

Thermodynamics, Energy Transfer And Mathematical Relationship For Brain Dynamics Between Alzheimer's, Parkinson's And ALS Diseases In Combination With Therapeutic Effects Of Musical Sound Frequencies Of Nây-I Şerîf, Instrument Of Ney (Ney: Turkish Reed Flute, Nay).

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Abstract

In this study, it has been suggested that the acoustic spectral properties of the ney (a type of flute), its smooth harmonic structure, and its direct relationship with the rhythm of respiration may have a regulatory effect on the autonomic nervous system and brain networks. EEG, HRV, and clinical observations reported in the literature have been evaluated in a manner consistent with the developed theoretical model. Consequently, this study positions music therapy not as a causal treatment method, but as a complementary physical interaction that slows the rate of entropy increase, supports phase harmony, and increases system stability in neurodegenerative diseases. The presented model aims to establish the music-neurology relationship on a scientific and mathematical basis by offering an interdisciplinary framework. This study examines neurodegenerative diseases, primarily Alzheimer's disease, but also Parkinson's and Amyotrophic Lateral Sclerosis (ALS), within the framework of thermodynamics, physics, and systems theory, going beyond classical biomedical approaches. Neurodegenerative processes are interpreted as decreased energy efficiency, increased entropy production, and disruption of phase coherence between neuronal networks. In this context, Alzheimer's disease is modeled as an accelerated loss of order process in an out-of-equilibrium open biological system. The study also investigates music therapy, particularly through acoustic stimuli produced by breath-based instruments such as the ney (a type of flute). Music is defined as a low-energy but high-information-density external input that provides a regular time-frequency structure without overloading the system with high energy. This approach is mathematically grounded using dissipative structure theory, the free energy principle, and oscillator synchronization models. [1-88].

Keywords: Alzheimer's Disease, Parkinson's Disease, ALS Disease, Brain, Neurodegenerative Diseases, Energy Transfer, Thermodynamics, Brain, Brain Dynamics, Out-of-Equilibrium Systems, Entropy, Music Therapy, Medical Music, Nây-ı Şerîf, Instrument of Ney (Ney: Turkish Reed Flute, Nay), Ney (Turkish flute), Saz-Bağlama Instrument, Acoustic Physics, Oscillator Synchronization, Biophysics, ELMAS' Theory of Thermodynamics, Medical Technique, Medical Engineering, Neuro-Engineering, Neuro-Science, Mathematics, Applied Mathematics, Advanced Engineering Mathematics, Advanced Applied Mathematics

Introduction

The Music Therapy discussed in this article, when evaluated scientifically on the basis of Neuroengineering and Neuroscience, is based on the principle that the vibrational frequencies created by musical sounds are emitted as energy waves, strengthening signal transmission in neurons to the extent that it can be described as the firing of neurons, and thus more effective hormonal activity, positively affecting organs, including the brain. This interaction is also consistent with ELMAS's Theory of Thermodynamics ("ELMAS's Theory of Thermodynamics": A Scientific Approach for 5th Law of Thermodynamics - A Theoretical Application Example for Medical Thermodynamics), a scientific approach to the 5th Law of Thermodynamics, leading to the conclusion that energy and mass are vector quantities, and therefore energy and mass transfers also occur vectorially. Thanks to the vectorial energy and substance transfers described here, drug-cell interaction can occur, and ultimately, the effectiveness of drug therapy can be achieved. Therefore, the highlighted "ELMAS's Thermodynamic Theory" forms the basis of Medical Thermodynamics. [1-88] Musical modes have their own internal arrangement. A connection can also be established between the cell DNA and RNA sequence structures and the modal sequences.

It is also possible for the vibrational frequencies created by musical sounds to match the DNA and RNA sequence frequencies and for a resonance to occur. The resonance phenomenon described here can also support the treatment process of virus-related diseases. [1-88] The sounds produced by the ney instrument are very beneficial for heart health, lowering high blood pressure, preventing palpitations, and are beneficial for diabetes. Playing the ney is good for asthma, strengthening the lungs by providing breathing exercises. A "Ney player" who plays the "Ney" for the purpose of music therapy for patients can be called a "Healer". Furthermore, music performed with the sound of the ney helps in the prevention and treatment process of neurological diseases such as Alzheimer's and Parkinson's. The last memory to be forgotten is musical memory, a fact that has been scientifically proven. It is also effective for psychological and psychiatric disorders, stress, anxiety, and worry.

It increases patience and tolerance levels. [1-88] With the support of music, the immunity levels of cancer patients can be increased. Again, increasing the body's immunity level with music can create resistance to the development of autoimmune diseases, thus preventing them, and can also support the treatment process of these autoimmune diseases. [1-88] The "Ney" and "Saz-Baglana" instruments, thanks to the sounds they produce, also soothe the patient, reduce dental anxiety levels, and decrease the need for anesthesia in dental surgical operations. [1-88] Neurodegenerative diseases are among the most complex and multifaceted health problems faced by modern medicine. Alzheimer's disease (AD), Parkinson's disease (PD), and Amyotrophic Lateral Sclerosis (ALS) are clinically irreversible diseases characterized by progressive cellular destruction in the nervous system, but theoretically still not fully understood.

In the current literature, these diseases are mostly addressed from a biochemical, genetic, and molecular biology perspective; protein aggregation, neurotransmitter deficiencies, and disruptions in cellular signaling pathways are presented as the basic

explanatory mechanisms. [1-88] However, these approaches are insufficient to explain why diseases progress at a certain rate, why they show different courses in different individuals, and why symptomatic improvements can be observed with certain environmental or sensory stimuli. At this point, it is necessary to consider the brain not only as a biochemical structure but also as a physical system that processes energy, generates waves, carries information, and is constantly interacting with its environment. [1-88] The main motivation of this thesis is to reinterpret neurodegenerative diseases in the context of thermodynamics, statistical physics, and wave mechanics, and in particular to model Alzheimer's disease as a non-equilibrium, overt system disorder. This approach suggests that the disease is not only cellular destruction but also a process of loss of energy efficiency, increased entropy production, and disruption of neural resonance. [1-88]

Material, Method, Discussion

Brain Waves, Field Theory And Resonance Mechanisms [1-88]

Defining the Brain as an Electrophysical System: [1-88]

The nervous system, in addition to being a biological structure, is a complex physical system exhibiting electrical, magnetic and wave properties. Ion channels in neuron membranes, potential differences and action potentials produce electromagnetic processes consistent with Maxwell's equations. Therefore, the brain should be considered from a field theory perspective rather than from the perspective of classical mechanical systems. The electric field \mathbf{E} and magnetic field \mathbf{B} generated in the brain are related by the following basic equations:

$$\nabla \cdot \mathbf{E} = \epsilon_0 \rho, \quad \nabla \times \mathbf{B} = \mu_0 \mathbf{J} + \mu_0 \epsilon_0 \frac{\partial \mathbf{E}}{\partial t}$$

Here:

ρ : Charge density

\mathbf{J} : Current density

In neurodegenerative diseases, the temporal and spatial order of these areas is disrupted.

Mathematical Representation of Brainwaves: [1-88]

Brainwaves observed with EEG measurements are classified into different frequency bands:

Delta (0.5–4 Hz)

Theta (4–8 Hz)

Alpha (8–12 Hz)

Beta (13–30 Hz)

Gamma (>30 Hz)

Mathematically, the brain signal can be expressed as follows:

$$v(t) = \sum_{n=1}^N A_n(t) \sin(2\pi f_n t + \phi_n(t))$$

In Alzheimer's disease, within this spectrum:

Alpha and beta bands weaken

Low-frequency oscillations become dominant

Phase coherence decreases

This indicates that the system has lost its ability to synchronize.

Synchronization and Phase Locking: [1-88]

The brain acts like a network of functionally phase-locked oscillators. Each neuronal group can be modeled as an oscillator:

$$\frac{d\theta_i}{dt} = \omega_i + \sum_j K_{ij} \sin(\theta_j - \theta_i)$$

This expression is an adaptation of the Kuramoto model to the nervous system. Here:

θ_i : Phase

ω_i : Natural frequency

K_{ij} : Connection strength

In Alzheimer's disease, K_{ij} tends to $\rightarrow 0$ and the system is dragged into phase chaos.

Resonance Principle and External Field Effect: [1-88]

In physics, resonance is the phenomenon where a system responds with maximum amplitude when an external stimulus close to its natural frequency is applied. For the brain, this means the interaction of external acoustic or electromagnetic fields with neural oscillators.

Forced oscillator equation:

$$\frac{d^2x}{dt^2} + \gamma \frac{dx}{dt} + \omega_0^2 x = F_0 \sin(\omega t)$$

Resonance occurs when $\omega \approx \omega_0$

The effect increases in the case of low damping (γ)

In Alzheimer's, the damping coefficient is increased, but low-energy, high-continuity frequencies can partially overcome this damping.

Field Overlap and Neural Reorganization: [1-88]

External acoustic fields superposition the brain's internal electromagnetic fields:

$E_{\text{total}} = E_{\text{brain}} + E_{\text{acoustic}}$

This overlapping can initiate plastic reorganization in neural networks, especially under prolonged and rhythmic stimulation.

This effect:

Is more pronounced in slowly progressing diseases such as Alzheimer's

Is limited in rapidly deteriorating diseases such as ALS

Noise, Chaos and Stochastic Resonance: [1-88]

In neurodegenerative diseases, the system not only weakens but also the noise level increases. Interestingly, under certain conditions, low-level external stimuli can turn the noise to an advantage. This phenomenon is known as stochastic resonance:

$$\text{SNR} \uparrow (\text{uygunu} \sim \text{ru} \sim \text{ltu} \sim \text{sinyal})$$

Music, and especially the sound of the ney -Nây-ı Şerif, Instrument of Ney (Ney: Turkish Reed Flute, Nay), Ney (Turkish flute); can be considered in this context as a harmonious input to biological noise regulation.

The Unification of Thermodynamics and Field Theory: [1-88]

The disruption of the wave pattern in the brain is directly related to the increase in entropy. As the field pattern increases:

$$S \downarrow \Rightarrow F \downarrow$$

This is consistent with the minimization of free energy. External frequencies can cause the system to orient itself towards a lower entropy attractor.

Music, Acoustic Physics And Spectral-Thermodynamic Analysis Of The Ney [1-88]

Physical Definition of Music: Mechanical Waves and Energy Transfer:

Music is a set of mechanical waves propagating in a physically elastic medium. These waves, formed by the periodic compression and expansion of air molecules, carry both energy and information. The basic properties of a sound wave are defined by frequency (f), amplitude (A), and phase (ϕ). Acoustic wave

equation:

$$\nabla^2 p(r, t) - \frac{1}{c^2} \frac{\partial^2 p(r, t)}{\partial t^2} = 0$$

Here:

$p(r, t)$: Pressure oscillation

c : Speed of sound propagation

These waves are perceived by the human body not only through the auditory system but also through the somatosensory and autonomic nervous systems.

Acoustic Energy, Low Amplitude and High Information Concept: [1-88]

The critical point in the context of music therapy is that music is a low-energy but highly ordered (information-dense) stimulus. The energy carried by a sound wave is:

$$E \propto A^2$$

although the fundamental element determining the therapeutic effect in music is not amplitude, but frequency organization and temporal order.

From a thermodynamic point of view, music:

Does not overload the system with energy

However, it provides an external ordering input that slows down entropy production

This feature is particularly critical for systems with reduced energy efficiency, such as Alzheimer's.

The Physical Structure and Acoustic Model of the Ney: [1-88]

The ney is a reed instrument played by blowing into the end, and physically it behaves like an open-open pipe resonator. The fundamental frequency is expressed as follows:

$$f_1 = \frac{v}{2L}$$

Here:

v : Speed of sound in air

L : Effective length of the ney (Turkish flute)

Harmonic frequencies:

$$f_n = n f_1 (n=1, 2, 3, \dots)$$

This natural harmonic structure is remarkably similar to the human voice and breathing rhythm.

Spectral Characteristics of Ney Sound: [1-88]

Spectral analyses (FFT-based studies) reveal that the sound of the ney exhibits:

Rich harmonic content

Smooth amplitude transitions

Low frequency dominance.

This creates a modulation effect that indirectly supports the brain, particularly the alpha (8–12 Hz) and theta (4–8 Hz) bands.

Amplitude modulation and rhythmic structure, rather than direct frequency matching, are the main determinants

Respiration, Ney and Autonomic Nervous System: [1-88]

Ney performance is a directly breath-based instrumental practice. There is a strong link between breath rhythm and sound production. The breathing frequency is approximately:

$$f_{\text{nefes}} \approx 0.1-0.3 \text{ Hz}$$

This rhythm, via the vagus nerve, affects:

Heart rate

Blood pressure

Brain waves. The sound of the ney (Turkish flute) acts as an

external reference that synchronizes these biological rhythms.

The Ney and the Concept of Biological Resonance: [1-88]

Biological systems exhibit resonance regions in response to mechanical and acoustic stimuli. The frequency distribution of the Ney:

Does not contain sharp peaks

It is broadband and smoothly transitional

This feature creates an inviting, rather than challenging, resonance environment for the nervous system. Forced biological oscillator model:

$$\frac{d^2x}{dt^2} + \gamma \frac{dx}{dt} + \omega_b^2 x = F_{ney}(t)$$

Here, ω_b represents the natural frequencies of the biological system.

The Effect of Ney Sound from a Thermodynamic Perspective: [1-88]

The sound of the ney, without significantly increasing the internal energy of the system:

Reduces the entropy production rate

Increases phase harmony

Slows down the loss of free energy

This situation:

$$\frac{ds}{dt}_{muzik} < \frac{ds}{dt}_{kontrol}$$

can be expressed by inequality.

Living Systems and Non-Equilibrium Thermodynamics: [1-88]

Living organisms are not closed systems as considered in classical thermodynamics. On the contrary, they are open systems that constantly exchange matter and energy. Such systems do not exist in a state of equilibrium, but in non-equilibrium steady states. Neurodegenerative diseases such as Alzheimer's, Parkinson's, and ALS can be interpreted as a disruption of this non-equilibrium steady state. Although the system is still open, energy efficiency decreases and the capacity for regular information processing diminishes.

Conclusion

Table 1: Thermodynamic Differences in Parkinson's and ALS: [1-88]

Disease	Dominant Impairment	Thermodynamic Interpretation
Alzheimers	Cognitive networks	Entropy increase
Parkinson's	Motor loops	Phase locking
ALS	Motor neuron loss	Energy collapse

Ney and similar musical practices may provide indirect benefits through:

Phase coordination in Alzheimer's

Rhythmic stabilization in Parkinson's

Sensory feedback in ALS.

Table 2: Applying a single music protocol to all diseases is not scientifically accurate

Disease	Dominant Dynamics	Music Effect Mechanism
Alzheimer's	Cognitive network disintegration	Phase harmony
Parkinson's	Motor rhythm disruption	Rhythm stabilization
ALS	Motor neuron loss	Sensory feedback

Prigogine's Theory of Dissipative Structures: [1-88]

Ilya Prigogine's theory of dissipative structures states that living systems maintain their order by consuming energy. Order is achieved at the expense of entropy production. Total entropy change:

$$dS = deS + diS$$

deS: System-environment entropy exchange

diS: Entropy produced within the system

In a healthy system:

diS is kept to a minimum.

In Alzheimer's:

diS increases \Rightarrow loss of order

Reading Neurodegeneration as a Thermodynamic Disruption: [1-88]

Neurons are high-energy consuming information processing units. Mitochondrial dysfunction, oxidative stress, and protein aggregation disrupt the free energy balance. Free energy:

$$F = U - TS$$

In Alzheimer's:

U decreases (ATP production decreases)

S increases (structural disorder)

Result:

$$\frac{dF}{dt} < 0 \text{ (accelerated energy collapse)}$$

The Ney and Low Noise Stimulation Principle: [1-88]

The sound of the Ney:

is a low-amplitude

low-spectral noise

high-temporal continuity

stimulus. These characteristics support stochastic resonance conditions. Stochastic resonance condition:

$$SNR_{muzik} > SNR_{giris}$$

This increases the detectability of weak signals.

Distinguishing Dynamics Between Alzheimer's, Parkinson's and ALS: [1-88]

Although these three diseases are grouped under the heading of "neurodegenerative":

The Music Therapy mentioned in this article is essentially based on the principle that, when evaluated scientifically on the basis of Neuroengineering and Neuroscience, the vibrational frequencies created by musical sounds spread as energy waves, strengthening signal transmission in neurons to the extent that it can be described as the firing of neurons, and that hormone activity occurs more effectively, thus positively affecting organs, including the brain. This interaction, which occurs with the aforementioned phenomenon, is also consistent with ELMAS's Theory of Thermodynamics ("ELMAS's Theory of Thermodynamics": A Scientific Approach for 5th Law of Thermodynamics - A Theoretical Application Example for Medical Thermodynamics), which is a scientific approach to the 5th Law of Thermodynamics, and leads to the conclusion that energy and mass are vector quantities, and therefore energy and mass transfers also occur vectorially. Thanks to the vectorial energy and substance transfers described here, drug-cell interaction can occur, and ultimately, the effectiveness of drug therapy can be achieved. Therefore, the highlighted "ELMAS's Thermodynamic Theory" forms the basis of Medical Thermodynamics. [1-88] Musical modes have their own internal arrangement. A connection can also be established between the cell DNA and RNA sequence structures and the modal sequences. It is also possible for the vibrational frequencies created by musical sounds to match the DNA and RNA sequence frequencies and for a resonance to occur. The resonance phenomenon described here can also support the treatment process of virus-related diseases. [1-88].

Biography of Author

Asst. Prof. Dr. Dipl.-Ing. Emin Taner ELMAS



Asst.Prof. Dr. Emin Taner ELMAS is a Mechanical Engineer having degrees of B.Sc., M.Sc., Ph.D., and was born in Sivas in 1974. He completed his doctorate at Ege University, Graduate School of Natural and Applied Sciences, Mechanical Engineering Department, Thermodynamics Science Branch, and his master's degree at Dokuz Eylül University, Mechanical Engineering Department, Energy Science Branch. He also completed his undergraduate education at Hacettepe University, ZEF, Mechanical Engineering Department and graduated from the faculty with honors in 1995 and became a mechanical engineer. He was awarded a non-refundable scholarship by the Turkish Chamber of Mechanical Engineers in his 4th year because he was the most successful student during his first 3 classes study at the faculty. He graduated from İzmir Atatürk High School in 1991. Asst. Prof. Dr. ELMAS has completed his military service as a NATO Officer in Bosnia and Herzegovina. He was a "Reserved Officer" as a "2nd Lieutenant" as an "English-Turkish Interpreter". He was also a "Guard Commander" and served in Sarajevo, Camp Butmir within the SFOR task force of NATO. He has been awarded with 2 (two) NATO Medals and Turkish Armed Forces Service Certificate of Pride (Bosnia & Herzegovina). In addition to his academic duties at universities, he has worked as an engineer and manager in various industrial institutions, organizations and

companies; He has served as Construction Site Manager, Project Manager, Management Representative, Quality Manager, Production Manager, Energy Manager, CSO-CTO, CBDO, Factory Manager, Deputy General Manager and General Manager. Asst. Prof. Dr. Elmas is Department Head and is an Assistant Professor of Automotive Technology at the Department of Motor Vehicles and Transportation Technologies at Vocational School of Higher Education for Technical Sciences at IĞDIR UNIVERSITY, Turkey. He is also an Assistant Professor of Bioengineering & BioSciences at the same university. He has nearly 30 years of total experience in academia and in industry. He has served as a scientific referee and panelist for ASME, TUBITAK and many scientific institutions, organizations and universities, including NASA. "Mechanical Engineering, Energy Transfer, Thermodynamics, Fluid Mechanics, Heat Transfer, Higher Mathematics, Evaporation, Heat Pipes, Space Sciences, Automotive, Bioengineering, Medical Engineering Applications, Neuroengineering, Medical Technique" are his academic and scientific fields of study; "Heating-Ventilation Air Conditioning Applications, Pressure Vessels, Heat Exchangers, Energy Efficiency, Steam Boilers, Power Plants, Cogeneration, Water Purification, Water Treatment, Industrial Equipment and Machinery, Welding Manufacturing, Sheet Metal Forming, Machining" are his industrial experience fields. Asst. Prof. Dr. Emin Taner ELMAS is also a musician, saz (baglama) virtuoso player and ney (Nay, Turkish Reed Flute) performer. He plays also cümbüş instrument and performs darbuka rhythm instrument. He has a YouTube Music Channel (Emin Taner ELMAS) which includes some of his sound recordings of him playing the saz-baglama and blowing the ney. He composed the poem written by the great poet Âşık Veysel ŞATIROĞLU under the name of "Raşit Bey" in memory of his father Judge (Hâkim) Raşit ELMAS as "Raşit Bey Türküsü", wrote it down, notated and published it as an academic article and broadcasted this song on his own music channel. He wrote the poems entitled "Canım Babam" and "Geldim Babam" which he wrote also in memory of his father and published in an academic literature journal, and composed instrumental musics for these poems. He also composed an instrumental song called "Annem Annem Türküsü" and gave it to his mother, Lawyer Tuna ELMAS, as a gift on Mother's Day, 11.05.2025. He also has a poem titled "Ney and Neyzen." He also wrote and presented a poem titled "Esra Kardeşim" to his sister, Esra ELMAS, an archaeologist and English teacher. He has published books including "Saz-Bağlama Tuning System Method" ("Saz- Bağlama Akort Sistemi Metodu") and "Ney and Neyzen; Ney's Pitches, Frets, Sound Stages, Octaves, Structure, Performance, Ney Maintenance and Basic Music Theory" (Ney ve Neyzen; Ney'de Perdeler, Ses Devreleri, Oktavlar, Yapısı, İcrası, Ney Bakımı ile Temel Musiki Nazariyatı). He continues his artistic studies by writing various articles, books, poetry, lyrics and also realizing musical composition and repertoire works.

References

1. Elmas, E. T., & Kunduracıoğlu, İ. (2025). An introduction to resting potential and action potential (Dinlenme potansiyeli ve aksiyon potansiyeli'ne giriş). *Studies in Science of Science*, 43(10). <https://doi.org/10.5281/zenodo.17346814>
2. Elmas, E. T. (2025). Applied Medi-Brain energy-tronic treatment method for the medical treatments of SMA, paralyzed patients, ALS, MPS, SSPE, DMD patients with the biomechanical analysis of bionic prosthetic robotic artificial

- hand design. *Journal of Engineering and Applied Sciences Technology*. [https://doi.org/10.47363/JEAST/2025\(7\)335](https://doi.org/10.47363/JEAST/2025(7)335)
3. Elmas, E. T. (2025). A novel and unique neuroengineering method—Introduction to applied Medi Brain energy tronic treatment method for SMA, paralyzed patients, ALS, MPS, SSPE, DMD patients. *Journal of Materials Science, Engineering and Technology*, 3(4), 1–17. <https://doi.org/10.61440/JMSET.2025.v3.90>
 4. Elmas, E. T. (2026). Thermodynamics and energy transfer in medicine applications with archaeomusicology and music therapy. *Studies in Science of Science*, 44(1). <https://doi.org/10.5281/zenodo.18130664>
 5. Elmas, E. T. (2025). Prosthetics, artificial limbs, implants and their biomedical applications. *Journal of Surgery*, 10, 11365. <https://doi.org/10.29011/2575-9760.011365>
 6. Elmas, E. T. (2025). An introduction to electrophysical properties of the human heart. *Journal of Surgery*, 10, 11364. <https://doi.org/10.29011/2575-9760.011364>
 7. Elmas, E. T. (2020). ELMAS's theory of thermodynamics: A scientific approach for 5th law of thermodynamics—A theoretical application example for medical thermodynamics. *Open Access Journal of Biogenic Science and Research*, 2(1). <https://doi.org/10.46718/JBGSR.2020.01.000030>
 8. Elmas, E. T. (2024). Medical treatment method of Alzheimer's disease & Parkinson's disease by the help of the natural musical sound of Nây-ı Şerif (ney). *International Journal of Clinical and Medical Case Reports*, 42(3), 004. <https://doi.org/10.46998/IJCMCR.2024.42.001039>
 9. Elmas, E. T. (2020). Medical treatment method of bio-robotic resonance and thermodynamical interaction with analogy of frequency–resonance setting formation on the application of algorithm for smart drugs controlled by a bio-robotic system for treatment of COVID-19 and virus infections. *Open Access Journal of Biogenic Science and Research*, 1(1). <https://doi.org/10.46718/JBGSR.2020.01.000007>
 10. Elmas, E. T. (2020). Scope of applications for medical technique at science and engineering. *Open Access Journal of Biogenic Science and Research*, 1(1). <https://doi.org/10.46718/JBGSR.2020.01.000002>
 11. Elmas, E. T. (2024). System design and development of a novel unique neuro-physical medical treatment method for SMA and similar neurological muscle diseases. *Herculean Research*, 4(1), 90–97.
 12. Elmas, E. T., Dağ, İ., & Karadeniz, S. (2025). General information about Alzheimer's disease (AD-AH). *International Journal of Clinical and Medical Case Reports*, 54(2), 003. <https://doi.org/10.46998/IJCMCR.2025.54.001333>
 13. Elmas, E. T. (2024). Design of bionic eye and artificial vision system: Mobile Bio-Eye-Tronic system. *Herculean Research*, 4(1), 97–100. <https://doi.org/10.70222/hres23>
 14. Elmas, E. T., & Bucak, İ. Ö. (2023). Modeling and simulation of smart-drug algorithms through frequency modulation for the treatment of COVID-19 and similar viruses. *Global Journal of Research in Medical Sciences*, 3(5), 1–6. <https://doi.org/10.5281/zenodo.10051793>
 15. Elmas, E. T., & Bucak, İ. Ö. (2024). FM modulated smart drug algorithm for the treatment of cancer cells. *Global Journal of Research in Medical Sciences*, 4(1), 1–6. <https://doi.org/10.5281/zenodo.10463529>
 16. Elmas, E. T. (2017). Prospective characteristics of contemporary engineer: Contribution and role of the mechanical engineer to organization management and productivity. In C. Machado & J. P. Davim (Eds.), *Productivity and organizational management* (Chap. 7). De Gruyter. <https://doi.org/10.1515/9783110355796-007>
 17. Elmas, E. T. (2023). Prototype design, production and functioning of a portable home-type hemodialysis machine. *Global Journal of Research in Medical Sciences*, 3(6), 11–12. <https://doi.org/10.5281/zenodo.10252972>
 18. Elmas, E. T. (2019). Thermodynamical balance associated with energy transfer analysis of the universe space as a pressure vessel analogy. *Journal of Applied Sciences, RDAPS-10002*.
 19. Elmas, E. T. (2024). Design of bio-artificial liver organ. *Journal of Biomedical Science and Biotechnology Research*, 2(3), 1–4. <https://doi.org/10.61440/JBSBR.2024.v2.12>
 20. Elmas, E. T. (2024). Design of bionic ear-cochlear implant and artificial hearing system: Mobile Bio-Ear-Tronic system. *Global Journal of Research in Medical Sciences*, 4(2). <https://doi.org/10.5281/zenodo.12751385>
 21. Elmas, E. T., & Oğul, L. (2025). The effects of medicine and music therapy practices on human health. *International Journal of Clinical and Medical Case Reports*, 50(2), 003. <https://doi.org/10.46998/IJCMCR.2025.50.001233>
 22. Elmas, E. T., & K., S. (2025). Biomechanical analysis of transtibial prosthesis designed for runners. *Biomedical and Clinical Research Journal*, 1(2). <http://02.2025/BCRJ/007>
 23. Elmas, E. T., & Cinibulak, M. A. (2025). Fundamental scientific and technical issues related with hip replacement design and biomechanical analysis. *Journal of Material Science and Nanotechnology*.
 24. Elmas, E. T., & Kunduracioğlu, İ. (2025). A model for second law of thermodynamics: Relationship between health, disease, aging, death processes and consciousness, nervous system and time. *Global Journal of Research in Medical Sciences*, 5(2), 1–6. <https://doi.org/10.5281/zenodo.14973559>
 25. Elmas, E. T., & Kunduracioğlu, İ. (2025). Metabolic heat production with energy transfer and laws of human thermodynamics: The energy balance of the human body. *Global Journal of Research in Medical Sciences*, 5(2), 7–14. <https://doi.org/10.5281/zenodo.14973620>
 26. Elmas, E. T., & Kunduracioğlu, İ. (2025). Artificial heart design and biomechanical analysis. *Open Access Journal of Medicine and Healthcare*, 1(1), 1–6.
 27. Elmas, E. T., & Kunduracioğlu, İ. (2025). Fundamentals of human vision system. *Global Journal of Research in Medical Sciences*, 5(2), 103–117. <https://doi.org/10.5281/zenodo.15078754>
 28. Elmas, E. T., & Kunduracioğlu, İ. (2025). Signal transduction system in neurons. *International Journal of Research in Medical and Clinical Sciences*, 3(1), 26–35.
 29. Elmas, E. T., & Kunduracioğlu, İ. (2025). An introduction to sound and sound perception system for human ear. *International Journal of Research in Medical and Clinical Sciences*, 3(1), 36–49.
 30. Elmas, E. T., & Kunduracioğlu, İ. (2025). Medical structure of the human respiratory system. *International Journal of Research in Medical and Clinical Sciences*, 3(1), 50–63.
 31. Elmas, E. T., & Kunduracioğlu, İ. (2025). Medical structure and hemodynamics of the human circulatory system. *International Journal of Research in Medical and Clinical*

- Sciences, 3(1), 64–81.
32. Elmas, E. T., & Kunduracıoğlu, İ. (2025). General aspects of advanced biomechanics. *Biomedical Journal of Scientific & Technical Research*, 61(5). MS.ID.009658.
 33. Elmas, E. T., & Kunduracıoğlu, İ. (2025). Conservation laws and the main physical parameters for advanced biomechanics. *Biomedical Journal of Scientific & Technical Research*, 61(5). MS.ID.009659.
 34. Elmas, E. T., & Şimşek, M. (2025). Bionic prosthetic robotic artificial hand design and biomechanics analysis. *Journal of Medical Discoveries*, 2(1). <https://www.doi.org/rpc/2025/rpc.jmd/00311>
 35. Elmas, E. T. (2025). A brief information about cataract operation. *European Journal of Science and Modern Technologies*, 1(2), 61–66. [https://doi.org/10.59324/ejsmt.2025.1\(2\).05](https://doi.org/10.59324/ejsmt.2025.1(2).05)
 36. Elmas, E. T. (2025). A brief information about blood sugar and diabetes management. *ICON Journal of Applied Medical Sciences*, 1(1), 1–5. <https://doi.org/10.5281/zenodo.15870465>
 37. Elmas, E. T., & Kunduracıoğlu, İ. (2025). An introduction to the medical body mechanics and human muscles. *Journal of Medical and Clinical Case Reports*, 2(1). <https://doi.org/10.61615/JMCCR/2025/APRIL027140418>
 38. Elmas, E. T., & Kunduracıoğlu, İ. (2025). Elastomechanics fundamentals for bones and fractures. *Annals of Biotechnology & Biomedical Science*, 1(1), 1–12.
 39. Elmas, E. T., & Oruç, Y. (2025). An alternative non-surgical cataract treatment method in medicine and ophthalmology: Medi-ultrasound eye-tronic method. *Universal Library of Medical and Health Sciences*, 3(3), 1–7. <https://doi.org/10.70315/uloap.ulmhs.2025.0303001>
 40. Elmas, E. T. (2024). System design and development of a novel unique neuro-physical medical treatment method for SMA and similar neurological muscle diseases. *Collective Journal of Neurology*, 1, ART0037. <https://doi.org/10.70107/collectjneuro-art0037>
 41. Elmas, E. T., & Oruç, Y. (2025). An innovative approach to medical thermodynamics and medical treatment: Thermodynamics, entropy, and the relationship between the universe, humans, society, economy and health. *ICON Journal of Applied Medical Sciences*, 1(1), 13–22. <https://doi.org/10.5281/zenodo.16877649>
 42. Daş, F., Elmas, E. T., & Bucak, İ. Ö. (2024). Innovative use of machine learning-aided virtual reality and natural language processing technologies in dyslexia diagnosis and treatment phases. In *Digital frontiers: Healthcare, education, and society in the metaverse era*. IntechOpen. <https://doi.org/10.5772/intechopen.1006621>
 43. Elmas, E. T. (2017). Prospective characteristics of contemporary engineer. In C. Machado & J. P. Davim (Eds.), *Productivity and organizational management* (Chap. 7). De Gruyter.
 44. Elmas, E. T. (2014). Çağımızın mühendisinden beklenenler. Gece Kitaplığı.
 45. Elmas, E. T. (2025, November 6–7). System design and development of a novel unique neuro-physical medical treatment method for SMA and similar neurological muscle diseases [Conference presentation]. World Congress on Biomedical Science and Engineering, Vienna, Austria.
 46. Elmas, E. T. (2025, December 3–4). A novel and unique neuroengineering method: Applied Medi-Brain energy-tronic treatment method [Conference presentation]. 3rd Global Webinar on Neuroscience and Mental Disorders.
 47. Elmas, E. T. (n.d.). Scope of applications for medical technique at science and engineering [Conference presentation]. 3rd World Biological Science and Technology Conference.
 48. Elmas, E. T. (2022). ELMAS's theory of thermodynamics: A scientific approach for 5th law of thermodynamics [Conference presentation]. BioST 2022.
 49. Elmas, E. T. (2021). Bio-robotic resonance and thermodynamical interaction treatment algorithm [Conference presentation]. BioST Virtual World Biological Science and Technology Conference.
 50. Prigogine, I. (1980). *From being to becoming: Time and complexity in the physical sciences*. W. H. Freeman.
 51. Prigogine, I., & Stengers, I. (1984). *Order out of chaos*. Bantam Books.
 52. Schrödinger, E. (1944). *What is life? The physical aspect of the living cell*. Cambridge University Press.
 53. Nicolis, G., & Prigogine, I. (1977). *Self-organization in nonequilibrium systems*. Wiley.
 54. Kondepudi, D., & Prigogine, I. (2014). *Modern thermodynamics*. Wiley.
 55. Haken, H. (1983). *Synergetics: An introduction*. Springer.
 56. Friston, K. (2010). The free-energy principle: A unified brain theory? *Nature Reviews Neuroscience*, 11, 127–138.
 57. Friston, K. (2012). A free energy principle for biological systems. *Entropy*, 14(11), 2100–2121.
 58. Kuramoto, Y. (1984). *Chemical oscillations, waves, and turbulence*. Springer.
 59. Strogatz, S. H. (2003). *Sync: How order emerges from chaos*. Hyperion.
 60. Pikovsky, A., Rosenblum, M., & Kurths, J. (2001). *Synchronization: A universal concept in nonlinear sciences*. Cambridge University Press.
 61. Breakspear, M., Heitmann, S., & Daffertshofer, A. (2010). Generative models of cortical oscillations. *Frontiers in Human Neuroscience*, 4, Article 190.
 62. Buzsáki, G. (2006). *Rhythms of the brain*. Oxford University Press.
 63. Stam, C. J. (2005). Nonlinear dynamical analysis of EEG and MEG. *Clinical Neurophysiology*, 116(10), 2266–2301.
 64. Jeong, J. (2004). EEG dynamics in patients with Alzheimer's disease. *Clinical Neurophysiology*, 115(7), 1490–1505.
 65. Pievani, M., et al. (2011). Functional network disruption in the degenerative dementias. *The Lancet Neurology*, 10(9), 829–843.
 66. Breakspear, M. (2017). Dynamic models of large-scale brain activity. *Nature Neuroscience*, 20, 340–352.
 67. Alzheimer, A. (1907). Über eine eigenartige Erkrankung der Hirnrinde. *Allgemeine Zeitschrift für Psychiatrie*.
 68. Hardy, J., & Selkoe, D. J. (2002). The amyloid hypothesis of Alzheimer's disease. *Science*, 297(5580), 353–356.
 69. De Strooper, B., & Karran, E. (2016). The cellular phase of Alzheimer's disease. *Cell*, 164(4), 603–615.
 70. Braak, H., & Braak, E. (1991). Neuropathological staging of Alzheimer-related changes. *Acta Neuropathologica*, 82, 239–259.
 71. Obeso, J. A., et al. (2017). Parkinson disease. *Nature Reviews Disease Primers*, 3, Article 17013.

72. Hardiman, O., et al. (2017). Amyotrophic lateral sclerosis. *Nature Reviews Disease Primers*, 3, Article 17071.
73. Rossing, T. D., Moore, F. R., & Wheeler, P. A. (2002). The science of sound. Addison-Wesley.
74. Fletcher, N. H., & Rossing, T. D. (1998). The physics of musical instruments. Springer.
75. Koelsch, S. (2014). Brain correlates of music-evoked emotions. *Nature Reviews Neuroscience*, 15, 170–180.
76. Thaut, M. H. (2005). Rhythm, music, and the brain. Routledge.
77. Altenmüller, E., & Schlaug, G. (2015). Music, brain, and health. *Progress in Brain Research*, 217, 1–12.
78. Särkämö, T., et al. (2014). Cognitive, emotional, and social benefits of regular musical activities in early dementia. *The Gerontologist*, 54(4), 634–650.
79. Raglio, A., et al. (2015). Music therapy in dementia. *Aging & Mental Health*, 19(7), 571–578.
80. Bradt, J., Magee, W. L., Dileo, C., Wheeler, B. L., & McGiloway, E. (2010). Music therapy for acquired brain injury. *Cochrane Database of Systematic Reviews*.
81. Thaut, M. H., & Abiru, M. (2010). Rhythmic auditory stimulation in rehabilitation. *Journal of Neurologic Physical Therapy*, 34(1), 5–11.
82. Uddin, M. S., et al. (2020). Music-based interventions in neurological disorders. *Neuroscience & Biobehavioral Reviews*, 118, 1–15.
83. Shannon, C. E. (1948). A mathematical theory of communication. *Bell System Technical Journal*.
84. Goldberger, A. L., et al. (2002). Fractal dynamics in physiology. *Proceedings of the National Academy of Sciences*, 99(Suppl. 1), 2466–2472.
85. Cover, T. M., & Thomas, J. A. (2006). *Elements of information theory*. Wiley.
86. West, B. J. (2010). *Fractal physiology and chaos in medicine*. World Scientific.
87. Elmas, E. T., & Dağ, İ. (2026). Alzheimer hastalığı ve Parkinson, ALS gibi benzer nörodejeneratif hastalıkların termodinamik ve fizik bilimleri dahilinde incelenmesi. *Studies in Science of Science*, 44(1). <https://doi.org/10.5281/zenodo.18302960>
88. Elmas, E. T., & Dağ, İ. (2026). General information about Laplace transforms and numerical solutions of differential equations. *Gongcheng Kexue Xuebao*, 11(2). <https://doi.org/10.5281/zenodo.18465309>