

Press Release

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The “Queen of the Night” does not whistle

New findings about the sound production mechanism of ultra-high-pitched operatic singing

Opera is like a good movie: it amplifies and extends human emotion and expression. To support this, opera singers are required to utilize the extreme limits of their voice range. Many pedagogical and scientific sources suggest that the highest pitches produced in classical singing can only be produced with a so-called “whistle” voice register, in analogy to ultrasonic voice production in rats and mice.

An international research team, led by Dr. Matthias Echternach from the Ludwig Maximilian University of Munich and Dr. Christian T. Herbst of the University of Vienna recently showed that the high-pitched operatic singing voice is produced differently than what many thought. Ultra-high-speed video footage, acquired via trans-nasal endoscopy in nine highly professional operatic sopranos, showed that voice production at the highest pitches of the classical singing voice range is supported by the same principle than speech and most other forms of singing: Depending on the sung pitch, the vocal folds in the throat vibrate and collide 1000 to 1600 times per second, commensurable with the produced sound's frequency. This is in stark contrast to the alleged, but now refuted “whistle” mechanism, which would have required for the vocal folds to be immobile during voice production.

The study thus demonstrates that the “default” mechanism of voice production in humans and most mammals also applies to the upper pitch ranges of operatic singing. Simulations with a computer model suggest that the singers can, among others, only produce their highest frequencies with a greatly increased tension in the vocal folds, supported by high expiratory air pressures.



The study's senior author Christian T. Herbst maintains: "This finally debunks a long-standing myth of voice pedagogy. It is remarkable that such extreme sounds can be produced with a rather common voice production mechanism – this is only possible with outstanding muscular fine-control over the singers' vocal instrument." Lead author Matthias Echternach adds that "it is truly amazing how some female singers can generate the extremely high tensions in their vocal folds that are required to produce these high-pitched sounds without incurring any vocal health issues. Why some singers succeed while others don't must remain open for now".

A manuscript with the title "Biomechanics of sound production in high-pitched classical singing" is available online at:
<https://www.nature.com/articles/s41598-024-62598-8>

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LMU University Hospital Munich

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Outstanding facilities of the LMU University Hospital include the oncological center CCC M and Bavaria's largest transplant center TxM.

The LMU University Hospital is represented in all German centers of health research.

The Medical Faculty of Ludwig Maximilians-University Munich and the LMU University Hospital make a significant contribution to the excellence strategy of the Ludwig Maximilians University in Munich.

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