	2005	Thorax
Cd14	179	15683456	2005	Scandinavian journal of immunology
Cd14	179	15660518	2005	Annual review of medicine
Cd14	179	15649267	2005	Clinical and experimental allergy
Cd14	179	15602630	2005	Journal of human genetics
Cd14	179	15378299	2004	Immunogenetics
Cd14	179	15356557	2004	The Journal of allergy and clinical immunology
Cd14	179	15281474	2004	Annals of allergy, asthma & immunology
Cd14	179	15241347	2004	The Journal of allergy and clinical immunology
Cd14	179	15191023	2004	Annals of allergy, asthma & immunology
Cd14	179	15136573	2004	The Journal of biological chemistry
Cd14	179	15007332	2004	The Journal of allergy and clinical immunology
Cd14	179	14749527	2003	Experimental & molecular medicine
Cd14	179	14641542	2003	European journal of immunogenetics
Cd14	179	14517492	2003	Blood coagulation & fibrinolysis
Cd14	179	14510720	2003	Allergy
Cd14	179	14501431	2003	Current opinion in allergy and clinical immunology
Cd14	179	12911501	2003	Pediatric allergy and immunology
Cd14	179	12897754	2003	The Journal of allergy and clinical immunology
Cd14	179	12760962	2003	American journal of respiratory cell and molecular biology
Cd14	179	12743572	2003	The Journal of allergy and clinical immunology
Cd14	179	12722945	2003	Immunological investigations
Cd14	179	12680871	2003	Clinical and experimental allergy
Cd14	179	12580907	2003	Clinical and experimental allergy
Cd14	179	12449174	2002	The European respiratory journal
Cd14	179	12397021	2002	American journal of respiratory cell and molecular biology
Cd14	179	12011764	2002	Medical science monitor
Cd14	179	11972599	2002	Clinical and experimental allergy
Cd14	179	11964695	2001	Current opinion in allergy and clinical immunology
Cd14	179	11936536	2002	The European respiratory journal

Cd14	179	11890712	2002	Clinical immunology (Orlando, Fla.)
Cd14	179	11753119	2002	Current opinion in pulmonary medicine
Cd14	179	11732288	2001	Pneumonologia i alergologia polska
Cd14	179	11590384	2001	The Journal of allergy and clinical immunology
Cd14	179	11574751	2001	International archives of allergy and immunology
Cd14	179	11521081	2001	Journal of endotoxin research
Cd14	179	11398078	2001	The Journal of allergy and clinical immunology
Cd14	179	11359627	2000	British medical bulletin
Cd14	179	11306916	NA	International archives of allergy and immunology
Cd14	179	11282774	2001	American journal of respiratory and critical care medicine
Cd14	179	11278629	2001	The Journal of biological chemistry
Cd14	179	11159017	2001	American journal of physiology. Lung cellular and molecular physiology
Cd14	179	11104731	2000	American journal of respiratory cell and molecular biology
Cd14	179	11090937	2000	Toxicology
Cd14	179	11022011	2000	American journal of human genetics
Cd14	179	10919504	2000	Allergy
Cd14	179	10907586	2000	Clinics in chest medicine
Cd14	179	10809960	2000	Immunology
Cd14	179	10804928	2000	The Israel Medical Association journal : IMAJ
Cd14	179	10719296	2000	The Journal of allergy and clinical immunology
Cd14	179	10631542	1999	Current opinion in immunology
Cd14	179	10594539	1999	Clinical and experimental allergy
Cd14	179	10587479	1999	Pulmonary pharmacology & therapeutics
Cd14	179	10432289	1999	The Journal of experimental medicine
Cd14	179	10069865	1999	The Journal of allergy and clinical immunology
Cd14	179	9890612	1999	Pediatric research
Cd14	179	9561931	1998	Inflammation
Cd14	179	9551731	1998	The European respiratory journal
Cd14	179	9450145	1997	Allergy
Cd14	179	9212832	1997	Journal of immunological methods
Cd14	179	9117017	1997	American journal of respiratory and critical care medicine
Cd14	179	8967507	1996	The American journal of physiology
Cd14	179	18475731	1996	Mediators of inflammation
Cd14	179	7767539	1995	American journal of respiratory and critical care medicine
Cd14	179	7812576	1995	American journal of respiratory and critical care medicine
Cd14	179	8207248	1994	Journal of immunology (Baltimore, Md. : 1950)
Cd14	179	8173641	1994	Pediatric allergy and immunology
Cd14	179	8386056	1993	Monaldi archives for chest disease
Cd200r1	0	0		
Mtm1	0	0		
Tlr7	36	23078048	2012	Inflammation & allergy drug targets

Tlr7	36	22882449	2012	Allergy
Tlr7	36	22857391	2012	BMC medical genetics
Tlr7	36	22727330	2012	Immunobiology
Tlr7	36	22657407	2012	The Journal of allergy and clinical immunology
Tlr7	36	22491246	2012	Journal of immunology (Baltimore, Md. : 1950)
Tlr7	36	22355409	2012	PloS one
Tlr7	36	22125636	2011	PloS one
Tlr7	36	22086297	2012	Current allergy and asthma reports
Tlr7	36	22035076	2012	British journal of pharmacology
Tlr7	36	21917654	2012	Thorax
Tlr7	36	21748646	2011	Methods in molecular biology (Clifton, N.J.)
Tlr7	36	21646801	2011	International archives of allergy and immunology
Tlr7	36	21480211	2011	European journal of immunology
Tlr7	36	21460120	2011	American journal of physiology. Lung cellular and molecular physiology
Tlr7	36	21389257	2011	Journal of immunology (Baltimore, Md. : 1950)
Tlr7	36	21375463	2011	Expert opinion on therapeutic targets
Tlr7	36	21364926	2011	PloS one
Tlr7	36	21335488	2011	Journal of immunology (Baltimore, Md. : 1950)
Tlr7	36	21167577	2011	The Journal of allergy and clinical immunology
Tlr7	36	21157038	2011	The Journal of clinical investigation
Tlr7	36	21131420	2011	Journal of immunology (Baltimore, Md. : 1950)
Tlr7	36	20412137	2010	Clinical and experimental allergy
Tlr7	36	20410486	2010	Journal of immunology (Baltimore, Md. : 1950)
Tlr7	36	20377514	2010	Current medicinal chemistry
Tlr7	36	20224068	2010	American journal of respiratory and critical care medicine
Tlr7	36	19735273	2009	Clinical and experimental allergy
Tlr7	36	19643938	2010	The European respiratory journal
Tlr7	36	19025588	2008	Journal of neuroinflammation
Tlr7	36	18682521	2008	Thorax
Tlr7	36	18220957	2007	Inflammation & allergy drug targets
Tlr7	36	18031246	2007	Biochemical Society transactions
Tlr7	36	18020622	2007	BioDrugs : clinical immunotherapeutics, biopharmaceuticals and gene therapy
Tlr7	36	17548618	2007	Journal of immunology (Baltimore, Md. : 1950)
Tlr7	36	17400732	2007	American journal of respiratory and critical care medicine
Tlr7	36	16361354	2006	American journal of physiology. Lung cellular and molecular physiology
Cybb	4	22982469	2012	Life sciences
Cybb	4	17293377	2007	American journal of physiology. Lung cellular and molecular physiology
Cybb	4	16608528	2006	Journal of negative results in biomedicine
Cybb	4	14588148	2003	Antioxidants & redox signaling
Atp6ap2	0	0		
Id2	0	0		

Slc26a4	9	22116372	2011	Cellular physiology and biochemistry
Slc26a4	9	22116359	2011	Cellular physiology and biochemistry
Slc26a4	9	22116352	2011	Cellular physiology and biochemistry
Slc26a4	9	21814192	2011	Clinical pharmacology and therapeutics
Slc26a4	9	21045265	2010	Disease markers
Slc26a4	9	19289392	2009	Journal of medical genetics
Slc26a4	9	19028979	2009	American journal of physiology. Lung cellular and molecular physiology
Slc26a4	9	18641360	2008	Journal of immunology (Baltimore, Md. : 1950)
Slc26a4	9	18424749	2008	Journal of immunology (Baltimore, Md. : 1950)
Ms4a7	0	0		
Ms4a6d	0	0		
Rab32	0	0		
Il33	45	23169007	2012	European journal of immunology
Il33	45	22694930	2012	The Journal of allergy and clinical immunology
Il33	45	22574108	2012	PloS one
Il33	45	22562552	2012	Applied biochemistry and biotechnology
Il33	45	22540331	2012	Allergy
Il33	45	22349136	2012	Inflammation research
Il33	45	22329990	2012	The Journal of experimental medicine
Il33	45	22307629	2012	Proceedings of the National Academy of Sciences of the United States of America
Il33	45	22233535	2012	Clinical and experimental allergy
Il33	45	22215666	2012	The Journal of biological chemistry
Il33	45	22112999	2012	Current opinion in pulmonary medicine
Il33	45	21804549	2011	Nature genetics
Il33	45	21802127	2011	The Journal of allergy and clinical immunology
Il33	45	21712394	2011	Journal of leukocyte biology
Il33	45	21682745	2011	Immunological reviews
Il33	45	21682736	2011	Immunological reviews
Il33	45	21629437	2010	Current genomics
Il33	45	21519352	2011	Nature reviews. Rheumatology
Il33	45	21301328	2011	Current opinion in allergy and clinical immunology
Il33	45	21276132	2011	Respirology (Carlton, Vic.)
Il33	45	21158975	2011	Journal of internal medicine
Il33	45	21150435	2011	Current opinion in allergy and clinical immunology
Il33	45	21071194	2010	Current opinion in immunology
Il33	45	20931364	2011	Current allergy and asthma reports
Il33	45	20926795	2010	Journal of immunology (Baltimore, Md. : 1950)
Il33	45	20860503	2010	The New England journal of medicine
Il33	45	20816195	2010	The Journal of allergy and clinical immunology
Il33	45	20625511	2010	PloS one
Il33	45	20608085	2010	the journal of the Japanese Respiratory Society

Il33	45	20200520	2010	Nature
Il33	45	20200518	2010	Nature
Il33	45	20153038	2010	The Journal of allergy and clinical immunology
Il33	45	20081870	2010	Nature reviews. Immunology
Il33	45	20014018	2010	Inflammatory bowel diseases
Il33	45	19906013	2010	Clinical and experimental allergy
Il33	45	19841166	2009	Journal of immunology (Baltimore, Md. : 1950)
Il33	45	19801525	2009	Journal of immunology (Baltimore, Md. : 1950)
Il33	45	19763788	2010	Inflammation research
Il33	45	19439663	2009	Proceedings of the National Academy of Sciences of the United States of America
Il33	45	19234154	2009	Journal of immunology (Baltimore, Md. : 1950)
Il33	45	19198610	2009	Nature genetics
Il33	45	19064280	2009	The Journal of allergy and clinical immunology
Il33	45	18802081	2008	Journal of immunology (Baltimore, Md. : 1950)
Il33	45	18539196	2008	The Journal of allergy and clinical immunology
Il33	45	17623648	2007	The Journal of biological chemistry
Ch25h	0	0		
Ifit3	0	0		
Igf1	1	16973978	2006	American journal of respiratory and critical care medicine
Vnn1	0	0		
Pon1	5	22738861	2012	Metabolism: clinical and experimental
Pon1	5	19575027	2009	Journal of human genetics
Pon1	5	19556304	2009	International immunology
Pon1	5	16943596	2006	Biological trace element research
Pon1	5	15210868	2004	Molecular interventions
Snx10	0	0		
Ifi30	0	0		
Itgb2	48	22157542	2012	The Journal of nutrition
Itgb2	48	22004287	2011	Respiratory research
Itgb2	48	21985360	2011	Clinical and experimental immunology
Itgb2	48	20413544	2010	The European respiratory journal
Itgb2	48	20351460	2010	Journal of infection in developing countries
Itgb2	48	19463772	2009	Experimental hematology
Itgb2	48	18771439	2009	Immunology
Itgb2	48	18760454	2008	The Journal of allergy and clinical immunology
Itgb2	48	18684982	2008	Journal of immunology (Baltimore, Md. : 1950)
Itgb2	48	18653650	2008	The European respiratory journal
Itgb2	48	18504400	2008	International archives of allergy and immunology
Itgb2	48	18056392	2007	Journal of immunology (Baltimore, Md. : 1950)
Itgb2	48	17379071	2007	Experimental hematology
Itgb2	48	17052676	2006	International immunopharmacology

Itgb2	48	16798840	2006	International immunology
Itgb2	48	16601351	2006	International archives of allergy and immunology
Itgb2	48	16601240	2006	American journal of respiratory cell and molecular biology
Itgb2	48	16393658	2006	Environmental health perspectives
Itgb2	48	12877819	2003	Pulmonary pharmacology & therapeutics
Itgb2	48	12760968	2003	American journal of respiratory cell and molecular biology
Itgb2	48	11504695	2001	American journal of physiology. Lung cellular and molecular physiology
Itgb2	48	10893047	2000	Inflammation research
Itgb2	48	10706734	2000	Journal of immunology (Baltimore, Md. : 1950)
Itgb2	48	10651778	2000	Clinical and experimental allergy
Itgb2	48	10453752	1998	Physiological research / Academia Scientiarum Bohemoslovaca
Itgb2	48	10390902	1999	ArerugÄ« = [Allergy]
Itgb2	48	10340944	1999	American journal of respiratory cell and molecular biology
Itgb2	48	10229100	1999	European journal of immunology
Itgb2	48	9860039	1998	Annals of allergy, asthma & immunology
Itgb2	48	9766628	1998	Journal of leukocyte biology
Itgb2	48	9758896	1998	International archives of allergy and immunology
Itgb2	48	9730868	1998	American journal of respiratory cell and molecular biology
Itgb2	48	9670977	1998	Journal of immunology (Baltimore, Md. : 1950)
Itgb2	48	9561931	1998	Inflammation
Itgb2	48	9561930	1998	Inflammation
Itgb2	48	9561923	1998	Inflammation
Itgb2	48	9187566	1997	Internal medicine (Tokyo, Japan)
Itgb2	48	9117017	1997	American journal of respiratory and critical care medicine
Itgb2	48	8886838	1996	Human gene therapy
Itgb2	48	8871058	1996	The European respiratory journal. Supplement
Itgb2	48	7576691	1995	American journal of respiratory cell and molecular biology
Itgb2	48	7812576	1995	American journal of respiratory and critical care medicine
Itgb2	48	7596088	1995	The Kurume medical journal
Itgb2	48	7829126	1994	Immunology letters
Itgb2	48	1358975	1992	Journal of immunology (Baltimore, Md. : 1950)
Itgb2	48	1353976	1992	American journal of respiratory cell and molecular biology
Itgb2	48	1586739	1992	Blood
Itgb2	48	1682072	1991	Clinical and experimental immunology
Clec4a2	0	0		
Clec4n	0	0		
C1ra	0	0		
C1rb	0	0		
B4galnt1	0	0		
Capg	0	0		
Reg3g	0	0		

Psap	0	0		

Supplementary Table 3. Pubmed search of genes present in gene signature previously reported to be associated with COPD

Gene Symbol	count	PMID	Year	Journal
Tgfbi	2	22617718	2012	Epigenetics : official journal of the DNA Methylation Society
Tgfbi	2	16710170	2006	Molecular vision
Matn4	0	0		
Clec7a	0	0		
Olr1	1	21412277	2011	Cell death & disease
Ctsz	0	0		
Mmp12	64	22952876	2012	PloS one
Mmp12	64	22949406	2012	Journal of cellular biochemistry
Mmp12	64	22888638	NA	Molekuliarnaia biologiia
Mmp12	64	22773692	2012	American journal of physiology. Lung cellular and molecular physiology
Mmp12	64	22305682	2012	The Journal of allergy and clinical immunology
Mmp12	64	22209925	2011	Current opinion in pulmonary medicine
Mmp12	64	21960547	2012	American journal of respiratory cell and molecular biology
Mmp12	64	21784967	2011	American journal of physiology. Lung cellular and molecular physiology
Mmp12	64	21778810	2011	Allergology international : official journal of the Japanese Society of Allergology
Mmp12	64	21647421	2011	PloS one
Mmp12	64	21524282	2011	Respiratory research
Mmp12	64	21445523	2011	Brazilian journal of medical and biological
Mmp12	64	21378275	2011	Blood
Mmp12	64	20920189	2010	Respiratory research
Mmp12	64	20815658	2010	Experimental lung research
Mmp12	64	20546881	2010	The Journal of allergy and clinical immunology
Mmp12	64	20395558	2010	American journal of respiratory and critical care medicine
Mmp12	64	20364456	2010	The New England journal of medicine
Mmp12	64	20357289	2010	The New England journal of medicine
Mmp12	64	20133923	2010	American journal of respiratory and critical care medicine
Mmp12	64	20074461	NA	International journal of immunopathology and pharmacology
Mmp12	64	20018959	2009	The New England journal of medicine
Mmp12	64	19797132	2010	The European respiratory
Mmp12	64	19706765	2009	Cancer research
Mmp12	64	19536155	2009	Nature
Mmp12	64	19293200	2009	Therapeutic advances in respiratory disease
Mmp12	64	18619044	2008	Genetika
Mmp12	64	18334288	2008	Matrix biology : journal of the International Society for Matrix Biology
Mmp12	64	17601747	2007	Protein expression and purification

Mmp12	64	17132494	2006	Methods in enzymology
Mmp12	64	16982869	2006	Journal of immunology (Baltimore, Md. : 1950)
Mmp12	64	16717027	2006	Inhalation toxicology
Mmp12	64	16676616	2005	Zhonghua liu xing bing xue za zhi = Zhonghua liuxingbingxue zazhi
Mmp12	64	16500946	2006	American journal of physiology. Lung cellular and molecular physiology
Mmp12	64	16481329	2006	The Journal of biological chemistry
Mmp12	64	16359550	2005	Respiratory research
Mmp12	64	16308335	2006	Thorax
Mmp12	64	16166618	2005	American journal of respiratory and critical care medicine
Mmp12	64	15983040	2005	The Journal of biological chemistry
Mmp12	64	15962117	2005	MemÃ³rias do Instituto Oswaldo Cruz
Mmp12	64	15781250	2005	Biochemical and biophysical research communications
Mmp12	64	15723202	2005	Inflammation research
Mmp12	64	15699789	2005	Current opinion in pulmonary medicine
Mmp12	64	15474460	2004	Biochemical and biophysical research communications
Mmp12	64	12851242	2003	American journal of respiratory and critical care medicine
Mmp12	64	12684241	2003	American journal of respiratory and critical care medicine
Mmp12	64	12634787	2003	Nature
Mmp12	64	12634771	2003	Nature
Mmp12	64	12504900	2003	Archives of biochemistry and biophysics
Mmp12	64	12383023	2002	American journal of pharmacogenomics
Mmp12	64	12225964	2002	American journal of physiology. Lung cellular and molecular physiology
Mmp12	64	11893658	2002	Chest
Mmp12	64	11875051	2002	Human molecular genetics
Mmp12	64	11575929	2001	Journal of molecular biology
Mmp12	64	11575928	2001	Journal of molecular biology
Mmp12	64	11237688	2001	Protein expression and purification
Mmp12	64	11199097	2001	Novartis Foundation symposium
Mmp12	64	11133493	2001	American journal of physiology. Lung cellular and molecular physiology
Mmp12	64	10998200	2000	Proceedings of the Society for Experimental Biology and Medicine.
Mmp12	64	10801980	2000	Proceedings of the National Academy of Sciences of the United States of America
Mmp12	64	10605792	1999	Thrombosis and haemostasis
Mmp12	64	10201943	1999	Journal of immunology (Baltimore, Md. : 1950)
Mmp12	64	9230755	1997	American journal of respiratory and critical care medicine
Mmp12	64	2438967	1987	The American review of respiratory disease
Per3	0	0		
Dab2	0	0		
Slc3a2	0	0		
Cyba	1	20080081	2010	Clinica chimica acta; international journal of clinical chemistry
Fpr2	1	22215599	2012	Proceedings of the National Academy of Sciences of the United States of America
Ctsk	3	19060845	2009	Modern pathology

Ctsk	3	17227755	2007	The Journal of biological chemistry
Ctsk	3	15161653	2004	The American journal of pathology
Ctss	0	0		
Dbp	23	21930252	2011	Respiratory physiology & neurobiology
Dbp	23	21228423	2011	Thorax
Dbp	23	19858350	2009	Chronic respiratory disease
Dbp	23	19552093	2008	Journal of the Indian Medical Association
Dbp	23	19386071	2009	Respirology (Carlton, Vic.)
Dbp	23	19002085	2008	PostÈ©py higieny i medycyny doÅ›wiadczalnej (Online)
Dbp	23	18797740	2008	Jornal brasileiro de pneumologia
Dbp	23	18336764	2007	Chinese journal of tuberculosis and respiratory diseases
Dbp	23	17568753	2007	Journal of human hypertension
Dbp	23	17192130	2006	American journal of cardiovascular drugs : drugs, devices, and other interventions
Dbp	23	16697362	2006	Clinica chimica acta; international journal of clinical chemistry
Dbp	23	16637263	NA	Molekuliarnaia biologiia
Dbp	23	16579403	NA	Indian journal of physiology and pharmacology
Dbp	23	16117430	2005	Klinicheskaia meditsina
Dbp	23	16078956	2005	Journal of the American Geriatrics Society
Dbp	23	15245906	2004	Trends in biotechnology
Dbp	23	11219471	2001	Clinical therapeutics
Dbp	23	10759446	2000	The European respiratory journal
Dbp	23	7841973	1994	Monaldi archives for chest disease
Dbp	23	1402344	1992	The Journal of the Kentucky Medical Association
Dbp	23	1616198	1992	Anales espaÃ±oles de pediatrÃa
Dbp	23	1982059	1990	Cardiovascular drugs and therapy
Dbp	23	2879733	1986	European journal of clinical pharmacology
Ctsb	0	0		
Laptm5	0	0		
Cxcl2	24	22360706	2012	Free radical research
Cxcl2	24	21961642	2011	Journal of environmental science and health.
Cxcl2	24	20887783	2010	Free radical biology & medicine
Cxcl2	24	20818377	2010	Nature medicine
Cxcl2	24	19744573	2009	Pulmonary pharmacology & therapeutics
Cxcl2	24	19293939	2009	PloS one
Cxcl2	24	19254149	2009	American journal of veterinary research
Cxcl2	24	19050257	2008	Journal of immunology (Baltimore, Md. : 1950)
Cxcl2	24	19004925	2009	The Journal of pharmacology and experimental therapeutics
Cxcl2	24	18310229	2008	American journal of physiology. Lung cellular and molecular physiology
Cxcl2	24	18256171	2008	The Journal of pharmacology and experimental therapeutics
Cxcl2	24	18052742	2007	American journal of veterinary research
Cxcl2	24	18021431	2007	Respiratory research

Cxcl2	24	18007984	2007	Environmental health perspectives
Cxcl2	24	17766584	2007	American journal of physiology. Lung cellular and molecular physiology
Cxcl2	24	17690174	2007	American journal of physiology. Gastrointestinal and liver physiology
Cxcl2	24	16929007	2006	Toxicological sciences : an official journal of the Society of Toxicology
Cxcl2	24	15833762	2005	American journal of physiology. Lung cellular and molecular physiology
Cxcl2	24	15668323	2005	American journal of respiratory cell and molecular biology
Cxcl2	24	15333327	2004	American journal of respiratory cell and molecular biology
Cxcl2	24	12476359	2003	Inhalation toxicology
Cxcl2	24	12359653	2002	American journal of respiratory and critical care medicine
Cxcl2	24	11798689	1999	Zhonghua nei ke za zhi [Chinese journal of internal medicine]
Cxcl2	24	9847020	1998	Veterinary immunology and immunopathology
Saa3	0	0		
Tmem106a	0	0		
Prkcd	0	0		
Clu	0	0		
Smpdl3b	0	0		
Lair1	0	0		
Itih4	1	18618493	2008	Proteomics
Grn	0	0		
Tgfbr1	0	0		
Lrg1	0	0		
Cd1d1	0	0		
C3	57	22462235	2011	Journal of traditional Chinese medicine
C3	57	21846943	2011	Disease markers
C3	57	21813741	2011	Radiology
C3	57	21524765	2011	Medicina clÃnica
C3	57	21270401	2011	Journal of immunology (Baltimore, Md. : 1950)
C3	57	20144890	2010	Experimental neurology
C3	57	19922730	2009	Current rheumatology reports
C3	57	19684087	2009	Journal of immunology (Baltimore, Md. : 1950)
C3	57	19101763	NA	Marine biotechnology (New York, N.Y.)
C3	57	18403672	2008	Chest
C3	57	17975205	2008	American journal of respiratory and critical care medicine
C3	57	17502296	NA	Annales de biologie clinique
C3	57	17471436	2007	The Journal of infectious diseases
C3	57	17331971	2007	The European respiratory journal
C3	57	16966403	2006	Infection and immunity
C3	57	16711502	2006	Revista espaÃ±ola de anestesiologÃa y reanimaciÃ³n
C3	57	16574942	2006	American journal of respiratory cell and molecular biology
C3	57	16571611	2006	The European respiratory journal
C3	57	16512391	2006	Klinicheskaia meditsina

C3	57	16113417	2004	Proceedings of the American Thoracic Society
C3	57	15159749	2004	StomatologiiÍ¡a
C3	57	14563253	2003	Revista clÃnica espaÃ±ola
C3	57	12615868	2003	The Journal of antimicrobial chemotherapy
C3	57	11606842	2001	Investigative radiology
C3	57	11591733	2001	Journal of immunology (Baltimore, Md. : 1950)
C3	57	11371519	2001	Journal of bacteriology
C3	57	11045117	2000	Presse mÃ©dicale (Paris, France : 1983)
C3	57	10218320	1998	Journal of the Indian Medical Association
C3	57	10189505	1999	Acta neurochirurgica
C3	57	9266867	1997	Chest
C3	57	9071161	1997	Nihon KyÅbu Shikkan Gakkai zasshi
C3	57	8926173	1996	Der Hautarzt
C3	57	8541823	1995	Monaldi archives for chest disease
C3	57	7751050	1995	The Indian journal of medical research
C3	57	7878554	1994	Thorax
C3	57	8137654	1993	Zhonghua nei ke za zhi [Chinese journal of internal medicine]
C3	57	1564151	1992	Journal of the American Academy of Dermatology
C3	57	2228068	1990	The Indian journal of medical research
C3	57	2129476	NA	Archivos de investigaciÃ³n mÃ©dica
C3	57	2196033	1990	Archives of virology
C3	57	2784010	1989	Stereotactic and functional neurosurgery
C3	57	3069024	1988	Annales de dermatologie et de vÃ©nÃ©rÃ©ologie
C3	57	3649280	1987	Clinical immunology and immunopathology
C3	57	3454206	1987	Acta paediatrica Hungarica
C3	57	3702213	1986	Kidney international
C3	57	2424179	1986	VÅtreshni bolesti
C3	57	3875903	1985	South African medical journal
C3	57	6208579	NA	Revista clÃnica espaÃ±ola
C3	57	6978407	1982	Journal of clinical & laboratory immunology
C3	57	7251858	1981	The Journal of clinical investigation
C3	57	6911988	1981	Acta medica Austriaca
C3	57	7202596	1980	European journal of respiratory diseases
C3	57	7354236	1980	The Journal of laboratory and clinical medicine
C3	57	112044	1979	Immunology
C3	57	308809	1978	British journal of diseases of the chest
C3	57	1004644	1976	Naunyn-Schmiedeberg's archives of pharmacology
C3	57	806400	1975	Clinical allergy
LOC100048759	0	0		
Fn1	0	0		
Emr1	0	0		

Chi3l3	1	21915293	2011	PloS one
Acp2	0	0		
H2-Ab1	0	0		
Havcr2	0	0		
Cfb	1	21697997	2011	International journal of chronic obstructive pulmonary disease
C2	24	22462235	2011	Journal of traditional Chinese medicine
C2	24	22458856	2012	Journal of environmental science and health
C2	24	21813741	2011	Radiology
C2	24	19922730	2009	Current rheumatology reports
C2	24	19716045	2009	The Journal of heart and lung transplantation
C2	24	19651244	2009	Respiratory physiology & neurobiology
C2	24	19136241	2009	Respiratory medicine
C2	24	17804442	2008	The European respiratory journal
C2	24	17384086	2007	American journal of physiology. Lung cellular and molecular physiology
C2	24	17379851	2007	American journal of respiratory and critical care medicine
C2	24	16102443	2005	The Journal of heart and lung transplantation
C2	24	16008605	2005	Clinical transplantation
C2	24	15171561	2004	Zhongguo yi xue ke xue yuan xue bao. Acta Academiae Medicinae Sinicae
C2	24	12615868	2003	The Journal of antimicrobial chemotherapy
C2	24	12561617	2001	Wei sheng yan jiu = Journal of hygiene research
C2	24	12184862	2002	Journal of aerosol medicine
C2	24	11964752	2002	Current opinion in allergy and clinical immunology
C2	24	11561763	2001	Virchows Archiv : an international journal of pathology
C2	24	10780759	2000	The European respiratory journal
C2	24	9641386	1998	The European journal of surgery.
C2	24	3565938	1987	The American review of respiratory disease
C2	24	3773900	1986	Monographs in allergy
C2	24	6836186	1983	Research in veterinary science
C2	24	663425	1978	Respiration; international review of thoracic diseases
Cp	72	23132203	2012	Medical care
Cp	72	23000935	2012	The American journal of geriatric psychiatry
Cp	72	22726610	2012	BMC pulmonary medicine
Cp	72	21439045	2011	Biomedical engineering online
Cp	72	21340182	NA	Brazilian journal of otorhinolaryngology
Cp	72	21211434	2010	Chinese journal of stomatology
Cp	72	21157643	2010	Current opinion in investigational drugs (London, England : 2000)
Cp	72	21110197	2011	Heart and vessels
Cp	72	21092098	2010	Trials
Cp	72	20536425	2010	Current topics in medicinal chemistry
Cp	72	20463253	2010	Proceedings of the American Thoracic Society
Cp	72	19998041	2010	Lung

Cp	72	19995653	2009	Revue de pneumologie clinique
Cp	72	19560768	2009	Gastrointestinal endoscopy
Cp	72	19350630	2009	International journal of cancer. Journal international du cancer
Cp	72	19058490	NA	Revista alergia Mexico (Tecamachalco, Puebla, Mexico : 1993)
Cp	72	19052510	2008	ArerugÄ« = [Allergy]
Cp	72	18619824	2008	Respiratory medicine
Cp	72	18441096	2008	American journal of physiology. Lung cellular and molecular physiology
Cp	72	18188083	2008	Journal of occupational and environmental medicine
Cp	72	18028276	2008	Transfusion
Cp	72	17526197	2007	TerapevticheskiÄ arkhiv
Cp	72	17287299	2007	Thorax
Cp	72	16495069	2006	European journal of cardio-thoracic surgery
Cp	72	16249920	2006	European journal of applied physiology
Cp	72	16249313	2005	Physiological genomics
Cp	72	16236083	2005	International journal of clinical practice
Cp	72	16222887	NA	The Journal of international medical research
Cp	72	16113464	2005	Proceedings of the American Thoracic Society
Cp	72	16002925	2005	Chest
Cp	72	15474975	2005	The international journal of biochemistry & cell biology
Cp	72	15289103	2004	Journal of molecular biology
Cp	72	14769726	2004	Chest
Cp	72	14512671	NA	Respiration; international review of thoracic diseases
Cp	72	12740284	2003	Chest
Cp	72	12504900	2003	Archives of biochemistry and biophysics
Cp	72	12371533	2002	Journal of investigational allergology & clinical immunology
Cp	72	12211408	2002	Current opinion in investigational drugs (London, England : 2000)
Cp	72	11980276	2001	Monaldi archives for chest disease
Cp	72	11798603	2001	Zhonghua nei ke za zhi [Chinese journal of internal medicine]
Cp	72	11780351	2001	Chinese medical journal
Cp	72	11171871	2001	International journal of epidemiology
Cp	72	11075875	2000	Cancer causes & control : CCC
Cp	72	10934068	2000	American journal of respiratory and critical care medicine
Cp	72	10232436	1999	The European respiratory journal
Cp	72	10193378	1998	Thorax
Cp	72	9253724	1997	Journal of occupational and environmental medicine
Cp	72	7593895	1995	Intensive care medicine
Cp	72	7647736	1995	Pneumonologia i alergologia polska
Cp	72	8005246	1994	The European respiratory journal
Cp	72	8310540	1993	La Tunisie mÃ©dicale
Cp	72	8368923	1993	Archives of surgery (Chicago, Ill. : 1960)
Cp	72	8511687	1993	South African medical journal

Cp	72	1339048	NA	Cancer epidemiology, biomarkers & prevention
Cp	72	1585224	1992	South African medical journal
Cp	72	1392658	1992	Polish journal of occupational medicine and environmental health
Cp	72	1895584	1991	Nihon KyÃbu Shikkan Gakkai zasshi
Cp	72	2129991	1990	Chirurgie
Cp	72	2804252	NA	Biopharmaceutics & drug disposition
Cp	72	2805949	1989	Zhonghua nei ke za zhi [Chinese journal of internal medicine]
Cp	72	2919340	1989	South African medical journal
Cp	72	2688602	1989	Arquivos brasileiros de cardiologia
Cp	72	3258445	1988	South African medical journal
Cp	72	3356633	1988	Journal of applied physiology (Bethesda, Md. : 1985)
Cp	72	3622017	1987	Chest
Cp	72	4048084	1985	Preventive medicine
Cp	72	6508357	NA	Archives of environmental health
Cp	72	6838047	1983	The American review of respiratory disease
Cp	72	6837720	1983	The American journal of pathology
Cp	72	7065516	1982	The American review of respiratory disease
Cp	72	7330656	1981	Schweizerische medizinische Wochenschrift
Cp	72	760740	1979	British journal of clinical pharmacology
Ly6i	0	0		
Pigr	7	22053820	2012	Journal of proteome research
Pigr	7	21512171	2011	American journal of respiratory and critical care medicine
Pigr	7	20706611	2010	Journal of biomedicine & biotechnology
Pigr	7	12654638	2003	American journal of respiratory cell and molecular biology
Pigr	7	12615618	2003	American journal of respiratory and critical care medicine
Pigr	7	11208645	2001	American journal of respiratory and critical care medicine
Pigr	7	11082760	2000	Acta oto-rhino-laryngologica Belgica
C1qb	0	0		
Bst1	0	0		
Muc1	13	21569324	2011	BMC pulmonary medicine
Muc1	13	21474912	2011	Respiration; international review of thoracic diseases
Muc1	13	21206098	2011	JOP : Journal of the pancreas
Muc1	13	20886351	2011	International archives of occupational and environmental health
Muc1	13	20538446	2010	Respiratory medicine
Muc1	13	19960788	2009	Sarcoidosis, vasculitis, and diffuse lung diseases
Muc1	13	18595202	2008	Biomarkers : biochemical indicators of exposure, response, and susceptibility to chemicals
Muc1	13	16969297	2006	Transplantation
Muc1	13	12605318	2003	Clinical rheumatology
Muc1	13	12010847	2002	Chest
Muc1	13	11015008	2000	Nephron
Muc1	13	9685530	1998	Lung

Muc1	13	7548906	1995	Tubercle and lung disease
Lgals3bp	0	0		
Hvcn1	0	0		
Slc6a20a	0	0		
Orm1	0	0		
Orm2	0	0		
Bcl2a1d	0	0		
Bcl2a1a	0	0		
Bcl2a1b	0	0		
Csf2rb2	0	0		
Tifa	0	0		
Itgax	4	16940747	2006	International archives of allergy and immunology
Itgax	4	16907910	2006	Clinical and experimental immunology
Itgax	4	16424380	2006	American journal of respiratory cell and molecular biology
Itgax	4	8902456	1996	The European respiratory journal
Il1rn	15	23071879	2012	Oman medical journal
Il1rn	15	22343222	2012	American journal of respiratory cell and molecular biology
Il1rn	15	22163019	2011	PloS one
Il1rn	15	21814463	2011	International journal of chronic obstructive pulmonary disease
Il1rn	15	20650986	2011	The European respiratory journal
Il1rn	15	20064207	2010	Arthritis research & therapy
Il1rn	15	19608716	2009	American journal of respiratory and critical care medicine
Il1rn	15	19291375	2009	Journal of clinical immunology
Il1rn	15	18579366	2008	Respiratory medicine
Il1rn	15	18364273	2008	The Kaohsiung journal of medical sciences
Il1rn	15	17380888	NA	Molekuliarnaia biologiia
Il1rn	15	15766560	2005	Biochemical and biophysical research communications
Il1rn	15	12928941	2003	Zeitschrift fÃ¼r Rheumatologie
Il1rn	15	12467523	2002	Mediators of inflammation
Il1rn	15	11053025	2000	American journal of physiology. Lung cellular and molecular physiology
Chi3l1	7	22554524	2012	Biochemical and biophysical research communications
Chi3l1	7	21968467	2012	Respiration; international review of thoracic diseases
Chi3l1	7	21949714	2011	PloS one
Chi3l1	7	21915293	2011	PloS one
Chi3l1	7	20656949	2011	American journal of respiratory cell and molecular biology
Chi3l1	7	19491341	2009	American journal of respiratory cell and molecular biology
Chi3l1	7	18802121	2008	Journal of immunology (Baltimore, Md. : 1950)
Cd68	38	22798194	2012	Cell biochemistry and biophysics
Cd68	38	22362876	2012	Chest
Cd68	38	22215599	2012	Proceedings of the National Academy of Sciences of the United States of America
Cd68	38	21970519	2011	Respiratory research

Cd68	38	21681974	2011	Diagnostic cytopathology
Cd68	38	21512269	2011	Experimental animals / Japanese Association for Laboratory Animal Science
Cd68	38	21197447	2010	Mediators of inflammation
Cd68	38	20495756	2010	Romanian journal of morphology and embryology
Cd68	38	20472710	2010	American journal of physiology. Lung cellular and molecular physiology
Cd68	38	19736178	2009	Thorax
Cd68	38	19353346	2008	COPD
Cd68	38	19218194	2009	American journal of respiratory and critical care medicine
Cd68	38	19118262	2009	Chest
Cd68	38	18268925	2007	International journal of chronic obstructive pulmonary disease
Cd68	38	19105585	2008	Drugs
Cd68	38	17988392	2007	Respiratory research
Cd68	38	17557771	2007	Thorax
Cd68	38	17504799	2007	The European respiratory journal
Cd68	38	16424444	2006	American journal of respiratory and critical care medicine
Cd68	38	16050471	2005	journal of the Japanese Respiratory Society
Cd68	38	20477652	2005	Expert review of clinical immunology
Cd68	38	15607122	2005	Pulmonary pharmacology & therapeutics
Cd68	38	15047949	2004	Thorax
Cd68	38	14605067	2003	Chest
Cd68	38	12816740	2003	American journal of respiratory and critical care medicine
Cd68	38	12668802	2003	Thorax
Cd68	38	12149529	2002	Thorax
Cd68	38	12070058	2002	American journal of respiratory and critical care medicine
Cd68	38	11199094	2001	Novartis Foundation symposium
Cd68	38	10984367	2000	The Journal of allergy and clinical immunology
Cd68	38	10843939	2000	Chest
Cd68	38	10802223	2000	Free radical biology & medicine
Cd68	38	10607796	2000	Thorax
Cd68	38	10435362	1999	Internal medicine (Tokyo, Japan)
Cd68	38	9847291	1998	American journal of respiratory and critical care medicine
Cd68	38	9403729	1997	The American journal of pathology
Cd68	38	9117016	1997	American journal of respiratory and critical care medicine
Cd68	38	8564109	1996	American journal of respiratory and critical care medicine
Gatm	0	0		
Olfm1	0	0		
Sirpa	0	0		
Ptgs1	6	22324934	2012	Expert opinion on therapeutic targets
Ptgs1	6	22204820	2012	Immunobiology
Ptgs1	6	21798652	2011	Archivos de bronconeumologÃa
Ptgs1	6	21458581	2011	Prostaglandins & other lipid mediators

Ptgs1	6	15921208	NA	American journal of rhinology
Ptgs1	6	15301300	2004	Journal of investigational allergology & clinical immunology
Ccl9	0	0		
Ccl6	1	16645178	2006	American journal of respiratory cell and molecular biology
1100001G20Rik	0	0		
Bpifb1	0	0		
Procr	0	0		
Lbp	10	20129855	2010	IEEE transactions on medical imaging
Lbp	10	19718433	2009	PloS one
Lbp	10	19010986	2009	The European respiratory journal
Lbp	10	18979835	2008	Medical image computing and computer-assisted intervention
Lbp	10	16740168	2006	BMC pulmonary medicine
Lbp	10	15356561	2004	The Journal of allergy and clinical immunology
Lbp	10	11514694	2001	Thorax
Lbp	10	10468134	1999	The Journal of infection
Lbp	10	9731007	1998	American journal of respiratory and critical care medicine
Lbp	10	8795671	1996	Thorax
Rab20	0	0		
F10	2	22970026	2012	Experimental and therapeutic medicine
F10	2	18534165	2008	Ugeskrift for laeger
Naip2	0	0		
Cd14	31	23117214	2013	Biomaterials
Cd14	31	22355383	2012	PloS one
Cd14	31	21439805	2011	Respiratory medicine
Cd14	31	21129004	2011	Scandinavian journal of immunology
Cd14	31	20709824	2011	American journal of respiratory and critical care medicine
Cd14	31	20438701	2010	Biochemical and biophysical research communications
Cd14	31	20080799	2010	Proceedings of the National Academy of Sciences of the United States of America
Cd14	31	19675120	2010	Innate immunity
Cd14	31	19361972	2009	Respiratory medicine
Cd14	31	19119705	2008	Annals of allergy, asthma & immunology
Cd14	31	19085563	2008	Experimental lung research
Cd14	31	19080469	2008	Zhonghua yi xue za zhi
Cd14	31	19010986	2009	The European respiratory journal
Cd14	31	18446588	2008	The Journal of asthma : official journal of the Association for the Care of Asthma
Cd14	31	17574828	2007	Respiratory medicine
Cd14	31	17384086	2007	American journal of physiology. Lung cellular and molecular physiology
Cd14	31	17072032	2006	Journal of physiology and pharmacology
Cd14	31	16907910	2006	Clinical and experimental immunology
Cd14	31	16606450	2006	Respiratory research
Cd14	31	16406722	2007	Pulmonary pharmacology & therapeutics

Cd14	31	16004610	2005	Respiratory research
Cd14	31	15879152	2005	Journal of immunology (Baltimore, Md. : 1950)
Cd14	31	15802338	2005	The European respiratory journal :
Cd14	31	15660518	2005	Annual review of medicine
Cd14	31	15544629	2004	Clinical and experimental immunology
Cd14	31	15138625	2004	International journal of molecular medicine
Cd14	31	12684293	2003	Chest
Cd14	31	11440642	2001	Journal of interferon & cytokine research
Cd14	31	10707942	2000	Journal of medical microbiology
Cd14	31	8998075	1997	American journal of respiratory cell and molecular biology
Cd14	31	8033141	1994	Cancer research
Cd200r1	0	0		
Mtm1	0	0		
Tlr7	0	0		
Cybb	4	18952568	2009	American journal of respiratory cell and molecular biology
Cybb	4	18403597	2008	The American journal of pathology
Cybb	4	16123991	2006	Pediatric blood & cancer
Cybb	4	15983040	2005	The Journal of biological chemistry
Atp6ap2	0	0		
Id2	1	17395785	2007	American journal of physiology. Regulatory, integrative and comparative physiology
Slc26a4	5	22116372	2011	Cellular physiology and biochemistry
Slc26a4	5	22116359	2011	Cellular physiology and biochemistry
Slc26a4	5	22116352	2011	Cellular physiology and biochemistry
Slc26a4	5	21814192	2011	Clinical pharmacology and therapeutics
Slc26a4	5	18424749	2008	Journal of immunology (Baltimore, Md. : 1950)
Ms4a7	0	0		
Ms4a6d	0	0		
Rab32	0	0		
Il33	2	21682745	2011	Immunological reviews
Il33	2	20608085	2010	Nihon KokyÅ«ki Gakkai zasshi = the journal of the Japanese Respiratory Society
Ch25h	0	0		
Ifit3	0	0		
Igf1	0	0		
Vnn1	0	0		
Pon1	6	22738861	2012	Metabolism: clinical and experimental
Pon1	6	22528954	2012	Sleep & breathing = Schlaf & Atmung
Pon1	6	22015083	2011	Respiratory medicine
Pon1	6	18635682	2008	Journal of medical genetics
Pon1	6	17613085	2007	Inhalation toxicology
Pon1	6	16380766	2005	Saudi medical journal
Snx10	0	0		

Ifi30	0	0		
Itgb2	10	21976223	2011	Clinical and vaccine immunology : CVI
Itgb2	10	21651795	2011	Respiratory research
Itgb2	10	19574534	2010	American journal of respiratory cell and molecular biology
Itgb2	10	17626109	2007	The European respiratory journal
Itgb2	10	17573488	2007	Chest
Itgb2	10	16807266	2006	The European respiratory journal
Itgb2	10	11953106	2002	Chinese journal of tuberculosis and respiratory diseases
Itgb2	10	11817553	2002	Equine veterinary journal
Itgb2	10	10707942	2000	Journal of medical microbiology
Itgb2	10	8902456	1996	The European respiratory journal
Clec4a2	0	0		
Clec4n	0	0		
C1ra	0	0		
C1rb	0	0		
B4galnt1	0	0		
Capg	0	0		
Reg3g	0	0		
Psap	0	0		

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