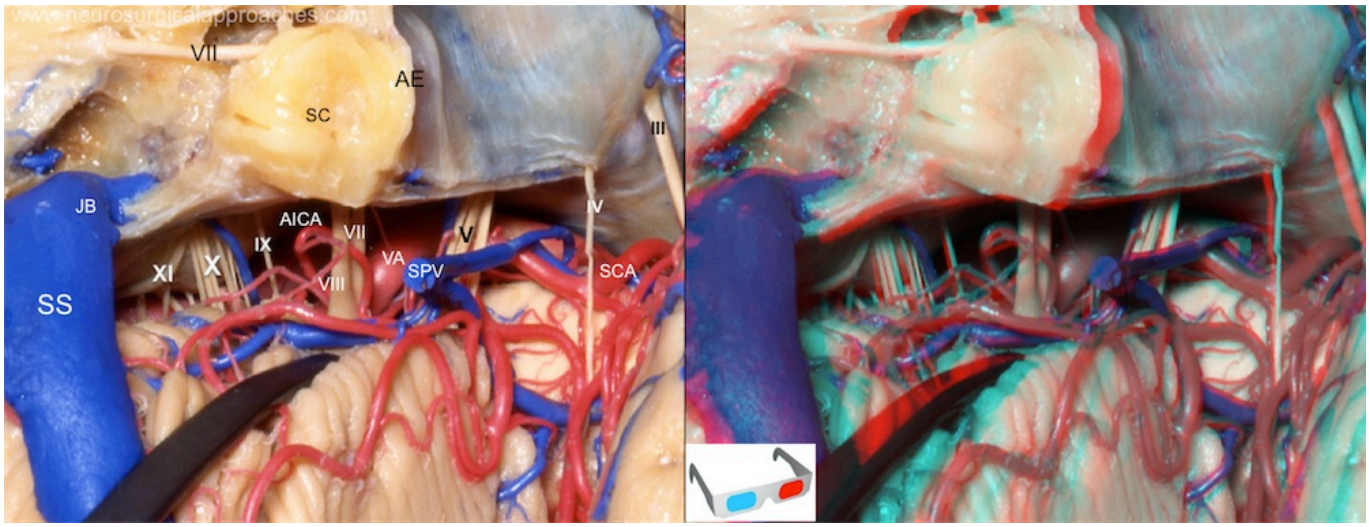
Semicircular canal

A semicircular canal or a semicircular duct is one of three semicircular, interconnected tubes located inside each ear. The three canals are:

the horizontal semicircular canal (also known as the lateral semicircular canal), superior semicircular canal (also known as the anterior semicircular canal), and the posterior semicircular canal (also known as the inferior semicircular canal).



AE: arcuate eminence; AICA: anteroinferior cerebellar artery; JB: jugular bulb; SC: semicircular canals; SCA: superior cerebellar artery; SPV: superior petrosal vein; SS: sigmoid sinus; VA: vertebral artery.

Although many mathematical methods were used to analyze the neural activity under sinusoidal stimulation within linear response range in vestibular system, the reliabilities of these methods are still not reported, especially in nonlinear response range. Here we chose nonlinear least-squares algorithm (NLSA) with sinusoidal model to analyze the neural response of semicircular canal neurons (SCNs) during sinusoidal rotational stimulation (SRS) over a nonlinear response range. Our aim was to acquire a reliable mathematical method for data analysis under SRS in vestibular system. Our data indicated that the reliability of this method in an entire SCNs population was quite satisfactory. However, the reliability was strongly negatively depended on the neural discharge regularity. In addition, stimulation parameters were the vital impact factors influencing the reliability. The frequency had a significant negative effect but the amplitude had a conspicuous positive effect on the reliability. Thus, NLSA with sinusoidal model resulted a reliable mathematical tool for data analysis of neural response activity under SRS in vestibular system and more suitable for those under the stimulation with low frequency but high amplitude, suggesting that this method can be used in nonlinear response range. This method broke out of the restriction of neural activity analysis under nonlinear response range and provided a solid foundation for future study in nonlinear response range in vestibular system [1].

1)
Ren P, Li B, Dong S, Chen L, Zhang Y. The reliability of nonlinear least-squares algorithm for data analysis of neural response activity during sinusoidal rotational stimulation in semicircular canal neurons. PLoS One. 2018 Jan 5;13(1):e0190596. doi: 10.1371/journal.pone.0190596. eCollection 2018. PubMed PMID: 29304173.