

# A Genetic Variant Near Olfactory Receptor Genes Associates With Cilantro Preference



S. Wu, J.Y. Tung, A.B. Chowdry, A.K. Kiefer, J.L. Mountain, N. Eriksson 23andMe, Inc., Mountain View, CA

## “A very stinking herbe”

Many people love the taste of fresh cilantro (*Coriandrum sativum*, also called coriander), while others despise it with every fiber of their being. The debate has raged for centuries. Pliny extolled its “refreshing” properties, a medieval herbalist claimed that the leaves had a “venomous quality,” and, more recently, beloved culinary icon Julia Child opined that cilantro had “kind of a dead taste” and that she would “pick it out if [she] saw it and throw it on the floor.”



*Oh, coriander.  
If ‘pure evil’ had a taste?  
It would taste like you.*  
by SilverSpoon at  
IHateCilantro.com

## So fresh or so clean?

Cilantro’s dual nature may lie in its key aroma components, which consist of various aldehydes. The unsaturated aldehydes (mostly decanal and dodecanal) are described as fruity, green, and pungent; the (E)-2-alkenals as soapy, fatty, pungent, and “like cilantro.” Of the many descriptors that “haters” use, soapy is the most common.

## Is cilantro love/hate a genetic trait?

It is not known why cilantro is so differentially perceived. Cilantro preference varies with ancestry and may be influenced by exposure. Genetic factors are also thought to play a role but to date no studies have found genetic variants influencing cilantro taste preference.

## Methods

We conducted the first-ever genome-wide association study of cilantro preference. Participants were drawn from the more than 180,000 genotyped customers of 23andMe, Inc., a consumer genetics company.

### Phenotype data collection

Participants reported their age and answered two questions about cilantro online:

1. “Does fresh cilantro taste like soap to you?” (Yes/No/I’m not sure)
2. “Do you like the taste of fresh (not dried) cilantro?” (Yes/No/I’m not sure)

See Table 1 for a summary of the phenotype data. Sex and ancestry were determined based on genetic data; for the GWAS and replication, participants were of European ancestry.

**Table 1. Summary of cohorts analyzed**

	N	Female	Age (SD)
Tastes soapy	1994	0.566	49.0 (15.0)
Doesn’t taste soapy	12610	0.489	48.3 (15.2)
Total	14604	0.500	48.4 (15.2)
Dislikes cilantro	3181	0.487	47.1 (16.6)
Likes cilantro	8906	0.420	43.8 (14.5)
Total	12087	0.438	44.7 (15.1)

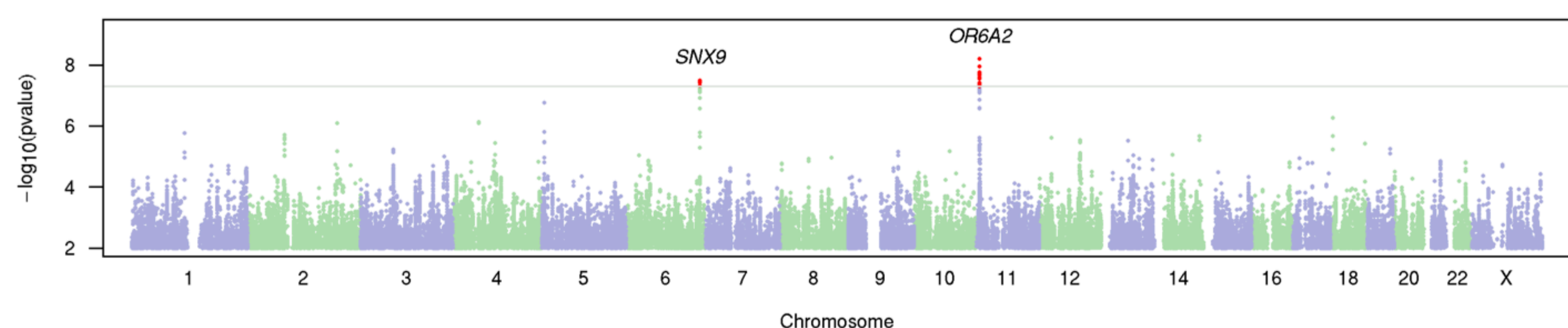
### Genotyping

Participants were genotyped for 586,916 to 1,008,948 SNPs on one of three Illumina-based BeadChips. A total of 7,356,559 imputed SNPs were included in the analysis.

### Statistical analysis

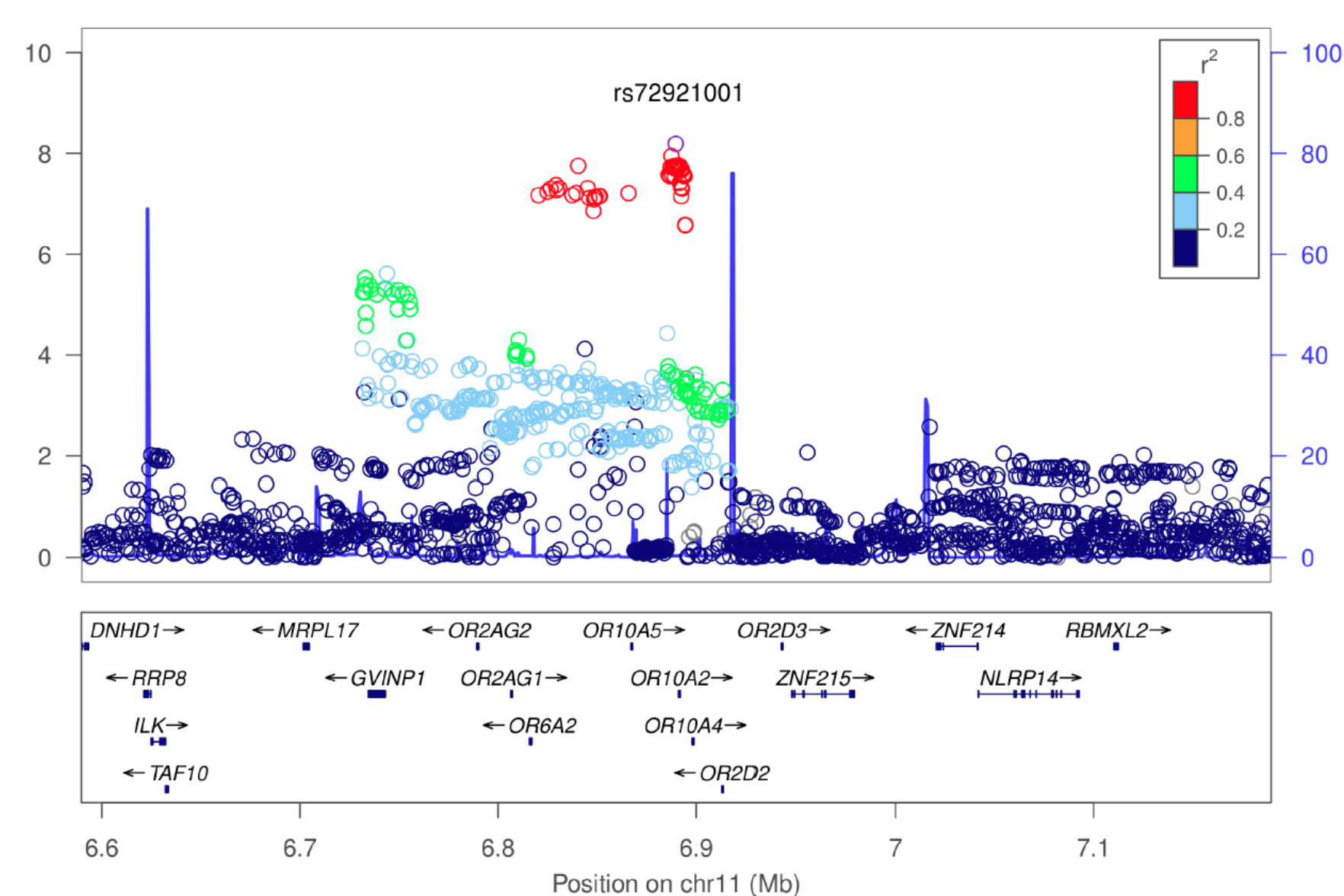
For the GWAS and replication, p-values were calculated using a likelihood ratio test with age, sex, and five main principal components as covariates. ORs and p-values for the differences in soapy-taste detection between sexes and populations were calculated directly, without covariates.

## Results and discussion



**Figure 1. Manhattan plot of association with cilantro soapy-taste.**

We found one genome-wide significant association for cilantro soapy-taste that was confirmed in the cilantro preference population (see Figure 1): **rs72921001** ( $p_{\text{discovery}} = 6.4 \times 10^{-9}$ , OR = 0.81,  $p_{\text{replication}} = 0.0057$ ). A second SNP that was significantly associated with cilantro soapy-taste did not replicate with cilantro like/dislike (rs114184611;  $p_{\text{discovery}} = 3.2 \times 10^{-8}$ , OR = 0.68,  $p_{\text{replication}} = 0.49$ ).



**Figure 2. Associations near rs72921001**

rs72921001 lies on chromosome 11 within a cluster of eight olfactory receptor genes, of which **OR6A2** is the most promising candidate. A wide range of odorants have been found to activate **OR6A2**, all of them aldehydes. **Several aldehydes known to bind to OR6A2 play a key role in cilantro aroma**, such as decanal and (E)-2-decanal. rs72921001 is also in high LD ( $r^2 > 0.9$ ) with three non-synonymous SNPs in **OR10A2**.

**Table 2. Cilantro soapy-taste by ancestry**

Population	Not soapy (%)	Soapy (%)	Total	MAF	p-value
Ashkenazi	634 (85.9%)	104 (14.1%)	738	0.355	0.56
South Europe	458 (86.6%)	71 (13.4%)	529	0.335	0.25
Europe all	13213 (87.0%)	1973 (13.0%)	15186	0.373	$1.23 \cdot 10^{-8}$
North Europe	11794 (87.2%)	1736 (12.8%)	13530	0.376	$1.17 \cdot 10^{-8}$
All	16196 (87.6%)	2299 (12.4%)	18495	0.356	$3.94 \cdot 10^{-8}$
African-American	545 (90.8%)	55 (9.2%)	600	0.224	0.87
Latino	820 (91.3%)	78 (8.7%)	898	0.350	0.29
East Asia	424 (91.6%)	39 (8.4%)	463	0.283	0.22
South Asia	322 (96.1%)	13 (3.9%)	335	0.371	0.0078

We also found significant differences by sex and ancestry in soapy-taste detection.

**Women are more likely to detect a soapy taste and to dislike cilantro (Table 1); African Americans, Latinos, East Asians, and South Asians are all significantly less likely to detect a soapy taste compared to Europeans (Table 2).**

Using GCTA, we estimate a **low heritability** for cilantro soapy-taste at **0.087**. It is possible that other genetic factors, including rare variants, influence cilantro preference, or that cilantro preference does not have a strong genetic component.

## References

Eriksson, N. et al. (Submitted) Preprint at <http://arxiv.org/abs/1209.2096> (2012).

McGee, Harold. “Cilantro Haters, It’s Not Your Fault.” *The New York Times*. 13 April 2010. Online.

IHateCilantro.com. Online.