The human vomeronasal organ
To preserve or not?

There is an ongoing debate among scientists regarding the significance of the vomeronasal organ (VNO), a small defined area of uncertain function inside the nose in humans. During nasal surgery, this organ can be permanently damaged, thereby ceasing any associated function. Dr Tjasse D Bruintjes, ear, nose, and throat surgeon at Leiden University Medical Center, and Dr Ronald LAW Bleys, anatomist at the University Medical Center Utrecht, the Netherlands, conducted extensive research on the elusive organ to settle the debate for good.

Septoplasty is a surgical procedure to straighten the structure inside the nose that separates the nostrils, called the septum. The surgeon straightens the septum by cutting and removing parts before repositioning it, a process that may cause injury to the mucosa (the inner lining tissue of the nose). This may affect an area inside the nose called the vomeronasal organ (VNO), otherwise known as the Jacobson's organ.

The relatively small Jacobson's organ has caused a lot of uproar in the scientific world – for two main reasons: a lack of evidence as to whether the VNO does in fact exist in humans, and a lack of understanding about whether the human VNO performs the same functions as its animal counterparts. Answering this second question is especially crucial because if the VNO is in fact a functional organ in humans, surgeons should try to preserve it during nasal surgery.

Dr Tjasse Bruintjes, ear, nose, and throat surgeon at Leiden University Medical Center and Dr Ronald LAW Bleys, anatomist at the University Medical Center Utrecht, the Netherlands, have taken matters into their own capable hands. By scrutinising the research literature, they set out to answer some key questions: firstly, can the vomeronasal organ be found in the human nose? Second, is the VNO functional in humans? And ultimately, should surgeons try to identify the VNO and avoid damaging it during nose surgery?

WHAT IS THE VOMERONASAL ORGAN?
The VNO is a sensory organ located inside the nose (nasal) cavity or the roof of the mouth of most amphibia, reptiles, and mammals. Although first discovered by the 17th century Dutch anatomist Frederik Ruysch, the VNO was later studied in detail by Ludwig Jacobson, a Danish army surgeon.

Interestingly, the VNO derives its alternative name – the Jacobson's organ – from the surgeon, who is now popularly credited for its discovery.

In most amphibia, reptiles, and some mammals, the VNO is an area within the main nasal cavity. It is made up of a group of sensory cells that can detect specific molecules, including pheromones – the special chemicals produced and secreted by some animals to trigger a specific response in other animals of the same species. In this way, the VNO allows animals to communicate via chemical messages (olfactory signals) within their social groups regarding their sexual readiness and availability, tracking and hunting prey, potentially with aggression and territorial behaviour.

DO HUMANS HAVE A VNO?
Despite the longstanding debate within the scientific community about the presence of VNO in humans, recent studies have shown evidence of its existence. More specifically, inside the human nose, there is an area on the front lower part of the septum, approximately 2 cm from the nostrils, that can be seen with the naked eye and can be present in one or both sides – a septal mucosal pit.

While conducting their research, Bruintjes and Bleys wanted to find out whether this structure – the septal mucosal pit – is an opening leading to a human VNO or whether it is just an evolutionary remnant, or in fact part of a different structure altogether. To achieve this, they undertook a thorough review of previous studies conducted on human cadavers. The researchers carried out their own examinations on individuals using a medical investigation called rigid endoscopy (a procedure involving the insertion of a tiny camera inside the nasal cavities through the nostrils to capture videos, pictures, as well as collect tissue samples). They also examined the nasal mucosa of human cadavers under the microscope.

The results of their study revealed that most humans have a VNO in the form of a small duct, measuring...
between 2–10 mm in length, which ends in a small pouch towards the back of the nose. However, the septal mucosal pit was not always found to be connected to the organ; it often led to a different structure inside the nose, either a gland duct or a structure called the nasopalatine recess or fossa. This discovery raised the important question of how any potential pheromones would be transferred to the VNO if the two were not connected.

**IS THE HUMAN VNO FUNCTIONAL?**

While the team found structural evidence regarding the human VNO in previous studies, the role of the VNO in humans is also a controversial matter. Taking a closer look at the evidence around its function, Bruintjes and Bleys found a previous study which measured the electrical response of live tissue after administering human pheromones – special chemicals that trigger a specific response in other animals of the same species. But is this the VNO’s function in humans?

**The human VNO is most likely a vestigial organ – an evolutionary relic – that has no evident functionality or importance.**

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Additionally, the team noted that these findings were not confirmed by the discovery of nerve cells or nerve connections in the human VNO – structures necessary for the transfer of such sensory information that would provide evidence of relevant activity. In animals with well-developed VNOs, there are specialised nerve structures to carry the information to an accessory olfactory bulb, an organ in the forebrain which is also not present in humans. This means that humans don’t have the ability to receive information from potential vomeronasal receptor cells. Furthermore, the genes coding the vomeronasal receptor proteins, as well as the proteins necessary for transferring the signals, are seemingly mutated in humans, reconfirming that they are no longer functional.

**SHOULD SURGEONS PRESERVE THE VNO?**

We now address the researcher’s third question – does damage to the human VNO during nasal surgery affect the patient’s social life in terms of selecting mates and creating relationships? The team concluded that although the vomeronasal organ is found in most human adults, it does not appear to have the structure and properties required for it to be functional. This inference does not rule out the possibility of a pheromone-related communication in humans, since this could potentially be facilitated by other sensory organs such as the olfactory organ (the organ that serve the sense of smell). While there isn’t a record of significant scientific evidence for such communication at present, future studies could prove otherwise.

Based on the available evidence, Bruintjes and Bleys conclude that the human VNO is most likely a vestigial organ – an evolutionary relic – that has no evident functionality or importance. Therefore, the VNO does not require special attention and need not be preserved during surgery.

**References**


**Behind the Research**

Dr Tjasse D Bruintjes

Dr Ronald LAW Bleys

**Research Objectives**

Bruintjes and Bleys investigate the function of the vomeronasal organ (VNO) in the human nasal septum and conclude whether the VNO must be preserved during septal surgery.

**Detail**

**Bio**

Dr Tjasse D Bruintjes is an otolaryngologist with a PhD in nasal valve anatomy. He is a board-certified facial plastic surgeon at Geleire Hospital, Apeldoorn, and works as a professor of otolaryngology at Leiden University Medical Center, the Netherlands. Bruintjes focuses on the nasal anatomy and vestibular disorders.

Dr Ronald LAW Bleys works as a Professor of Clinical Anatomy at the University Medical Center Utrecht, the Netherlands. His research focuses on the autonomic nervous system, especially interactions with blood vessels and inflammation.

Bleys has collaborated with multiple surgical clinicians on clinical anatomical research projects, with a special focus on oesophageal cancer surgery.

**References**


**Personal Response**

What inspired you to investigate the controversial anatomical structure and function of the VNO?

Lively discussions at nasal surgery courses about the significance of a septal mucosal pit prompted us to look into this structure in more detail.

Do you think there is a need to study the organ further or do you opine that the scientific research should focus on the olfactory bulb instead?

It may be of interest to investigate whether certain molecular aspects of developing human VNO epithelial cells and/or functional cells of the VNO are present elsewhere in humans, such as in the olfactory bulb.