

“Integration of Embedded AI and Medical Heat Pipes in Robotic Neurosurgery: A Novel Framework Based on Elmas’s Thermodynamic Theory”

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ARTICLE INFO

Received: 📅 October 01, 2026

Published: 📅 October 15, 2026

Citation: Emin Taner ELMAS. “Integration of Embedded AI and Medical Heat Pipes in Robotic Neurosurgery: A Novel Framework Based on Elmas’s Thermodynamic Theory”. Biomed J Sci & Tech Res 67(1)-2026. BJSTR. MS.ID.010442.

ABSTRACT

Objective: This study presents an interdisciplinary framework that autonomizes the thermal management of high-temperature laser ablation and ultra-low-temperature cryoprobe applications, which represent opposing thermal poles in robotic neurosurgery operations. The thermal sensitivity of neural tissues and the risk of permanent neuron damage developing at temperatures above 43°C necessitate a micron-level stable thermal control. Accordingly, the study aims to optimize surgical robots both in terms of hardware and software.

Method: The theoretical foundation of the study is based on the principles of “ELMAS’s Thermodynamic Theory”, the “5th Law of Thermodynamics”, and “Bio-Robotic Resonance” developed by Asst. Prof. Dr. Emin Taner Elmas. In the hardware layer, dual-phase medical heat pipes integrated into the tip of the robotic arm (end-effector), having a diameter of 0.8 mm, flexible, and containing sintered copper powder micro-capillaries with water-graphene nano-fluid, were utilized. In the software layer, an embedded artificial intelligence (AI) engine supported by machine learning models was developed, capable of real-time data processing from micro-sensors on the heat pipe and performing digital twin-based live thermal mapping (HUD). The validation of the system was designed with a 5-step validation protocol encompassing computerized thermal modeling, synthetic gel tests, ex-vivo organ tests, in-vivo animal experiments, and preclinical human simulation.

Findings: The integration of the micro-heat pipe provided passive cooling without requiring an external energy source, thereby suppressing peripheral heat dissipation (thermal dissipation) during laser operations and maintaining healthy neural tissues within a stable range of 37°C - 38°C. In cryoprobe applications, it acted as a passive heat barrier, creating reverse thermal gradients along the probe shaft, protecting healthy tissues along the entry path while performing instantaneous shock freezing cycles (freeze-thaw) at the target tumor site. The predictive algorithms of the AI engine predicted the thermal saturation at the tissue border milliseconds in advance and successfully activated the haptic lock (fail-safe) mechanism that applies resistance to the surgeon’s master control arms at critical thresholds.

Conclusion: The developed autonomous thermal management architecture elevates surgical robots beyond being merely devices that produce mechanical motion into intelligent protective shields that thermally sense the tissue. The integration of Dr. Elmas’s medical thermodynamics equations into robotic software demonstrates at a preclinical level that a micron-level precise, autonomous, and thermally safe hybrid surgical platform can be established for brain tumor resections. [1-111]

Keywords: Robotic Neurosurgery; Medical Heat Pipes; Elmas’s Theory of Thermodynamics; Fifth Law of Thermodynamics, Embedded AI; Bio-Robotic Resonance; Thermal Management Systems; Laser Ablation Cooling; Neuro-Cryoprobe; Haptic Fail-Safe Control

Introduction

Neurosurgery is one of the most critical surgical branches requiring micron-level anatomical precision, where even the smallest mistake made during an operation can lead to permanent neurological deficits or mortality in the patient. Today, robotic surgery systems offer mechanical advantages such as filtering the surgeon's hand tremors, high-resolution 3D imaging, and multi-axis mobility (degree of freedom) in deep tissues, thereby increasing the success rate in brain tumor resections. However, in contrast to this revolutionary development in the mechanical capabilities of robotic instruments, the control and management of thermal energy generated during operational processes still remain a fundamental problem waiting to be solved. Brain tissue and the components of the central nervous system are cellular structures with the highest sensitivity to temperature changes in the body. Every thermal fluctuation above physiological limits threatens cellular integrity; indeed, a temperature rise to 43°C and above in neural tissues causes irreversible protein denaturation, cellular necrosis, and permanent neuron loss within seconds. High-frequency electrocauteries and fiber-optic laser systems (e.g., CO₂ or Nd:YAG), which are frequently used in modern neuro-oncology surgeries to vaporize (ablate) or cut tumor tissue, generate local heat reaching thousands of degrees Celsius at the target point. The uncontrolled thermal energy released during this process spreads to neighboring healthy brain tissues via radiation and conduction (thermal dissipation), causing deep tissue damage beyond the surgical margin.

Similarly, in cryosurgery (cryoprobe) applications used for treating deep-seated lesions and aiming to destroy tissue by freezing it between -40°C and -160°C, when the volumetric boundaries of the ice-ball cannot be controlled millimetrically, critical vascular structures and functional nerve pathways (motor/speech centers) surrounding the tumor are subjected to freezing damage. Existing surgical robotic platforms lack the ability to monitor, evacuate, or autonomously limit heat flow at these opposing thermal poles (extreme hot and extreme cold) in real time. Traditional water-cooled lines, on the other hand, restrict the micro-joint flexibility of robotic arms due to their thick hose structures and additional hardware weight, carry infection risks, and fail to meet the micron-level miniaturization requirements needed by neurosurgery. This situation necessitates the transformation of surgical robots from being mere mechanical guides into intelligent thermal protection shields that can sense and manage heat. In this study, to bring a radical and holistic solution to the thermal management crisis in robotic neurosurgery, an autonomous surgical platform architecture is proposed that combines flexible micro-heat pipes in the hardware layer and embedded artificial intelligence (AI) algorithms in the software layer.

The theoretical and practical foundations of this proposed system are based on "ELMAS's Theory of Thermodynamics", the "5th Law of Thermodynamics", and "Bio-Robotic Resonance" approaches, which blend human physiology with engineering principles, introduced

to the literature by Asst. Prof. Dr. Emin Taner Elmas. This interdisciplinary vision, which treats the human body as a complex and dynamic "bio-machine", brings a new dimension to the applications of dual-phase heat transfer mechanisms in medical technology. Within the scope of the developed framework, the water-graphene nano-fluid micro-heat pipes with a diameter of 0.8-1.2 mm positioned at the tip of the robotic arm (end-effector) passively remove excess heat from the surgical bed within milliseconds without requiring an external energy source, or protect healthy neurons by creating a dynamic thermal isolation barrier along the cryoprobe shaft. Simultaneously, the embedded AI engine, which incorporates Elmas's thermodynamic equations into its core software, processes instantaneous temperature and heat flux data coming from micro-sensors to present the surgeon with a live thermal map (Thermal Overlay) on a 3D screen and autonomously activates haptic brake (fail-safe) protocols that prevent the surgeon from making mistakes at critical thresholds.

In this paper, the micro-hardware optimization, software, and AI architecture of the proposed intelligent thermal management system will be detailed; a 5-step experimental validation protocol extending from computerized modeling to preclinical human simulation will be presented for the system's verification. In light of the findings obtained, it will be discussed how Dr. Elmas's medical thermodynamics and bio-engineering studies form a strong academic and technical foundation for future AI-supported and tissue-sensitive safe robotic surgery platforms. [1-111]

Method, Findings and Discussion

The interdisciplinary studies of Asst. Prof. Dr. Emin Taner Elmas in the fields of medical technique and bio-engineering can be directly used in and contribute to robotic surgery technologies at both theoretical and practical levels. The approaches of Dr. Elmas, who is a senior mechanical engineer and an expert in energy transfer and thermodynamics, treating the human body as a "bio-machine", hold significant potential for the hardware and software development of surgical robots. The main areas where his work can be integrated into robotic surgery are as follows: [1-111]

Bio-Robotic Resonance and Precision Control Algorithms

The "Bio-Robotic Resonance" and frequency-resonance adjustment theories developed by Emin Taner Elmas on cancer and other chronic diseases can be adapted to the operating principles of surgical robots. Use in Robotic Surgery: This theory can be utilized in developing intelligent control algorithms that dynamically optimize the force and precision (haptic feedback) applied by robotic surgical arms while touching tissue according to the natural vibration frequency of the tissue.

Medical Heat Pipes and Thermal Management Systems

Dr. Elmas has studies on the applications of medical heat pipes in medical technique within the framework of the "5th Law of Thermo-

dynamics” and the “ELMAS Thermodynamic Theory”. Use in Robotic Surgery: These thermodynamic approaches can be directly utilized in designing critical micro-cooling and precision thermal management systems at the tips of energy-generating and heat-emitting surgical instruments such as lasers, electrocauteries, or cryoprobes used in robotic surgery systems. In this way, thermal damage to healthy tissues during surgery can be prevented.

Bionic and Bio-Mechanical Modeling

The author has mechanics-oriented studies such as hip prosthesis bio-mechanics, artificial heart designs, and transtibial prosthesis analyses for runners. Use in Robotic Surgery: These bio-mechanical modelings can form a fundamental input in the design of mechanical joints of robotic surgery consoles and patient-side modules that are fully compatible with human anatomy and possess higher mobility (degrees of freedom).In summary; Emin Taner Elmas’s Medical Thermodynamics and bio-engineering studies, which adapt engineering principles to human physiology, offer a strong academic and technical infrastructure for the development of future artificial intelligence-supported, more tissue-sensitive, and thermally safer robotic surgery systems. The engineering approaches developed by Asst. Prof. Dr. Emin Taner Elmas on heat pipes and dual-phase heat transfer mechanisms can be directly used in the thermal management of robotic surgery systems, cooling of precision surgical instruments, and cryosurgery applications. The medical heat pipes examined by Dr. Elmas within the framework of the ELMAS Thermodynamic Theory and the 5th Law of Thermodynamics can be integrated into the following critical areas in robotic surgery: [1-111]

Thermal Management of Robotic Surgical Tips (End-Effector): Lasers, ultrasonic cutters, or high-frequency electrocauteries used in robotic surgery generate intense heat during operations.

- **Passive Cooling:** The feature of heat pipes to remove heat

from the sensitive region passively (without needing an external energy source) prevents the tip portions of robotic arms from overheating.

- **Tissue Safety:** The dissipation of excess generated heat to healthy tissues is prevented, thereby increasing surgical precision and patient safety.

Cryosurgery and Cryoprob Efficiency: The dual-phase heat transfer systems addressed by Dr. Elmas within the scope of his Medical Heat Pipes Study play an active role in cryosurgery operations.

- **Precise Temperature Control:** The execution of instantaneous and controlled cooling/heating cycles by cryoprobes on the target tumor or diseased tissue can be optimized with heat pipe technology.
- **Robotic Integration:** Cera-surgical safety can be maximized by maximizing the thermal conductivity coefficient of flexible or mini cryoprobes managed from the robotic surgery console.

Compact and Lightweight System Design: Robotic surgical arms have strict weight and volume constraints; heavy cooling mechanisms restrict the mobility of robotic arms.

- **Micro-Scale Solutions:** Heat pipes designed at the micro-scale provide high thermal conductivity without bringing an additional load to the joint structure of robotic arms.
- **Device Lifespan:** Keeping internal electronic components and motor drivers at optimum temperature reduces the risk of failure and extends the lifespan of robotic systems.

The thermodynamic approaches and medical heat pipe theory of Asst. Prof. Dr. Emin Taner Elmas can radically increase the efficiency and safety of both high-temperature-producing laser cutting systems and ultra-low-temperature-operating cryoprobes in robotic surgery.

Table 1: Robotic Surgery Heat Pipe Integration: Laser vs. Cryoprob.

Criterion	Laser Cutting Systems (High Heat Management)	Cryoprob Systems (Extreme Cold Management)
Core Task	Passively removing and dissipating high heat at the surgical tip.	Providing instantaneous heat transfer to quickly freeze and controllably thaw target tissue.
Critical Gain	Preventing the burning of healthy tissues (thermal necrosis).	Fixing the tumor boundary sharply without causing freezing damage to surrounding tissues.
Fluid Selection	Water or special nano-fluids suitable for high temperatures.	Phase change of liquid nitrogen, argon, or helium suitable for cryogenic temperatures.

How heat pipes can be integrated into two opposite thermal poles is summarized in the table and detailed analysis below:

Integration with Laser Cutting Systems (Heat Dissipation and Tissue Protection): Fiber optic lasers integrated into the tips of surgical robots can generate local heat reaching thousands of degrees Celsius while cutting or burning tissue. The ultra-high thermal conductivity of heat pipes comes into play at this point: [1-111]

- **Prevention of Peripheral Thermal Damage:** Healthy tissues right next to the point hit by the laser beam can be damaged due to radiation and heat dissipation. Micro-heat pipes to be placed at the very tip of the robotic arm (end-effector) absorb this excess heat away from the surgical bed within milliseconds.
- **Continuous Focusing and Lens Safety:** Optical lenses in

the laser head can expand due to heat and disrupt the surgical focus. Heat pipes keep the lens periphery at a stable temperature, allowing the robot to make micro-level precise cuts throughout the surgery.

- **Miniaturization (Scaling Down):** Traditional water-cooled laser lines require thick hoses and restrict the degrees of freedom (mobility) of the robotic arm. The closed-circuit passive heat pipes in Elmas's theory perform cooling without loading extra volume or weight onto the robotic arm.

Integration with Cryoprob Systems (Ultra-Fast Volumetric Freezing): Cryosurgery aims to destroy diseased or tumor tissues by freezing them between -40°C and -160°C . Heat pipe technology provides the following advantages in cryoprobe managed by robotic arms:

- **Superconducting Heat Extraction:** To destroy cells, the freezing process must occur very rapidly (in slow freezing, cells can protect themselves). Heat pipes performing dual-phase heat transfer extract heat from the target tissue at tremendous speed, creating instantaneous shock freezing cycles (freeze-thaw cycles).
- **Dynamic Thermal Shaft Isolation:** Only the very tip (needle) of the cryoprobe needs to be freezing, while the healthy organ pathways through which the probe passes must remain warm. Heat pipes act as an "intelligent heat barrier" by creating reverse thermal gradients along the probe shaft. Thus, only the tumor targeted by the robot freezes; the entry path is not damaged.
- **Rapid Thawing Mode:** After the tumor is frozen, the tip must be warmed rapidly for the probe to separate safely from the tissue. Thanks to the bidirectional operating capability of the heat pipe (interchanging roles of evaporator and condenser), the tip is brought to thawing temperature within seconds with a micro-heating signal sent from the robot.

Conclusion and Synergy

Within the framework of Dr. Emin Taner Elmas's bio-engineering vision, these two systems can be combined into a single "Hybrid Robotic Surgery Platform". The robot can cut and clean the tumor with a laser within the same surgical operation while freezing microscopic cell remnants at the border zones with a cryoprobe. Thermal stability at both ends will be provided by micro-heat pipes based on Elmas's theory. Integrating thermal management hardware (heat pipes) with the artificial intelligence (AI) and control software of surgical robots elevates operations to the level of "autonomous thermal safety". Dr. Emin Taner Elmas's Bio-Robotic Resonance and intelligent system approaches can serve as a bridge in transferring real-time data from physical heat pipes to software algorithms. This integration provides

surgical robots with the following AI-supported capabilities during laser cutting and cryoprobe processes: [1-111]

AI-Supported "Thermal Prediction" and Automatic Speed Adjustment

During laser cutting or cryoprobe freezing, the rate of heat dissipation changes according to the type of tissue (fat, muscle, liver, etc.).

- **Algorithm Operation:** Micro-sensors on the heat pipes measure the heat transfer rate at the level of nanoseconds and transmit it to the software.
- **Software Action:** Artificial intelligence predicts that the tissue will overheat or the wrong area will freeze before the damage even occurs. If thermal limits are approached, the robot software automatically reduces the power of the laser or millimetrically slows down the movement speed (cutting tempo) of the robotic arm.

Real-Time "Digital Twin" and Thermal Mapping

A software layer is created on the screen of the surgical robot that shows thermal changes that the surgeon cannot see with the naked eye.

- **Algorithm Operation:** Dr. Elmas's thermodynamic equations are embedded into the robot software (embedded software), simulating fluid movements in the evaporator (vaporizer) and condenser (liquefier) regions of the heat pipe.
- **Software Action:** A live "Thermal Map" (Thermal Overlay) appears on the organ on the surgery screen. Artificial intelligence shows the surgeon how close the laser or cryoprobe is to the healthy cell border (e.g., a critical vessel) using color codes (Red: Danger, Blue: Safe) and locks the robotic arm if necessary.

Intelligent Resonance Control and Fluid Flow Rate Optimization

The capillary structure (wick) and phase-changing fluid inside the heat pipes operate with the highest efficiency at certain resonance frequencies.

- **Algorithm Operation:** In accordance with Dr. Elmas's "Bio-Robotic Resonance" theory, the mechanical vibrations of the robot and the thermal oscillations of the fluid inside the heat pipe are software-synchronized.
- **Software Action:** The robot software optimizes the operating frequency of the surgical instrument at the micro-level, preventing the fluid inside the heat pipe from drying out (dry-out). Thus, even in the most challenging and long-lasting tumor operations, cooling/freezing performance continues with zero loss.

Autonomous Cryogenic Cycle Management (Freeze-Thaw)

In cryoprobe operations, the correct “Freeze-Thaw” cycle is critical for the complete destruction of the tumor.

- **Algorithm Operation:** Machine learning models processing feedback (haptic and thermal feedback) from the heat pipe detect exactly at which second the tissue transitions into a crystallized (ice) form.
- **Software Action:** The robot resets human error, stopping the volume of the ice-ball right at the tumor boundary. As soon as the process finishes, it switches to autonomous thawing mode by reversing the flow direction of the heat pipe with software valve controls. In summary; thanks to this integration, the surgical robot ceases to be just a mechanically moving device; it turns into an AI-powered thermal protection shield that feels and interprets heat, preventing the surgeon from making mistakes. The holistic system architecture combining the hardware capabilities of heat pipes with intelligent software and the design of the thermal interface (UI/UX) that the surgeon will see during the operation are as follows: [1-111]

Software Architecture and Data Flow Diagram: The system is based on a layered software architecture that processes capillary movements and temperature gradients inside the heat pipe within milliseconds.

[Hardware Layer]  Micro-Sensors (Heat pipe evaporator and condenser tips)

[Core Software]  “ELMAS Thermodynamic Engine” (Solution of heat transfer equations)

[Artificial Intelligence / AI]  Predictive Algorithms (Tissue type recognition & Overheating/freezing prediction)

[Control Mechanism]  Motor Drivers (Laser Power limitation / Cryoprob Flow Valve / Haptic Brake)

[User Interface]  Surgeon Console (HUD Screen & Haptic Vibration)

Surgeon Console Screen (UI/UX) Design: The surgeon’s main 3D surgery screen is enriched with critical thermal layers (HUD - Heads-Up Display), similar to Medical UI Interfaces or advanced da Vinci 5 Intelligent UI systems of conventional surgical robots. The screen consists of 4 main dynamic zones:

Center Zone: Live Thermal Overlay

- **In Laser Mode:** A circular heat map is drawn on the tissue according to data from the heat pipe, centering on the point touched by the laser tip. This map is updated dynamically as the heat pipe extracts heat. Tissues within the safe limit are shown in green, those starting to heat up in yellow, and re-

gions approaching the critical threshold (e.g., 60°C thermal necrosis limit) as flashing transparent red.

- **In Cryoprob Mode:** The volume of the formed ice-ball inside the organ is modeled in 3D. Areas where the tumor is 100% frozen are bordered in dark blue, while surrounding healthy tissues not targeted but at risk are bordered with a light blue contour.

Left Panel: Heat Pipe Status Monitor (Heat Pipe Telemetry)

- **Evaporator / Condenser Temperature Graph:** The instantaneous temperature difference (ΔT) between the end of the heat pipe in the surgical bed and the cooling end behind the robotic arm flows as a linear graph. The excessive steepening of the graph informs the surgeon that the heat pipe is approaching its maximum capacity (dry-out point).
- **Fluid Efficiency Index:** There is a bar ranging from 0% to 100% showing the stability of the phase change inside the pipe, based on Elmas’s resonance theory.

Right Panel: AI Safety Assistant (AI Safety Panel)

- **Tissue Profiler:** Artificial intelligence analyzes the density of the tissue being cut at that moment: “Detected Tissue: Liver Parenchyma - Heat Dissipation Coefficient: Nominal”.
- Autonomous Status Notifications:
-  “WARNING: 1.2 mm left to healthy tissue border. Heat pipe evacuation capacity 85%.”
-  “LOCK active: Laser power reduced by 30% for thermal protection purposes.”

Bottom Panel: Instrument Control Bars:

- **For Laser:** Power (Watt), Pulse Frequency (Hz), and Heat Pipe Return Temperature.
- **For Cryoprob:** Gas Pressure (Argon/Helium) and Autonomous Cycle Counter (“Cycle 1/2: Freezing Phase - Remaining Time: 45 sec”).

Haptic Feedback and Safety Protocols (Fail-Safe): The system does not just remain as visual warnings; it sends physical feedback to the control handles (master controllers) in the surgeon’s hand: [1-111] Haptic Hardening (Thermal Wall): If the heat pipe capacity is exceeded during laser cutting and the temperature of the surrounding tissue reaches the critical limit, the control arms in the surgeon’s hand harden (apply resistance) in a way that prevents them from being moved forward. The surgeon cannot physically go further and burn the tissue. Autonomous Retraction: In cryoprob applications, the moment the ice-ball reaches the tumor boundary previously marked by the surgeon, the software cuts the gas flow in less than a tenth of

a second, switches the heat pipe to “thawing mode,” and automatically retracts the robotic arm to a safe distance of 1 mm. Brain Surgery (Neurosurgery) is the area where this AI-powered and heat-piped thermal management system will be most critical and life-saving. Brain tissue is one of the organs most sensitive to temperature changes in the body. Temperatures of 43°C and above lead to permanent damage and loss of function in brain cells (neurons). The laser cutting and cryoprobe applications of the developed system in brain tumor operations (neuro-oncology) take place as follows:

Thermal Protection and Laser Cutting in Brain Tumor Resection: During the removal of tumors close to the brainstem or critical motor centers using lasers (e.g., CO₂ or Nd:YAG lasers), the risk is extremely high.

- **Micro-Heat Piped Surgical Curette:** The periphery of the laser cutting instrument at the tip of the robotic arm is wrapped with micro-heat pipes as thick as a strand of hair. While the laser vaporizes the tumor (ablation), the high thermal energy released is instantly absorbed by these pipes.
- **Protection of Healthy Neurons:** The dissipation of heat sideways (thermal dissipation) in brain tissue is prevented. While the AI interface shows the surgeon the boundary of the speech or movement center millimetrically, the autonomous control mechanism keeps the temperature of the brain tissue within a stable range of 37°C to 38°C.
- **Optical Precision:** Cerebrospinal fluid (CSF) or blood leakage can contaminate or overheat the laser lens. The heat pipe system keeps the instrument head cold, reducing fogging and tissue adhesion on the lens to zero.

Cryoprob in Deep-Seated Tumors (Neuro-Cryosurgery):

The system is groundbreaking in destroying tumors in the depths of the brain (e.g., thalamus or hypothalamus regions) that cannot be reached by conventional surgery, by freezing them.

- **Precise “Ice-Ball” Control:** When performing cryosurgery in the brain, the ice-ball must not exceed the tumor boundary even by 1 millimeter; otherwise, the patient may be paralyzed. AI calculates the freezing rate inside the brain tissue instantaneously using Dr. Elmas’s thermodynamic models.
- **Intelligent Shaft Isolation:** While the cryoprobe enters through the cerebral cortex to reach the deep tumor, it must not damage the healthy brain pathways it passes through. The heat pipe keeps the body (shaft) of the probe stable at body temperature (37°C), while dropping only the needle tip inside the tumor to -80°C. Neural networks along the passage path are fully preserved.

Neuro-Interface (HUD) Screen on the Surgeon Console:

During brain surgery, the surgeon’s 3D microscope/console screen is updated as follows:

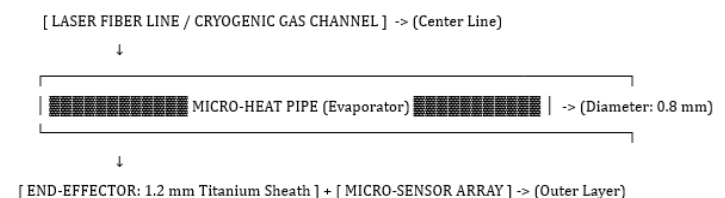
- **MR/CT Fusion Thermal Map:** The brain MR taken before the surgery is loaded into the robot software. AI combines this MR with data coming from the heat pipe. The surgeon sees live on a colorful tractography (nerve pathways) map how much heat or cold any nerve pathway (e.g., the optic nerve) is exposed to in the background while cutting the tumor.
- **“Critical Area” Alarm:** If the laser or cryoprobe comes too close to the main arteries supplying the brain, the AI Assistant on the right panel of the screen flashes to warn the surgeon:  “WARNING: 0.8 mm to Arteria Cerebri Media boundary. Thermal barrier active.”

Neurosurgery-Specific Haptic Safety (Fail-Safe) Protocol:

Autonomous Braking (Thermal Lock): While the surgeon cleans the tumor with the console in hand, if the evacuation capacity limit of the heat pipe is exceeded or if the brain tissue momentarily reaches 40°C, the robot software locks the steering arm in the surgeon’s hand within milliseconds. The robot does not allow the surgeon to make a deeper cut even at the micron level, turns off the laser, switches the heat pipe to maximum cooling mode, and waits for the brain to return to its own temperature. [1-111]

Conclusion

Transition from engineering theory to clinical life: The micro-hardware design and clinical simulation stages required to apply Dr. Emin Taner Elmas’s medical heat pipes and bio-robotic approaches to brain surgery are detailed below: [1-111]



Ultra-Thin Diameter Technology (0.8 - 1.2 mm):

- The outer diameter of the cutting instrument at the tip of the robotic arm is optimized to be at most 1.2 mm.
- The micro-heat pipe inside is a flexible copper-titanium or graphene alloy tube with a thickness of 0.8 mm.

Capillary Structure (Wick Structure) and Nano-Fluid Selection:

- In brain surgeries, the robot arm constantly changes angles. To operate independently of gravity, the inside of the heat pipe is coated with sintered copper powder micro-capillaries.
- Water-graphene nano-fluids, whose heat transfer rate is 40% higher than normal water and provide full compliance with Elmas’s theory, are used as the fluid.

Flexible Joint Integration:

- To enable the robot to move within the curves of the brain, the heat pipes are designed as flexible bellows. Thus, even if the robotic wrist is bent 90 degrees, phase change and heat transfer inside are not interrupted.

Clinical Simulation Stages (5-Step Verification)

The system must pass a rigorous testing process before it can enter the operating room and the AI software can correctly protect the brain.

[STEP 1] → [STEP 2] → [STEP 3] → [STEP 4] → [STEP 5]

Computerized Synthetic Gel Ex-Vivo Tissue In-Vivo Animal
Pre-Clinical

Thermal Model Laboratory Tests Experiments Human
Simulation

Step 1: Computerized Thermal Modeling (Numerical Simulation)

- Process:** Dr. Elmas's thermodynamic equations are transferred to ANSYS Fluent or COMSOL software.
- Purpose:** The heat dissipation that the laser will create in the brain tissue and the ice-ball volume of the cryoprobe are simulated in a computer environment. The AI's "thermal prediction controller" is trained with this digital data.

Step 2: Synthetic Gel Laboratory Tests (Phantom Gel)

- Process:** Ballistic agarose gel molds that 100% mimic the thermal and mechanical properties of the human brain are prepared.
- Purpose:** The robotic arm enters the gel. The laser is fired and the cryoprobe is operated. The time it takes for the heat pipe to evacuate heat is measured with millisecond precision using fiber optic thermocouples placed inside the gel. The AI's "live colorful heat map" is calibrated on the interface.

Step 3: Ex-Vivo Tissue Tests (Organic Verification)

- Process:** Tests are performed on fresh bovine brain tissues obtained from slaughterhouse animals.
- Purpose:** Thermal damage boundaries are determined in real cellular structures. Post-operative tissues are examined under a microscope (histological analysis) to prove whether the heat pipe reduces thermal necrosis (cell death) to zero.

Step 4: In-Vivo Animal Experiments (Live Blood Flow Effect)

- Process:** Studies are conducted under anesthesia on ethically-approved live animal models (usually pig or sheep brain

structures).

- Purpose:** Blood flow (perfusion) in live tissue is like a cooling tower that naturally dissipates heat. The system updates AI algorithms by taking the thermal effects of blood flow into account. The accuracy of haptic safety locks (the robot's reflex to stop the surgeon) in a live subject is tested.

Step 5: Pre-Clinical Human Simulation (Cadaver & VR)

- Process:** A surgeon sits at a real console. The robot is used by wearing virtual reality (VR) glasses or on medical cadavers.
- Purpose:** Whether the interface (HUD) tires the surgeon (cognitive load), the clarity of warnings, and the compliance of haptic feedbacks with the surgeon's hand sensation are tested one last time, making the surgical robot ready for surgical operations. [1-111]

References

- Elmas, Emin Taner (2020) ELMAS's Theory of Thermodynamics": A Scientific Approach for 5th Law of Thermodynamics -A Theoretical Application Example for Medical Thermodynamics. Op Acc J Bio Sci & Res 2(1).
- Emin Taner ELMAS (2024) Medical Treatment Method of Alzheimer's Disease & Parkinson's Disease by the Help of the Natural Musical Sound of Nây-ı Şerif, Instrument of Ney (Ney: Turkish Reed Flute, Nay). IJCMCR 42(3): 004.
- Elmas Emin Taner (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" developed for the "Treatment of Covid-19, Coronavirus and Virus Infections". Open Access Journal of Biogener Science and Research (BGSR) 1: 1.
- Elmas Emin Taner (2020) Scope of Applications for Medical Technique at Science and Engineering, Open Access Journal of Biogener Science and Research (BGSR), Op Acc J Bio Sci & Res 1: 1.
- Emin Taner ELMAS (2024) System Design and Development of a Novel Unique Neuro-Physical Medical Treatment Method for SMA-SPINAL MUSCULAR ATROPHIA-Disease and for Similar Neurological Muscle Diseases. Herculean Res 4(1):90-97.
- Fevzi Daş, Emin Taner Elmas and İhsan Ömür Bucak (2024) Book Chapter: Innovative Use of Machine Learning-Aided Virtual Reality and Natural Language Processing Technologies in Dyslexia Diagnosis and Treatment Phases; From the Edited Volume Digital Frontiers - Healthcare, Education, and Society in the Metaverse Era; Written By Fevzi Daş, Emin Taner Elmas and İhsan Ömür Bucak, DOI: 10.5772/intechopen.1006621, IntechOpen Limited, UNITED KINGDOM; indexed in the Book Citation Index in Web of Science™ Core Collection (BKCI)
- Emin Taner ELMAS (2024) Design of Bionic Eye and Artificial Vision System; a Unique Project "Mobile Bio-Eye-Tronic System". Herculean Res 4(1):97-100.
- Emin Taner ELMAS (2024) Project for "Amphibious Mobile Snow Track Ambulance" for Healthcare System. Am J Biomed Sci & Res 22(4).
- Emin T Elmas, İhsan Ö Bucak (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.

10. Emin T E, İhsan Ömür B (2024) FM Modulated Smart Drug Algorithm for the treatment of Cancer Cells. In *Global Journal of Research in Medical Sciences* 4(1): 1-6.
11. Emin Taner ELMAS (2023) Prototype Design, Production and Functioning of a Portable (Movable), Home-Type (Domestical) Hemodialysis Machine (Unit). In *Global Journal of Research in Medical Sciences* 3(6): 11-12.
12. Elmas Emin Taner (2019) Thermodynamical Balance Associated with Energy Transfer Analysis of the Universe Space as a Pressure Vessel Analogy. *Journal of Applied Sciences*, Redelve International Publications (1): RDAPS- 10002.
13. Elmas Emin Taner (2017) Productivity and Organizational Management (The Book) (Chapter 7): Prospective Characteristics of Contemporary Engineer (By the Approach of Mechanical Engineering) Contribution and Role of the Mechanical Engineer to the Organization Management and Productivity. Machado Carolina, Davim J Paulo (Eds.), DEGRUYTER, Walter de Gruyter GmbH, Berlin / Boston, Spain (ISBN:978-3-11-035545-1).
14. Elmas Emin Taner (2017) Prospective Characteristics of Contemporary Engineer (By the Approach of Mechanical Engineering) Contribution and Role of the Mechanical Engineer to the Organization Management and Productivity). DeGruyter, Germany.
15. Emin Taner Elmas (2024) Design of Bio-Artificial Liver Organ. *J Biomed Sci Biotech Res* 2(3): 1-4.
16. ELMAS ET (2024) Design of Bionic Ear-Cochlear Implant and Artificial Hearing System; a Unique Project "Mobile Bio-Ear-Tronic System". *Journal homepage* 4(02).
17. Emin Taner ELMAS, Levent OĞUL (2025) The Effects of Medicine and Music Therapy Practices on Human Health. *IJCMCR* 50(2).
18. Emin Taner E, Servet K (2025) Biomechanical Analysis of Transtibial Prosthesis Designed for Runners. *Biomedical and Clinical Research Journal* 1(2).
19. Emin Taner ELMAS, Yavuz ORUÇ (2026) A Novel Mobile Bio-Eye-Tronic System Based on the Elmas's Thermodynamic Theory for Cataract Disease. *Studies in Science of Science* 44(2): 1003-2053.
20. ET Elmas, MA Cinibulak (2025) Fundamental Scientific and Technical Issues related with the "Hip Replacement Design and Biomechanical Analysis". *Journal of Material Science and Nanotechnology* 1(1): 101.
21. ELMAS Emin Taner, KUNDURACIOĞLU I (2025) A Model for Second Law of Thermodynamics, Relationship between Health, Disease, Aging, Death Processes and Consciousness, Nervous System and Time. In *Global Journal of Research in Medical Sciences* 5(2): 1-6.
22. ELMAS Emin Taner, KUNDURACIOĞLU I (2025) Metabolic Heat Production with Energy Transfer and Laws of Human Thermodynamics: The Energy Balance of the Human Body. In *Global Journal of Research in Medical Sciences* 5(2): 7-14.
23. Elmas ET, Kunduracioğlu I (2025) Artificial Heart Design and Biomechanical Analysis. *Open Access Journal of Medicine and Healthcare Research Article* 1(1): 01-06.
24. ELMAS Emin Taner, KUNDURACIOĞLU I (2025) Fundamentals of Human Vision System. In *Global Journal of Research in Medical Sciences* 5(2): 103-117.
25. ET Elmas (2025) Kitchen Hood Design & Manufacturing Project 3D Modeling, Engineering Calculations, and Technical Drawings for Igdir University Medico Social Building Dining Hall". *Matsci Nano J* 1(1): 102.
26. Emin Taner ELMAS, İsmail KUNDURACIOĞLU (2025) Signal Transduction System in Neurons. *International Journal of Research in Medical and Clinical Sciences* 3(1): 26-35.
27. Emin Taner ELMAS, İsmail KUNDURACIOĞLU (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.
28. Emin Taner ELMAS, İsmail KUNDURACIOĞLU (2025) Medical Structure of the Human Respiratory System. *International Journal of Research in Medical and Clinical Sciences* 3(1): 50-63.
29. Emin Taner ELMAS, İsmail KUNDURACIOĞLU (2025) Medical Structure and Hemodynamics of the Human Circulatory System. *International Journal of Research in Medical and Clinical Sciences* 3(1): 64-81.
30. Emin Taner ELMAS, İsmail KUNDURACIOĞLU (2025) General Aspects of Advanced Biomechanics. *Biomed J Sci & Tech Res* 61(5).
31. Emin Taner Elmas, İsmail KUNDURACIOĞLU (2025) Conservation Laws and the Main Physical Parameters for Advanced Biomechanics. *Biomed J Sci & Tech Res* 61(5).
32. Emin T Elmas, M Şimşek (2025) Bionic Prosthetic Robotic Artificial Hand Design and Biomechanics Analysis. *Journal of Medical Discoveries* 2(1).
33. ELMAS ET (2025) Prosthetics, Artificial Limbs, Implants and Their Biomedical Applications. *J Surg* 10: 11365.
34. ELMAS ET (2025) An Introduction to Electrophysical Properties of the Human Heart. *J Surg* 10: 11364.
35. Elmas ET (2025) A Brief Information about Cataract Operation. *European Journal of Science and Modern Technologies* 1(2): 61-66.
36. ELMAS, Emin Taner (2025) A Brief Information about Blood Sugar and Diabetes Management. In *ICON Journal of Applied Medical Sciences* 1(1): 1-5.
37. Emin Taner Elmas, I Kunduracioglu (2025) An Introduction to the Medical Body Mechanics and Human Muscles. *Journal of Medical and Clinical Case Reports* 2(1).
38. Emin TE, İsmail K (2025) Elastomechanics Fundamentals for Bones and Fractures. *Ann Biotech & Biomed Sci* 1(1): 1-12.
39. Emin Taner ELMAS, Yavuz ORUC (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): 01-07.
40. Emin Taner ELMAS (2024) System Design and Development of a Novel Unique Neuro-Physical Medical Treatment Method for SMA- Spinal Muscular Atrophy Disease and for Similar Neurological Muscle Diseases. *Collect J Neurol* 1: ART0037.
41. Emin Taner ELMAS (2024) Design of Bionic Eye and Artificial Vision System; a Unique Project "Mobile Bio-EyeTronic System". *Collect J Robotics AI* 1: ART0038.
42. Elmas, Emin Taner (2025) Productivity and Organizational Management; Management Tools, Human Resource Management, Contemporary Engineers (The Book), (2nd Edn.), (Chapter 8): Prospective Characteristics of Contemporary Engineer (By the Approach of Mechanical Engineering) Contribution and Role of the Mechanical Engineer to the Organization Management and Productivity. Machado Carolina, Davim J Paulo (Eds.), DEGRUYTER, Walter de Gruyter GmbH, Berlin / Boston, (ISBN:978-3-11-914732-3)
43. Elmas Emin Taner (2025) Prospective Characteristics of Contemporary Engineer (By the Approach of Mechanical Engineering) Contribution and Role of the Mechanical Engineer to the Organization Management and Productivity). DeGruyter, Germany.
44. Emin TE, M Şimşek (2025) Bionic Prosthetic Robotic Artificial Hand Design and Biomechanics Analysis. *Journal of Medical Discoveries* 2(1).

45. Emin Taner ELMAS, Servet KAYA (2025) The Effect of Eye and Vision on the Body's Balance System. *Biomed J Sci & Tech Res* 61(5).
46. Emin Taner ELMAS, Murat SIMSEK, "A Novel Unique Neuro-Physical Medical Treatment Method for SMA – Spinal Muscular Atrophy Disease, Paralyzed Patients, ALS patients, MPS, SSPE, DMD Patients and for Similar Neurological Muscle Diseases", *Universal Library of Medical and Health Sciences*, 2025; 3(3): 32-52.
47. Emin Taner ELMAS, Thermodynamic and Mathematical Model of Human Brain for Neurodegenerative Diseases; Alzheimer's Disease (AD) Parkinson's Disease (PD) and Amyotrophic Lateral Sclerosis (ALS) *International Journal of Science, Engineering and Technology*, 2026, 14:1.
48. Emin Taner ELMAS, The Exploration of Alzheimer's Disease, along with other Neurodegenerative Disorders like Parkinson's and ALS, through the lens of Thermodynamics and Physical Sciences involves conducting a Thermodynamic Analysis of Alzheimer's including the Potential Connections between Treatment methods and the Therapeutic Effects of Musical Sound Frequencies produced by instruments such as the Nây-ı Şerîf, Instrument of Ney (Ney: Turkish Reed Flute, Nay) and others, *Gongcheng Kexue Xuebao* || Volume 11, No.02, 2026 || ISSN 2095-9389
49. Emin Taner Elmas (2025) "Applied Medi-Brain Energy-Tronic Treatment Method" for the Medical Treatments of SMA – Spinal Muscular Atrophy Disease, Paralyzed Patients, ALS Patients, MPS, SSPE, DMD Patients with the Biomechanical Analysis of Bionic Prosthetic Robotic Artificial Hand Design. *Journal of Engineering and Applied Sciences Technology* 7(12).
50. ELMAS ET (2026) Scientific and Technical Introduction to - "Applied Medi-Brain Energy-Tronic Treatment Method"- which is a Novel and Unique Physiological, Neuroengineering and Neuroscientific Medical Treatment Method for SMA – Spinal Muscular Atrophy Disease, Paralyzed Patients, ALS patients, MPS, SSPE, DMD Patients and Other Similar Neurological Diseases. *J Psychol Neurosci* 8(1): 1-19.
51. ELMAS ET (2026) Thermodynamics and Energy Transfer in Medicine Applications with Archaeomusicology and Music Therapy, *Studies in Science of Science* 44(1): ISSN:1003-2053.
52. Emin Taner ELMAS, Ibrahim DAĞ (2026) The Study of Alzheimer's Disease and Similar Neurodegenerative Diseases such as Parkinson's and ALS within the Framework of Thermodynamics and Physical Sciences, Presentation of a Thermodynamic Analysis of Alzheimer's Disease, and Investigation of How Treatment Can Be Related to the Musical Sound Frequencies Produced by the Ney and Other Instruments (The study of Alzheimer's Disease and similar neurodegenerative diseases such as Parkinson's and ALS within the framework of Thermodynamics and Physical Sciences, the presentation of a thermodynamic analysis of Alzheimer's Disease, and the investigation of how the treatment can be related to the musical sound frequencies produced by the ney and other instruments); *Studies in Science of Science* | ISSN:1003-2053 [https://sciencejournal.re/44\(1\)](https://sciencejournal.re/44(1)).
53. Emin Taner ELMAS (2026) Evaluation and Analysis of Medical Technique Application Areas in Science and Engineering from the Perspective of the Turkish Economy, *Journal of Xidian University* ISSN No:1001-2400, 20(1).
54. Emin Taner ELMAS (2026) Thermodynamic Energy Transfer Modeling of Neurodegeneration with the ELMAS's Theory of Thermodynamics which is the Main Scientific Approach for 5th Law of Thermodynamics. *Research Paper* 8(3): 1-22.
55. Editor: Assoc. Prof. Dr. Ahmet Beyzade Demirpolat, Author: Emin Taner Elmas - Next-Generation Technologies in Mechanical Engineering: 4.
56. Editor: Assoc. Prof. Dr. Ahmet Beyzade Demirpolat, Author: Emin Taner Elmas - Next-Generation Technologies in Mechanical Engineering: 5.
57. Emin Taner ELMAS (2026) Multifaceted Holistic Medical Health Engineering Combined with Science and Art. *International Journal of Research in Medical and Clinical Sciences* 4(1): 91-102.
58. Emin Taner ELMAS (2026) *Kitap: Bilim ve Sanat ile Çok Yönlü Bütüncül Yaklaşım*. ISBN: 978-625-382-263-7, E-ISBN: 978-625-382-264-4 Vizetek Yayıncılık, Ankara.
59. Emin Taner Elmas (2026) Cancer Medical Treatment in Conjunction with the ELMAS's Theory of Thermodynamics which is the Main Scientific Approach for 5th Law of Thermodynamics. *Journal of Nanosciences Research & Reports* 8(2): 1.
60. Emin Taner Elmas (2026) Adaptation of AI Simulation Integrated Artificial Heart and Cardiology Applications with ELMAS's Theory of Thermodynamics, which is the Main Scientific Approach to the 5th Law of Thermodynamics. *J of Card Vas Insights* 2(2): 01-14.
61. Emin Taner Elmas (2026) Adaptation of AI Simulation Integrated Artificial Heart and Cardiology Applications with ELMAS's Theory of Thermodynamics, which is the Main Scientific Approach to the 5th Law of Thermodynamics. *J of Card Vas Insights* 2(2): 01-14.
62. Emin Taner Elmas (2026) "Medical Heat Pipes" - "Heat Pipe Applications in Medical Technique" on the Basis of "Elmas's Theory of Thermodynamics and 5th Law of Thermodynamics. *Journal of Engineering and Applied Sciences Technology* (8): 352.
63. Emin Taner Elmas (2026) Traditional Diagnostic Methods of Alzheimer's Disease and Evaluation of Alzheimer's Diagnosis with Blood Tests. *International Journal of Research in Medical and Clinical Sciences* 4(1): 127-140.
64. Emin Taner ELMAS (2026) SCIENCE AND ART with a Multifaceted and Multidisciplinary Holistic Approach. *Vizetek Yayıncılık, Ankara* ISBN: 978-625-382-284-2, E-ISBN: 978-625-382-285-9.
65. Emin Taner Elmas (2026) ELMAS's "Energy-Tronic Medical Treatment Methods" based on the principles of Biomechanics and Neuro-Physics in connection with the Applications of BCI Brain-Computer Interface for Modeling of Neurological Diseases. *J. of Adv Clin Neu Res* 2(2): 01-17. *WMJ/JACNR*-120.
66. ELMAS ET (2026) DBS - Deep Brain Stimulation Application for Parkinson's Disease on the basis of ELMAS's EnergyTronic System. *J Sur & Surgic Proce* 4(2): 1-11.
67. ELMAS ET (2026) Engineering-Based Technological Transformation in Dentistry and Endodontics and its Impact on Türkiye's Competitiveness in the Health Tourism Market. *International Journal of Medical Science and Dental Health* 12(04): 84-92.
68. Emin Taner ELMAS (2026) "Application of ELMAS's Theory of Thermodynamics & 5th Law of Thermodynamics for Design and Optimization of ECMO (Extracorporeal Membrane Oxygenation) Machine and Life Support Units. " *International Journal of Clinical Case Reports and Clinical Reviews* 1(1).
69. Emin Taner ELMAS (2026) Diagnosis and Treatment of Internal Bleeding with "Medical Thermodynamics" which is the "Medicine of the Future". *Biomed J Sci & Tech Res* 65(3).
70. Emin Taner ELMAS. Design and Optimization of Mobile ECMO (Extracorporeal Membrane Oxygenation) Machine and Life Support Units. *International Journal of Research in Medical and Clinical Sciences*. 2026; 4(1): 156-166.
71. Emin Taner ELMAS, "-Pancreatic Cancer Diagnosis and Medical Teatment- "ELMAS Medi-Bio-Energy Tronic" Medical Device System Design Study for Pancreatic Cancer Diagnosis Working on the Principle of "ELMAS's Theory of Thermodynamics" and "5th Law of Thermodynamics" in Connection with Medical Teatment by FM Modulated Bio-Robotic Resonance and

- Thermodynamical Interaction", Universal Library of Medical and Health Sciences, 2026; 4(2): 21-44.
72. Emin Taner ELMAS, et al. (2026) AI-Enabled Bionic Eye and Artificial Vision System "AI – Enabled Mobile Bio-Eye-Tronic System" Based on the Scientific Framework of "Elmas's Theory of Thermodynamics". 02-26.
 73. Emin Taner ELMAS, Artificial Blood Model & Ideal "Super Blood" Model (Optimized Homeostasis) with "ELMAS's Theory of Thermodynamics and 5 th Law of Thermodynamics including Hemodynamic Principles. Jour of Clin Cas Rep, Med Imag and Heal Sci 14 (4)-2026.
 74. Emin Taner ELMAS (2026) Application of "ELMAS's Theory of Thermodynamics" & the "Fifth Law of Thermodynamics" Approach with "Bio-Robotic Resonance and Thermodynamic Interaction Method" for the Medical Diagnosis and Treatment of Colon Cancer (Colorectal Cancer). AJMCRR 5(5): 1-25.
 75. Emin Taner Elmas (2026) Life Support Units including ECMO Machine, Artificial Kidney (Dialysis), Artificial Liver, Artificial Pancreas, Artificial Lung (Advanced Oxygenator) Applications under a single ELMAS's Operating System with Integrated Life Support Software "Central Homeostasis Processor". J Recent Adv Nanomed & Nanotech 2(1): 555578.
 76. Emin Taner ELMAS (2026) "Engineering Design and Operational Analysis of Cardiopulmonary Bypass (CPB) Machines with the 5th Law of Thermodynamics and ELMAS's Theory of Thermodynamics". Universal Library of Medical and Health Sciences 4(3): 52-62.
 77. Emin Taner ELMAS (2026) "Designing a Next-Generation Smart Artificial Cornea from the Perspective of Bio-Robotic Resonance and Medical Thermodynamics: A Multidisciplinary Engineering Approach". Universal Library of Medical and Health Sciences 4(2): 45-57.
 78. Emin Taner Elmas (2026) Technical Design Study of a Mobile Portable (Movable), Home-Type (Domestical) Hemodialysis Machine Working as an Artificial Kidney. Journal of Internal Medicine Research & Reports 5(2): 155.
 79. ELMAS ET (2026) The Relationship and Treatment of Autoimmune Diseases, Particularly Thyroid Diseases, with Stress: Bio-robotic Resonance and Thermodynamical Interaction with Analogy of Frequency-Resonance Setting Formation Method and the Use of the 5th Law of Thermodynamics within the Scope of ELMAS's Theory of Thermodynamics and ELMAS's Equation. J Psychol Neurosci 8(3): 1-20.
 80. ELMAS ET (2026) Scientific, Technical and Economic Analysis and Feasibility Study of a Domestic Medical Factory that will Design and Manufacture Intensive Care Life Support Units, Medical Devices and Machinery Using Domestic and National Resources. In INSR Journal of Mathematics, Science and Technology Education (Vol. 2, Number 6, pp. 1-23).
 81. Elmas ET (2026) ELMAS thermodynamic theory and FM-modulated bio-robotic resonance approach for the early diagnosis and treatment of pancreatic cancer. Frontiers in Research 6(3): 186-203.
 82. Emin Taner Elmas; Modern Approaches in Engineering, Book Chapter 5: –"Elmas's Theory of Thermodynamics" and "The 5th Law of Thermodynamics" Based Diagnosis and Medical Treatment of Pancreatic Cancer – Part 1: ("Elmas Medi-Bio-Energy Tronic" Medical Device System Design Study: Methodological System Design for Medical Treatment Linked to FM-Modulated Bio-Robotic Resonance and Thermodynamic Interaction, Based on the Principles of "Elmas's Theory of Thermodynamics" and "The 5th Law of Thermodynamics," for Pancreatic Cancer Diagnosis), 2026, Vizetek Publishing, Ankara, E-ISBN: 978-625-382-319-1, DOI: 10.54637/Vizetek.9786253823191, Editor: Assoc. Prof. Dr. Emre Arabaci
 83. Emin Taner Elmas; Modern Approaches in Engineering, Book Chapter 6: –"Elmas's Theory of Thermodynamics" and "The 5th Law of Thermodynamics" Based Diagnosis and Medical Treatment of Pancreatic Cancer – Part 2: ("Elmas Medi-Bio-Energy Tronic" Medical Device System Design Study: Methodological System Design for Medical Treatment Linked to FM-Modulated Bio-Robotic Resonance and Thermodynamic Interaction, Based on the Principles of "Elmas's Theory of Thermodynamics" and "The 5th Law of Thermodynamics," for Pancreatic Cancer Diagnosis, with Artificial Intelligence Integration), 2026, Vizetek Publishing, Ankara, E-ISBN: 978-625-382-319-1, DOI: 10.54637/Vizetek.9786253823191, Editor: Assoc. Prof. Dr. Emre Arabaci.
 84. Emin Taner Elmas; International Research in the Field of Mechanical Engineering-V; Book Chapter:"Elmas's Theory of Thermodynamics and Hemodynamics the 5th Law of Thermodynamics within Hemodynamic Principles," Together with the Artificial Blood Model and the Ideal "Super Blood" Model (Optimized Homeostasis), 2026, Eğitim Publishing House, Isbn: 978-625-8824-24-7 E-Isbn: 978-625-8824-25-4, Editor: Prof. Dr. Murat Makaraci.
 85. Emin Taner Elmas; International Research in the Field of Mechanical Engineering-V; Book Chapter, Innovative Medical Technique Applications in Mechanical Engineering Using "Mechanical Rehabilitation" and "Bionic Artificial Organs", 2026, Eğitim Publishing House, Isbn: 978-625-8824-24-7 E-Isbn: 978-625-8824-25-4, Editor: Prof. Dr. Murat Makaraci.
 86. Emin Taner ELMAS (2026) "Closed-Loop Feedback Bio-Robotic Resonance Method and FM Modulated Smart Drug Algorithm Based on the 5th Law of Thermodynamics in Glioblastoma - Brain Cancer - Treatment", 10.43681/Limite. 2026. V1616.72701, Limite Journal | ISSN:1888-4067/ E-ISSN:2253-7929 16(7).
 87. Elmas E T, Akçin F (2026) Early Detection and Targeted Treatment of Colorectal Cancer Using an ELMAS-Based, AI- and Nanotechnology-Assisted Multilayer Smart Drug System. Advanced Research Journal 13(4): 10-50.
 88. Emin Taner ELMAS, ELMAS's Theory of Medical Thermodynamics and the Fifth Law of Thermodynamics Based Closed-Loop Feedback Bio-Robotic Resonance Method and FM Modulated Smart Drug Algorithm in Glioblastoma - Brain Cancer Treatment, Limite Journal | ISSN:1888-4067/E-ISSN:2253-7929, 16(7).
 89. Elmas ET, Akçin F (2026) From Wearable Sensing to Digital Twins: A Critical Narrative Review and Design Framework for Artificial Intelligence-Enabled Early Detection, Telemonitoring, and Risk Stratification in Pulmonary Hypertension. Cardiology and Angiology: An International Journal 15(3): 110-135.
 90. ELMAS, Emin Taner (2026) Scientific, Technical and Economic Analysis and Feasibility Study of a Domestic Medical Factory that will Design and Manufacture Intensive Care Life Support Units, Medical Devices and Machinery Using Domestic and National Resources. In INSR Journal of Mathematics, Science and Technology Education (2(6): 1-23).
 91. Emin Taner ELMAS, Melahat BATU AĞIRKAYA, Scientific, Technical, and Economic Analysis and Feasibility Study of a Domestic Medical Factory to Design and Manufacture Intensive Care Life Support Units, Medical Devices, and Machines Using Domestic and National Resources, (A comprehensive scientific, technical, and economic analysis and feasibility study on the establishment of a domestic medical factory focused on designing and manufacturing intensive care life support units, alongside other medical devices and machinery utilizing national resources and domestic capabilities), Limite Journal | ISSN:1888-4067/E-ISSN:2253-7929, 16(8).
 92. Emin Taner ELMAS, Feyyaz AKÇİN (2026) "Combined Smart Gastric Capsule -1": Extraction of Active Ingredients from Iğdır Thyme and Iğdır Licorice — Plants Grown in Iğdır Province — via Supercritical CO₂ Extraction, and Production of Domestic and National Smart Drugs for Gastric Ulcers and Helicobacter Pylori (H. pylori): Literature-Based Scientific Rationale and Proposed R&D Methodology, "Combined Smart Gastric Capsule": Extraction of Active Ingredients from Iğdır Thyme and Iğdır Licorice Plants Grown in Iğdır Province via Supercritical CO₂ Extraction and Production of Domestic and National Smart Drugs for Gastric Ulcers and Helicobacter Pylori (H. pylori): Literature-Based Scientific Rationale and Proposed R&D

- Methodology, Journal of Systems Engineering and Electronics (ISSN NO: 1671-1793) 36(7).
93. Emin Taner ELMAS, Feyyaz AKÇİN, Biyotik Biyo-yapay Akciğer Modelinin Tasarımı, Mühendisliği ve Üretimi: ELMAS'ın Termodinamik Kanseri Teorisi ile Termodinamiğin Beşinci Yasası, Biyorobotik/Alan Tabanlı Tedavi ve Canlı Doku Akciğer Mühendisliğini Kapsayan Entegre Bir Araştırma Çerçevesi, (Design, Engineering, and Manufacturing of a Bionic Bioartificial Lung Model: An Integrated Framework Research Spanning ELMAS's Thermodynamic Cancer Theory together with Fifth Law of Thermodynamics, Biorobotic/Field-Based Treatment, and Living-Tissue Lung Engineering), Limite Journal | ISSN:1888-4067/E-ISSN:2253-7929, 16(8).
 94. Emin Taner ELMAS, Feyyaz AKÇİN, Yapay Zekâ Destekli Süperkritik CO₂ Ekstraksiyonu, Karşılaştırmalı Fitokimyasal Karakterizasyon ve Alzheimer Hastalığı için Safran (Crocus sativus L.) Biyoaktiflerinin Nanomühendislik Temelli Akıllı İlaç Salım Sistemleri (Artificial Intelligence-Guided Supercritical CO₂ Extraction, Comparative Phytochemical Characterization and Nanoengineered Smart Drug Delivery of Saffron (Crocus sativus L.) Bioactives for Alzheimer's Disease), Limite Journal | ISSN:1888-4067/E-ISSN:2253-7929, 16(8).
 95. Elmas ET, Dağ İ (2026) Termal ve Akışkan Bilimleri Açısından Alzheimer Hastalığının NavierStokes Denklemleri İle Modellenmesi, Erken Teşhis ve Tedavi Yaklaşımları. In INSR Journal of Multidisciplinary Studies 2 (8):34-47.
 96. Elmas ET (2026) The integration of "ELMAS's Theory of Thermodynamics" and "5th Law of Thermodynamics" into ECMO (Extracorporeal Membrane Oxygenation) Machine Design and Validation. J Med Clin Case Stu 2(1): 1-9.
 97. ET ELMAS (2026) Türk Halk Müziği İcracılığında "ELMAS Modeli" ve "ELMAS Eklü": Emin Taner Elmas'ın Ses, Tavrı ve Akort Metodolojisine Disiplinlerarası Bir Yaklaşım ve Karpal Tünel Sendromu. OS Publications 2026 August 4(3): 194-206.
 98. Emin Taner ELMAS (2026) Mathematical Formulation of ELMAS's Theory of Thermodynamics and the Fifth Law in Medical Thermodynamic Applications, Limite Journal | ISSN:1888-4067/E-ISSN:2253-7929, 16(9).
 99. Emin Taner ELMAS (2026) ELMAS'ın Termodinamik Teorisi ve Termodinamiğin Beşinci Yasası Işığında FM Modüle Edilmiş Biyo-Robotik Rezonans ve Termodinamik Etkileşim Metodunun Matematiksel Formülasyonu ile Diferansiyel Denklemi, Limite Journal | ISSN:1888-4067/E-ISSN:2253-7929, 16(9).
 100. (2026) Emin Taner ELMAS, Mathematical Formulation and Differential Equation of FM Modulated Bio-Robotic Resonance and Thermodynamic Interaction Method in Light of ELMAS's Thermodynamic Theory and the Fifth Law of Thermodynamics, Limite Journal | ISSN:1888-4067/E-ISSN:2253-7929, 16(9).
 101. Emin Taner ELMAS (2026) "Comprehensive Thermodynamic Re-evaluation of Ebola Virus Pathogenesis: Interdisciplinary Mechanistic Solutions via the ELMAS's Theory of Thermodynamics and the 5th Law of Thermodynamics", Universal Library of Medical and Health Sciences 4(3): 106-116.
 102. Emin Taner Elmas (2026) Application of Elmas's Theory of Thermodynamics and Vectorial Multiphase Flow Dynamics to Optimize Heat Recovery and Fluid Management in Petroleum and Natural Gas Pipelines. Journal of Oil, Petroleum and Natural Gas Research SRC-JOPNGR-127.
 103. Emin Taner ELMAS (2026) "Kuantum Mekanik ve Kuantum Termodinamiği Temelli Akıllı Tıp Tekniği Sistem Tasarımı: ELMAS'ın Termodinamik Teorisi, 5. Yasa ve FM Biyorobotik Rezonans Entegrasyonu ile Kanseri Tedavisi", (Smart Medical Technique System Design Based on Quantum Mechanics and Quantum Thermodynamics: Cancer Treatment via ELMAS Thermodynamic Theory, the 5th Law, and FM Biorobotic Resonance Integration), Limite Journal | ISSN:1888-4067/E-ISSN:2253-7929, 16(9).
 104. Emin Taner ELMAS, Feyyaz AKÇİN, Iğdır Florasına Özgü Civanperçemi (2026) (Achillea millefolium) ve Yaban Nanesi (Mentha longifolia) Tserlerinin Mikroklima-Bağımlı Fitokimyasal ve Biyolojik Karakterizasyonu ile Distal Gastrointestinal/Anorektal Hedefli Akıllı Salım Platformuna Entegrasyonu, Microclimate-Dependent Phytochemical and Biological Characterization of Yarrow (Achillea millefolium) and Wild Mint (Mentha longifolia) from the Iğdır Flora and Their Integration into a Distal Gastrointestinal/Anorectal-Targeted Smart Release Platform, Limite Journal | ISSN:1888-4067/E-ISSN:2253-7929 16(9).
 105. Emin Taner Elmas (2026) Application of Elmas's Theory of Thermodynamics and Vectorial Multiphase Flow Dynamics to Optimize Heat Recovery and Fluid Management in Petroleum and Natural Gas Pipelines. Journal of Oil, Petroleum and Natural Gas Research SRC-JOPNGR-127.
 106. Emin Taner Elmas (2026) Elmas's Theory of Medical Thermodynamics and The Fifth Law of Thermodynamics Based Closed-Loop Feedback Bio-Robotic Resonance Method and Fm Modulated Smart Drug Algorithm in Glioblastoma - Brain Cancer Treatment. Japan Journal of Clinical & Medical Research. SRC/JJCMR-270.
 107. Elmas ET, Akçin F (2026) Artificial Intelligence-Guided Supercritical CO₂ Extraction, Comparative Phytochemical Characterization and Nanoengineered Smart Drug Delivery of Saffron (Crocus sativus L.) Bioactives for Alzheimer's Disease. J of Med Ima & MedEdu Res 3(5): 01-34.
 108. Elmas E T, Akçin, F (2026) Design, Engineering, and Manufacturing of a Bionic Bioartificial Lung Model: An Integrated Research Framework Spanning ELMAS's Thermodynamic Cancer Theory together with the Fifth Law of Thermodynamics, Biorobotic/ Field-Based Treatment, and Living-Tissue Lung Engineering J of Med Ima & Med Edu Res 3(5): 1-40.
 109. ELMAS, Emin Taner (2026) Mühendislik Destekli Onkoloji: ELMAS'ın Termodinamik Teorisi ile Termodinamiğin Beşinci Yasası, Biyofrekans Modülasyonu ve Akış Dinamiği Optimizasyonunun Lösemi (Kan Kanseri) Klinik Yönetimine Entegrasyonu. In INSR Journal of Mathematics, Science and Technology Education 2(9): 1-15.
 110. Emin Taner ELMAS (2026) "Quantum Mechanics, Quantum Thermodynamics, ELMAS's Thermodynamic Theory, the 5th Law of Thermodynamics, and Frequency Modulated (FM) Biyorobotik Resonance Integration for Intelligent Biomedical System Design and Cancer Treatment Protocol", Universal Library of Medical and Health Sciences 4(3): 124-134.
 111. Elmas ET, Akçin F (2026) Iğdır Florasında Bulunan Astragalus Spp. (Geven) Ve Artemisia Spp. (Yavşan) Biyoaktif Fraksiyonlarının Bağırsak Sağlığındaki Potansiyeli: Geven Polisakkaritlerinin Bağırsak Mukozal Bariyerini İyileştirme, Yararlı Mikroorganizmaları Destekleme Ve Kısa Zincirli Yağ Asitlerini Artırma Potansiyeli Üzerinden Kolon-Hedefli Akıllı Kapsül Yaklaşımı. In INSR Journal of Mathematics, Science and Technology Education 2(9): 16-61.

ISSN: 2574-1241

DOI: [10.26717/BJSTR.2026.67.010442](https://doi.org/10.26717/BJSTR.2026.67.010442)

Emin Taner ELMAS . Biomed J Sci & Tech Res



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