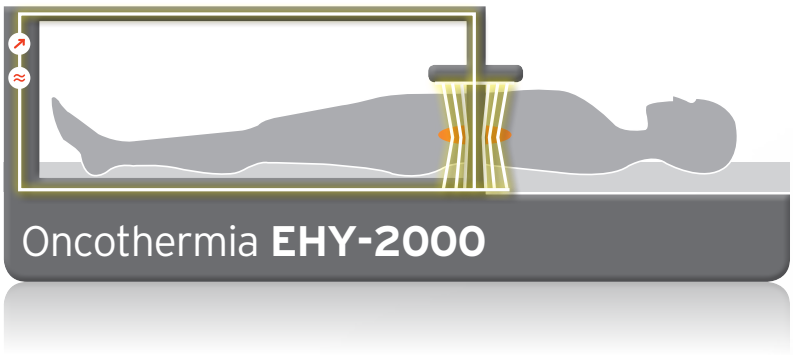
onco therm
hightech medicine

Oncothermia
EHY-2000

New Paradigm in Electro-Hyperthermia

Oncothermia

Complementary medical therapy
in the fight against cancer



Selectivity

Selectively focuses the electric field on cancer cell by the biophysical differences between cancer cell and normal cell.

WHAT DIFFERS ONCOTHERMIA FROM CONVENTIONAL HYPERTHERMIA

Oncothermia, a unique improvement on conventional oncological Hyperthermia, represents the next generation of Hyperthermia therapy. Oncothermia does more than simply warm deep layers of tissue. It also combines such warming a modulated electric field, with a carrier frequency of 13.56MHz, that is generated by electrodes. It selectively destroys malignant cells by applying the required specific energy dose.

While traditional Hyperthermia functions solely via certain thermodynamic parameters, such as temperature, Oncothermia functions by controlling absorbed energy doses, via an approach similar to that used in radiation therapy. Oncothermia moves beyond conventional heat therapies by using controlled, selective energy transfer. Oncothermia transports energy directly to malignant cells, via a selecting electric field.

The therapy thus functions in a largely apoptotic manner. The entire treatment is controlled by the modulated electric field that passes through the patient. In the process, the tumor becomes a constant, controllable parameter within a closed electric circuit.

Modulation

Enhances RF's effectiveness by detecting cancer cell's inherent signal that can distinguish the cancer cell from normal cell.

Self tuning

Personalizes RF energy of each treatment by analyzing patient's impedance in accordance with body size, weight, movement and other parameters.

Synergy effect

Oncothermia brings synergy effect when it is applied concurrently with either Chemotherapy or Radio-therapy.

Selectivity

Selection by conductivity

Focuses RF on tumor using the biophysical difference between tumor and normal cell. Cancer cell consumes excessive energy and its surrounding is highly ion concentrated. Therefore it naturally draws more RF. [See Fig. 1 and Fig. 2]

Selection by dielectric constant

Helps RF to distinguish tumor from normal cell by cancer cell's structural characteristic. Tumor has disorganized cell structure unlike healthy cell and this unique structure reacts differently on RF than normal cell. Therefore, RF can detect and focus its energy on tumor. [See Fig. 3]

Healthy Cell

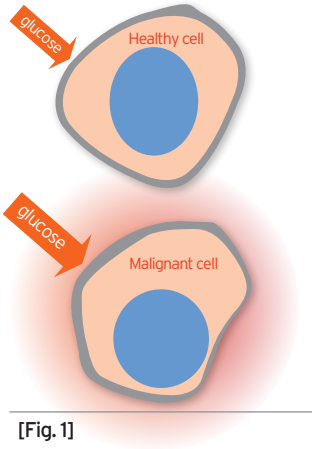
glucose+$6O_2$ ▶ $6CO_2$+36ATP

Low glucose influx
Normal ECM
High Membrane potential
Strong connection to next cells
Texture order
Collectivity
Served by the collective

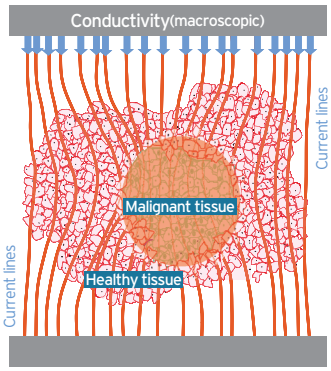
Malignant Cell

glucose ▶ 2Lactic acid+2ATP

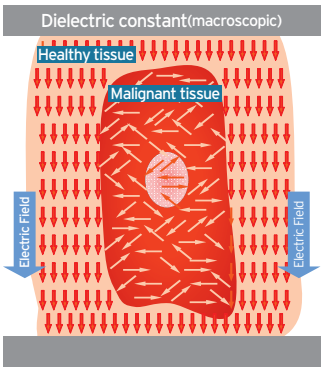
High glucose influx
High ion-concentration in ECM
Low membrane potential
Lazy connection to next cells
Disorder
Autonomy
Fighting with all others



[Fig. 1]



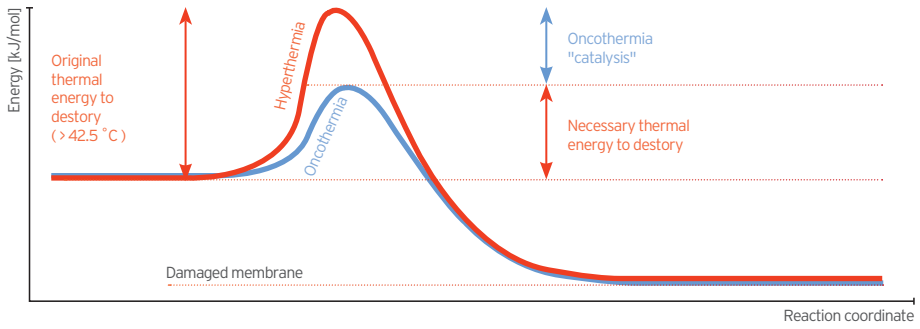
[Fig. 2]



[Fig. 3]

Modulation

It is a technology that automatically optimizes frequency, amplitude and strength of the RF. This enables the RF to distinguish tumor better, therefore cancer cells absorb maximum amount of RF energy.The major role is to act like catalysis to reduce threshold energy required to cause phase change. Thus, Oncothermia with its far better efficacy than conventional hyperthermia, uses much less power to achieve the thermal energy for treatment.



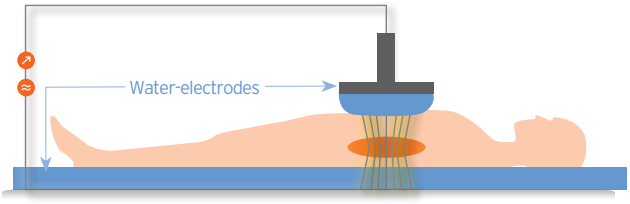
Self tuning

A function that automatically checks and monitors the impedance of each body part or changes of impedance caused by breathing or movements of patients and adjust the RF energy accordingly in real time.

Oncothermia _ energy-controlled electro hyperthermia

Capacitive Heating
Patient is a part of the electric system ▶ Controllable

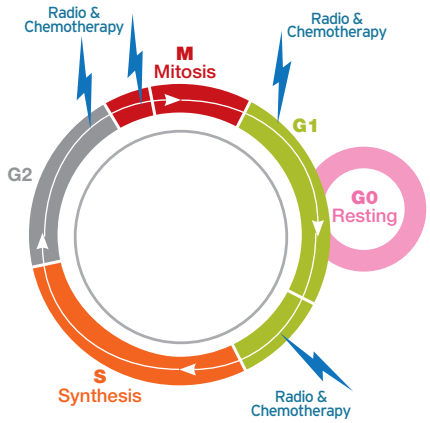
oncothermia device measures and controls the energy



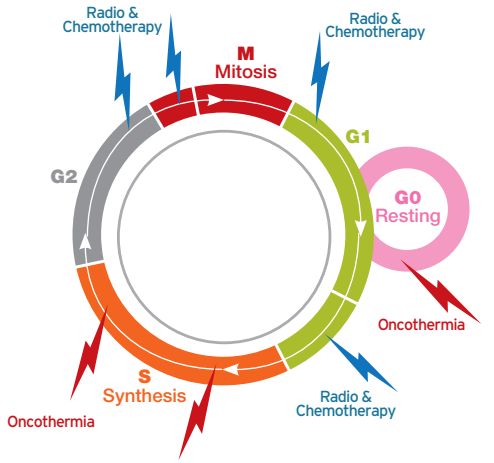
Real time RF energy adjustment

Synergy Effect with Radiotherapy & Chemotherapy

Radio & chemo sensitivity _ M > G2 > G1 > S > G0



Oncothermia works at S, G0



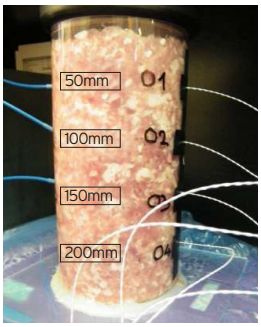
Oncothermia works as radio and chemo sensitizer. Radio efficacy becomes enhanced in the condition of high oxygen presence, which can be created by Oncothermia.

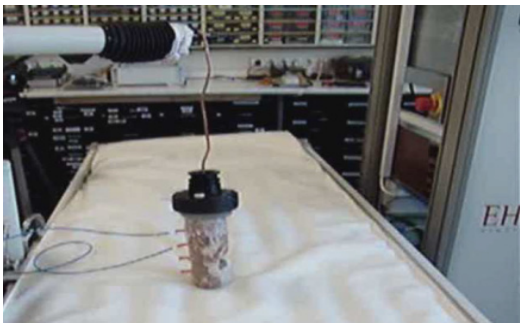
Chemo efficacy becomes higher after Oncothermia because Oncothermia promotes blood flow and metabolism fast which allows chemo drugs to concentrate and perform better in the treatment area.

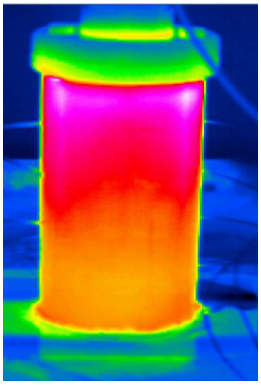
Deep Heating

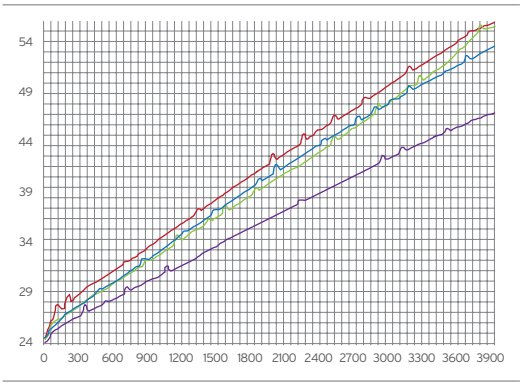
Human body is much more complicated than meat phantom but we could at least confirm that the temperature at 5cm, 10cm, 15cm and 20cm depth of meat phantom rose 21~30°C.

This means the temperature at each depth of human body rises homogeneously and it is more than enough to treat deep seated tumor.









Model experiment setting

- Room temperature : 24°C
- Phantom
  - mixed pork-meat, reproducing muscle and fat tissue combination, which models the living body complexity.
  - diameter * height : 10cm * 25cm (thickness of an average cohexia-suffering cancer patient)
- Thermometer
  - Tateyama & Oncotherm thermometry system(blue)
  - Thermo Ipitek thermometry system(white)
  - Test condition : temperature in depth(5cm, 10cm, 15cm, 20cm) 75W during 1hr

Result

temperature development

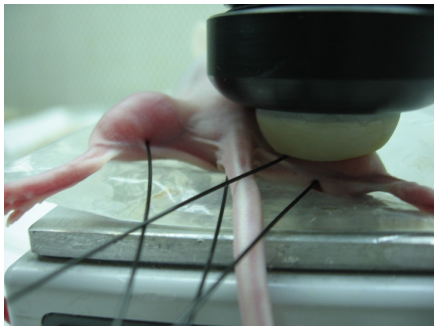
5cm	24°C ▶ 54°C	30°C increase
10cm	24°C ▶ 53°C	29°C increase
15cm	24°C ▶ 51°C	27°C increase
20cm	24°C ▶ 45°C	21°C increase
	Average	27°C increase

Pre-clinical study

Animals

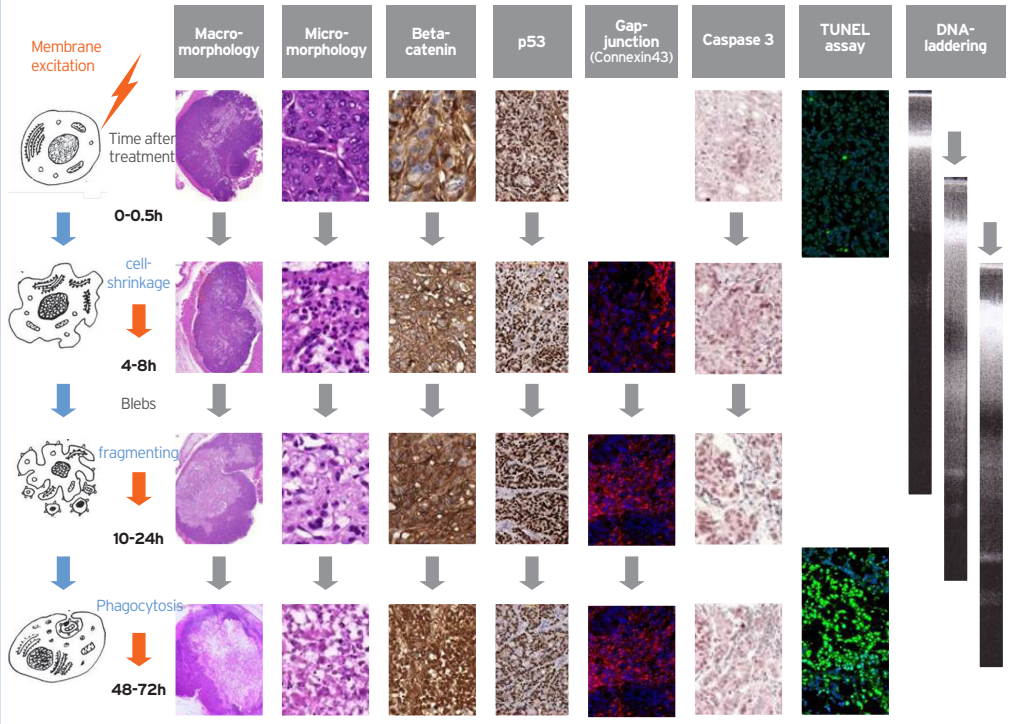
HT29 human colorectal carcinoma cell line derived xenograft tumor model in nude mouse.

External electromagnetic field activates signal transduction pathways, concluding to apoptotic cell-death



BALB/c (nu/nu) mice

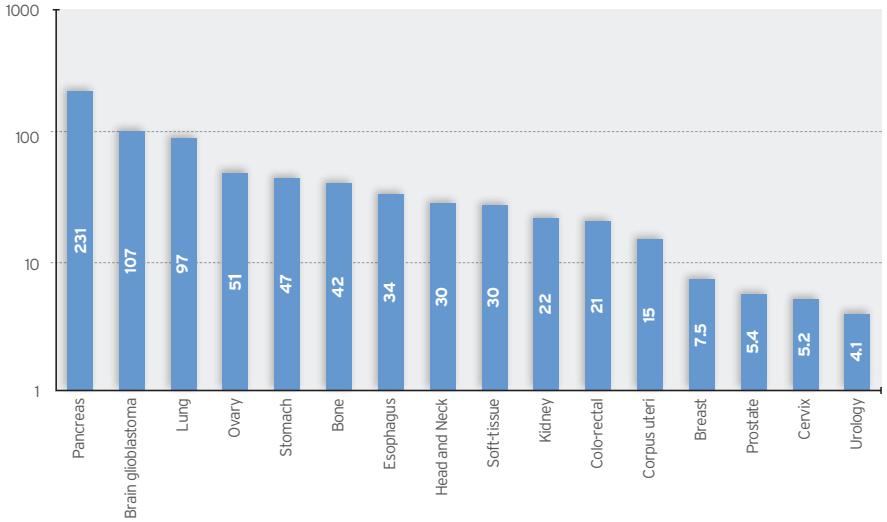
Inoculation of HT29 (human colorectal adenocarcinoma) in both femoral region (3*106 cells/0,1ml) of 6-8 week old females 18 days later **single shot** treatment for (30 min)



Andocs G, Szasz O, Szasz A. (2009) In vitro and in vivo evidences of effects of modulated rf-conducting heating. 25th Annual Meeting of the European Society for Hyperthermic Oncology, ESHO, Verona, June 4-6.

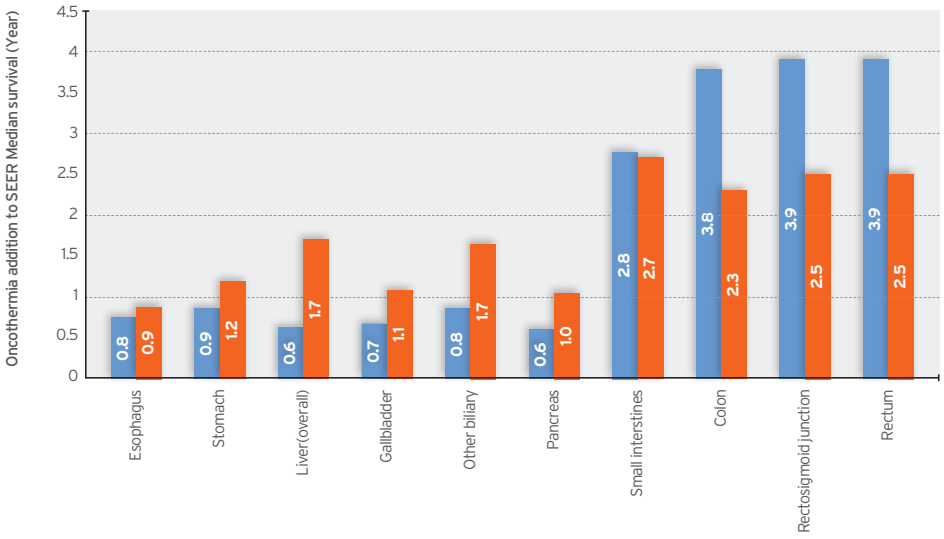
Oncothermia Perspectives

It is feasible to apply oncothermia as a routine treatment modality in advanced cases, when the "gold standards" have failed or are no longer applicable, or when boosting /resensitization is necessary. The results for first-year survival ratio in oncothermia above that of the SEER database [see Fig. 4]



[Fig. 4]
Additional percentages to SEER data by oncothermia in the first-year survivals

Represent a real promise for future applications. The survival benefits shown by median survival in oncothermia for gastrointestinal diseases [see Fig. 5].

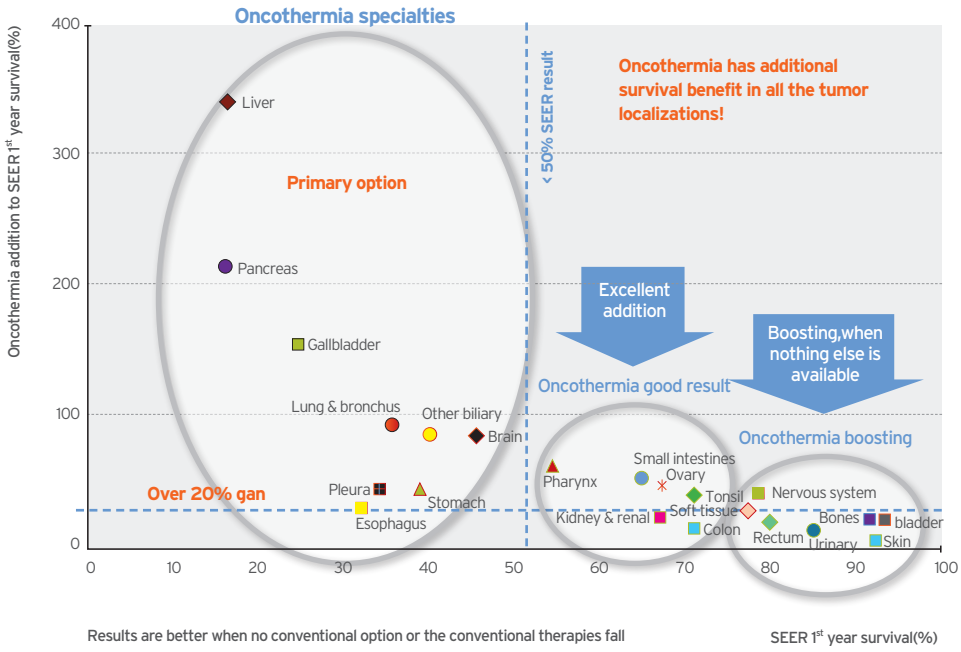


[Fig. 5]
NCI/USA database(SEER)
Additional effect of Oncothermia
Comparison of oncothermia results(median survival) to SEER database for gastroin-testinal tumors

Oncothermia Perspectives

Grouping the first-year survivals results by the relative benefit over SEER, we can distinguish three groups of localizations for oncothermia applications [see Fig. 6] : a group where oncothermia offers especially good results (like liver, pancreas, lung, esophagus, brain, etc.), a group showing moderate improvement (like head and neck, kidney, ovary), and a group where the additional benefit is around 20% (like rectum, colon, skin, breast).
However, in all the cases we have better results when oncothermia is applied, and even in the group showing mild improvement over the standards the advantage of oncothermia begins when the standard treatments are no longer applicable.

Success_Oncothermia success in 1st year survival



[Fig. 6]
Oncothermia benefit on first-year survival, relative to SEER data

Oncothermia definitely has a future in curative and palliative care in oncology.

It is a complementary method, applicable only in cases where improvement of the gold standards is necessary for variable reasons. There is a long path before us to make oncothermia a well-established routine among the standard modalities. However, the journey has begun and with the support of smart researchers and clinicians oncothermia will reach its goal.

EHY-2000 Specifications

Main RF unit

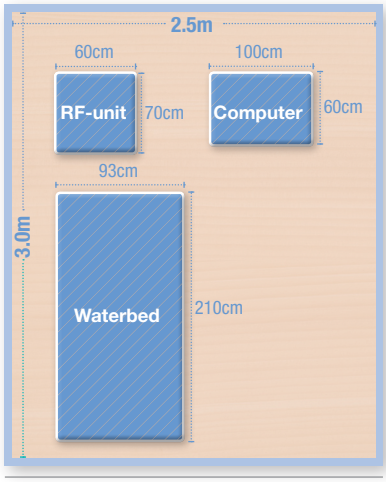
Weight : 175kg
Size : 700 x 600 x 1750mm (LxWxH)
Power Input : 220~230VAC/50~60Hz
Power Consumption : ≈1600VA/7A
Electrical safety classification : Class I, Type BF
(according to IEC60601-1)

01 Amplifier module
RF frequency generated : 13.56MHz
Maximum power by RF generator : 250W
Maximum output useful power : 150W

02 Control Module
Output frequency modulation range: 0 - 5kHz.
Controls all functions related to safety for both patients and system itself.

03 Tuner Module
Automatically adjusting the impedance changes, due to patient's movement like breathing, to keep the power optimal.

Minimum space required



Waterbed

Controllable Surface temperature range : 25 - 38˚C
Temperature control step : 0.1˚C
Maximum weight of patient : 150Kg
Size : 2100 x 930 x 700 mm (L x W x H)
Weight : 300Kg including water mattress filled distilled water
Amount of distilled water : 100 liters
Display and control buttons
Electrical safety classification : Class I, Type BF
(according to IEC60601-1)

Option

Oncotherm Temperature Measurement Device

Comparison with other devices

Heat generating method in RF Capacitive Coupling

	Conductive Method (Oncothermia)	Radiative Method (Others)
Heat generation principle	Joule Heat	Molecular spin & Collision (Polarization & Depolarization)
Selectivity	Selectivity by Conductivity, dielectric constant and fractal physiology	No selectivity
Penetration Dept	40 – 28cm	20 – 14cm Requires forceful cooling on skin due to intensive heat on surface area
RF generating method per different object	Adjust current and voltage by measuring the impedance of the object(patient body) real time	No difference
Measuring actually absorbed energy	Feedback circuit measures reflected energy (Forward Power = Treatment Power + Reflect Power)	Impossible (Total energy = Treatment power + Reflect power + Cooling power)

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