

## The adulthood: 21 years of Oncothermia

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Background: Hyperthermia was the very first oncotherapy in human medical history. It was virtually forgotten till the discovery of the electromagnetic radiations. From that time hyperthermia has a rapid development in the modern oncotherapy, [1], [2]. This relatively simple, physical-physiological method has a phoenix-like history with some bright successes and many deep disappointments. The reason is simple: the technique to deliver the appropriate energy and selectively target the deep-seated tumor, was not available. Oncothermia solved this long time open problem. It is based on the well-known traditional hyperthermia practice but extends it applicability and makes the process controllable and reproducible. Oncothermia works on effective and precisely selective cell-destruction [3]; it mobilizes the natural protecting mechanisms, and kills the malignant cells by apoptosis and immune reactions. To construct the method was a biophysical and technical problem; this is why a non-medical practitioner like myself could have a role in its development.

Discussion: Oncothermia is far not a device alone. It is a method based on the state-of-art of the biomedicine, and the devices are the tools to perform the method optimally [4]. This process is actively exist in all the movement of Oncotherm from its establishment, and decides the 21 year old history. This method was the first which curatively applied the results of the most modern achievements of fractal physiology [5], [6] and reached a cellular selectivity of the method by patented way worldwide. The oncothermia satisfies all the modern requirements of the up-to-date oncological modalities:

- ❖ Oncothermia is personalized, gently, painless treatment-modality, with rare side effects (skin redness);
- ❖ Oncothermia is applicable complementary to all the known conventional oncotherapies;
- ❖ Oncothermia is non-toxic, local and depresses the toxicity of the parallel applied other treatments also;
- ❖ Oncothermia has low risk/benefit ratio,
- ❖ Oncothermia is a definite tool for longer survival;
- ❖ Oncothermia does not suppress the quality of life, even moderates the side-effects of the parallel treatments;
- ❖ Oncothermia is (in comparison to the other treatments) cheap and effective, its cost/benefit ratio is very low.

Oncothermia results are strongly science based. It had long way from laboratory to clinical use [7].

- ❖ Oncothermia is the very first method using the thermally induced electric field effects as curative force in oncology [8], showing the field dependent cell killing of malignancies.
- ❖ The used frequency is 13.56 MHz. This affects the cell-membrane and effectively uses the beta-dispersion to destroy it.
- ❖ This frequency makes higher applicability due to no Faraday cage is necessary by its application.
- ❖ The carrier frequency is modulated in oncothermia method. While the unmodulated methods simple deliver the power (absorbed heat) oncothermia delivers information (making apoptosis and all the other effects which are proven.)
- ❖ The electric field makes the job in condition of moderate temperature increase, and not the absorbed heat makes necrotic processes like in other hyperthermia solutions. The electric field has no physical or physiological contra-reactions (negative feedback) which is the case of temperature (heat) alone.
- ❖ Due to the apoptotic way the applied incident power of Oncothermia is a small fraction of others. This makes the focus of oncothermia precise [no extensive heat-flow is generated from the target to the neighbourhood. The parasite heat-flows at classical heating smear the focus by time.
- ❖ The relatively small incident energy makes the process more controllable, no considerable heat, heat is taken away uncontrolled by the surface cooling. The process is controlled by the impedance of the body in oncothermia, so the target is a part of the electric circuit, it is tightly and real-time controlled.
- ❖ Due to the smaller applied energy the side effects (and generally the safety) in oncothermia is much more optimal, practically no side effects are existing.
- ❖ Due to the power-control, measurement of the temperature is not necessary (even it is not

important, due to the temperature makes the “smearing” of the focus), we measure the incident energy (like the “gold-standard radiotherapy does also). This approach makes the oncothermia does physical (the temperature is not a dose), and makes unnecessary to measure the temperature of the target. This avoids many side-complications (possible inflammations, disseminations, ulcerous wounds, etc.).

- ❖ Of course the electronic solution and the full control and the electrode arrangement are also entirely different to solve the above points to optimize the oncothermia approach.

Conclusions: Oncothermia opened new dimensions in hyperthermic oncology. Summarizing with a simple analogy by a phrase for medicine: “The difference between the medicine and the poison is only the dose”. Oncothermia is taking care about the correct dosing. This makes its difference from classical heating processes! Oncothermia had used its “childhood” for basic developments which are described above. The method had been grown up, and reached the “adulthood”. We are proud on these facts and on the versatile devices which we are producing. But the devices are not enough alone! We need their application, we need the cooperation of the smart physicians who are using these equipments. Oncotherm is indebted for the doctors and nurses, whom work realizes the development of the method. We are especially thankful for the German quality-control and quality management which improves the devices day-by-day and raise the reputation of the German medicine and the European innovative habits.

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