## Introduction
Phantogeusia is a taste disorder defined by an abnormal taste sensation when the mouth is empty. The condition has not received much attention and its pathogenesis remains to be clarified. Genes for a family of taste receptors, T2Rs, are identified in the region adjacent to the bitter taste genes. These proteins are bitter taste receptor genes in the tongue of patients with phantogeusia.

### Subjects
A total of 43 patients complained of a taste sensation in their empty mouths when the mouth is empty. The condition has not received much attention and its pathogenesis remains to be clarified. Genes for a family of taste receptors, T2Rs, are identified in the region adjacent to the bitter taste genes. These proteins are bitter taste receptor genes in the tongue of patients with phantogeusia.

### Methods
The tongue papillae of the patients and control subjects were collected and subjected to gene expression analysis. A total of 43 patients, who visited the ENT clinic of Nihon University Medical Center, were enrolled in this study. The patients consisted of 12 males and 31 females, with an average age of 68 years (range, 39 to 82 years). A control group consisted of 24 cases, 14 males and 10 females, with an average age of 66 years (range, 39 to 80 years), who had no complaints of taste disturbances.

### Results
In regards to the spontaneous abnormal taste modalities in patients with phantogeusia, bitter sensation was claimed in 26 cases, sweetness in 11 cases, saltiness in 11 cases, metallic with bitter taste sensation in 7 cases (counting with overlapped cases).

### Discussion
Phantogeusia is a unique taste disorder that is defined by an abnormal taste sensation when the mouth is empty. A patient presenting with such a condition is not uncommon in clinical practice. However, it is not clarified what induced these increased expression frequencies specific taste receptor genes are increased in the tongue of phantogeusia patients and how these increased expression frequencies are implicated in the pathogenesis of phantogeusia. We consider it necessary to study further quantitative and qualitative alterations as well in these taste receptor genes that should be increased in expression frequency in patients with phantogeusia. This study was the report that suggested the possibility of taste receptor genes being involved in the pathogenesis of phantogeusia.

### CONCLUSIONS
The results of this study revealed that the taste receptor genes, TAS2R42 and T2R3, are expressed in the tongue of patients with spontaneous abnormal taste sensation at significantly higher levels compared to that of control healthy subjects. A significant increase in the expression of TAS2R42, TAS2R43, and T2R3 genes was shown in patients with bitter sensation in an empty mouth. A significant difference was observed between the control group and the phantogeusia group without bitter taste sensation in the expression of TAS2R42 (p = 0.049). These results suggest a role of the taste receptor gene, TAS2R42, in phantogeusia patients with spontaneous abnormal taste sensation, as we suggest that the taste receptor genes, TAS2R42 and T2R3, contribute to the development of especially bitter taste sensation with an empty mouth.

### REFERENCES
1. Massachusetts Institute of Technology. "Phantogeusia: a unique taste disorder that is defined by an abnormal taste sensation when the mouth is empty. A patient presenting with such a condition is not uncommon in clinical practice. However, it is not clarified what induced these increased expression frequencies specific taste receptor genes are increased in the tongue of phantogeusia patients and how these increased expression frequencies are implicated in the pathogenesis of phantogeusia. We consider it necessary to study further quantitative and qualitative alterations as well in these taste receptor genes that should be increased in expression frequency in patients with phantogeusia. This study was the report that suggested the possibility of taste receptor genes being involved in the pathogenesis of phantogeusia."