

# openSNP

## An open data resource for personalized genotype & phenotype data

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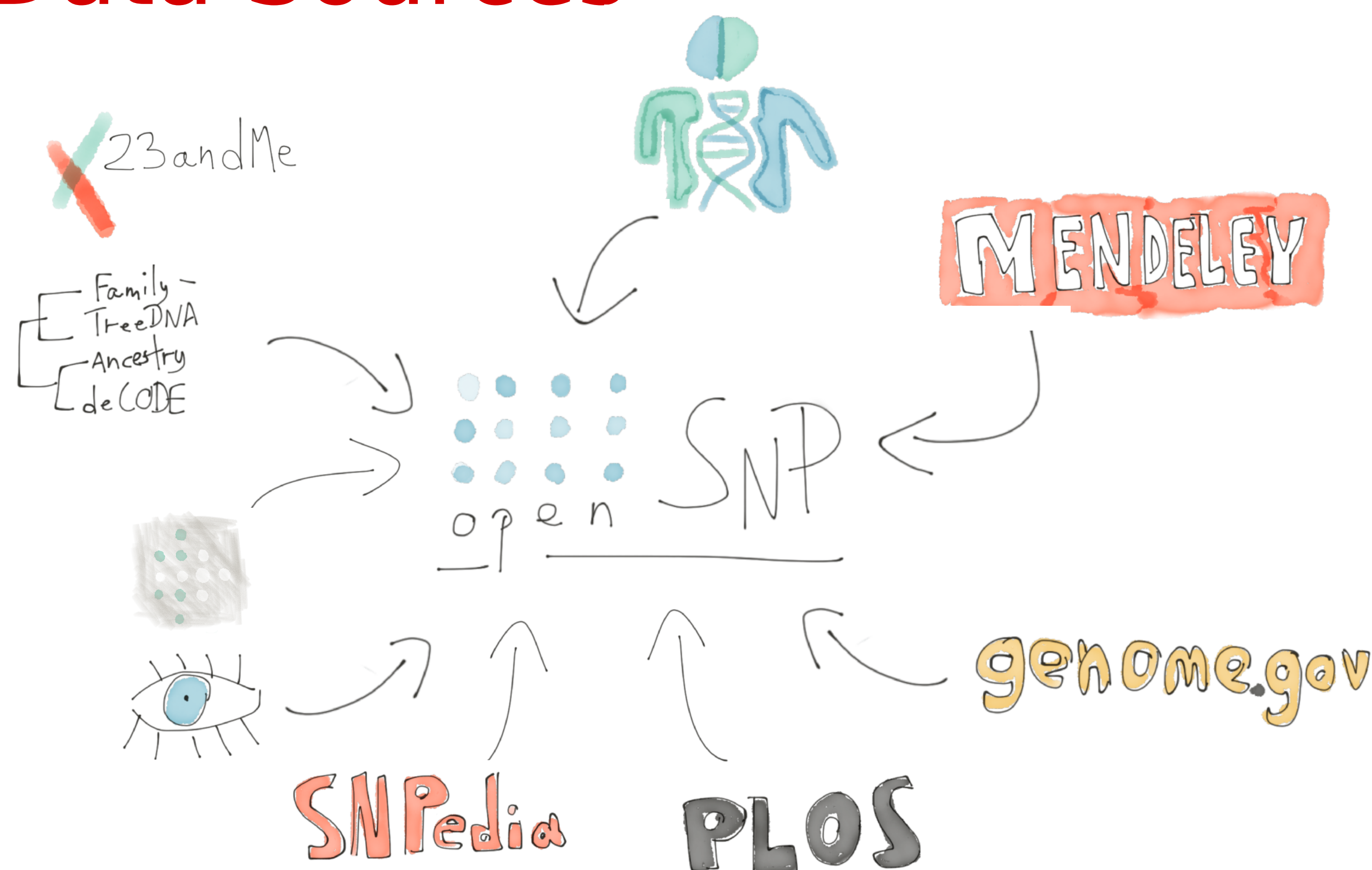
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## Introduction

Direct-To-Consumer (DTC) genetic testing, as offered by companies such as *23andMe*, *FamilyTreeDNA* or *Ancestry*, has been on the rise in the last couple of years: *23andMe* alone has over 1 million customers worldwide who have had their genomes tested [1]. Those services usually check for Single Nucleotide Polymorphisms (SNPs) using microarrays, though Exome and Whole Genome sequencing services are also currently entering the market [2]. Many of those DTC customers allow their service providers to use the data for in-house research.

If only a small fraction of DTC customers would make their data publicly available, a rich and free data resource for scientists all over the world could be created. With openSNP we created a platform where people can donate their genetic & phenotypic data into the public domain.

## Data Sources



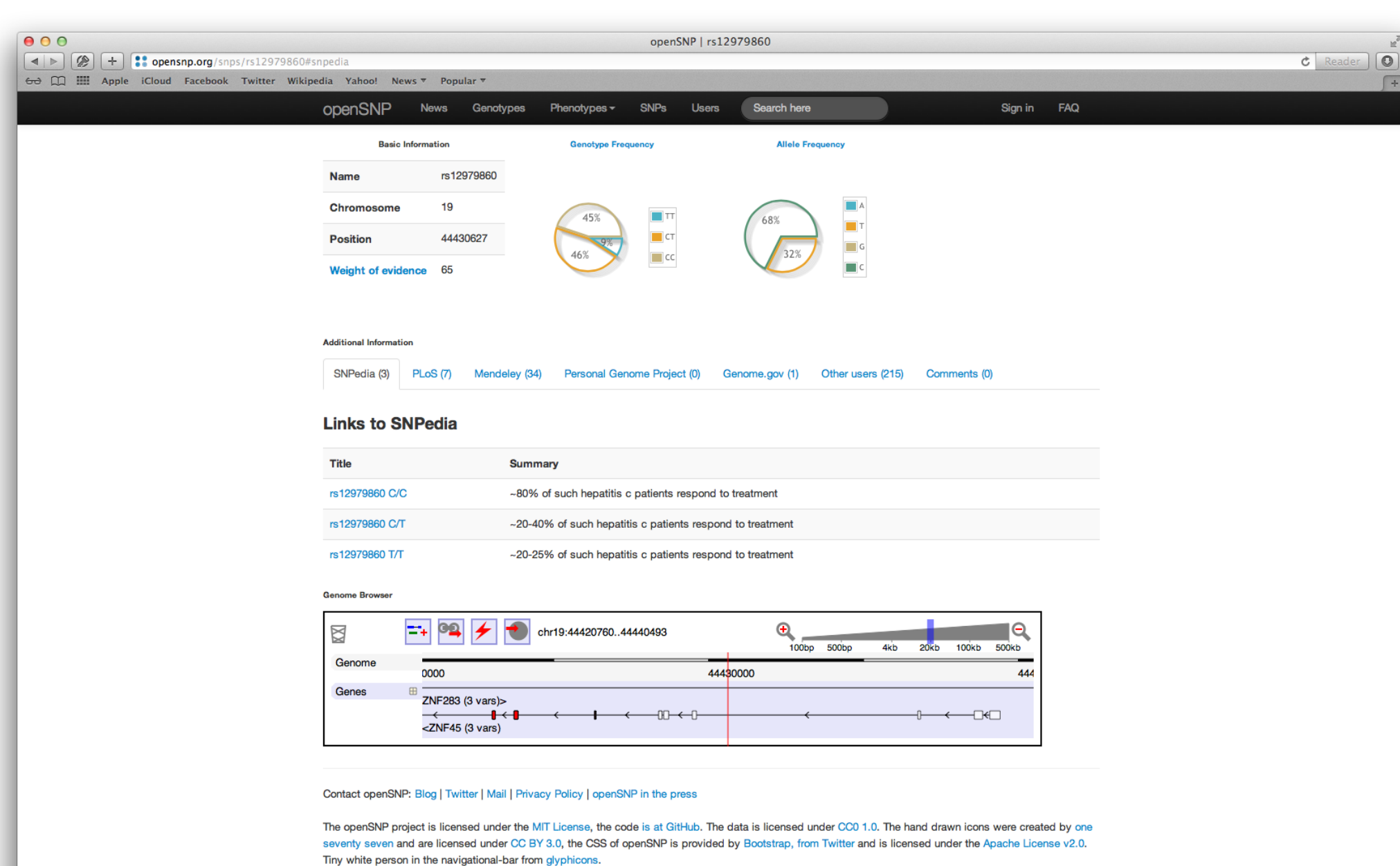
**Figure 1** The different data inputs of openSNP

People can upload their **personal genetic data**, coming from sources like 23andMe, FamilyTreeDNA, Ancestry.com and deCODEme without any need to convert their input files. Additionally support for generic VCF files is offered.

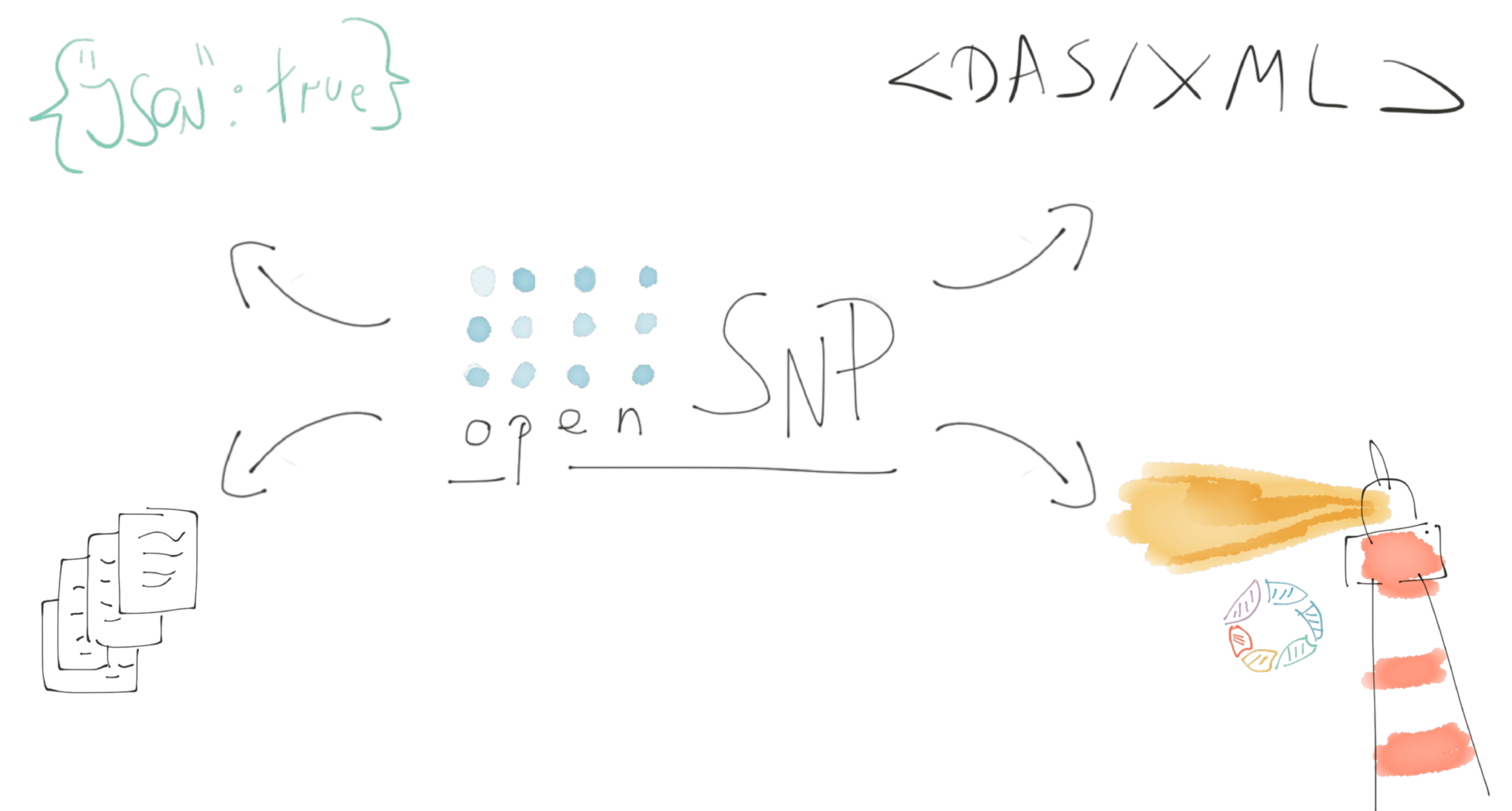
People can also **collect phenotypes**. They are entered using either text or by uploading pictures. New phenotype categories are generated by the users themselves. Additionally people can publish their personal activity data, as recorded by Fitbit [3].

To annotate the individual variants present, we mine external services for primary literature (PLOS, Mendeley) and known associations (SNPedia [4], GWAS Catalog [5], GET Evidence System [6]).

## The Web Platform



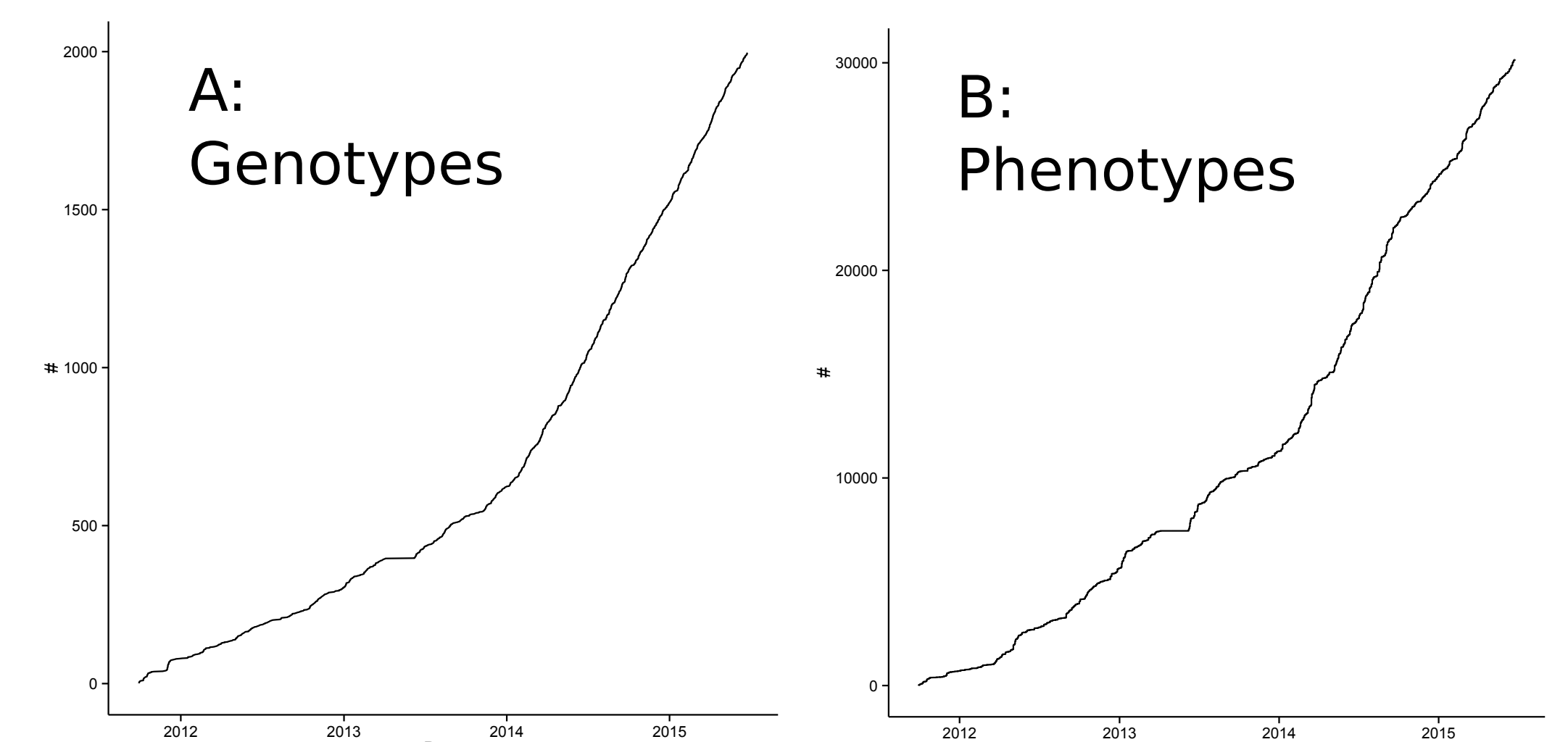
**Figure 2** Screenshot of detailed SNP view. Showing genome browser & annotations



**Figure 3** The different output methods openSNP offers

The genotype and phenotype data can be downloaded using different strategies. People can download all data sets in a single zip-archive or get only data sets associated with a given phenotype. Additionally **openSNP offers different APIs**: there is a custom JSON-API and the *Distributed Annotation System* (DAS) [7]. OpenSNP also works as a Beacon for the *Global Alliance for Genomics and Health* [8].

## Usage



**Figure 4** Growth of openSNP.

**A** shows number of genetic data sets. **B** shows the number of phenotypes

Between the start of openSNP on 27.09.2011 and 19.06.2015 3841 people have signed up for an account. In total, over 2000 genetic data sets have been uploaded by the users. Those users also have provided a total of 4743 entries on 360 different phenotypes, which range from hair- and eye-colour to political beliefs. Amongst other things, the data from openSNP have been used to research genomic privacy [9], teach students using real world data [10] and even to create art [11].

**The application can be found at <https://opensnp.org> and the code is released under MIT License at <https://github.com/gedankenstuecke/snpr>. All data uploaded is dedicated into the Public Domain using Creative Commons Zero.**

## References

- [1] <http://blog.23andme.com/news/one-in-a-million/>
- [2] <https://www.23andme.com/exome/>
- [3] <http://www.fitbit.com>
- [4] Cariaso M and Lennon G. (2012) Nucl. Acids Res. 40 (D1): D1308-D1312
- [5] Welter D, MacArthur J, Morales J et al. (2014) Nucl. Acids Res V42: D1001-D1006
- [6] Ball MP, Thakuria JV, Zaranek AW, et al. (2012) PNAS 109: 11920- 11927.
- [7] Dowell R, Jakerst R, Day A et al. (2001) BMC Bioinformatics 2: 7.
- [8] <http://genomicsandhealth.org/>
- [9] Humbert M, Huguenin K, Hugonot J, Ayday E, Hubaux J. (2015) 15th Privacy Enhancing Technologies Symposium
- [10] <https://www.coursera.org/course/usefulgenetics>
- [11] <https://soundcloud.com/thesoundofpeople/>



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