Annual Tinnitus Report

Tinnitus Awareness Week 2026

February 2026

Tinnitus is waking up the dragon:

China is steering the next decade of breakthroughs in tinnitus science.

Global Patterns in Tinnitus Research

Epidemiology, clinical interventions, and somatic tinnitus now lead global progress.

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Editorial

National Tinnitus Awareness Week 2026

National Tinnitus Awareness Week is a time to celebrate how far our field has come and to recognise the dedication of colleagues across the globe who continue to advance our understanding of tinnitus. It is a week that highlights innovation, collaboration and the growing confidence with which researchers and clinicians approach this condition. In recent years the tinnitus community has become more connected than ever.

"LET'S CELEBRATE NATIONAL TINNITUS AWARENESS WEEK AS TINNITUS RESEARCH IS RISING, COLLABORATION IS STRENGTHENING, AND HOPE IS GROWING"

Experts now gather regularly at the World Tinnitus Congress (WTC)/International Tinnitus Seminar (ITS), the Tinnitus Research Initiative (TRI) Conference, the International Conference on Hyperacusis and Misophonia (ICHM), and the International Conference on Pharmacology and Gene Therapy for Tinnitus.

This rich cycle of scientific exchange has created a lively and ambitious global network with shared goals and shared momentum. The purpose of this Annual Tinnitus Report is to honour that collective progress. By bringing together global evidence, thematic trends, national profiles and translational insights from the past twelve months, the report reflects the achievements of this growing community and offers a clear and engaging picture of where tinnitus research stands and where it is heading. Researchers, clinicians, audiologists, engineers, psychologists, and patient leaders are contributing knowledge at a pace that would have been unimaginable a decade ago. Breakthroughs now emerge from multiple continents and diverse scientific traditions. As part of this global effort, and as an organisation recognised in 2023 by the UK government as an independent research institute, we remain committed to supporting and contributing to this shared momentum.

The evidence from this year highlights a field that is active, creative and engaged. Our PubMed search identified 502 tinnitus focused articles within the twelve-month period we examined. These publications span epidemiology, clinical innovation, digital therapeutics, vascular otology, neuromodulation and foundational neuroscience. Together they demonstrate the wide range of approaches that researchers across the world are bringing to tinnitus and related conditions, and they show the scientific energy that continues to shape the field.

A particularly encouraging development is the strong and complementary leadership emerging across countries. China continues to advance neural, vascular and precision sound therapy research with remarkable speed, and the United States continues to excel in population studies, stepped care models and clinical innovation. Together these countries produce more than forty percent of the global literature, setting a high standard that inspires continued activity across Europe, Asia, Oceania and the Middle East. Countries are influencing one another's scientific direction and helping elevate the ambition of the field as a whole.

Within this report, readers will find analyses reflecting the international momentum of tinnitus research. Global Patterns in Tinnitus Research, 2024–2025 maps worldwide research activity and dominant scientific themes, while Tinnitus Is Waking Up the Dragon and The Eagle Rises examine the complementary roles of China and the United States in driving progress. Interview-based narratives with researchers from China, North America, Europe and India provide insight into what the field requires to achieve sustained advances. A dedicated section on organisational developments explores how professional bodies and charities in the United Kingdom and United States are responding through standards, training, service design and advocacy. The report also includes patient perspectives expressed through art. Finally, the education section outlines preparations for the TRI Conference 2026 in Berlin and the 4th World Tinnitus Congress and XV International Tinnitus Seminar in London in 2027, alongside developments in structured clinical education through the CBT-Hear Training and Certification Programme.

The purpose of this report is therefore twofold. It offers a clear summary of global tinnitus research from the past year, and it reflects the collaborative spirit that defines modern tinnitus science. It recognises the achievements of colleagues around the world and celebrates the shared commitment to improving understanding, assessment and treatment. Above all, it aims to support a future in which tinnitus, hyperacusis and misophonia are understood with greater precision and approached with confidence, compassion and scientific insight.

Tinnitus research is rising. Collaboration is strengthening. Knowledge is deepening. As you read this report, we invite you to see the collective progress of a field that is moving forward together. In the words of Aristotle, *the whole is greater than the sum of its parts.*

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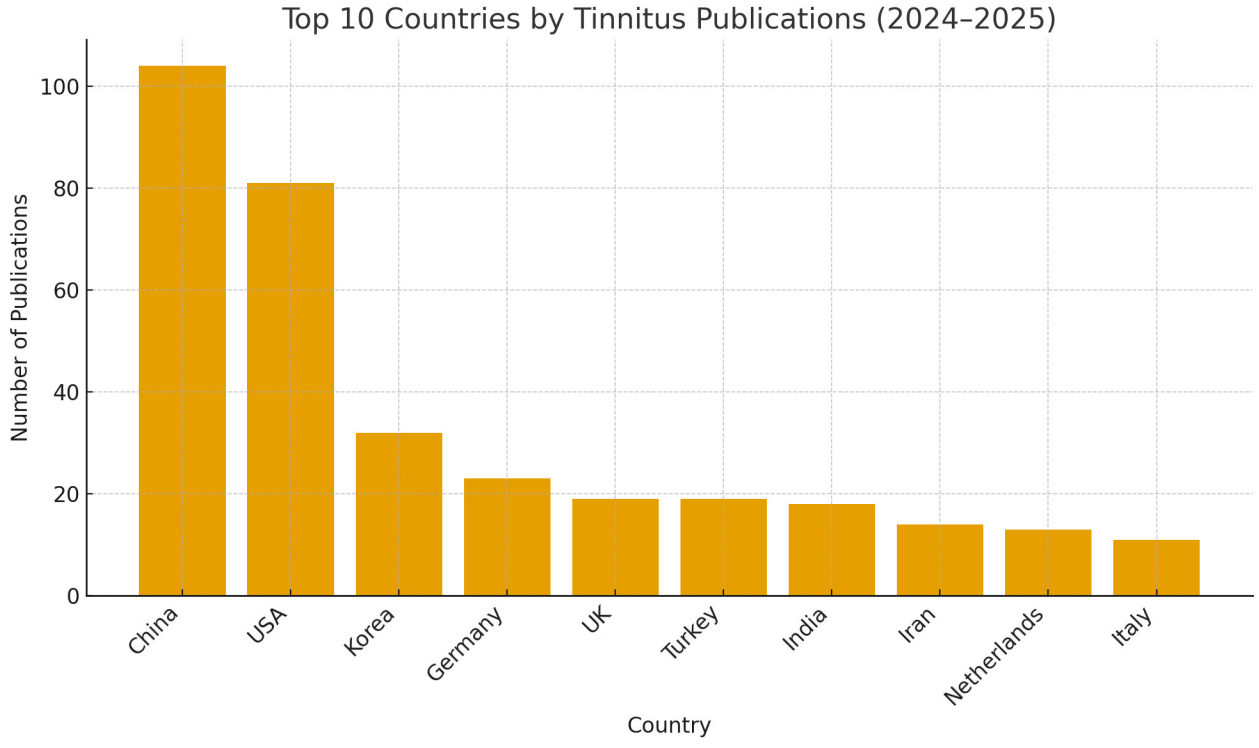
Global Patterns
in Tinnitus Research 2025

Understanding where tinnitus research is produced and what topics dominate offer insight into global trends, emerging priorities, and the scientific capacity of different regions. This analysis examines all tinnitus studies published between 1 November 2024 and 31 October 2025 with “tinnitus” in the title and an English-language abstract.

A total of 502 articles were identified. Of these, 446 met the eligibility criteria for geographic analysis. Among the 446 eligible studies, the geographic distribution of publications was uneven. As shown in the bar diagram below, China represented the largest proportion of the literature (n = 104, 23.3 percent) followed by the United States (n = 81, 18.2 percent). The Republic of Korea contributed 32 publications (7.2 percent) and Germany contributed 23 (5.2 percent). A second tier of contributors consisted of the United Kingdom and Turkey (each n = 19, 4.3 percent), India (n = 18, 4.0 percent), Iran (n = 14, 3.1 percent), and the Netherlands (n = 13, 2.9 percent). Italy and New Zealand each produced 11 publications (2.5 percent). The remaining countries individually accounted for fewer than two percent of the evidence base.



Where Tinnitus Research Is Published in 2025?

Analysis of publication outlets showed that tinnitus research was concentrated within a relatively small group of journals. Hearing Research published the largest number of eligible studies (21 articles, 4.4 percent of the dataset), followed by European Archives of Oto-Rhino-Laryngology (19 articles, 4.0 percent), Journal of Clinical Medicine (17 articles, 3.5 percent), and The Laryngoscope (16 articles, 3.3 percent). Additional core outlets included the Indian Journal of Otolaryngology and Head and Neck Surgery and the International Journal of Audiology (each 15 articles, 3.1 percent), Otology & Neurotology (14 articles, 2.9 percent), Frontiers in Neuroscience and PLOS ONE (each 12 articles, 2.5 percent), and Frontiers in Neurology (11 articles, 2.3 percent). Three further journals each contributed 10 eligible articles: Cureus, Scientific Reports, and Seminars in Hearing (all 2.1 percent). Beyond these core outlets, the remaining journals published fewer than ten articles each, indicating that tinnitus research disperses widely once the central publication group is exceeded.

"HOW WE CONDUCTED THIS ANNUAL REVIEW"

A PubMed search was performed on 18 November 2025 using the term "tinnitus" in the title, covering publications from 1 November 2024 to 31 October 2025. The search identified 502 records. After removing non-eligible items (studies without abstracts, non-English abstracts, and editorials without data), 446 studies met the inclusion criteria, which required an English abstract, the presence of the word "tinnitus" in the title, publication within the 12-month period, and classification as a peer-reviewed scientific article. Bibliographic data were extracted from MEDLINE files using hierarchical tagging to ensure accurate capture of titles, abstracts, authors, affiliations, journal data, publication type, language and date. Country assignment was based on the first author's affiliation; when the country was not stated, city and institution names were used to infer location, followed by manual verification which corrected approximately twenty ambiguous cases. These 446 eligible studies were used for all bibliometric, geographic, thematic and domain-level analyses. Each study was assigned to a primary thematic category derived from its title to allow country-level comparisons, and a broader domain-level synthesis was carried out using both titles and abstracts to map key scientific trends. All procedures, extraction rules and coding frameworks were fully documented to ensure transparency and reproducibility, and interested readers may contact the *Hashir International Institute* for access to the complete methodological documentation or dataset.

Global thematic distribution of tinnitus research

Analysis of the tinnitus publications worldwide revealed a diverse spread of scientific activity across six research themes, with clear areas of concentration. The largest category was epidemiology and population studies (146 of 446, 32.7 percent), reflecting a substantial global interest in understanding tinnitus through large-scale observational datasets and examining associations with lifestyle, systemic disease, sleep, psychological factors, noise exposure, military service, and COVID-19. The second largest theme was clinical interventions and treatment approaches (132 of 446, 29.6 percent), indicating sustained international efforts to evaluate therapeutic strategies that can have positive impact on the life of people experiencing distressing tinnitus including cognitive behavioural therapy (CBT), digital and internet-based CBT, hearing aids and cochlear implants, tailored sound therapies, neuromodulation, pharmacotherapy, acupuncture, and other multimodal treatments.

"IN 2025, GLOBAL TINNITUS RESEARCH CENTRED ON EPIDEMIOLOGY AND TREATMENTS, WITH THE REMAINDER SPREAD ACROSS STRUCTURAL, NEURAL, MEASUREMENT, AND BASIC SCIENCE AREAS."

Pulsatile, venous and structural tinnitus represented 12.3 percent of publications (55 of 446), highlighting structural vascular mechanisms as a major global research area, particularly involving venous sinus stenosis, jugular bulb anomalies, dural arteriovenous fistulas, and surgical or endovascular correction.

Brain and neural mechanisms (46 of 446, 10.3 percent) formed a substantial body of research focused on alterations in brain connectivity, neural oscillations, neurochemistry, and regional microstructural differences. A further 49 studies (11.0 percent) were classified under measurement, prediction and methods, encompassing work on tinnitus questionnaires, psychometric validation, prediction models, machine learning, consensus processes, diagnostic pathways, and bibliometric mapping. Finally, basic auditory, animal and cellular models comprised the smallest category globally (18 of 446, 4.0 percent), indicating a lower relative volume of preclinical mechanistic research compared with clinical and population-based work.

Taken together, the thematic distribution suggests that contemporary tinnitus research worldwide in 2025 was primarily driven by understanding epidemiological risk patterns and comorbidity profiles and evaluating treatment approaches, while structural venous pathology and neural mechanisms represent important but more specialised scientific domains. Each theme will be discussed in detail in this report.

Tinnitus Is Waking up the Dragon

Where Ancient Culture Meets the Frontier of Brain and Vascular Science

Reported tinnitus prevalence varies substantially across studies in China, with values spanning from 4.3% to 51.33% [1]. This variability was influenced by demographic factors of the study populations such as age, gender, occupation, noise exposure as well as the method in which tinnitus was defined in each survey.

"IN 2025, CHINA REPRESENTS THE UNDISPUTED CENTRE OF GRAVITY IN GLOBAL TINNITUS RESEARCH."

A bibliometric analysis of tinnitus specific PubMed records published between 1 November 2024 and 31 October 2025 identified 502 studies, of which 446 were eligible for geographic analysis. China occupied first place with 104 publications, representing 23.3 percent of all eligible studies.

The United States followed at 18.2 percent. Korea, Germany, the UK, Turkey and India formed the next tier.

Researchers from China are now publishing their tinnitus studies not only in domestic Chinese journals but also in high-impact international journals such as Hearing Research, Frontiers in Neurology, Frontiers in Neuroscience and Otology & Neurotology, reflecting a marked rise in the global visibility and scientific influence of Chinese tinnitus research. This signals the emergence of tinnitus as a defined scientific priority in China.

The thematic composition of the 104 Chinese papers reveals a distinctive scientific identity. Research on brain and neural connectivity represented the largest category at 27.9 percent. These studies established China as a leader in circuit level tinnitus mechanisms, neurochemical pathways and functional network abnormalities. Epidemiological and population-based studies constituted the second largest category at 26 percent. These studies frequently used very large datasets (not limited to data from China) to analyse associations between tinnitus and metabolic disease, sleep quality, psychological distress, cardiovascular risk and immune function. Clinical intervention studies accounted for 20.2 percent but differed noticeably from Western models that prioritise cognitive behavioural therapy (CBT) led and stepped care interventions. Chinese work demonstrated a pluralistic therapeutic culture in which neuromodulation, acupuncture, music therapy, sound-based retraining and drug combinations were studied alongside CBT. Research on surgeries and advance investigations focused on pulsatile and venous tinnitus represented 13.5 percent of the total and stands out as a highly specialised area that has not historically been explored at similar scale in other countries.

"WHOOSHING TINNITUS OFTEN COMES FROM VASCULAR STRUCTURAL PROBLEMS AND CORRECTING THEM CAN STOP THE NOISE."

The leadership behind this scientific expansion is especially evident when examining the work of specialised centres. Across Shanghai, several specialist centres have made important contributions to tinnitus science and clinical care, with multiple lines of research and treatment running simultaneously across institutions.

At the Eye & ENT Hospital of Fudan University in Shanghai, clinicians have advanced the diagnosis and treatment of pulsatile and venous pulsatile tinnitus by identifying structural causes such as sigmoid sinus wall and jugular bulb anomalies, carotid abnormalities, and venous sinus stenosis. Their dedicated pulsatile tinnitus clinic has pioneered high-resolution imaging, hemodynamic modelling, transcanal recording, and 4D-flow MRI, leading to innovative vascular reconstruction procedures. With more than 350 surgical cases and a high success rate, the centre has become a leader in surgically treatable tinnitus. They also offer comprehensive care for subjective tinnitus, supported by an integrated mobile app.

At the Department of Otorhinolaryngology Head and Neck Surgery / Geriatric Tinnitus and Deafness Center at Huadong Hospital Affiliated to Fudan University, tinnitus research and care span many areas. One component of their programme involves the use of a comprehensive tinnitus examination protocol that incorporates psychoacoustic testing across extended high frequencies, sound therapy trials and hearing aid trials to support individualised treatment planning. The department also carries out otoneurological skull base procedures relevant to tinnitus and conducts research on topics such as the interaction between peripheral deafferentation and emotional processing, as well as epidemiological studies of tinnitus and deafness in older adults. For vascular pulsatile tinnitus, ultrasound, computed tomography (CT), magnetic resonance angiography (MRA) and magnetic resonance venography (MRV) guide the use of interventions such as sigmoid sinus wall reinforcement surgery.

At the Sixth People's Hospital Affiliated to Shanghai Jiao Tong University School of Medicine, tinnitus research and clinical activity also cover multiple domains. One area of ongoing work explores precision neuromodulation for chronic subjective tinnitus, including clinical trials using repetitive transcranial magnetic stimulation (rTMS) combined with transcranial magnetic stimulation and electroencephalography (TMS-EEG) to identify neurophysiological biomarkers that could guide personalised treatment. Mechanistic studies integrating functional magnetic resonance imaging (fMRI), electroencephalography (EEG) and neuromodulation are examining neural circuits involving the prefrontal cortex, anterior cingulate and salience network and their contribution to the persistence of tinnitus.

"THIS HYBRID FIELD, PARTLY VASCULAR AND PARTLY PRECISION THERAPY, EXEMPLIFIES CHINA'S MULTIDISCIPLINARY APPROACH TO TINNITUS."

The same centre also contributes to research into the psychological and systemic dimensions of tinnitus. Studies on stress, psychological distress and anxiety, including during the COVID-19 period, have provided evidence that emotional regulation and systemic health influence tinnitus severity.
These findings add to international recognition that tinnitus severity relates not only to auditory function but also to cognitive-emotional factors and broader wellbeing.

Taken together, the work undertaken at Fudan University, Huadong Hospital and the Sixth People's Hospital represents only a fraction of the wider activity across these large and diverse centres. The examples summarised here show how vascular otology, auditory neuroscience, neural circuit research, neuromodulation, personalised acoustic therapy and psychological epidemiology are all advancing in parallel rather than in competition. The result is a multidimensional research landscape in which vascular, auditory, neural and psychological mechanisms are examined side by side. This layered growth supports immediate improvements in care for people experiencing tinnitus today while also investing in understanding the mechanisms that give rise to tinnitus and the development of potential curative treatments in the future.

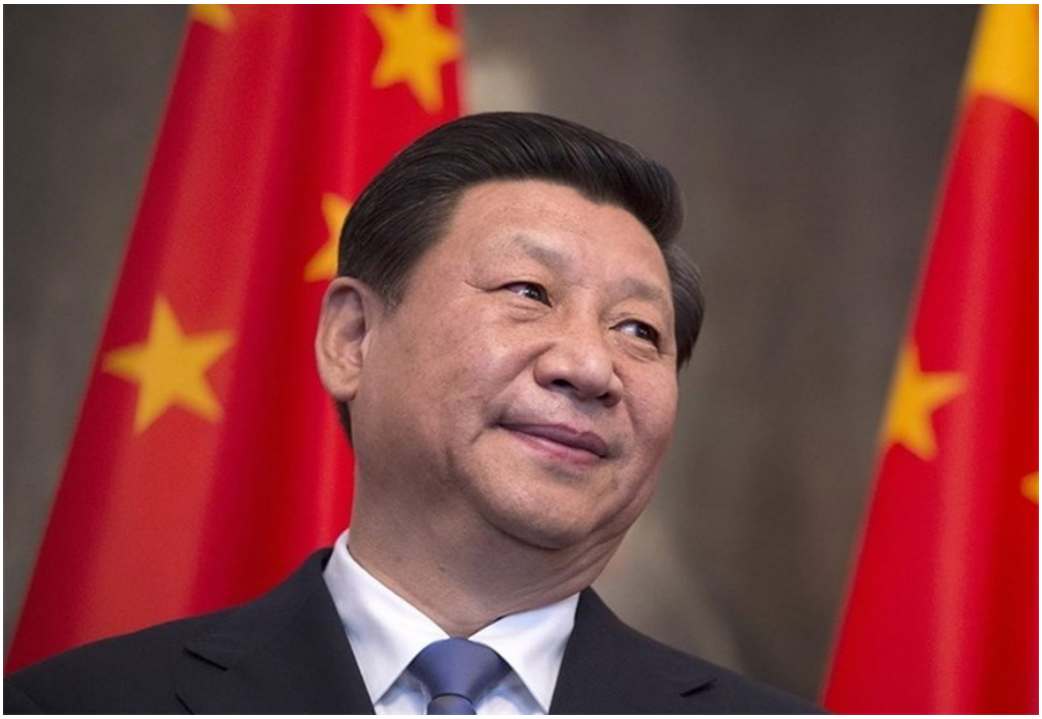
China's rapid acceleration in tinnitus research is influenced by several population and environmental factors. Rapid industrialisation, widespread occupational and recreational noise exposure, elevated urban noise levels and increasing life expectancy — reaching 79 years in 2024 — are likely contributing to a rise in noise-induced and age-related tinnitus, as well as greater visibility of the condition. National investment in brain imaging and neurosurgery has created fertile conditions for tinnitus-based neuroscience. Academic incentives encourage international publication in ENT and neurology. Specialist tinnitus units are now embedded within major hospitals. Policy makers increasingly regard tinnitus as a burden related to ageing and mental health, not just a secondary symptom of hearing loss.

"ENVIRONMENTAL NOISE AND POPULATION AGEING ARE MAJOR DRIVERS OF TINNITUS PREVALENCE, SUGGESTING THAT CHINA FACES INCREASING CLINICAL DEMAND IN THE COMING YEARS."

Ten years ago, tinnitus in China was widely viewed as a chronic condition with limited treatment options, and management often centred on traditional Chinese medicine. This picture has changed. Research across the country has shown that tinnitus has identifiable vascular, neural and systemic drivers that can be evaluated using structural imaging, neural modelling and acoustic response patterns.

These developments have pushed several once peripheral ideas into mainstream discussion, including the possibility that some tinnitus cases may be reversible through vascular reconstruction or neural reafferentation, that personalised acoustic therapy can be delivered with predictive precision, and that frailty and cognitive decline shape treatment outcomes. Evidence also supports a network-based model in which tinnitus is sustained by large-scale brain signalling rather than cochlear injury alone.
The dragon has awakened. China has moved from the periphery of tinnitus research to one of its major engines of discovery, and its momentum is reshaping direction and ambition worldwide.

The future direction of tinnitus research in China cannot be separated from the broader national strategy shaped by Xi Jinping. Medical research is viewed not simply as a clinical endeavour but as a strategic instrument of national power, scientific development and long-term economic security. Xi has repeatedly stated that medical science is a most powerful weapon against disease and has placed healthcare innovation at the centre of the Healthy China 2030 framework. Within this vision, biotechnology, precision medicine, neurotechnology and traditional Chinese medicine coexist rather than compete. The expectation is that scientific progress will arise from the integration of modern molecular and imaging techniques with millennia of accumulated medical knowledge. This policy environment strongly favours the direction in which tinnitus research in China is already heading.



Chinese President Xi Jinping reiterated China's proposal to strengthen global cooperation in health research, promoting the vision of a "human community of health for all" in 2025.

Applied to tinnitus, this framework suggests a near-term expansion of brain-based research, with advanced imaging and network analyses becoming central. Chinese laboratories already lead in brain connectivity studies, and national priorities in neuroscience and artificial intelligence position tinnitus as a model for neural circuit mapping. Techniques such as fMRI, MRS, and machine learning–based network decoding are therefore likely to enter mainstream tinnitus research for diagnosis and subtyping.

Second, the enormous national attention to longevity and anti-ageing science provides a fertile environment for studying tinnitus as part of the ageing phenotype. Recent evidence from Chinese groups linking frailty, cognition and tinnitus is perfectly aligned with national interest in healthy longevity and age-related brain health. This makes it plausible that tinnitus will increasingly be framed not only as an otological disorder but also as a biomarker of brain ageing, neuroinflammation and metabolic vulnerability. Such a perspective will strengthen funding support for large population and cohort studies and for precision stratification models.

Third, the national encouragement to combine traditional Chinese medicine (TCM) with modern biomedical innovation will influence tinnitus therapeutics. We can anticipate new clinical trials that combine personalised music or sound therapy with acupuncture, scalp electroacupuncture, herbal pharmacology, neuromodulation or stress reduction frameworks grounded in both TCM and neuroscience. Rather than an alternative or marginal addition, TCM will be positioned as a partner in system level brain regulation and neurovascular modulation. Such an integrated paradigm is far more likely to emerge in China than in Western research ecosystems.

Fourth, there is a national mandate to solve core technological weaknesses in high end medical equipment. Venous pulsatile tinnitus has already emerged as an area in which Chinese vascular otology leads the world. It is realistic to predict the development of domestically manufactured high resolution neurovascular imaging systems, low radiation skull base scanners, advanced Doppler sonography for jugular venous flow assessment and new robotic or image guided surgical tools for sigmoid wall reconstruction. Structural tinnitus pathologies will likely become a showcase for Chinese surgical engineering in the coming decade.

Fifth, Xi has repeatedly emphasised international health cooperation. For tinnitus research this will encourage cross border clinical trials, data sharing agreements and Belt and Road collaborations with partner nations. China will not conduct tinnitus research in isolation. Given that China and the United States already represent 41.5 percent of global tinnitus publications, a period of scientific competition followed by collaboration is predictable. The global tinnitus community will increasingly depend on Chinese data for neural connectivity, vascular mechanism and precision sound-based therapy, while China will increasingly engage with Western stepped care psychological treatment models and cochlear implant research.

"EARLY COMPETITION BETWEEN CHINA AND THE UNITED STATES IN TINNITUS RESEARCH IS PROBABLE, YET MUTUAL DEPENDENCE ON EACH OTHER'S DATA AND METHODS WILL GRADUALLY SHIFT THE LANDSCAPE TOWARD COLLABORATION."

Finally, the national strategy for epidemic preparedness and public health surveillance will influence tinnitus epidemiology. Large scale digital health platforms, hearing health registries and real time symptom reporting systems will allow tinnitus to be monitored at a population level. When combined with sleep, stress, cardiovascular and nutrition data, this will create the first national framework in which tinnitus is monitored as a physiological signal of public health rather than an isolated symptom. This direction will reshape global understanding of the condition.

Taken together, all of these predictions fit coherently within the scientific momentum already visible in China. Neural network mapping will intensify. Structural and vascular tinnitus surgery will expand. Personalised sound therapy will become progressively more data driven. Ageing and cognition will take a central position in tinnitus heterogeneity. Traditional Chinese medicine and modern neurotechnology will be combined rather than separated. High end medical equipment for skull base and neurovascular imaging will become an area of national innovation. International cooperation will grow rather than contract.

We can say that the trajectory of developments in tinnitus science is being shaped not only by academic decisions but also by national strategy. Tinnitus has entered the domain of state supported scientific priorities in China. If the current momentum continues, the next decade of major breakthroughs in tinnitus research is more likely to come from Beijing, Shanghai, Nanjing, Guangzhou and Wuhan than from Boston, London or Berlin. The world of tinnitus science has changed direction. **The dragon has awakened and is still rising.**

Reference:

1.Zhang D, Xu Q, Caimino C, Baguley DM. The prevalence of tinnitus in China: a systematic review of the literature. J Laryngol Otol 2021; 135: 3–9.

The Eagle Rises:

USA Tinnitus Research Is Closing In

The global landscape of tinnitus research has many active contributors, yet the trajectory of the United States stands out for its strategic clarity and rapid consolidation. Between 1 November 2024 and 31 October 2025, researchers in the United States produced 81 eligible studies. Taken together, these publications reveal a research culture highly focused on population data, clinical delivery and treatment evaluation. When viewed in comparison with China, which has also become a major force in tinnitus science, the distinctive character of the American approach becomes even more apparent.

This article reviews the principal research themes emerging from United States publications during the study period, contrasts them with the dominant themes observed in China and explores the political and health-research policy environment that helps to explain the current direction of American tinnitus science. Understanding these differences is crucial for identifying global complementarities and designing collaboration models that accelerate progress for patients worldwide.

Research Themes in the United States

Nearly one third of American studies, 24 papers or 29.6 percent, examined tinnitus using large cohort analyses. Many relied on Department of Defence and Veterans Affairs datasets and explored associations between tinnitus and depression, anxiety, suicide risk, dementia, long-term noise exposure and post COVID symptoms. This reflects a public health orientation shaped by the needs of service members and veterans. China also contributes strongly to epidemiological work but tends to focus on metabolic, systemic and lifestyle factors using large international databases. The American emphasis is more tightly aligned with behavioural mental health and health service challenges inside its national population.

Clinical intervention research was the next most prominent category. Twenty papers, representing 24.7 percent of the United States output, evaluated interventions including CBT, digital CBT, neuromodulation, pharmacological combinations and cochlear implants. These studies emphasised real-world scalability and integration within healthcare pathways. In contrast, China has a broader clinical portfolio that often includes complementary therapies such as acupuncture and music-based protocols. The American clinical agenda is more heavily weighted toward structured psychological therapy and device-based innovation.

"AMERICAN TINNITUS RESEARCH IS INCREASINGLY DEFINED BY LARGE POPULATION STUDIES, SCALABLE CLINICAL INTERVENTIONS, PATHWAY-FOCUSED DIAGNOSTICS AND SERVICE-DEVELOPMENT PRIORITIES, REFLECTING A PUBLIC-HEALTH AND CARE-DELIVERY ORIENTATION THAT CONTRASTS WITH CHINA'S BIOLOGICALLY DRIVEN AND MECHANISTIC RESEARCH EMPHASIS."

Research on pulsatile and structural tinnitus appeared in 14 publications, or 17.3 percent. These studies centred on diagnostic workflows, imaging algorithms and endovascular decision making. Compared with China, which frequently reports on surgical reconstruction techniques and postoperative imaging, the United States literature places greater emphasis on multidisciplinary efficiency and optimisation of care pathways rather than solely on procedural success.

Method development accounted for 11 studies, or 13.6 percent. These papers introduced new questionnaires, validated patient reported outcome measures and proposed new models of clinical service delivery. The focus lies in strengthening consistency and access across the healthcare system. China also contributes to methodological science, although frequently through genomic mapping, statistical modelling and machine learning. The American thrust is directed toward clinical organisation and the evaluation of service performance.

Only small proportions of United States papers focused on neural mechanisms or basic auditory models. Eight studies, 9.9 percent, explored brain activity, cortical processing, auditory gating and neurotransmitter systems. Four studies, 4.9 percent, examined animal and cellular pathways. While important, these areas represent a minority of United States activity but dominate in China, where neural and mechanistic studies form the single largest category. The contrast is clear. China prioritises biological explanation, whereas the United States prioritises clinically applied knowledge.

Overall, the American research profile reflects a mature and increasingly coordinated emphasis on public health structures, treatment pathways and measurable service outcomes. China supplies depth in mechanistic neuroscience. The United States supplies breadth in population surveillance and pragmatic intervention evaluation. Both directions strengthen the international field, but the rise of the United States is increasingly visible not only in output but in thematic coherence.

The bald eagle is associated with focus and ascent. In a similar way, the trajectory of tinnitus research in the United States shows upward momentum. It is driven by clinical need, informed by large population datasets and guided by the search for effective care. When contrasted with the expanding output from China, the identity of American tinnitus research becomes even more distinct.

Policy Environment and the Direction of American Tinnitus Research

The current profile of American tinnitus research cannot be separated from the broader political and policy structures that shape medical science. During the first Trump administration, national research strategy relied predominantly on private-sector innovation, competitive grant structures and market-driven medical technology rather than centralised state programming. Public health systems remained decentralised and federal policy favoured deregulation and the leadership of private industry. Operation Warp Speed revealed that rapid breakthroughs are possible when the federal government focuses on a targeted medical objective, but this level of coordinated attention remained the exception rather than the organising principle.

This environment encouraged tinnitus research that emerged primarily from academic medical centres, the Department of Defence and Veterans Affairs research networks and public-private collaborations. The American system thus evolved as a translational and entrepreneurial ecosystem driven by competition for innovation, rather than a nationally unified scientific strategy.

The current landscape continues in this direction. Rapid growth in digital therapeutics, large multi-site trials within the veteran population, stepped-care treatment implementation and commercially driven neuromodulation platforms illustrate the same pattern. The United States appears set to continue rewarding speed, risk taking and commercial scalability. Whether this decentralised model ultimately overtakes or coexists with more centralised national research systems emerging elsewhere remains an open question, but both are now shaping the global tinnitus agenda.

The Changing Role of Animal Models

Animal experimentation once played a central role in tinnitus research, particularly during the 2000s and early 2010s. Noise trauma models, salicylate induction and dorsal cochlear nucleus hyperactivity studies generated hypotheses that now underpin much of tinnitus neuroscience. In recent years, however, animal-based tinnitus publications have sharply declined. This shift does not reflect scientific consensus against animal research and it is not the result of formal restriction. Instead, it stems from changing policy incentives that strongly favour human-relevant research.

Across the first Trump administration (2017–2021), the Biden administration (2021–2025), and the second Trump administration (from 2025), federal incentives have steadily shifted away from animal models toward human-based approaches, including stem-cell systems, organ-on-chip platforms, computational toxicology, advanced neuroimaging, and large-scale genetics. Despite differing motivations, animal research now receives support mainly when it offers clear mechanistic insight or direct therapeutic relevance. The first Trump administration applied fiscal pressure through proposed NIH cuts and caps on indirect costs, weakening animal research infrastructure. The Biden administration reframed the transition as scientific modernisation, removing mandatory animal testing before human trials under FDA Modernization Act 2.0 and promoting human-based platforms in NIH funding calls. The second Trump administration has further accelerated the decline through restructuring and grant freezes that destabilise high-cost laboratories. Across all three periods, the outcome converges: animal studies remain viable only when human research cannot address the question.

In 2025, U.S. Health Secretary Robert F. Kennedy Jr. called for expanded federal health research focused on chronic and under-studied conditions, including autism and Lyme disease, as part of a broader reform agenda. President Donald Trump publicly endorsed these priorities, framing them within a "Make America Healthy Again" strategy that emphasised redirection of research funding and national health innovation.

Refinement Rather Than Decline

Funding agencies now judge animal study proposals based on whether the research meaningfully clarifies mechanism and whether it accelerates therapeutic translation. For tinnitus, this means that animal research remains viable in areas such as fundamental auditory neuroscience, network-level dysregulation, gene therapy, synaptopathy repair, regenerative techniques, neuromodulation and plasticity-based interventions. The earlier era in which tinnitus was induced in rodents without a focused mechanistic or therapeutic objective has lost competitiveness. Instead of disappearing, animal studies are becoming fewer but more specialised, with growing emphasis on mechanistic neural coding, circuit-level biomarkers, synaptic restoration and validation of therapeutic targets that cannot yet be addressed using exclusively human data.

Looking Ahead

"AMERICAN TINNITUS RESEARCH IS RISING LIKE THE NATIONAL EAGLE, POWERED BY DECENTRALISED CLINICAL INNOVATION AND A STRATEGIC SHIFT TOWARD HUMAN-CENTRED TRANSLATIONAL SCIENCE, WITH ANIMAL MODELS USED ONLY WHERE THEY ADD UNIQUE VALUE."

The evolution of American tinnitus research is the outcome of both scientific and policy forces. The national agenda remains shaped by decentralised research investment, strong military health data infrastructure and commercially driven clinical innovation. At the same time, the decline in animal studies reflects a shift toward human neurobiology, population modelling and translational deployment. Animal models remain indispensable when they offer insights that no other method can access. The next phase of progress will depend on their strategic use, alongside research grounded in conscious auditory perception and human clinical response.

The eagle is rising not through symbolism but through strategic direction. If the current momentum continues, the United States is likely to consolidate its position as one of the most influential drivers of global tinnitus research in the decade ahead.

The Foundations of a Cure:

Basic Research in a Shifting Policy Landscape

For nearly five decades, Professor Richard Salvi has shaped global understanding of tinnitus and hyperacusis. His body of work spans molecular mechanisms, neural plasticity, and translational pathways, and his influence continues to define how the field approaches the biology of phantom auditory perception. In this year's annual report, he reflects on the position of basic auditory research at a time when clinical innovation is accelerating and health-research policy systems are reshaping scientific priorities. His analysis highlights the foundational work that must be strengthened if future therapies are to move beyond symptom management toward true suppression or cure.

Professor Richard Salvi (USA)

A Stabilising Phase for Animal and Cellular Research

The proportion of animal and cellular tinnitus studies in recent years has declined relative to large-scale population and clinical work, prompting concerns about the future of basic auditory research. Rather than a collapse, however, the trend appears to represent a stabilisation following an earlier period of rapid growth. Animal research increased steadily from the mid-2000s to a peak around 2017, followed by a moderate decline and a largely steady plateau across the past five years. Whether levels rise or fall in the future will depend less on scientific preference and more on the availability of dedicated funding and the emergence of technological breakthroughs. In other words, the trajectory of basic tinnitus research continues to be shaped primarily by the economics of science and the tools that unlock new lines of enquiry.

The Central Bottleneck: Capturing the Phantom Sound

The most distinctive challenge in tinnitus research is that humans can verbally report the presence and quality of a phantom sound, whereas animals cannot. Behavioural paradigms exist, but they remain slow, indirect and difficult to scale, particularly for chronic tinnitus. The field's next major leap will require high-throughput systems that determine not only whether an animal has tinnitus, but also what the percept "sounds like" and how intrusive it is. Developing such tools would transform both mechanistic research and therapeutic development, enabling rapid testing of interventions while also identifying the neural correlates of tinnitus in a more precise manner. Artificial intelligence is expected to play a crucial role in this evolution, detecting multidimensional patterns in behaviour and neural activity that cannot be discerned manually.

Professor Richard Salvi (USA)

Shared Mechanisms, Distinct Triggers: Tinnitus and Hyperacusis

Tinnitus and hyperacusis frequently co-occur and may arise from similar antecedents such as ototoxic drugs or high-intensity sound exposure. Their clinical expression, however, can differ substantially. For many patients, silence increases awareness of tinnitus and moderate sound promotes habituation; yet for others, especially those with coexisting hyperacusis, quiet environments feel safer and routine sound exposure can aggravate both hyperacusis and tinnitus. Despite this variability, low-to-moderate sound exposure combined with counselling remains clinically valuable, although the therapeutic window is highly individual. These contrasting patterns suggest partially overlapping neural circuits with distinct activation thresholds and context-dependent regulation. Future mechanistic and animal studies should therefore focus not only on co-occurrence but on how neural signatures diverge under controlled acoustic conditions.

Phenotyping: The Missing Link in Treatment Stratification

One of the most persistent barriers to personalised tinnitus care is the difficulty of identifying subgroups that respond differently to specific treatments. From a mechanistic standpoint, treatment stratification in animals is constrained by the fact that subgroup distinctions in humans remain poorly defined beyond the division between subjective and objective tinnitus. Without clear clinical phenotypes, animal phenotyping cannot progress far. The path forward will require large multidimensional datasets across behaviour, physiology, genetics and neuroimaging that can reveal patterns currently invisible to conventional analysis. As these phenotypes emerge, animal research will be able to model them more precisely and support the development of targeted interventions.

Three Priorities to Advance Basic Research Toward a Cure

Professor Salvi proposes a clear three-part roadmap for moving basic auditory science toward curative outcomes. First, he argues for the development of fast and reliable methods to determine the subjective nature of tinnitus in animal models, enabling researchers to identify not only whether tinnitus is present but what the percept resembles and how intrusive it is. Second, he emphasises the need to advance brain-wide imaging techniques such as fMRI, MRS and EEG to capture the distributed neural activity that sustains persistent tinnitus rather than focusing on isolated structures. Third, once these two foundations are in place, he advocates for systematic drug-screening pipelines to identify compounds capable of suppressing tinnitus. Across all three priorities, Salvi sees artificial intelligence as a powerful accelerator, capable of integrating complex behavioural, biological and neural datasets at a scale and precision that traditional analytic methods cannot achieve.

Toward the Next Breakthrough

Professor Salvi's reflections demonstrate that the future of tinnitus treatment does not depend solely on expanding clinical services, digital therapeutics or neuromodulation devices. These developments are needed and welcome, but the ability to silence the phantom percept will ultimately rest on strengthening the biological foundations of the field. The conditions that make tinnitus so difficult to study — its subjectivity, its variability and its neural complexity — are the same conditions that make progress possible once measurement and modelling barriers are overcome.

Basic auditory research remains the foundation of a cure. As health-research policy shifts in response to economics, national priorities and technological change, the challenge for the tinnitus community will be to ensure that mechanistic science retains the support it needs to deliver the breakthroughs that clinical innovation alone cannot provide. If this balance is achieved, the next decade may mark the point where foundational neuroscience and translational medicine finally converge to deliver therapies that move beyond coping and bring true quiet within reach.

RICHARD SALVI ON SCIENTIFIC PROGRESS

Progress in tinnitus treatment will depend on revitalising basic auditory and animal research by developing far better ways to detect and characterise tinnitus in animals, then using those breakthroughs alongside AI and brain imaging to identify neural mechanisms and accelerate drug discovery for humans.

Epidemiology of Tinnitus and Population Studies in 2025

A Global Picture of Risk, Vulnerability and Multisystem Interaction

Between November 2024 and October 2025, 146 publications examined tinnitus through an epidemiological lens, revealing a condition shaped by far more than auditory factors alone. These studies leveraged some of the most comprehensive datasets available, including national health surveys, biobank repositories, occupational health databases, military cohorts, and insurance registries. Their collective findings situate tinnitus within a wider network of metabolic, psychological, demographic, and environmental influences, reinforcing its status as a multisystem population health issue.

Cardiometabolic and Systemic Health Links

"TINNITUS IS A MULTISYSTEM, POPULATION-LEVEL HEALTH CONDITION SHAPED BY METABOLIC, PSYCHOLOGICAL, DEMOGRAPHIC AND ENVIRONMENTAL FACTORS."

Cardiometabolic investigations formed a major component of the literature. Multiple cross-sectional and cohort analyses concluded that tinnitus is associated with diabetes, metabolic syndrome, obesity-related indices, and specific lipid markers such as the triglyceride–glucose index and the atherogenic index of plasma. Elevated fasting glucose, haemoglobin A1c, and hypertension also showed consistent associations in mid-life and older adults.

A parallel group of studies examined systemic inflammatory and medical factors. Gastro-oesophageal reflux disease, obstructive sleep apnoea, and headache disorders were each associated with increased tinnitus prevalence or severity. A smaller number of datasets reported weak or null associations between tinnitus and cardiovascular morbidity or mortality, underscoring population heterogeneity.

Psychiatric and Psychological Determinants

The evidence base continues to confirm that psychological factors are central to tinnitus burden. Numerous cohort studies concluded that tinnitus co-occurs with anxiety, depression, and sleep disturbance, with psychiatric symptoms outperforming audiological variables in predicting distress levels. Longitudinal and cross-lagged models demonstrated that these relationships are bidirectional: pre-existing distress increases the likelihood of tinnitus onset, and tinnitus in turn elevates later distress. Anxiety, in particular, often precedes subsequent tinnitus worsening.

Findings relating to suicidality remained consistent with prior research: suicidal ideation and behaviour were more common among individuals with severe tinnitus, especially when accompanied by insomnia or depressive symptoms.

Demographic, Lifestyle and Occupational Influences

Across population surveys, tinnitus prevalence increased with age but plateaued in the oldest age groups. While several studies reported higher prevalence in males, this difference narrowed after accounting for occupational noise. Lifestyle evidence was mixed, although certain dietary patterns showed small but measurable effects in either protective or contributory directions. Work-related outcomes suggested that tinnitus, particularly when accompanied by hyperacusis, can impair employment capacity and contribute to sickness absence.

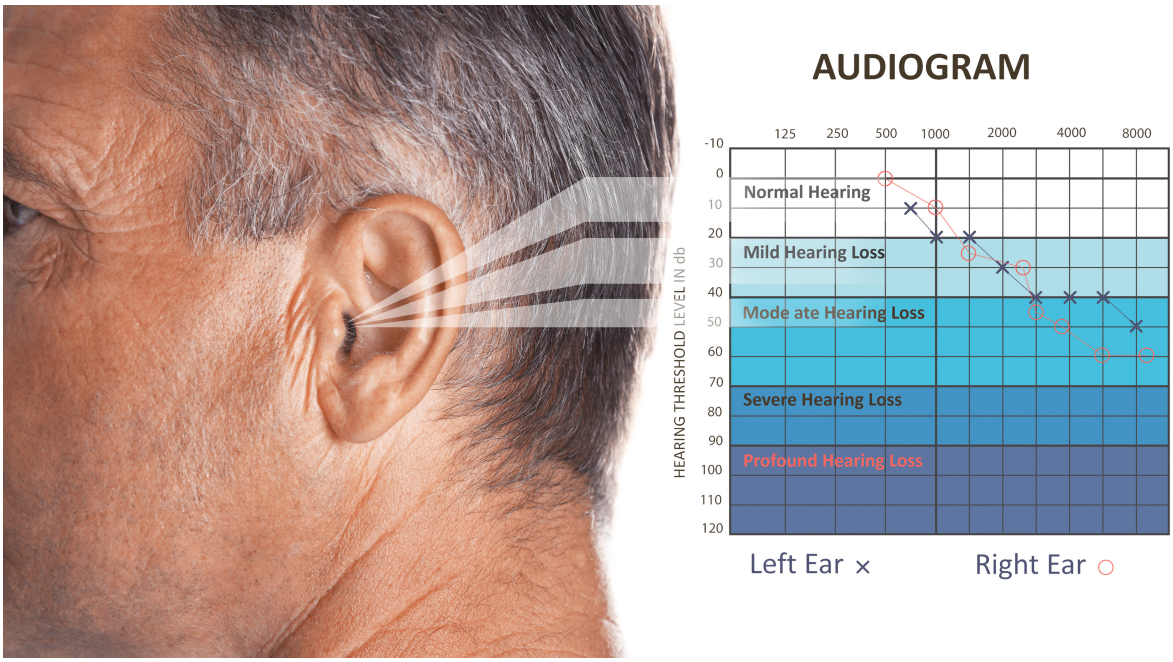
Occupational and environmental noise exposure remained one of the strongest epidemiological findings. Both civilian and military datasets consistently concluded that high-intensity occupational noise significantly increases tinnitus risk. Prospective analyses demonstrated that tinnitus frequently persists long after blast exposure or acoustic trauma. Studies in musicians, dental professionals, and industrial workers added further support, highlighting elevated prevalence and distress in chronically exposed groups.

Auditory Function and “Hidden” Dysfunction

Several population-level studies examined auditory physiology beyond pure tone audiometry. Alterations in auditory brainstem responses, otoacoustic emissions, and masked speech perception were documented in individuals with tinnitus even when audiograms were clinically normal. These findings support the role of subclinical cochlear dysfunction—or “hidden hearing loss”—as a relevant factor in certain subgroups.

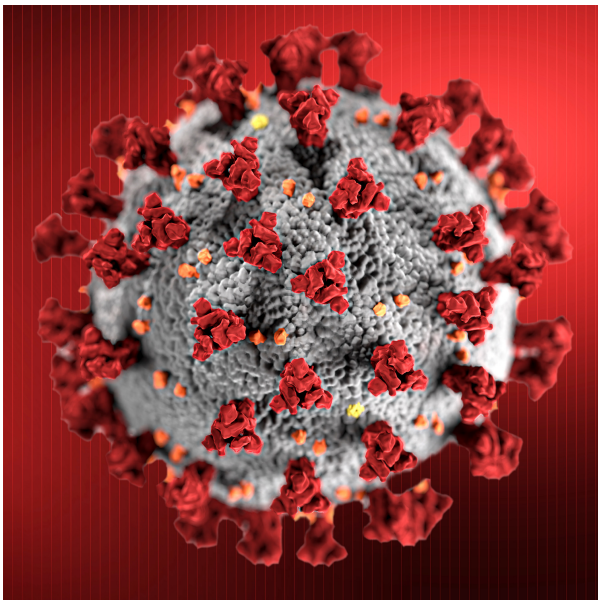
Course, Progression and Predictors of Change

Longitudinal cohort designs provided valuable insight into symptom trajectory. While tinnitus severity is stable for most individuals, a meaningful minority experience gradual deterioration. Predictors of worsening included sleep disruption, psychiatric distress, and cardiometabolic burden. Studies on day–night hyperarousal highlighted persistent physiological activation as a potential maintaining factor. Ecological momentary assessment further demonstrated that tinnitus loudness and distress fluctuate dynamically across the day and are strongly modulated by emotional and contextual cues.



COVID-19 and Pandemic-Related Effects

COVID-19–related research concluded that SARS-CoV-2 infection or vaccination can precede tinnitus onset for a small number of individuals, but the overall absolute risk is low. Psychological factors—stress, social isolation, lifestyle disruption—were more influential drivers of worsening symptoms during the pandemic. Individuals with pre-existing anxiety, sleep difficulties, or high tinnitus distress were most susceptible.



Cognition, Ageing and Neurodegeneration

Studies examining cognitive decline and dementia yielded mixed results. Large biobank analyses found associations between tinnitus and cognitive impairment, but these were generally mediated by hearing loss and depression rather than tinnitus itself. Other analyses reported minimal or no independent relationship after adjusting for confounders. Overall, the evidence suggests that tinnitus functions more as a marker of multisystem vulnerability than as an independent causal factor in neurodegenerative processes.

Overall Interpretation

Across the 146 epidemiological studies published in 2024–2025, tinnitus emerges as a population-level phenomenon shaped by interacting metabolic, psychological, lifestyle and environmental factors. These findings argue against narrow, single-mechanism models and highlight the need for multidisciplinary approaches grounded in cardiometabolic, mental health, occupational health and auditory science perspectives

Key New Epidemiological Learnings 2025

TINNITUS HAS A METABOLIC SIGNATURE

Across multiple cohorts, tinnitus clusters with metabolic dysregulation, including glucose imbalance, lipid abnormalities and hypertension.

"New learning: tinnitus may represent part of a broader systemic metabolic profile rather than a purely auditory disorder."

ANXIETY IS A LEADING PREDICTOR OF TINNITUS WORSENING

Longitudinal analyses showed that anxiety frequently precedes later deterioration in tinnitus severity.

"New learning: stabilising anxiety early may interrupt the pathway to escalating tinnitus distress."

HIDDEN HEARING DYSFUNCTION MATTERS

ABR and otoacoustic studies demonstrated auditory dysfunction even when pure tone audiometry appears normal.

"New learning: epidemiological definitions of "normal hearing" need to expand beyond the audiogram."

COVID-19 ACTED PRIMARILY AS AN AMPLIFIER OF VULNERABILITY

Most pandemic-related worsening of tinnitus arose from psychological and contextual stressors rather than direct viral effects.

"New learning: pandemic-era spikes in tinnitus burden reflect vulnerability, not widespread viral causation."

A MINORITY FOLLOW A PREDICTABLE WORSENING TRAJECTORY

Sleep disturbance, psychiatric comorbidity and cardiovascular burden reliably identify individuals at risk of long-term deterioration.

"New learning: early identification enables preventative, targeted interventions."

OCCUPATIONAL NOISE REMAINS THE MOST POWERFUL MODIFIABLE RISK FACTOR

Chronic high-intensity noise exposure is consistently the strongest predictor of tinnitus across civilian and military populations.

"New learning: prevention belongs in public health and workplace policy, not only in audiology services."

Clinical Interventions and Treatment Approaches (2025)

Evolving evidence on what works, for whom, and under what conditions

Across the 446 eligible publications from 2024 to 2025, a total of 132 studies evaluated interventions for tinnitus and related sound intolerance conditions. These papers reflect the widest therapeutic landscape seen in recent years, including psychological therapies, hearing and sound based strategies, neuromodulation, pharmacological and supplement based treatments, surgical and procedural interventions, somatosensory approaches, acupuncture and traditional medicine, digital health solutions and multi component healthcare models. The collective evidence shows that tinnitus distress is modifiable through several pathways. Improvements in quality of life, coping, sleep and emotional wellbeing are common. Complete elimination of tinnitus or large reductions in loudness remain less predictable and vary across patient subgroups.

Psychological therapies

Psychological interventions formed the largest group of clinical studies. Cognitive behavioural therapy remained the most consistently supported approach. Trials of face to face CBT, internet based CBT and smartphone delivered CBT concluded that these interventions reliably reduce tinnitus distress and often improve anxiety, depression and sleep. Stepped care pathways that integrate CBT elements produced clinically important changes, and many patients moved from severe to moderate or mild questionnaire ranges.

Digital CBT was found to be feasible, scalable and acceptable, with effect sizes approaching those of therapist delivered interventions for users who remained engaged. Other psychological approaches, including acceptance and commitment therapy, hypnosis and brief biofeedback programmes, usually produced short term reductions in tinnitus distress or psychosomatic symptoms, particularly in individuals who had not responded to previous treatments.

Sound based and hearing related treatments

A large body of work focused on sound therapy and hearing interventions. Conventional hearing aids consistently reduced tinnitus distress and improved speech perception in noise for individuals with hearing loss. Loudness reduction was less consistent, highlighting the difference between perceptual intensity and emotional burden.

Some studies suggested that gain adjustments tailored to tinnitus pitch may enhance benefit, while others found similar improvements across standard fitting strategies. Research on enriched acoustic environments, sound generators and remote sound delivery systems concluded that these approaches can reduce tinnitus handicap, especially when combined with counselling or CBT informed support.

Customised sound therapies, including notched music and tailor made notched sound, produced mixed results. Variability in tinnitus pitch stability, sound tolerance and auditory profile likely contributed to inconsistent findings.

Counselling based care and tinnitus retraining therapy

Studies evaluating tinnitus retraining therapy concluded that TRT can reduce tinnitus distress when delivered with structured counselling and sound enrichment. Evidence for complete suppression of tinnitus was limited. Comparative research showed that supportive, structured management approaches deliver similar improvements when patient education, reassurance and continuity of care are prioritised. Comprehensive clinic models highlighted that clarity of information and repeated contact may be as important as the specific sound therapy technique.

Neuromodulation

Neuromodulation remained a major focus of clinical research. Meta analyses and clinical trials of repetitive transcranial magnetic stimulation generally concluded that rTMS can reduce tinnitus severity in the short term for some patients. Long term effects were more variable. Personalised targeting strategies showed potential advantages, although evidence remains preliminary.

Trials of transcranial direct current stimulation and transcranial random noise stimulation produced inconsistent results. Some studies reported small to moderate improvements, while others found no meaningful difference compared to sham.

Bimodal neuromodulation, which combines auditory stimulation with somatosensory input, showed promising outcomes. Several studies concluded that this approach can lead to clinically meaningful reductions in tinnitus distress over several weeks or months. Not all patients respond and long term durability requires further research, but this modality represents an important development.

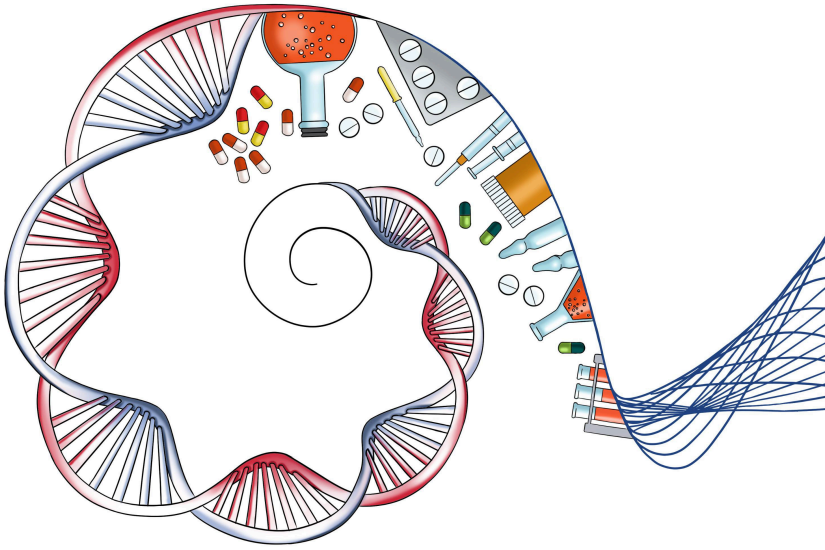
Experimental invasive neuromodulation, including deep brain stimulation, was limited to case series. These reports suggested benefit in a small number of highly selected individuals with severe and refractory tinnitus.

Pharmacological and supplement based treatments

Pharmacological studies produced diverse findings. Combinations such as nortriptyline with topiramate and verapamil with paroxetine were associated with reductions in tinnitus severity, particularly in individuals with comorbid depression, anxiety or migraine. These benefits were balanced by side effect concerns and the need for careful patient selection.

Trials of agents including memantine, betahistine and acamprosate produced mixed results. Some studies identified modest improvement, while others found no advantage compared to placebo.

Supplement based interventions, including coenzyme Q10, herbal formulas and commercial products, often reported small to moderate improvements in tinnitus severity or associated symptoms. Many of these studies were small and methodologically limited.



Analyses of pharmacovigilance databases identified drugs associated with tinnitus onset or worsening, although these studies were observational and not designed to evaluate treatment efficacy.

Acupuncture and traditional medicine

Acupuncture based treatments, including scalp acupuncture, electroacupuncture and auricular acupressure, were often concluded to reduce tinnitus severity and, in some cases, improve sleep and anxiety. Effect sizes varied and evidence quality was frequently moderate or low. Combined protocols involving acupuncture with medications or sound therapy showed potential but require larger controlled studies.

Procedural and surgical interventions

Surgical and endovascular treatments proved particularly effective for pulsatile tinnitus caused by identifiable structural or vascular abnormalities. Case series and cohort studies reported high rates of substantial or complete resolution following venous sinus stenting, sigmoid sinus wall reconstruction or targeted embolisation. These interventions were generally associated with favourable safety profiles in carefully selected patients.

For individuals with unilateral or asymmetric sensorineural hearing loss, cochlear implants and active bone conduction implants frequently produced major reductions in tinnitus severity. Many patients described near or complete suppression when the device was activated, supporting the role of implantable devices as direct tinnitus treatments.

Otological surgeries, such as tympanoplasty and procedures for superior semicircular canal dehiscence, often improved tinnitus when the underlying pathology was corrected. Complete resolution was not guaranteed.

Somatosensory and temporomandibular interventions

Evidence for somatosensory approaches continued to expand. Manual therapy, physiotherapy and temporomandibular disorder treatment were frequently effective when tinnitus showed clear somatic modulation or when jaw, neck or masticatory dysfunction was present. Systematic reviews supported TMD directed management in relevant subgroups while noting heterogeneity in treatment protocols.

Somatosensory interventions such as transcutaneous electrical nerve stimulation for somatic tinnitus, stellate ganglion block and botulinum toxin injections for specific myoclonic or spasm related tinnitus produced symptom reduction in narrowly defined patient groups.

Digital health and online interventions

Digital and online interventions grew substantially during this period. Smartphone based CBT, app delivered sound therapy and online tinnitus courses consistently produced improvements in tinnitus distress with high user satisfaction. Continued improvement at extended follow up was observed in users who maintained engagement.

Internet delivered psychological interventions were described as cost effective and scalable, making them valuable in regions with limited access to specialist services. Adherence, digital literacy and motivation were prominent predictors of treatment benefit.

Multi component and service level models

Several studies described comprehensive tinnitus clinics, stepped care systems and national or institutional pathways. Integrated models that combined audiological assessment, counselling, CBT elements, sound therapy, hearing interventions and targeted medical or surgical referral consistently achieved meaningful reductions in tinnitus handicap for large proportions of patients. These programmes emphasised that standardisation of assessment, outcome measures and referral criteria improves patient experience and clinical consistency across services.

Overall interpretation

The 132 intervention studies collectively demonstrate that tinnitus distress is highly treatable. Psychological therapies, particularly CBT and digital CBT, have the strongest and most consistent evidence base. Hearing aids, sound therapy and cochlear implants provide substantial benefit for individuals with hearing loss. Neuromodulation, targeted surgical interventions for pulsatile tinnitus and somatosensory treatments all offer clear value for specific subtypes. Pharmacological and supplement-based strategies show more variable and often modest effects. Improvements are most consistent for distress, coping and functional impact rather than complete elimination of the tinnitus percept.

Key New Clinical Learnings 2025

DIGITAL CBT SCALES GLOBALLY

Digital programmes now achieve meaningful reductions in tinnitus distress, often approaching outcomes from therapist-delivered CBT.

"New insight: digital care is becoming central to tinnitus management."

BIMODAL NEUROMODULATION WORKS

Auditory plus somatosensory stimulation produces significant improvements for a substantial subset of patients.

"New insight: dual-channel stimulation is more effective than single-channel neuromodulation for selected patients."

Key New Clinical Learnings 2025 (*continued*)

IMPLANTS TREAT TINNITUS

Cochlear and bone conduction implants reliably suppress tinnitus in unilateral or asymmetric hearing loss.

"New insight: implantable devices can be considered direct tinnitus treatments when clinically appropriate."

PULSATILE TINNITUS IS TREATABLE

When the vascular or structural source is identified, targeted interventional radiology and surgery often result in near-complete symptom resolution.

"New insight: defined pulsatile tinnitus can achieve curative outcomes through precise anatomical intervention."

SOMATOSENSORY THERAPY HELPS

TMD management and musculoskeletal therapies reduce tinnitus in patients with clear somatic modulation.

"New insight: in somatic tinnitus, targeted physical treatment can be the primary mechanism of relief."

ACUPUNCTURE OFFERS MODEST BENEFIT

Traditional medicine approaches reduce tinnitus severity for many individuals, though effects are generally moderate.

"New insight: these approaches work best as supportive components within multimodal care."

STEPPED CARE DELIVERS RESULTS

Integrated care pathways combining education, CBT elements and sound therapy demonstrate strong outcomes in diverse settings.

"New insight: the structure and coherence of the pathway can be as important as the techniques within it."

The Psychoacoustic Lens:

Professor Brian C. J. Moore on the Future of Tinnitus Research and Assessment

Professor Brian C. J. Moore has shaped contemporary understanding of hearing and auditory perception for more than five decades. In our interview for this year's Annual Tinnitus Report, he places tinnitus research within the broader evolution of auditory science and issues a clear warning. Progress in treatment, mechanistic understanding and precision diagnosis will stall if the field allows psychoacoustic measurement to drift to the margins.

Professor Moore begins by reflecting on the contrasting research directions of China and the United States. China has prioritised neural mechanisms and biomedical investigation of tinnitus, whereas the United States has focused more on population-level epidemiology and the development of intervention programmes. These contrasting emphases reflect the pressures of national healthcare systems and funding models. There is widespread demand for rapid solutions rather than the slower and more labour-intensive research required to establish mechanisms. Professor Moore suggests that the mechanistic direction adopted in China may ultimately provide a stronger platform for treatment breakthroughs if it is maintained over time.

Professor Brian C.J. Moore (UK)

Within this global landscape, he points to a structural weakness shared by both countries. Research on measurement and prediction remains under-represented. Psychoacoustic characterisation of tinnitus occupies a far smaller proportion of today's literature than in earlier decades. Professor Moore believes this is not a reflection of reduced scientific importance, but of reduced expertise. Many researchers entering the tinnitus field have little formal background in psychoacoustics.

In some regions, the subject is not taught at all within audiology or psychology training. The consequence is that the field risks losing the very tools that allow systematic evaluation of tinnitus mechanisms and the effects of treatment.

"PROFESSOR MOORE ARGUES THAT THERE IS STILL MUCH TO DISCOVER IN TINNITUS PSYCHOACOUSTICS, INSISTING THAT PHENOMENA LIKE RESIDUAL INHIBITION AND EARLY NOISE-RELATED AUDITORY INJURY REQUIRE FAR DEEPER INVESTIGATION TO UNLOCK CLINICAL BENEFIT WITHOUT RISKING FURTHER HARM."

He challenges the assumption that psychoacoustics has already told us everything we need to know. Residual inhibition is a clear example. Some individuals experience short-term suppression of tinnitus following sound exposure and use it as a form of temporary relief. However, concerns remain about the sound levels required and whether they risk hearing damage.

Professor Moore argues that this phenomenon deserves far more investigation, both for its clinical potential and its implications for auditory mechanisms. He also highlights the need for psychoacoustic procedures that detect early noise-related auditory injury before tinnitus becomes established.

When describing what an ideal tinnitus assessment battery should contain, he returns to fundamentals of auditory science. Assessment should characterise the percept itself rather than focus solely on questionnaires about distress. Whether the tinnitus is tonal or noise-like, steady or fluctuating, high or low pitched, and the overall spectrum of the tinnitus should be established using appropriate psychoacoustic procedures. Loudness should be quantified using matching or a visual analogue scale. Determining whether tinnitus can be masked is valuable both clinically and scientifically. For Professor Moore, these elements are essential to link mechanisms, perceptual change and treatment outcomes.

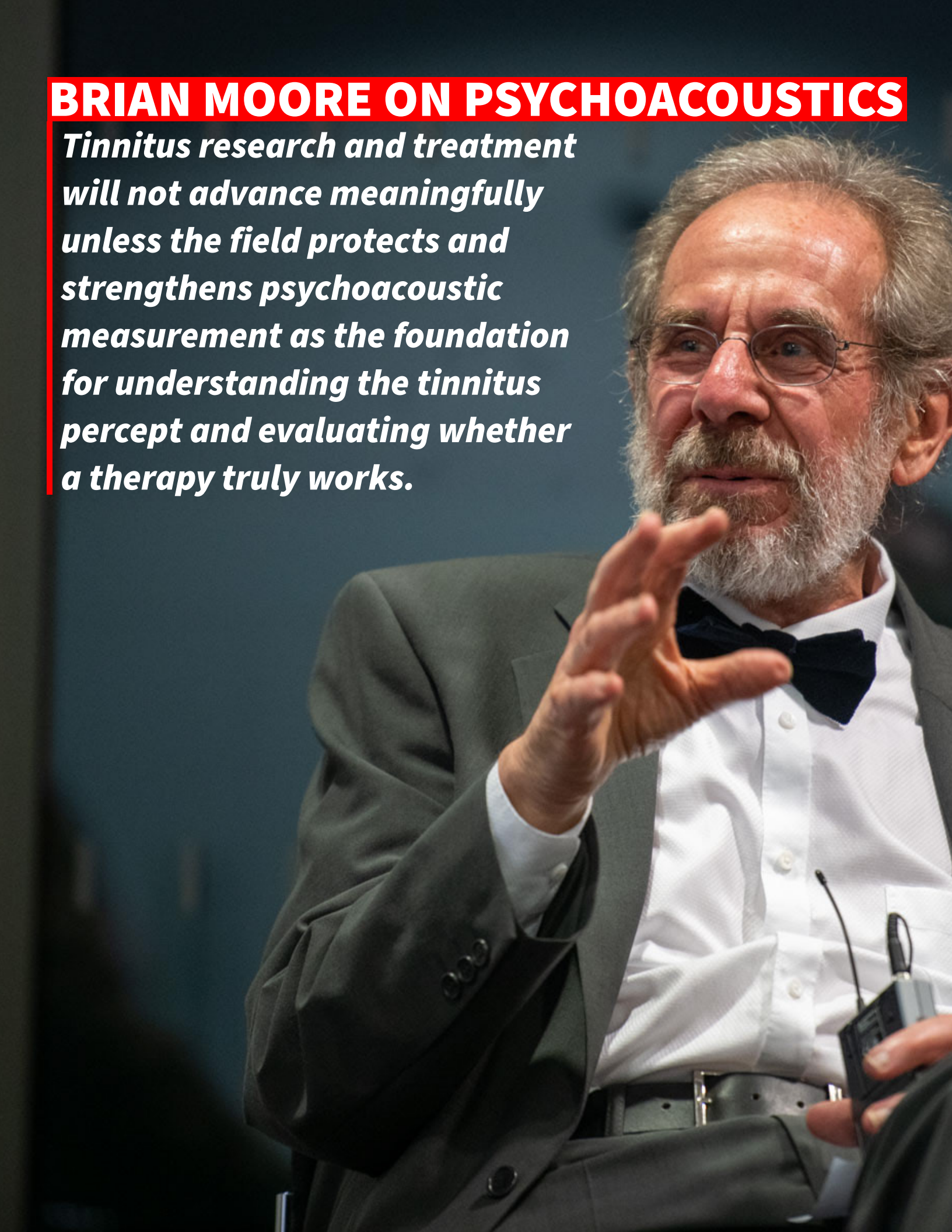
Although many of his recent publications are not directly about tinnitus, they carry lessons for the field. Work on auditory stream segregation, speech identification, temporal fine structure, soundscape perception and neural signal processing shows that perception is rarely shaped by a single isolated sound source. For most people, tinnitus is heard alongside environmental sounds rather than in silence. He believes the perceived loudness, clarity and intrusiveness of tinnitus are influenced by the surrounding acoustic scene.

The future of tinnitus science therefore requires an ecological shift, moving beyond silent laboratory spaces and towards investigating how tinnitus behaves in real world listening environments.

His reflections converge into a consistent message. Mechanistic research and clinical innovation both matter, but neither can succeed without precise and systematic measurement of the tinnitus percept. Psychoacoustics is not a legacy of the early era of tinnitus research. It is the scientific foundation that allows clinicians and researchers to determine what tinnitus is, how it changes and whether a treatment is working. For Professor Moore, protecting and advancing this foundation is one of the most important responsibilities the tinnitus field holds over the next decade.

BRIAN MOORE ON PSYCHOACOUSTICS

Tinnitus research and treatment will not advance meaningfully unless the field protects and strengthens psychoacoustic measurement as the foundation for understanding the tinnitus percept and evaluating whether a therapy truly works.



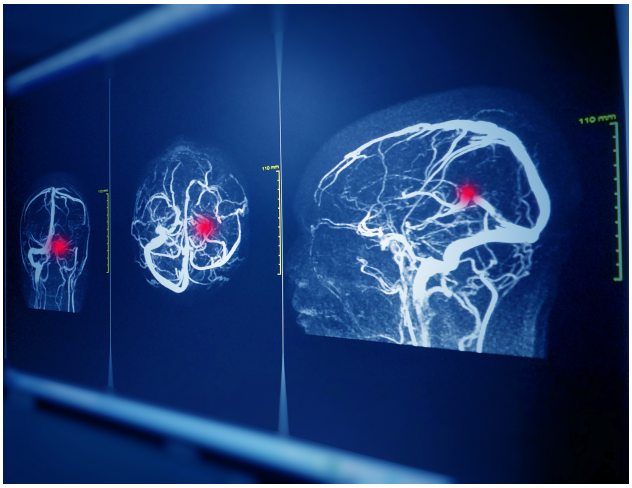
Pulsatile, Venous and Structural Tinnitus 2025

A distinct tinnitus subtype with high diagnostic yield and consistently treatable mechanisms

A total of 55 publications were grouped under the pulsatile, venous and structural tinnitus theme. These studies examined vascular and bony anomalies of the temporal bone and skull base, their haemodynamic consequences, diagnostic pathways and outcomes of endovascular or surgical intervention. Their conclusions converge on a clear message. Pulsatile and structurally mediated tinnitus forms a distinct clinical subtype in which careful anatomical assessment frequently reveals a correctable underlying lesion.

Venous sinus wall anomalies and stenosis

A large proportion of studies focused on sigmoid sinus and transverse sinus pathology. Case series and cohort data for sigmoid sinus wall dehiscence, sigmoid sinus diverticulum and transverse sigmoid junction stenosis consistently linked these lesions with unilateral, pulse synchronous tinnitus. Surgical reconstruction or resurfacing of the sigmoid sinus wall and venous sinus stenting were repeatedly associated with substantial or complete symptom resolution.



High resolution CT and four dimensional flow MRI demonstrated normalisation of venous flow after treatment. Authors concluded that the disappearance of turbulent jets and restoration of more laminar venous circulation closely paralleled tinnitus relief, offering strong mechanistic evidence for the role of abnormal venous haemodynamics.

Long term outcomes of stenting and reconstruction

Long term observational work concluded that venous sinus stenting provides durable tinnitus relief in most well selected patients with venous sinus stenosis and pulse synchronous tinnitus, with relatively low complication rates. Reports of sigmoid sinus wall reconstruction described similar patterns. Reduction of pressure gradients, elimination of focal flow acceleration and restoration of smooth flow were consistently aligned with symptom improvement.

Dural arteriovenous fistulas and vascular shunts

A major subgroup of publications examined dural arteriovenous fistulas and other vascular shunts. These lesions frequently presented with pulsatile tinnitus as the primary or only symptom. Case series described fistulas involving the sigmoid sinus, transverse sinus, superior petrosal sinus and diploic veins. Authors emphasised that these shunts can mimic more benign sinus wall anomalies, making careful angiographic assessment essential.

Endovascular embolisation was typically associated with abolition or marked reduction of tinnitus when complete occlusion was achieved. Some reports highlighted rare presentations, such as postpartum cases or paradoxical contralateral symptoms, reinforcing the importance of broad diagnostic consideration.

Rare vascular and structural causes

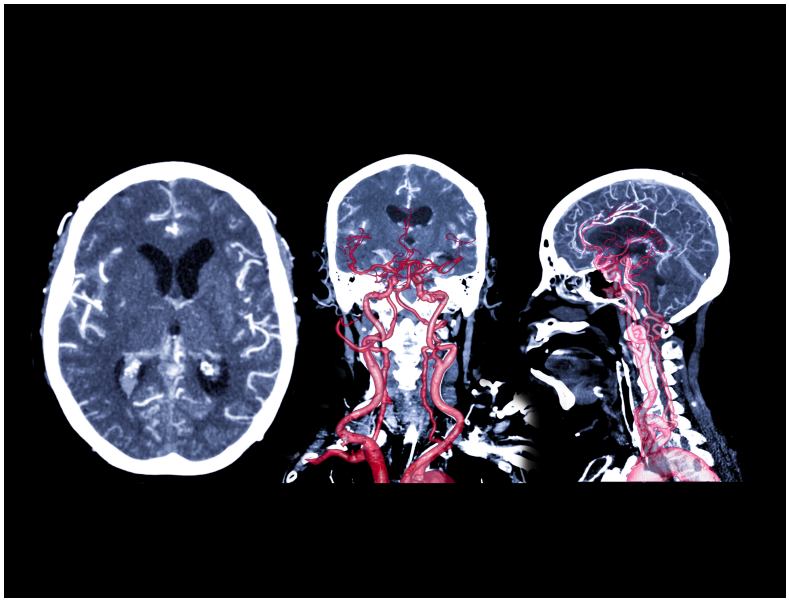
Another set of reports described rare vascular or structural lesions presenting with new onset pulsatile tinnitus. These included ascending pharyngeal artery to internal jugular vein fistulas after trauma, internal carotid artery dissection, diploic arteriovenous fistulas and radiation induced carotid stenosis. Targeted endovascular repair or stenting usually resulted in rapid and often complete symptom resolution.
Mass lesions compressing venous structures, such as tentorial meningiomas, sellar masses and vestibular schwannomas, were also identified. Surgical or radiosurgical treatment that restored venous outflow was commonly followed by improvement or disappearance of tinnitus.

Superior semicircular canal dehiscence and jugular bulb variants

Several studies investigated superior semicircular canal dehiscence and high jugular bulb variants. Findings indicated that these anomalies can independently produce pulsatile tinnitus or interact with venous sinus pathology to create complex auditory and vestibular symptoms. Combined surgical approaches were sometimes required. Jugular bulb diverticula and high jugular bulbs were repeatedly linked with turbulent flow near the middle or inner ear. Surgical resurfacing or endovascular embolisation often produced significant improvement.

Diagnostic imaging and structured evaluation

Imaging strategy was a major theme. Systematic reviews and expert consensus papers concluded that structured diagnostic algorithms improve yield and reduce unnecessary investigations. Computed tomography angiography, magnetic resonance angiography, high resolution temporal bone CT and time resolved MR angiography were consistently recommended as first line tests. Catheter angiography was reserved for suspected shunts or inconclusive non invasive imaging.



Studies of adjunctive diagnostic tools reported that ambient pressure tympanography can capture pulse synchronous middle ear pressure fluctuations. Objective sound recordings from the ear canal helped confirm vascular sources in selected patients. Research on spontaneous otoacoustic emissions and high resolution CT suggested possible roles in screening for sinus wall abnormalities in narrow clinical contexts.

Prognostic factors and clinical workflow

Several studies identified predictors of symptom persistence. In idiopathic intracranial hypertension, pulsatile tinnitus sometimes persisted despite resolution of papilloedema, and the number or severity of venous abnormalities on imaging predicted tinnitus presence. Other studies proposed that interactions among intracranial pressure, venous flow dynamics and sinus wall compliance contribute to symptom behaviour. Workflow analyses emphasised that pulsatile tinnitus should be separated early from non pulsatile forms because the likelihood of a structural or vascular cause is high. Timely referral to centres with expertise in neurovascular imaging and intervention increases diagnostic accuracy and improves access to definitive treatment. Given the intrusive rhythmic nature of symptoms, studies consistently reported major improvements in quality of life when the underlying lesion was identified and treated.

Overall interpretation

The 55 studies within this theme collectively describe pulsatile, venous and structural tinnitus as a highly diagnosable and frequently correctable subtype. Sinus wall defects, venous stenosis, arteriovenous shunts, rare vascular lesions and specific anatomical variants each represent treatable conditions. Endovascular and surgical interventions regularly achieve high rates of substantial or complete symptom resolution when guided by structured imaging and precise anatomical mapping.

Key New Pulsatile and Structural Tinnitus Learnings 2025

VENOUS SINUS PATHOLOGY IS HIGHLY TREATABLE

Sigmoid and transverse sinus wall defects and stenoses are now recognised as common drivers of unilateral pulsatile tinnitus, and repair or stenting often brings near total relief.

"New insight: venous sinus tinnitus has shifted from a diagnostic mystery to a mechanically explainable and usually correctable vascular disorder."

Key New Pulsatile and Structural Tinnitus Learnings 2025 (*continued*)

4D FLOW IMAGING MATCHES SYMPTOMS

Abnormal jets and pressure gradients disappear after treatment.

"New insight: tinnitus improvement aligns directly with haemodynamic normalisation."

PULSATILE TINNITUS AS EARLY VASCULAR ALERT

Some carotid and radiation-related disorders first manifest as tinnitus.

"New insight: pulsatile tinnitus can signal serious disease before deficits emerge."

STRUCTURED IMAGING IMPROVES DIAGNOSIS

Standardised pathways sharply raise diagnostic yield.

"New insight: workflow inconsistency, not technology, is the main barrier."

DAVFS AND SHUNTS ARE UNDER-DETECTED

These lesions frequently present with isolated tinnitus rather than broader signs.

"New insight: mild presentations can mask significant vascular pathology."

HIGH JUGULAR BULBS ARE A DISTINCT GROUP

Variants near the otic capsule can generate tinnitus alone or with other anomalies.

"New insight: small combined abnormalities require detailed temporal bone imaging."

CURE IS NOW REALISTIC

Targeted stenting, reconstruction, embolisation or surgery often eliminate symptoms when the lesion is precisely mapped.

"New insight: long-term resolution is now achievable for many pulsatile cases."

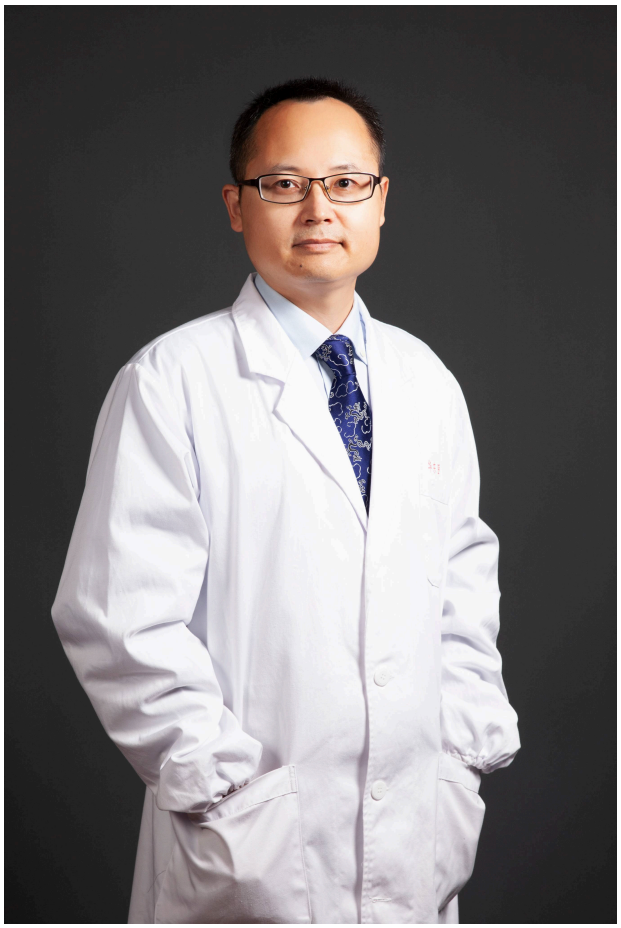
Precision Medicine for Tinnitus:

An Interview with Professor Zhao Han

Professor Zhao Han of Huadong Hospital, Fudan University, is a leading figure in the evolution of tinnitus research in China. His scientific contributions span vascular mechanisms, personalised acoustic therapy and ageing related heterogeneity, reflecting a multidisciplinary approach to both diagnosis and treatment.

ENT team at Huadong Hospital, Fudan University

The Department of Otorhinolaryngology Head and Neck Surgery, also known as the Geriatric Tinnitus and Deafness Center at Huadong Hospital, provides a full clinical pathway for tinnitus. Diagnostic assessment includes psychoacoustic testing across extended high frequencies, sound therapy trials and hearing aid evaluations to identify the likely causes of symptoms, including vascular pulsatile tinnitus. Treatment is centred on customised sound therapy, with surgical options when necessary. The department also performs advanced otoneurological skull base procedures such as cochlear implantation and acoustic neuroma surgery. Current research focuses on the relationship between peripheral deafferentation and emotions involving the amygdala, as well as epidemiology and integrative management of tinnitus in ageing populations.



Professor Zhao Han (China)

Professor Han's foundational work on venous sinus haemodynamics shifted the field toward measurable diagnostic pathways, and this continues to influence current thinking on pulsatile and vascular tinnitus. He now emphasises the need to understand why structural abnormalities in venous sinuses precede symptoms rather than causing them immediately. This delayed symptom pattern suggests the involvement of central gating mechanisms that determine whether and when patients develop tinnitus. It also raises the possibility that conservative treatment may cure many cases previously assumed to require surgery. Alongside this vascular focus, he notes possible shared mechanisms between pulsatile tinnitus and non pulsatile tinnitus associated with peripheral deafferentation, hinting at a unifying theoretical framework for what have traditionally been separate research areas.

Building on this mechanistic perspective, Han's research has also contributed to predicting which patients will respond to sound therapy. His work shows that individuals with tinnitus and hearing loss of up to 60 dB can benefit substantially from sound based interventions, but only when sleep and emotional health are addressed at the same time. Emotional dysregulation significantly reduces the effectiveness of sound therapy, even when the auditory prescription is correct. In patients with hearing loss greater than 60 dB, hearing aids should be introduced before sound therapy, as benefit is otherwise limited. Beyond these two factors, no other clinical or demographic variables consistently predict outcome, reinforcing the dominant influence of auditory and emotional processes in treatment response.

This insights connect with Han's recent focus on tinnitus, frailty and ageing. Although this work is still evolving, the effectiveness of treating hearing loss appears to play a central protective role for older adults. Listening effort may be a key mechanism linking tinnitus severity, cognitive vulnerability and functional decline, suggesting that targeted intervention for auditory effort could reduce broader ageing related risks. These observations are beginning to define a new preventive dimension to tinnitus care.

From these strands of evidence, Professor Han identifies three priorities for the next decade of tinnitus research. First, deeper investigation of peripheral deafferentation and central compensation, with particular attention to how emotional, sleep and auditory systems interact. Second, continued refinement of music based sound therapy, including optimisation of encoding strategies and methods to maximise adherence over time. Third, systematic study of tinnitus in people with clinically normal hearing, including the potential contribution of middle ear muscle dysfunction.

"PROFESSOR HAN'S CORE MESSAGE ON PULSATILE TINNITUS IS THAT VENOUS SINUS ABNORMALITIES ARE NOW A CLEARLY IDENTIFIABLE AND HIGHLY TREATABLE CAUSE, BUT SYMPTOMS EMERGE ONLY WHEN CENTRAL GATING MECHANISMS FAIL, MEANING MANY PATIENTS MAY BE CURED THROUGH PRECISE DIAGNOSIS AND TARGETED INTERVENTION RATHER THAN DEFAULTING TO SURGERY."

Taken together, Professor Han's research illustrates a coherent scientific vision in which biological mechanisms, psychological processes, vascular physiology and ageing related factors are integrated rather than siloed. The future he outlines is one of increasingly personalised, mechanism driven and clinically actionable tinnitus care, with prevention and early stratification woven into treatment planning from the outset.

ZHAO HAN ON PRECISION THERAPY

The key to future progress is recognising that tinnitus arises from the interaction between peripheral auditory changes and central gating mechanisms influenced by sleep and emotional regulation, making individualised, mechanism-based treatment both possible and necessary.

Measurement, Prediction and Methods 2025

A transition toward precision assessment and data driven tinnitus evaluation

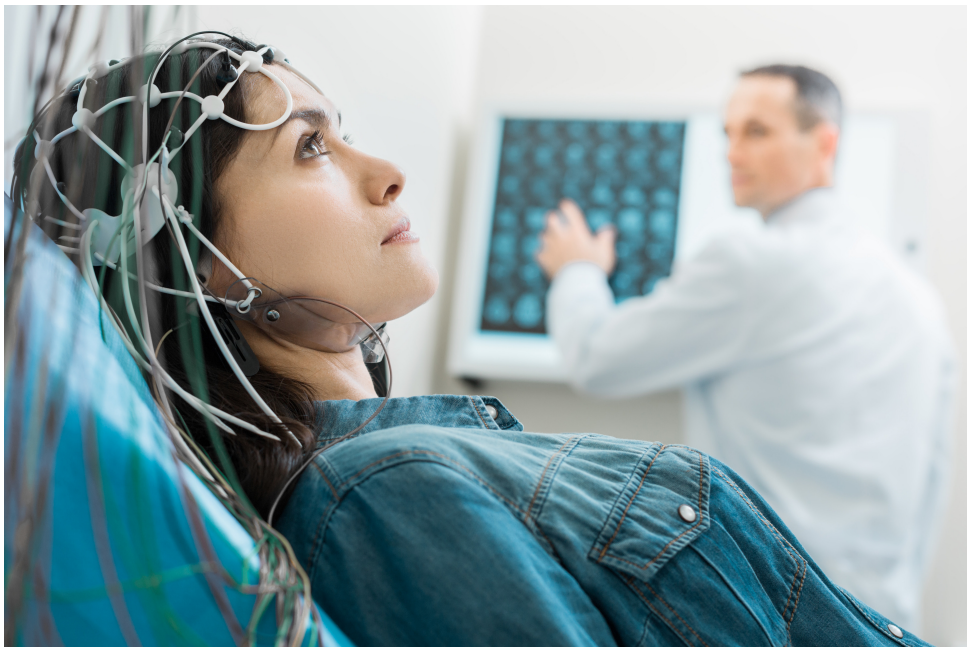
A total of 49 publications were categorised under the measurement, prediction and methods theme. These studies focused on improving how tinnitus is assessed, quantified and monitored across clinical and research settings. Despite methodological diversity, the shared aim was clear. The field is moving from subjective description toward standardised, multidimensional and predictive approaches that support more accurate diagnosis, prognosis and treatment planning.

Patient reported outcomes and psychometrics

A major stream of research examined patient reported outcome measures. Full length and shortened questionnaires continued to demonstrate good reliability, while translated versions showed satisfactory cross cultural validity. Several papers concluded that reductions in total questionnaire scores do not always represent meaningful improvement.

Subscale patterns were often more clinically informative than global scores, helping to differentiate changes in sleep, concentration, emotional reactivity and sound sensitivity.

Many authors emphasised that PROM interpretation must consider comorbidities such as anxiety, depression and temporomandibular disorder. These conditions influence both baseline PROM scores and responsiveness to treatment.



Diagnostic and neurophysiological markers

A significant body of work evaluated electrophysiological and neurophysiological markers, including auditory brainstem responses, cortical auditory evoked potentials, mismatch negativity, P300 responses and psychophysical indicators. At the group level, these markers distinguished individuals with tinnitus from those without, and several studies reported physiological changes following successful treatment.

However, authors consistently concluded that individual level diagnostic accuracy remains limited. Objective markers are promising as adjuncts but are not yet ready to function as standalone diagnostic tools.

Prediction modelling and prognostic tools

Prediction modelling expanded rapidly during the review period. Studies incorporating EEG microstates, resting state EEG patterns, audiological variables, psychometric indicators, ecological momentary assessment data and multimodal clinicodemographic features reported that machine learning models outperform traditional regression methods.

Across datasets, the most consistent prognostic variables were sleep disturbance, anxiety, sound sensitivity and baseline tinnitus distress. These factors were repeatedly identified as stronger predictors of treatment response than audiometric thresholds. Several authors concluded that psychological phenotype, rather than pure tone audiometry, may be the key determinant of prognosis.

Remote and decentralised assessment

Remote measurement methods were another major theme. Ecological momentary assessment and passive smartphone sensing consistently demonstrated substantial daily and hourly fluctuations in tinnitus loudness and distress. These fluctuations were much larger than what is typically captured through pre and post clinic questionnaires.

Longitudinal remote tracking showed that emotional state and situational context strongly modulate tinnitus perception. Several studies concluded that remote methods can detect early signs of improvement or deterioration well before changes are seen in traditional clinic based measures.

Short acoustic tests and residual inhibition

Short acoustic suppression tests and residual inhibition protocols were evaluated for their prognostic value. Although results varied, a meaningful subset of studies concluded that brief residual inhibition responses predict responsiveness to music based and acoustic therapies. Authors interpreted residual inhibition as a temporary rebalancing of auditory and non auditory networks, with predictive value for certain interventions.

Standardisation and pathway development

Methodological standardisation continued to develop. Delphi consensus papers concluded that consistent use of PROMs and systematic outcome reporting are essential for comparability across clinical trials. Analyses of stepped care models found that structured diagnostic pathways and triage algorithms reduce variability in service delivery and shorten time to effective treatment.

Bibliometric studies reported rapid growth in digital therapy, neuromodulation and neuroimaging research, while highlighting that inconsistent outcome measures remain a major barrier to high quality meta analysis.

Overall interpretation

Taken together, these 49 publications show that tinnitus assessment is entering a more structured and data driven phase. Traditional symptom self report remains essential, yet state of the art practice increasingly incorporates refined PROMs, predictive modelling, physiological markers and remote monitoring. The field is moving toward multidimensional assessment systems that can support personalised prognosis and more tailored intervention strategies.

Key New methodological Learnings 2025

OUTCOME MEASUREMENT IS MOVING TO PROFILES

Total scores miss clinically meaningful change, while subscales match patient-perceived benefit.

"New insight: focus on domain-level change, not totals."

PSYCHOLOGICAL FACTORS PREDICT BETTER THAN AUDIOLOGY

Sleep, anxiety, hyperacusis and baseline distress outperform hearing thresholds for forecasting outcomes.

"New insight: prognosis and planning should prioritise psychological phenotype."

PREDICTIVE MODELLING IS NEARING CLINICAL USE

Machine learning using psychometrics, sleep, emotion and EMA outperforms traditional prediction.

"New insight: personalised treatment allocation is achievable once models are embedded in routine care."

NEUROPHYSIOLOGICAL SIGNATURES ARE GROUP-LEVEL ONLY

EEG, ABR and cortical potentials separate tinnitus from controls but cannot diagnose individuals.

"New insight: these measures are best used as monitoring and research adjuncts."

REMOTE SYMPTOM TRACKING SHOWS HIGH VARIABILITY

Daily monitoring reveals large hour-to-hour fluctuations that clinic testing cannot capture.

"New insight: continuous remote measurement offers a more accurate picture of tinnitus behaviour."

STANDARDISATION IS NOW CRITICAL FOR PROGRESS

Inconsistent PROMs remain a major barrier to comparing studies and advancing knowledge.

"New insight: clinical progress may depend as much on measurement consistency as on new treatments."

Brain and Neural Mechanisms 2025

Tinnitus as a disorder of altered neural synchrony, impaired inhibition and large scale network reorganisation

A total of 46 publications were categorised under brain and neural mechanisms. These studies used neuroimaging, electrophysiology, neurotransmission analysis, network modelling and biochemical approaches to investigate the central origins of tinnitus. Despite methodological diversity, their conclusions consistently depict tinnitus as a disorder of aberrant central processing rather than a passive consequence of cochlear injury.

Large scale network connectivity and reorganisation

Many studies examined functional connectivity between large scale brain networks. Resting state functional MRI analyses concluded that tinnitus is associated with abnormal coupling between the default mode network, salience network, limbic network and auditory network. Graph theoretical studies reported increased clustering and reduced network efficiency, findings that suggest reorganisation toward less flexible neural information flow.

Comparisons between recent onset and chronic tinnitus indicated that network redistribution becomes more widespread as tinnitus persists. Increased connectivity between the precuneus, inferior temporal gyrus and auditory cortex was repeatedly linked with higher tinnitus distress.

Oscillatory dynamics and spectral signatures

Studies of neural oscillations concluded that tinnitus is characterised by elevated gamma activity and reduced alpha and beta synchrony. This pattern was interpreted as evidence of high frequency cortical hyperactivity combined with reduced inhibitory control. EEG microstate analyses showed temporal instability in microstate dynamics, which could classify tinnitus participants from controls.

Other work demonstrated abnormal temporal correlations of alpha oscillations over multiple time scales. Authors concluded that these patterns reflect disrupted inhibitory regulation. Sleep related studies further showed that oscillatory abnormalities persist across sleep stages, indicating that tinnitus related dysregulation extends beyond conscious perception.

Thalamocortical dysrhythmia

A substantial group of studies investigated thalamocortical dysrhythmia. These papers concluded that disrupted gating between thalamus and auditory cortex contributes to phantom auditory perception. Magnetoencephalography and combined imaging studies showed reduced sleep spindle synchronisation, interpreted as impaired thalamic inhibition. Deep learning EEG classification models using these features reported that thalamocortical dysrhythmia signatures can differentiate tinnitus severity levels.

Limbic and affective circuits

Another important subgroup focused on limbic involvement. Volumetric and functional MRI studies reported that tinnitus distress correlates with alterations in the anterior cingulate cortex, insula, hippocampus and amygdala. Magnetic resonance spectroscopy demonstrated shifts in anterior cingulate glutamate to glutamine ratios. Multiple multimodal studies concluded that tinnitus distress is better predicted by limbic activity than by primary auditory cortex function. Additional work showed that gamma and alpha coupling in frontal regions reflects increased attention shifting demands, linking emotional processing with perceptual persistence.

Neurotransmission and central inhibition

Several studies addressed inhibitory signalling. Auditory gating work showed reduced P50 suppression in tinnitus, indicating impaired sensory inhibition. Cortical auditory evoked potential studies reported reduced inhibitory control compared with controls. Basic science research demonstrated reduced GABA(A) receptor cell counts in the dorsal cochlear nucleus of tinnitus models. Studies of BK channels and ryanodine receptors found that deficits in these inhibitory pathways increase susceptibility to tinnitus.

Neural prediction of treatment response

A growing number of publications evaluated whether neural markers can forecast treatment outcomes. Brain connectivity studies concluded that reduced coupling between auditory and limbic networks predicts improvement following sound therapy. EEG microstate metrics and graph theoretical signatures were reported to predict responsiveness to cognitive behavioural therapy and music based interventions. Studies of repetitive transcranial magnetic stimulation found that pre treatment volumetric and connectivity profiles correlated with treatment magnitude.

Developmental, plasticity based and longitudinal mechanisms

A smaller group of studies focused on developmental and plasticity driven pathways. Combined structural and functional imaging demonstrated that auditory cortex and brainstem plasticity occurs in patients who develop tinnitus after surgical unilateral deafness, while those with equivalent deafness but no tinnitus did not show these changes. Longitudinal imaging analyses concluded that structural abnormalities in auditory and non auditory regions evolve gradually from early onset to chronic tinnitus. Functional near infrared spectroscopy showed altered auditory related haemodynamic responses in chronic tinnitus patients compared with controls.

Overall interpretation

Across all 46 studies, tinnitus emerges as a disorder of persistent alterations in neural synchrony, connectivity and inhibition within distributed cortical and subcortical networks. Rather than a single focal lesion, tinnitus reflects aberrant sensory prediction, pervasive network reorganisation and impaired top down control. These mechanisms stabilise the phantom auditory percept over time.

Key Mechanistic Brain Insights in Tinnitus 2025

TINNITUS IS A DISTRIBUTED NETWORK DISORDER

Salience, default mode, limbic and attention networks are consistently involved.

"New insight: tinnitus is a multi-network systems disorder."

THALAMOCORTICAL DYSRHYTHMIA NOW HAS STRONG SUPPORT

Altered gating, sleep spindle disruption and characteristic frequency coupling recur across studies.

"New insight: thalamocortical dysrhythmia is a reproducible neurophysiological signature."

TINNITUS ABNORMALITIES PERSIST DURING SLEEP

Oscillatory disturbances remain active across sleep stages rather than fading with awareness.

"New insight: tinnitus represents a sustained change in brain function."

TINNITUS DISTRESS ARISES AT THE LIMBIC–AUDITORY INTERFACE

Distress maps to ACC, hippocampus, amygdala and insula more than auditory cortex.

"New insight: emotional circuits explain the suffering, auditory circuits explain the sound."

REDUCED CENTRAL INHIBITION IS A SHARED MECHANISM

P50 deficits, cortical inhibition loss, reduced GABA signalling and ion channel changes converge.

"New insight: tinnitus reflects impaired inhibitory control rather than simple over-excitation."

NEURAL MARKERS CAN FORECAST TREATMENT RESPONSE

Connectivity patterns, EEG microstates and graph indices predict improvement with sound therapy or neuromodulation.

"New insight: neural biomarkers may enable precision treatment selection."

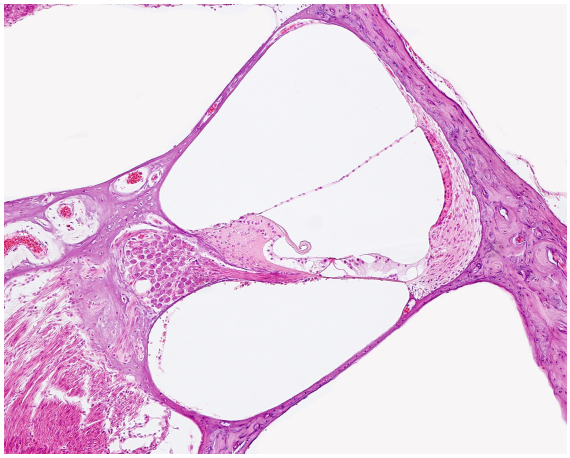
Basic Auditory, Animal and Cellular Models 2025

Mechanistic foundations of tinnitus: central maladaptation, inhibitory failure and stress sensitive biology

A total of 18 publications were categorised under basic auditory, animal and cellular models. These studies investigated tinnitus at its biological roots, examining cochlear and brainstem physiology, ion channel function, synaptic integrity, immune signalling and neuroplasticity in response to acoustic trauma, salicylate, or chronic stress. Although methods varied, the collective aim was clear. These papers seek to explain how tinnitus begins and persists at the microscopic and circuit level, independent of behavioural and clinical presentations.

Noise induced tinnitus and central hyperactivity

A major group of studies used rodent models of noise induced tinnitus. These papers consistently concluded that acoustic trauma produces sustained alterations in the cochlear nucleus and inferior colliculus, including increased spontaneous firing, disrupted auditory gating and abnormal temporal correlations in cortical oscillations. Importantly, these abnormalities often persisted even when hearing thresholds partially recovered. This pattern supports the concept that tinnitus represents a central maladaptive plasticity process rather than an ongoing consequence of peripheral damage.



Salicylate induced tinnitus and molecular signalling

A second cluster of studies examined pharmacologically induced tinnitus, primarily using high dose salicylate. These investigations concluded that salicylate triggers hyperactivity within brainstem auditory circuits through reduced GABAergic inhibition and dysregulation of BK potassium channels and ryanodine receptor signalling. These pathways were shown to amplify excitatory drive. Some work suggested that Nrf2 deficiency increases vulnerability to oxidative stress and enhances tinnitus susceptibility after salicylate exposure, indicating that genetic factors moderate risk.

Stress induced tinnitus and limbic auditory interactions

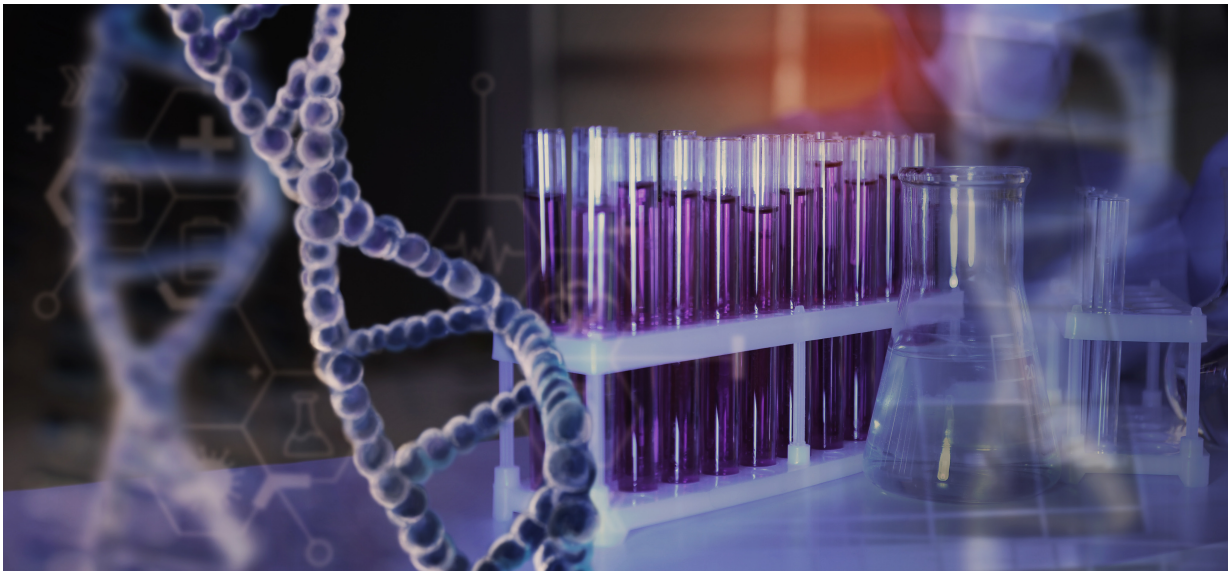
A smaller set of animal studies focused on stress induced tinnitus. These reports concluded that chronic stress alters synaptic transmission and gene expression in the hippocampus and prefrontal cortex. These changes were accompanied by anxiety like behavioural patterns and tinnitus like auditory phenotypes. The findings reinforce the biological connections between stress circuits and auditory processing, consistent with clinical evidence linking tinnitus severity with emotional distress.

Recovery mechanisms and targeted reversal

Several studies investigated recovery mechanisms and therapeutic modulation. Restoration of cochlear ribbon synapses using AC102, deep brain stimulation of the inferior colliculus and auditory somatosensory bimodal stimulation each reduced behavioural and electrophysiological indicators of tinnitus in animal models. These findings show that tinnitus related neural signatures are not fixed but reversible under controlled conditions. This plasticity offers a biological foundation for the development of neuromodulatory and molecular treatments.

Molecular and genetic pathways

Other investigations explored molecular and genetic influences. Expression quantitative trait loci studies and bioinformatic protein interaction mapping identified gene networks linked to synaptic transmission, immune signalling and neuroinflammatory pathways. Although early in development, these data point toward molecular targets that may guide future pharmacological interventions.



Overall interpretation

Taken together, the 18 basic science studies depict tinnitus as a centralised auditory disorder arising from maladaptive neural plasticity, inhibitory imbalance and stress sensitive biological pathways. Tinnitus related neural activity can develop after peripheral insult or pharmacological disruption, yet can also be reversed under targeted conditions. These findings support the long term goal of mechanism specific neuromodulatory and molecular therapies.

Key insights into tinnitus from basic auditory, animal, and cellular models in 2025

TINNITUS CENTRALISES EVEN AFTER THE EAR HEALS

Animal work shows that neural hyperactivity persists long after hearing thresholds recover.

"New insight: tinnitus is an active central disorder, not a residual ear problem."

PRECISE ION-SIGNALLING PATHWAYS DRIVE TINNITUS ONSET

BK channels and calcium-release receptors (e.g., ryanodine) repeatedly emerge as critical.

"New insight: tinnitus stems from specific molecular signalling errors rather than broad neurotransmitter imbalance."

CENTRAL TINNITUS SIGNATURES ARE REVERSIBLE

Ribbon-synapse repair, neuromodulation, and bimodal stimulation normalise tinnitus markers in animals.

"New insight: tinnitus-related brain changes are plastic and potentially recoverable."

INHIBITORY FAILURE IS A CORE MECHANISM

Consistent reductions in GABAergic inhibition match or exceed excitatory overactivity.

"New insight: tinnitus reflects impaired inhibitory control within auditory circuits."

STRESS CIRCUITS DIRECTLY SHAPE TINNITUS PHYSIOLOGY

Stress-induced models show hippocampal and prefrontal plasticity changes linked to tinnitus behaviour.

"New insight: stress contributes to tinnitus generation at a biological level."

MOLECULAR PROFILING IS REVEALING DRUGGABLE TARGETS

Transcriptomic studies now identify proteins and gene networks linked to susceptibility.

"New insight: tinnitus pharmacotherapy is becoming mechanism-specific."

Rewiring Tinnitus Science:

Professor Marlies Knipper on Molecular Signals, Networks and the Future of Mechanism-Driven Care

For decades, tinnitus research and treatment have largely been shaped by psychological models, behavioural interventions, hearing-focused technologies and large population studies. Running alongside these lines of work is a quieter but significant scientific shift that seeks to identify the biological origins of tinnitus with increasing precision. At the centre of this transition is Professor Marlies Knipper from the University Hospital Tübingen, whose research focuses on how auditory molecular changes in the cochlea can cascade into altered brain network dynamics and ultimately into subjective perception.

Professor Marlies Knipper (Germany)

Professor Knipper begins by addressing an imbalance in the global research landscape. Only a small proportion of tinnitus studies focus on basic auditory or cellular mechanisms, even though these areas are essential for understanding how tinnitus begins. She notes that stricter EU requirements have made animal work more difficult, and funding bodies increasingly prioritise translational projects that promise clinical results within short timeframes. The risk is clear. Without sufficient mechanistic research, the field could attempt to treat tinnitus without understanding the biological processes that generate and sustain it.

Her recent work highlights the central importance of the thalamus in tinnitus. Rather than functioning as a simple relay station, the thalamus plays a critical role in noise suppression and sensory integration. Evidence of altered thalamocortical activity in tinnitus patients, including reduced spontaneous alpha activity in the auditory cortex, points to a disruption of sensory gating. Tinnitus therefore becomes more than an auditory event. It reflects a failure of network-level regulation involving auditory and motor domains, and this provides a framework for understanding why some individuals succeed in suppressing internally generated noise while others do not.

"PROFESSOR KNIPPER'S CORE MESSAGE IS THAT TINNITUS RESEARCH MUST REFOCUS ON FUNDAMENTAL AUDITORY AND CELLULAR MECHANISMS — ESPECIALLY THALAMIC SENSORY-GATING PROCESSES — BECAUSE WITHOUT UNDERSTANDING THESE BIOLOGICAL DRIVERS, THE FIELD CANNOT DEVELOP ACCURATE, PERSONALISED TREATMENTS FOR TINNITUS, HYPERACUSIS, AND MISOPHONIA."

Knipper also notes that this network perspective bridges tinnitus with two related conditions. Hyperacusis and misophonia share similarities with tinnitus, but they do not arise from identical mechanisms. Her group proposes that tinnitus and hyperacusis originate primarily in the auditory periphery through different types of synaptopathy, while misophonia appears to emerge centrally.

This hypothesis is currently being tested using high-resolution imaging and targeted therapeutic interventions in well defined patient subgroups. The goal is to identify subclass-specific neural correlates that could support more personalised clinical pathways. The question then becomes how to convert molecular and neural discoveries into treatment. For Knipper, the challenge is not a lack of scientific ideas but a lack of shared standards and communication.

Laboratories and clinics must use comparable diagnostic tools and, ideally, shared objective functional or imaging biomarkers. Without such alignment, mechanistic breakthroughs risk poor replication and limited clinical impact. Large-scale collaboration and transparent communication between scientists, engineers, and clinicians will therefore be essential. Looking ahead, clear priorities emerge: the development of objective biomarkers to detect and track tinnitus mechanisms, harmonised diagnostic protocols that allow data to be combined across centres, and a shift from competitive silos toward shared validation of biological pathways and therapeutic hypotheses.

This work reflects an integrative vision of tinnitus in which cochlear synaptic changes, thalamocortical gating, large-scale network effects, emotional and sleep regulation, and subjective distress are understood as interacting components of a single phenomenon. Progress, she suggests, will depend less on any single model and more on the ability to bridge models and match treatments to mechanisms at the individual level. In a field often driven by pressure for rapid clinical delivery, this contribution is a reminder that durable advances arise when mechanistic clarity and clinical innovation evolve together.

KNIPPER ON UNIFIED DIAGNOSTICS

Real progress in tinnitus will only happen when the field unifies around shared diagnostic tools and objective biomarkers that link peripheral molecular changes to central network activity, allowing treatments to be matched to the actual mechanism in each patient.

Audiology, Measurement and the Future of Tinnitus Care in India:

An interview with Dr Prashanth Prabhu, All India Institute of Speech and Hearing, Mysuru

Tinnitus science is developing around the world, yet its trajectory is shaped heavily by the priorities of healthcare systems and research funders. In this year's Annual Tinnitus Report, we spoke with Dr Prashanth Prabhu, Assistant Professor of Audiology at the All India Institute of Speech and Hearing in Mysuru, to explore where the field is heading and what it means for patients and clinicians in India and beyond.

Dr Prabhu begins by reflecting on the current global emphasis in tinnitus research. Epidemiology, burden of disease, service modelling and clinical intervention trials are receiving the greatest attention. These areas are highly attractive to policymakers because they offer data that can influence guidelines and justify investment in clinical services. In contrast, measurement science, diagnostic refinement and auditory or neural mechanism research remain comparatively under supported. According to Dr Prabhu, this is not a matter of scientific disinterest, but rather the result of funding criteria that reward large, visible, near term outcomes over the slower and more technical work needed to understand individual differences and long term treatment responsiveness. The result is progress in service development without equivalent advancement in the foundational science that would allow personalised or stratified care.

Throughout the interview, Dr Prabhu returns repeatedly to the role of assessment. He believes that the future of tinnitus and hyperacusis care will be determined by the quality of the tools used to assess them. Good assessment should do more than measure treatment outcomes. It should determine how a patient is triaged, guide treatment selection, predict trajectories, identify comorbidities and monitor progress in realistic, everyday settings. He notes that many services rely too heavily on broad mental health questionnaires, which can overshadow the unique features of tinnitus, hyperacusis and misophonia. When a questionnaire is too general, a patient with severe sound intolerance may be categorised as simply anxious. A patient distressed by chewing or breathing sounds may be treated as though they have hyperacusis rather than misophonia. Small distinctions of this kind shape treatment decisions and ultimately shape outcomes.

“DR PRABHU’S CENTRAL MESSAGE IS THAT FUNDERS FAVOUR HIGH-VISIBILITY CLINICAL STUDIES OVER FOUNDATIONAL MEASUREMENT AND MECHANISM RESEARCH, LEADING TO SERVICE DEVELOPMENT WITHOUT THE ASSESSMENT TOOLS NEEDED FOR TRULY PERSONALISED, ACCURATE TINNITUS, HYPERACUSIS AND MISOPHONIA CARE.”

Dr Prashanth Prabhu (India)

The conversation then turns to digital and smartphone-based interventions. Dr Prabhu recognises the substantial potential of internet-based treatments. Structured digital self help, counselling modules and sound therapy libraries can increase access for people who live far from specialists or who struggle to afford regular appointments. International data shows that motivated adults who are comfortable with reading and self guided exercises often do well with digital programmes, particularly when they have stable internet access and a supportive environment. In India, the picture is more varied. Urban patients with strong digital literacy and access to smartphones tend to benefit most, while many people in rural communities experience barriers related to language, connectivity and awareness of tinnitus as a treatable condition. He believes digital tools will work best as part of a stepped model of care in which online resources provide first line support, while in person services are reserved for patients with complex needs or psychological comorbidity.

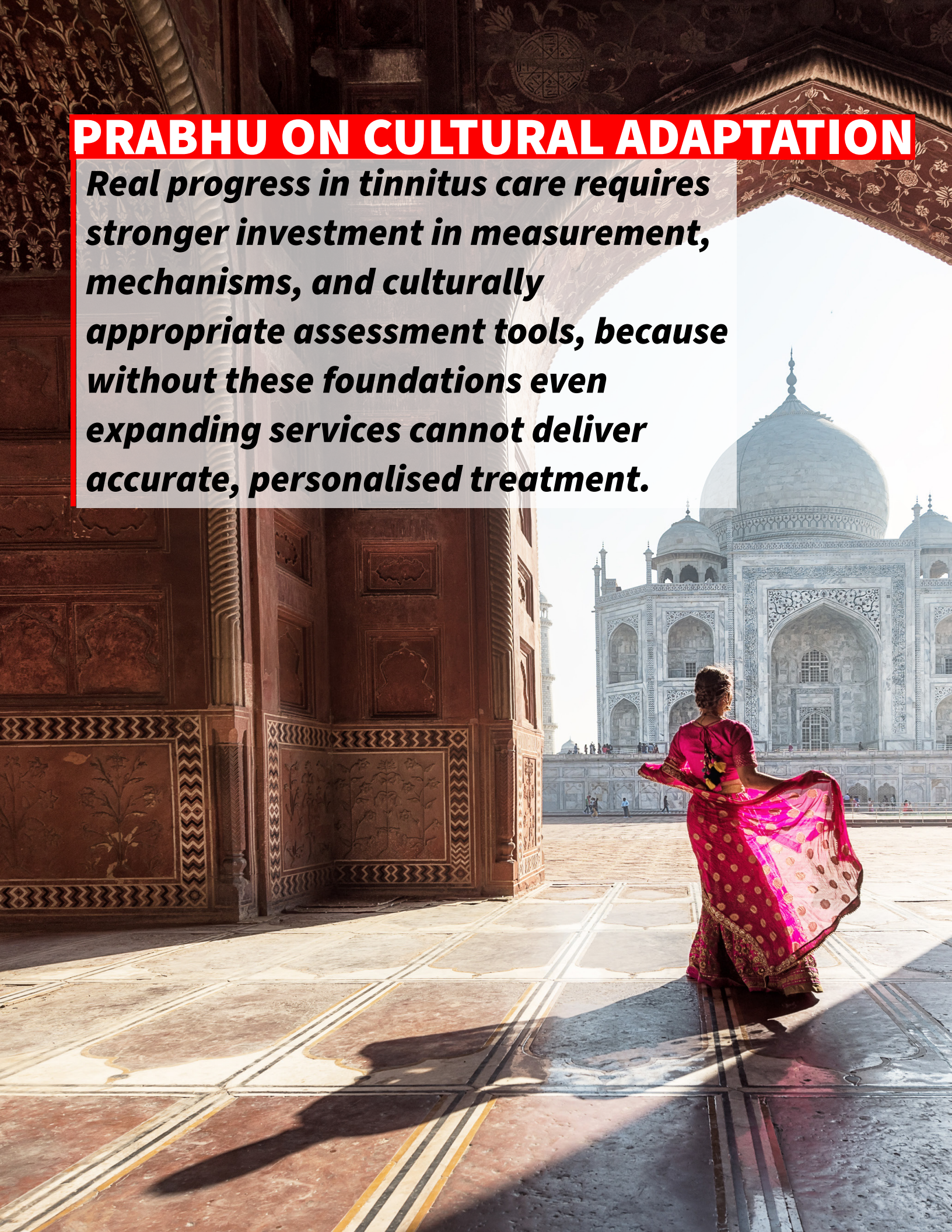
Dr Prabhu has built his career working across tinnitus, hyperacusis and misophonia, and his perspective on the relationship between them is grounded in clinical reality. All three involve an exaggerated emotional and physiological response to sound or sound related stimuli, together with shifts in attention and difficulty disengaging from auditory salience. However, their emotional profiles and triggers diverge in important ways. Tinnitus involves the perception of sound without an external source. Hyperacusis centres on intolerance to physical loudness. Misophonia is different, in that the sound is not remarkable for its intensity but for its pattern and its interpersonal context. People with misophonia do not simply struggle with a sound. They struggle with what the sound means and who produces it. When these three conditions are grouped under vague labels such as sound sensitivity, the risk of mismanagement increases. For Dr Prabhu, careful differentiation during assessment is essential.

The final part of the interview focuses on tinnitus research in India. The All India Institute of Speech and Hearing has contributed considerably through work on prevalence, risk factors, psychoacoustic profiling and intervention outcomes. Across the country, interest in tinnitus is growing among audiology and otolaryngology departments, and professional societies are beginning to allocate space for tinnitus within conferences and training events. Yet several structural gaps remain. India does not currently have a formal tinnitus association. Clinical protocols and management pathways are not uniform across centres. National scale epidemiological and clinical datasets are still limited. Dr Prabhu believes the coming years present an opportunity to address these gaps. He highlights culturally adapted assessment tools, electrophysiological investigation of cognitive and auditory processing, and pragmatic evaluations of stepped care as core areas of focus at his institute. He sees national collaboration and interdisciplinary partnership as crucial to shaping the next chapter of tinnitus research and care in India.

The discussion offers a clear message for health policy and science. The field has matured in visibility and clinical reach, but continued progress will require investment in mechanisms, measurement and culturally relevant models of care. India's tinnitus research community stands at a promising turning point. With coordinated effort, it has the potential to influence global practice while addressing the distinctive needs of its own diverse population.

PRABHU ON CULTURAL ADAPTATION

Real progress in tinnitus care requires stronger investment in measurement, mechanisms, and culturally appropriate assessment tools, because without these foundations even expanding services cannot deliver accurate, personalised treatment.



Precision Neuromodulation and the New Tinnitus Neuroscience:

An Interview with Professor Hui Wang, Shanghai Jiao Tong University

Professor Hui Wang's team at The Sixth People's Hospital Affiliated to Shanghai Jiao Tong University School of Medicine has become one of the most influential groups advancing tinnitus neuroscience. Their programme follows a vertically integrated model that links basic circuit mechanisms with clinical neuromodulation so discoveries in the laboratory directly inform patient treatment. This combined approach reflects their broader goal of developing mechanism-based therapies for chronic subjective tinnitus.

ENT tinnitus study team at The Sixth People's Hospital, Shanghai Jiao Tong University

The clinical arm of the programme centres on establishing a precision medicine model for repetitive Transcranial Magnetic Stimulation. Instead of relying on fixed stimulation parameters, the team uses TMS EEG combinations to measure each patient's cortical excitability and connectivity patterns before therapy begins. These physiological signatures are then fed into predictive models that help determine which form of rTMS is most suitable for an individual. In this way, treatment becomes tailored to the patient's neurobiology rather than imposed as a standard protocol.

Running in parallel, the laboratory group studies the top down neural circuits that shape auditory perception. Their work moves beyond traditional bottom up explanations and instead examines how prefrontal, cingulate and salience related networks influence auditory activity and contribute to the persistence of tinnitus. Multimodal imaging combined with neuromodulation is allowing the team to map the interactions between these systems, revealing how higher order networks contribute to the maintenance of phantom auditory sensations.

"TINNITUS NEUROMODULATION IS SHIFTING TOWARD A PRECISION-MEDICINE APPROACH IN WHICH RTMS IS TAILORED TO EACH PERSON'S NEURAL SIGNATURES WHILE PARALLEL RESEARCH MAPS THE HIGHER-ORDER BRAIN NETWORKS THAT SUSTAIN THE CONDITION."

One of the most important developments from Professor Wang's group in the past year was the identification of a detailed EEG signature for bothersome tinnitus. Specific patterns of theta to beta and gamma coupling were observed in auditory and non auditory regions and these patterns correlated closely with the degree of tinnitus related distress. Machine learning models trained on this oscillatory profile were able to distinguish patients with bothersome tinnitus with very high accuracy. These findings indicate that EEG based neural signatures are moving closer to practical clinical use, guiding decisions about rTMS targets, stimulation frequency and the potential integration of neuromodulation with pharmacological interventions. Professor Wang also brings a distinctive perspective to the relationship between functional tinnitus and pulsatile or structural tinnitus. In her view, the traditional separation between these conditions is too simplistic. A structural cause may initiate tinnitus, but over time the brain can develop maladaptive responses that continue even after the structural abnormality is corrected. This suggests that many forms of pulsatile tinnitus may gradually converge on central networks similar to those seen in functional tinnitus. Early diagnosis and timely intervention therefore become essential to prevent the transition from peripheral triggering to central maintenance.

When asked what would most accelerate progress in the coming decade, Professor Wang highlights two priorities. The first is personalised neuromodulation based on each patient's neural oscillation profile. The second is deep phenotyping through genetics, imaging, neural markers and clinical data to identify biologically meaningful tinnitus subtypes. Together, these approaches create a framework in which clearly defined subgroups can receive targeted therapy informed by their specific mechanisms. This integration of subtyping and personalised intervention offers one of the most promising routes to genuinely effective treatment. Professor Wang's programme illustrates a shift in tinnitus medicine toward a more precise and biologically grounded model. By combining circuit level discovery with tailored clinical intervention, her team is helping build a future in which tinnitus treatment is informed by objective biomarkers and aligned with the underlying mechanisms that sustain the condition.


The Sixth People's Hospital, Shanghai Jiao Tong University, China

HUI WANG ON BIOLOGICAL SUBTYPING

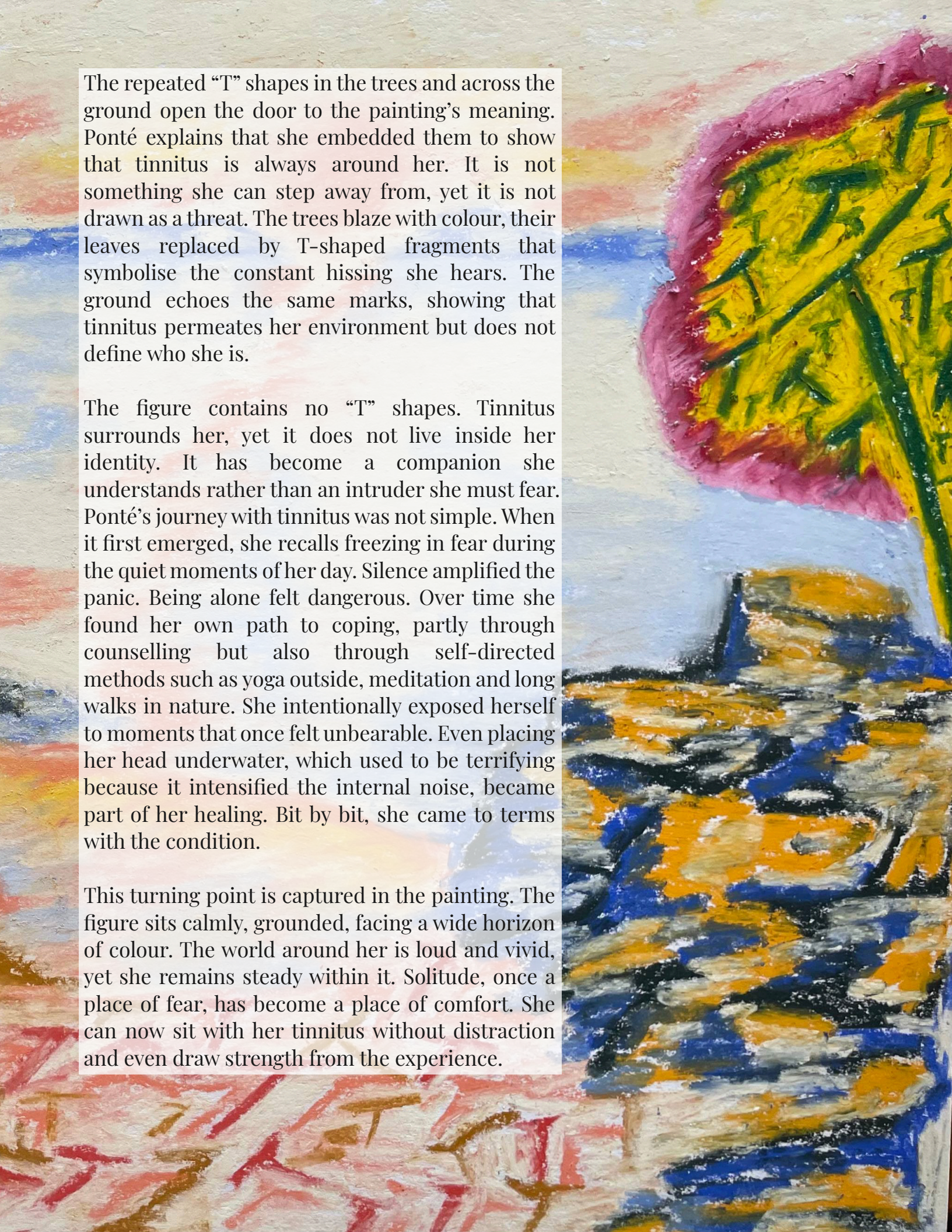
Meaningful progress in tinnitus treatment will come from integrating deep biological subtyping with personalised neuromodulation so that each patient receives therapy matched to their specific neural mechanisms.

From Earth to Sound: Living with Tinnitus

Painting by Eleanor Ponté

Some artworks are looked at. Others are lived with. From earth to sound ... living with Tinnitus belongs to the second category. Painted by 23-year-old English artist Eleanor Ponté, the work is not simply about tinnitus. It emerges from a life shaped by it. Rather than a depiction of auditory distress, it is a portrait of adaptation, of learning to breathe through intensity, and of building a meaningful world in the presence of a persistent sound.

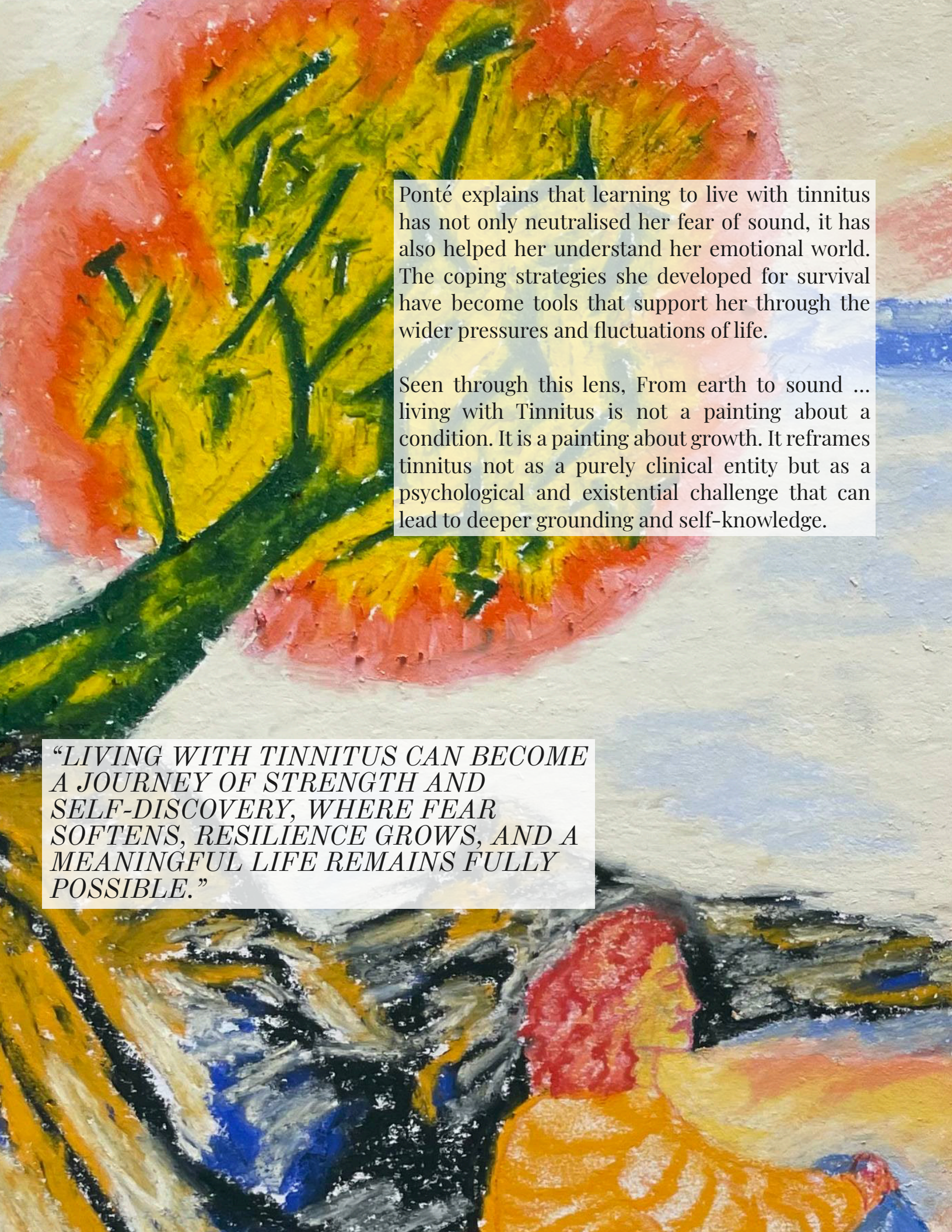
At first glance, the painting shows a solitary figure seated on the ground before a lake, framed by radiant trees and rocky outcrops. Nothing in the scene is quiet. Colour pulses, shapes vibrate, and the air seems to shimmer. The landscape is both beautiful and overwhelming. This paradox, beauty within intensity, sits at the heart of Ponté's story.



The repeated “T” shapes in the trees and across the ground open the door to the painting’s meaning. Ponté explains that she embedded them to show that tinnitus is always around her. It is not something she can step away from, yet it is not drawn as a threat. The trees blaze with colour, their leaves replaced by T-shaped fragments that symbolise the constant hissing she hears. The ground echoes the same marks, showing that tinnitus permeates her environment but does not define who she is.

The figure contains no “T” shapes. Tinnitus surrounds her, yet it does not live inside her identity. It has become a companion she understands rather than an intruder she must fear. Ponté’s journey with tinnitus was not simple. When it first emerged, she recalls freezing in fear during the quiet moments of her day. Silence amplified the panic. Being alone felt dangerous. Over time she found her own path to coping, partly through counselling but also through self-directed methods such as yoga outside, meditation and long walks in nature. She intentionally exposed herself to moments that once felt unbearable. Even placing her head underwater, which used to be terrifying because it intensified the internal noise, became part of her healing. Bit by bit, she came to terms with the condition.

This turning point is captured in the painting. The figure sits calmly, grounded, facing a wide horizon of colour. The world around her is loud and vivid, yet she remains steady within it. Solitude, once a place of fear, has become a place of comfort. She can now sit with her tinnitus without distraction and even draw strength from the experience.



Ponté explains that learning to live with tinnitus has not only neutralised her fear of sound, it has also helped her understand her emotional world. The coping strategies she developed for survival have become tools that support her through the wider pressures and fluctuations of life.

Seen through this lens, From earth to sound ... living with Tinnitus is not a painting about a condition. It is a painting about growth. It reframes tinnitus not as a purely clinical entity but as a psychological and existential challenge that can lead to deeper grounding and self-knowledge.

“LIVING WITH TINNITUS CAN BECOME A JOURNEY OF STRENGTH AND SELF-DISCOVERY, WHERE FEAR SOFTENS, RESILIENCE GROWS, AND A MEANINGFUL LIFE REMAINS FULLY POSSIBLE.”

The piece is featured at the end of our annual tinnitus report because it embodies something that graphs and research summaries cannot express. Lived experience does not begin and end with symptoms. Within fear there can be learning. Within disruption there can be strength. And within a world made louder by tinnitus, a person can still find and protect their quietness. Philosophers since antiquity have debated the meaning and moral purpose of art. In The Republic, Plato and Socrates argued that art is merely an imitation of reality, a copy once removed from truth. They warned that poetry and painting could corrupt the mind by appealing to emotion rather than reason, and therefore should be banned from the ideal city. Yet this painting contradicts that ancient suspicion. In its imitation of experience, it does not lead us away from truth. Instead, it draws us closer to the inner truth of what it means to live with tinnitus. Research describes the condition, but art discloses the person. Where data traces averages, this work reveals dignity. What Plato saw as imitation becomes here a direct form of knowledge, a way of encountering the lived reality that numerical evidence can never fully reach.

Ponté now describes herself as living side by side with her tinnitus. She takes precautions, honours the methods that helped her find peace, and carries the strengths she gained into the rest of her life. Her experience is no longer a limitation. It has become part of her resilience. From earth to sound … living with Tinnitus stands as testimony and also as invitation. It does not romanticise tinnitus or minimise its difficulty. It shows that meaning, joy and grounding remain possible, even when the sound remains.

From Earth to Sound: Living with Tinnitus (Painting by Eleanor Ponté)

Organisational Developments:

From Standards to Support: Tinnitus Care in a Changing World

Advancing Research and Conceptual Frameworks in Tinnitus *(updates from AAA)*

In the United States, 2025 saw renewed emphasis on consolidating tinnitus research across disciplines. The American Academy of Audiology's Academy Research Conference (ARC) 2025, held virtually in October, brought together expertise from audiology, medicine, and neuroscience to examine tinnitus as a multifactorial condition requiring integrated diagnostic and management approaches. Presentations addressed epidemiological risk factors, somatosensory tinnitus, sound tolerance conditions, behavioural neuroscience principles for sound therapy, and emerging therapeutic strategies. Increasing attention was paid to central sensitisation, mechanisms related to migraine, and neuroimaging findings linking tinnitus severity with co-occurring conditions. Collectively, the conference reinforced the need for clinically meaningful translation of research into practice and highlighted tinnitus as an ongoing research priority supported by NIH/NIDCD funding.

"THE AMERICAN ACADEMY OF AUDIOLOGY HIGHLIGHTED TINNITUS AS A SUSTAINED RESEARCH PRIORITY AT ARC 2025, EMPHASISING INTEGRATED, MECHANISM-INFORMED APPROACHES TO DIAGNOSIS AND MANAGEMENT."

Establishing Minimum Standards for Clinical Practice *(updates from APSO)*

A significant milestone in clinical governance was reached with the publication of the first dedicated U.S. tinnitus standard by the Audiology Practice Standards Organization (APSO). Released in December 2025, S5.1: Evaluation of Patients with Tinnitus defines minimum acceptable practices for the assessment of adult and paediatric patients presenting with tinnitus. Developed through a rigorous multi stage process involving subject-matter experts, public consultation, and legal and ethical review, the standard provides a structured framework for audiological evaluation related to tinnitus.

A complementary standard addressing treatment and management entered public review shortly thereafter, with publication anticipated in early 2026. Although framed as U.S.-specific, these freely available standards are already contributing to wider international discussions on consistency, competence, and accountability in tinnitus care.

"THE AUDIOLOGY PRACTICE STANDARDS ORGANIZATION (APSO) PUBLISHED THE FIRST U.S. TINNITUS EVALUATION STANDARD, MARKING A MAJOR STEP TOWARD DEFINING MINIMUM ACCEPTABLE CLINICAL PRACTICE."

Strengthening Professional Confidence and Psychological Awareness *(Updates from BSA)*

In the UK, efforts focused on addressing the growing psychological complexity of tinnitus and hyperacusis presentations. The British Society of Audiology Tinnitus and Hyperacusis Special Interest Group (BSA THSIG) delivered a national workshop on tinnitus, hyperacusis, and mental health at the NIHR Nottingham Hearing Biomedical Research Centre. The event responded directly to service evaluations showing that many audiologists feel underprepared when managing cases involving anxiety, depression, or suicidal ideation.

Training emphasised structured assessment, use of validated questionnaires, mental health screening, and supportive clinical communication. Delegates highlighted gaps in pre-registration education, limited access to supervision, and professional isolation. Insights from the workshop are informing a forthcoming THSIG position statement on the role of CBT and other psychological therapies in tinnitus care, alongside plans to develop stronger national peer-support networks.

"THE BRITISH SOCIETY OF AUDIOLOGY TINNITUS AND HYPERACUSIS SPECIAL INTEREST GROUP (BSA THSIG) ADDRESSED GAPS IN CLINICAL CONFIDENCE THROUGH NATIONAL TRAINING FOCUSED ON TINNITUS, HYPERACUSIS, AND MENTAL HEALTH."

Practice-Led Quality and Community-Oriented Care *(Updates from AIHHP)*

Independent audiology practices also contributed to advances in tinnitus care through service design and quality-focused initiatives. Across the UK, member practices of the Association of Independent Hearing Healthcare Professionals (AIHHP) continued to prioritise longer consultations, personalised assessment, and counselling-led care combining sound therapy, hearing technology, and wellbeing-focused support.

In partnership with Tinnitus UK, this work contributed to the development of the SoundChoice quality mark, intended to help patients identify providers committed to high standards of tinnitus care and community engagement. The initiative reflects a broader shift toward transparency, patient trust, and alignment with priorities identified by people living with tinnitus.

National Leadership, Research Integration, and Global Collaboration *(Updates from ENT-UK)*

At an organisational level, ENT UK expanded its strategic involvement in tinnitus through research leadership, partnerships, and patient information. As a strategic partner of the World Tinnitus Congress 2027, to be held in London, ENT UK is helping position UK clinicians and researchers within a global effort to advance understanding, management, and innovation in tinnitus care. Concurrently, ENT UK has been working with Tinnitus UK to update patient information resources, ensuring they reflect current best practice and lived experience.

Research integration was further strengthened through senior ENT leadership secondments within the NIHR, supporting closer collaboration between otology, audiology, and clinical research communities.

Strategic Advocacy and Measured Impact *(Updates from Tinnitus UK)*

The voluntary sector continued to play a central role in shaping the tinnitus landscape. Tinnitus UK launched its new 10-year strategy during 2025, following extensive engagement with people affected by tinnitus and professional stakeholders. The publication of Ringing the Alarm: the tinnitus care crisis highlighted persistent gaps in training, professional confidence, and patient experience. Over the year, Tinnitus UK expanded professional training initiatives, refreshed its organisational membership scheme, and delivered large-scale public support through helplines, online education, and peer networks. Early outcome data suggested improvements in reassurance, understanding, self-management, and clarity about care options among service users, reinforcing the value of coordinated, community-informed approaches.

"TINNITUS UK HAS RESET ITS DIRECTION THROUGH A PATIENT-LED 10-YEAR STRATEGY THAT COMBINES SYSTEM CHANGE, PROFESSIONAL DEVELOPMENT, AND MEASURABLE IMPACT IN SUPPORTING PEOPLE WITH TINNITUS."

CBT-Hear Training and Certification Programme

A Structured Pathway for Modern Tinnitus Care

CBT-Hear is a comprehensive, multi-level training and certification framework designed to expand access to safe, evidence-based psychological care for tinnitus, hyperacusis, and misophonia. Rooted in contemporary research and delivered through a progressive, competency-based pathway, the programme equips clinicians with the skills to assess, educate, counsel, and deliver focused CBT within defined professional boundaries. Its structure acknowledges a core clinical principle: tinnitus-related distress rarely reflects sound alone, but emerges from ongoing interpretation, prediction, and behavioural responses. At the same time, patients often present with multidimensional and interacting profiles, including otological, medical, somatic, or psychological comorbidities. CBT-Hear therefore provides a clear and ethical framework for addressing these processes in clinical practice, while recognising the wider complexity of real-world tinnitus care.

CBT-Hear

Cognitive Behavioural Therapy for Hearing Disorders

A three-stage pathway for specialist competency

The CBT-Hear pathway begins with the entry-level CBT-Hear Certified programme, an 18-hour masterclass that introduces foundational CBT principles, structured assessment, psychologically informed education, somatic awareness, and holistic support strategies. This stage enables clinicians to communicate effectively, reduce distress through education, and identify when specialist involvement is required.

Stage 2, CBT-Hear Certified Practitioner, offers 135 hours of structured learning and supervised clinical work. Practitioners learn to deliver full CBT-Hear interventions to individuals whose distress is driven by tinnitus or sound intolerance without underlying psychiatric comorbidity. Training focuses on case formulation, behavioural experiments, cognitive restructuring, attention strategies, relapse prevention, and the integration of digital CBT tools within stepped-care pathways.

Stage 3, CBT-Hear Certified Advanced Clinician, provides 66 hours of advanced supervision and case-based reflection. Clinicians learn to distinguish tinnitus- and sound-intolerance–related distress from distress arising from wider medical or psychological conditions. They learn to apply CBT-Hear to the former and refer to appropriate medical or psychological services for the latter. The programme develops advanced formulation, boundary management, and collaboration skills, preparing clinicians for senior roles within multidisciplinary care. Graduates may progress to CBT-Hear Certified Supervisor, and beyond that to Clinical Fellow, Faculty Fellow, or Honorary Fellow, recognising excellence in clinical practice, leadership, supervision, and contribution to the wider field.

CBT-Hear

Cognitive Behavioural Therapy for Hearing Disorders

A model designed for integrated, person-centred care

CBT-Hear is built around three clinical pillars: comprehensive assessment, psychologically informed education with holistic support, and targeted CBT for tinnitus and sound intolerance. The model integrates audiological expertise with psychological techniques, and aligns with contributions from physiotherapy, osteopathy, ENT, general medicine, and mental health disciplines. This creates a coherent, stepped-care pathway where each clinician operates safely within scope while contributing to a unified patient journey.

A forward-looking framework for modern tinnitus services

The CBT-Hear programme supports the ongoing evolution of tinnitus care toward stratified, multimodal, and personalised services. It offers a clear training route for clinicians across disciplines, builds workforce capacity, and ensures that psychological support is delivered safely, consistently, and with clinical depth. CBT-Hear brings mechanism and meaning together, helping clinicians understand how tinnitus works, how it affects people, and how thoughtful intervention can restore confidence, coping, and wellbeing.

Certification Pathway

"Provides specialist assessment, education, and support for tinnitus and sound intolerance within multidisciplinary care."

"Delivers full CBT-Hear interventions for tinnitus, hyperacusis, and misophonia without significant psychological comorbidity."

"Distinguishes primary sound-related distress from psychological comorbidity; applies CBT-Hear to the former, coordinates care for the latter."

"Provides structured clinical supervision to CBT-Hear clinicians, supporting reflective practice, case management, and ethical standards."

"Recognised for advanced clinical experience and meaningful contributions to service delivery, innovation, or complex casework."

"Awarded for excellence in supervision, training, research, or curriculum development within the CBT-Hear framework."

Cognitive Behavourial Therapy Programme for Tinnitus Hyperacusis & Misophonia

CBT-Hear

Designed for Audiologists, Psychologists and Allied Health Professionals

Ghent, Belgium

22-24 MARCH 2027

Course Directors

Dr. Hashir Aazh
United Kingdom

Prof. dr. Bart Vinck
Belgium

The Tinnitus Research Initiative (TRI) Conference 2026, Berlin, Germany

Celebrating 20 Years of Global Collaboration in Tinnitus Science

The Tinnitus Research Initiative (TRI) Conference 16–18 September 2026, led by Prof. Birgit Mazurek, presents a clear scientific vision centred on mechanistic discovery, biomarker-enabled diagnostics, and genuinely multimodal treatment innovation. Now in its third decade, TRI continues to establish itself as a global hub for translational research. The 2026 programme builds on this foundation with a provocative invitation to the field: Jump the Wall. Researchers are encouraged to challenge familiar assumptions, explore new theoretical and clinical territories, and cross disciplinary boundaries that have historically separated auditory science, psychology, neurology, psychiatry, and digital healthcare. Alongside this, the theme "Discover and Uncover Gaps" urges participants to identify where knowledge is missing, methods require strengthening, and collaborative approaches could accelerate progress.

The conference adopts an explicitly multidimensional understanding of tinnitus, treating auditory processes, psychosomatic factors, cognitive mechanisms, network-level brain dynamics, and somatosensory influences as interdependent systems rather than competing explanations. This integrated perspective shapes both the scientific sessions and the practical workshops that translate evolving evidence into new strategies for research and clinical practice.

Psychosomatic Aspects and Comorbidities

A major focus of TRI 2026 is the investigation of psychosomatic processes that contribute to tinnitus severity and persistence. Increasing evidence shows that affective dysregulation, attentional bias, and stress-linked neuroendocrine activity can amplify or sustain the subjective experience of tinnitus. Sessions within this track examine established and emerging comorbidities, including anxiety, depression, insomnia, and somatic symptom disorders, and emphasise the shared neurobiological substrates that make these conditions particularly relevant to tinnitus distress. The programme highlights the need for more refined diagnostic groupings and for identifying cross-cutting mechanisms that can support more precise clinical stratification. Workshops in this area include sessions on psychometric assessment in tinnitus research, cognitive behavioural therapy for tinnitus, psychosomatic interactions in symptom maintenance, and somatosensory influences such as temporomandibular and cervical spine factors. These sessions combine theoretical perspectives with practical demonstrations and discussion, guiding participants toward a more nuanced understanding of how emotional, cognitive, and musculoskeletal factors interact with auditory perception.

Hearing and Auditory Processing

Developments in auditory neuroscience continue to reshape tinnitus theory, and TRI 2026 devotes significant attention to these advances. The track on hearing and auditory processing examines how cochlear synaptopathy, hidden hearing loss, and high-frequency impairment interact with central gain mechanisms, altered neural synchrony, and predictive-coding processes. Together, these mechanisms illustrate how tinnitus may transition from an acute sensory event to a chronic perceptual state embedded within broader auditory–cognitive networks. Workshops on psychoacoustic profiling and on hearing aid fitting for tinnitus offer practical opportunities to examine how electrophysiological markers, psychoacoustic signatures, and computational auditory models can contribute to future diagnostic precision. The intention is to create a clear developmental pathway from basic auditory mechanisms to clinically applicable tools that improve assessment, prognosis, and personalised treatment planning.

Clinical Findings, Biomarkers, and Imaging in Mental Disorders

The integration of psychiatric research and neurobiological frameworks forms another defining element of the 2026 programme. This track examines the parallels between tinnitus distress and the brain network alterations commonly observed in mental health conditions. Presentations review findings from structural and functional MRI, EEG and MEG connectivity analyses, autonomic markers, and emerging digital behavioural phenotyping. These approaches make it possible to map disruptions across auditory, salience, and default mode networks onto the lived experience of tinnitus with increasing precision.

A dedicated workshop on diagnostic tools and biomarkers provides participants with an opportunity to work directly with emerging imaging and physiological measures. Particular attention is given to the challenges of biomarker validation, the identification of markers with prognostic potential, and the methodological and statistical standards required to transition promising indicators into large-scale clinical trials.

New Therapeutic Approaches from Neighbouring Disciplines

The 2026 programme also draws on scientific domains beyond traditional audiology. Contributions from neurology, psychiatry, pain research, physiotherapy, behavioural science, and digital healthcare reflect a deliberate shift toward holistic and multi-target treatment design. Sessions explore developments in neuromodulation, structured psychological therapies, pharmacological innovation, physiotherapy-driven somatosensory approaches, and digital therapeutics capable of delivering ecological momentary support or AI-enhanced clinical decision-making. A workshop on integrated tinnitus counselling exemplifies how these interdisciplinary perspectives can be brought together to refine therapeutic models. Participants are encouraged to consider tinnitus treatment as a multi-domain challenge that requires combining mechanisms and strategies across several fields rather than relying on a single modality.

Towards a Mechanism-Based and Personalised Future

Throughout all tracks, TRI 2026 promotes a transition from symptom-focused management to mechanism-based and personalised care pathways. Realising this ambition depends on harmonised methodological standards, coordinated international networks, and longitudinal data infrastructures capable of capturing multimodal information at scale. The conference provides a setting in which these components can be aligned and strengthened.

Interactive workshops and structured discussions encourage participants to translate conceptual and mechanistic insights into concrete research designs and clinically meaningful innovations. By challenging entrenched assumptions, identifying missing links, and experimenting with new models, the TRI Conference 2026 positions itself as a catalyst for the next phase of tinnitus science. Its overarching vision is to support a field that is rigorous, collaborative, and capable of delivering evidence-informed, personalised care for individuals living with tinnitus.

Prof. Dr. Birgit Mazurek (Germany)

"THE 20TH TRI CONFERENCE MARKS A DECISIVE MOMENT FOR THE FIELD, BRINGING TOGETHER TWO DECADES OF SCIENTIFIC PROGRESS WITH A RENEWED CALL TO CROSS DISCIPLINARY BOUNDARIES, UNCOVER KNOWLEDGE GAPS, AND ACCELERATE THE DEVELOPMENT OF MECHANISM-BASED, PERSONALISED TINNITUS CARE."

The 4th World Tinnitus Congress and XV International Tinnitus Seminar London 2027

From Mechanism to Meaning: The ABC of Tinnitus

From 30 June to 2 July 2027, the 4th World Tinnitus Congress and XV International Tinnitus Seminar will take place in London, hosted by the Hashir International Institute. The theme, From Mechanism to Meaning: The ABC of Tinnitus, is inspired by T. S. Eliot's question, "Where is the wisdom we have lost in knowledge?" and frames tinnitus through three pillars: A = Auditory science, B = Behavioural understanding, and C = Clinical innovation. The aim is to link basic mechanisms with lived experience and practical care, so that tinnitus services are guided not only by data but by thoughtful application.

An 11 track scientific framework

The congress scientific programme is structured across eleven integrated tracks that span the full spectrum of tinnitus research and clinical care. These include neurophysiology and neural correlates of tinnitus; cognitive, emotional, and psychological mechanisms; cognitive behavioural therapies and psychosocial interventions; genetics, biomarkers, and molecular mechanisms; neuromodulation, stimulation, and emerging therapies; audiological interventions and hearing technologies; somatosensory and multisensory influences on tinnitus; pharmacology, botanicals, and nutritional therapies; clinical phenotyping and subgroup analysis; medical and vascular aetiologies; and the study of consciousness, inner music, and auditory imagery. Each track is led by recognised experts from neurology, otolaryngology, audiology, psychology, neuroscience, and related fields. The structure supports deep specialist sessions while encouraging cross talk between basic scientists, clinicians, and methodologists, with a clear focus on stratified, multimodal, and personalised care.

Distinguished lectures: linking history, science, and care

A renewed Distinguished Lecture Series will run alongside the tracks. Lectures such as the Marilyn Penner Lecture (psychoacoustics), Mary Meikle Lecture (neurobiology), Tonndorf Lecture (auditory science), Jack Vernon Torch Lecture (mentorship and community), and Jane Henry Quiet Mind Lecture (psychological care) honour figures who helped shape modern tinnitus research.

Newer formats, including the Praxis Lecture (translational impact), the Harmonia Lecture (integrative frameworks), and the Ouroboros Lecture (mechanism and meaning) invite speakers who bridge disciplines and connect empirical findings with clinical practice, ethics, and patient experience.

XV International Tinnitus Seminar
WTC
4th World Tinnitus Congress
LONDON 2027

The 4th World Tinnitus Congress and XV International Tinnitus Seminar Roadmap:

Mechanism-Based and Personalised Futures in Tinnitus Care

A global interdisciplinary faculty across psychoacoustics, CBT, neuromodulation, neuroscience, epidemiology, pharmacology, and music psychology will work alongside charities, audiology and ENT societies, research institutes, and specialist media to build a shared roadmap for mechanism-based and personalised futures in tinnitus care. Through an 11-track structure, a curated lecture series, and collaborative partnerships, the congress will support the integration of biological mechanisms with lived experience and clinical meaning, helping delegates translate evidence into humane, individualised services grounded in both scientific precision and patient-centred wisdom.

Final Words

Dr Hashir Aazh

Tinnitus research and care continue to evolve within an increasingly global and distributed funding landscape, in which different regions contribute complementary strengths. Europe remains particularly well suited to large-scale collaboration, shared data infrastructure, and cross-border research, especially in areas linked to mental health, digital health, and health system resilience (Tolonen, 2025). North America continues to offer strong opportunities for translational research, industry partnerships, and innovation, notably for work related to auditory injury, digital therapeutics, and high-burden populations, where awareness of evolving funding priorities can support effective positioning (Greer et al., 2025; The White House, 2025). Across Asia, expanding clinical research capacity, access to large patient populations, and growing investment in health research support large-scale trials and real-world studies, with longer-term potential increasing as strategic alignment between research priorities and population health continues to strengthen (Owens, 2025; Kumar et al., 2024).

Looking ahead, progress may depend less on the leadership of individual regions than on the strength of connections between them. Integrating European collaborative infrastructures, North American translational capacity, and Asian scale offers a powerful framework for addressing the biological, psychological, and clinical complexity of tinnitus. This remains a central ambition of the World Tinnitus Congress (London, 2027).

Finally, in a Platonic and Socratic sense, the future of tinnitus research lies not in definitive answers, but in asking better questions, sustaining dialogue, and pursuing shared understanding across borders and disciplines.

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HASHIR AAZH ON GLOBAL TINNITUS

Tinnitus research is best advanced through a globally connected approach that draws on European collaboration, American translational capacity, and Asian scale, guided by careful attention to context and a Socratic commitment to asking better questions rather than seeking premature certainty.