Biological Research Activities in the FEL Center – 2006

In collaboration with Prof. Korenstien & Dr. Firer

During 2006 we continued to test the effect of microwave radiation on defined biological systems.

1. Studies on enzyme activity

Begun in 2005, we continued to study the effects of 100GHz radiation on the activity of the enzyme alkaline phosphatase. We have tested the effects of irradiating the enzyme prior to or during its incubation with substrate. From these activity measurements we used Michaelis-Menton equations to calculate properties of the enzyme such as substrate affinity, enzyme velocity and turnover number. These studies revealed that irradiation for 2 hours prior to addition of substrate significantly reduces enzyme activity, although the reduction is only about 5%. The irradiation does not seem to effect the affinity of the enzyme for its substrate (that is there is apparently no molecular alteration) however enzyme velocity is effected.

2. Antigen-Antibody interactions

Recently, we began a series of experiments designed to test whether similar irradiation would affect the ability of an antibody to bind its specific antigen. In preliminary experiments it appears that this is not the case.

3. Consultation

The User Center gave technical support to the bio-experiments performed by Prof. Korenstein, as follows:

a. Modification of mm-wave experimental setup in TAU to provide measurements estimating interaction of electromagnetic waves with bio-cells for different levels of RF power and different kinds of modulation.
b. Calibrating the modified setup and estimating 2D distribution of RF power (frequency 100 GHz) at the place where illuminated bio-container is located.
c. Calibrating mm-wave detector employed in bio-experiments using of HP mm-wave absolute power meter.

4. Facilities

The facilities available for biological experiments are described in the following figures; Figure 1 describes our incubator for performing controlled radiation exposure of biological samples. Figure 2 reveals the radiation source and mode exciter under the table which are used to irradiate the biological samples. The internal structure of the incubator is revealed in Figure 3 including the wave guide opening for sample exposure and the anti reflection material covering the incubator internal walls. Figure 4 gives a close up picture of the radiation source and mode exciter. The solid state millimeter wave source is connected via a standard wave guide to the mode exciter which couples the radiation into the over-moded corrugated wave guide which is connected to biological sample. Figure 5 describes a special plastic vessel containing the biological material is located above the open over-moded corrugated wave guide, thus enabling irradiation . Finally figure 6 describes a close up look at the special plastic vessel containing the biological material which is radiation transparent.

Fig 1: Incubator for performing controlled radiation exposure of biological samples

Fig 2: The same Incubator with the radiation source and mode exciter revealed under the table

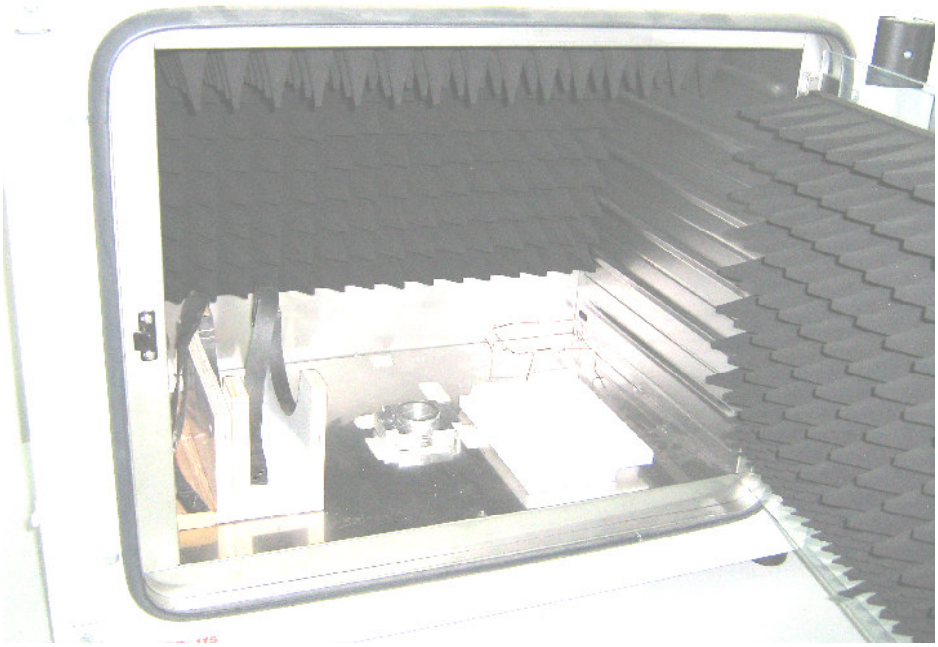

Fig 3: The internal structure of the incubator is revealed including the wave guide opening for sample exposure and the anti reflection material covering the incubator internal walls.

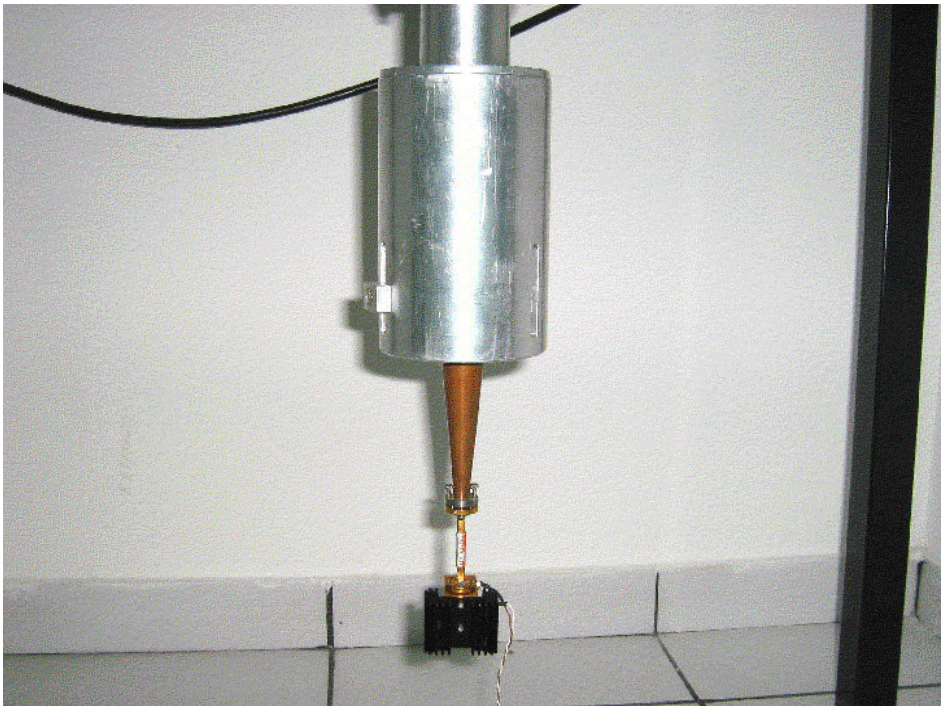

Fig 4: A close up of the radiation source and mode exciter. The solid state millimeter wave source is connected via a standard wave guide to the mode exciter which couple the radiation into the over-moded corrugated wave guide.

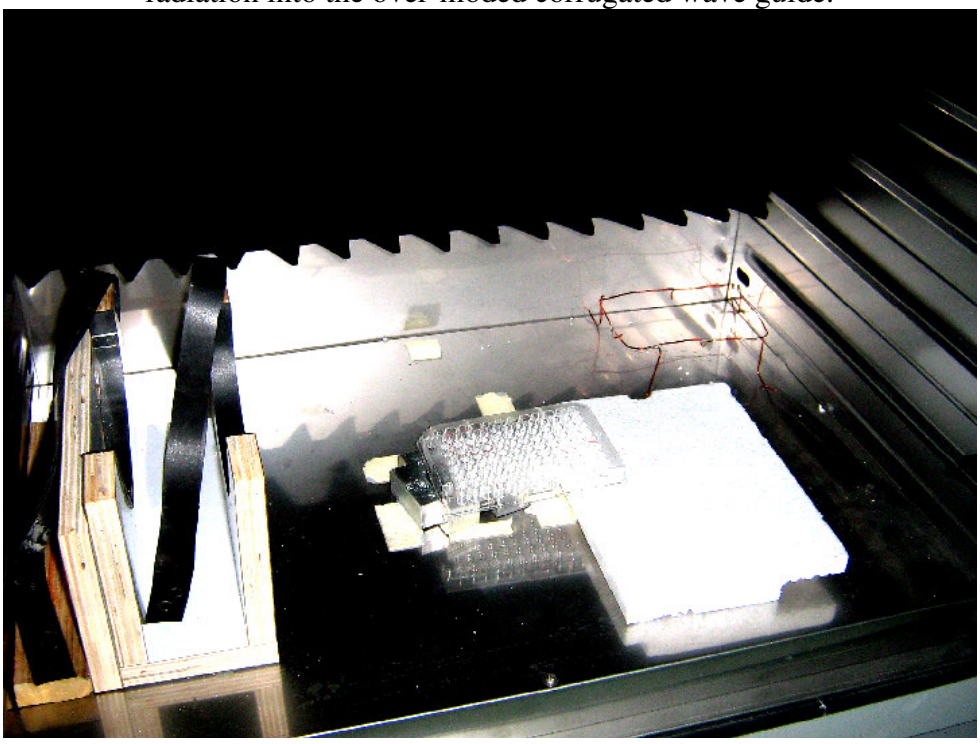

Fig 5: A special plastic vessel containing the biological material is located above the open over-moded corrugated wave guide, thus enabling irradiation .

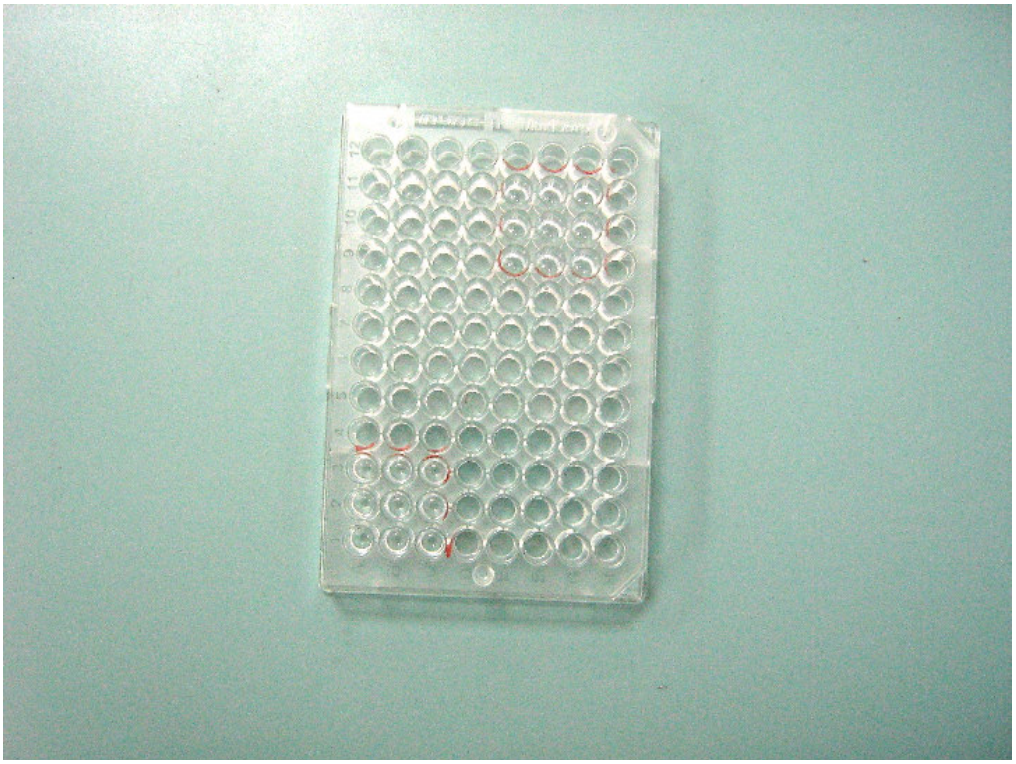

Fig 6: A close up look at the special plastic vessel containing the biological material which is radiation transparent.