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**Research project:**

**Influence of RF EMF on the electrical properties of ionophore doped and undoped synthetic membranes**

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Prof. Detlefsen, TU München (Exposure)

Duration: May 1997 – June 1998

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**Objective**

- Reproduction of the FGF-Project of Prof. Boheim and Prof. Hansen to investigate the influence of high frequency EMF on synthetic phospholipid membranes (bilayers)
- Recalculation and -construction of the experimental setup used by Prof. Boheim for his own electrophysiological measurements

**Results**

- Reproduction of the formerly observed field effects
- Replacement of the standard test chamber by a round test chamber caused distinctly reduced field strengths and amplitudes of the excess currents
- Elementary molecular mechanisms responsible for the effects on the bilayers are still unclear; a direct transfer of the insights to biological membranes is not possible
- Occurrence of excess currents is theoretically explained by the rectifier effect

**Exposure**

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Exposure parameters	
Carrier frequency	900 MHz, pulsed
Power	0-7 W
Duty cycle	1:8
Electrical field strength (rectangular measuring chamber)	26.500 V/m*
Electrical field strength (round measuring chamber)	13.600 V/m*

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\* calculated for 1 Watt feeding power at the place of the membrane

- in a rectangular waveguide

**Statistics**

Investigation of 220 bilayers in about 1.300 single experiments



## Object

- synthetic phospholipid membranes; solvent containing (n-decan)

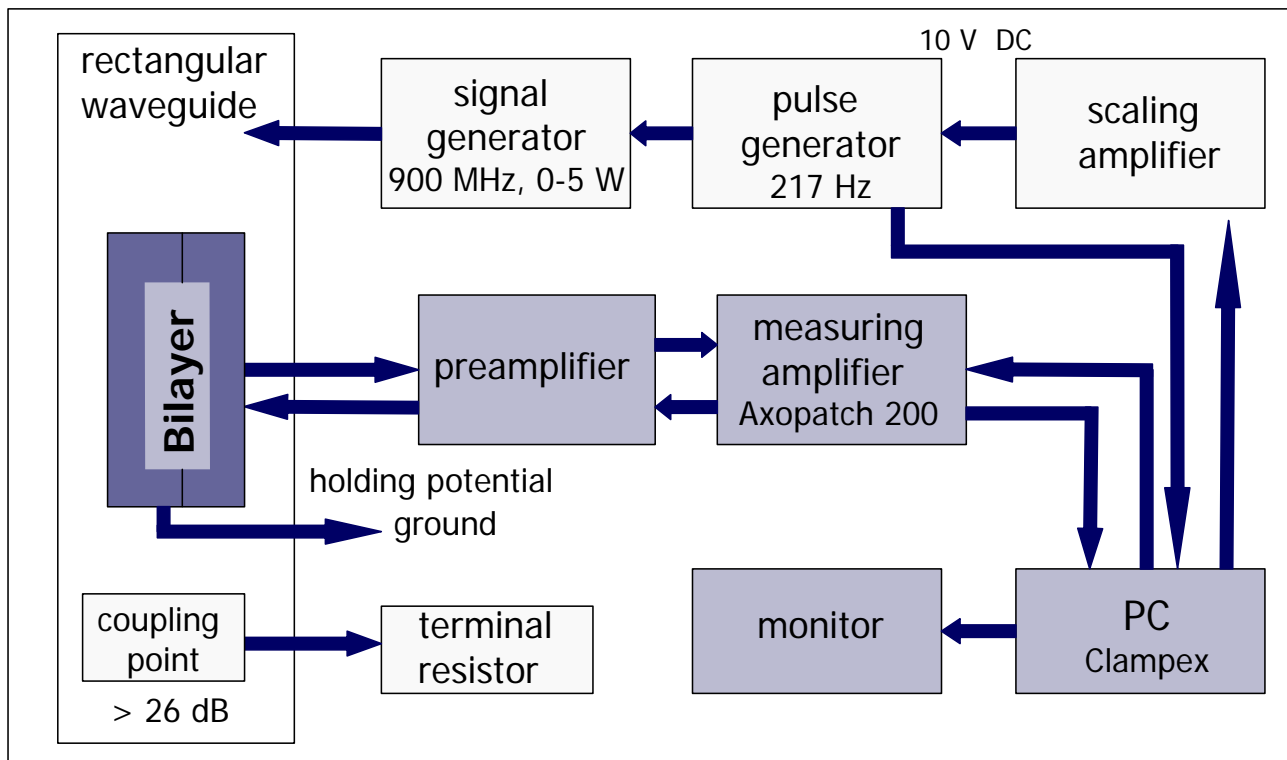
## Investigation parameters

Determination of the amplitude of the excess current with dependence on the following influences:

- DC bias voltage (-100 up to +100 mV)
- Membrane capacity; depending on the area (20 - 300 pF)
- Output power of the transmitter (0 - 7 W)
- Orientation of the membrane to the electrical field (0 - 360°)
- Geometry of the measuring chamber (rectangular, round)
- Presence of three antibiotics alamethicin, gramicidin or valinomycin respectively (ionophores or ion-carriers)

According to the experimental design variations in DC bias voltage (-110 mV to +140 mV) and transmitter power fed into the waveguide (0-7 W)

## Block circuit diagram of the setup

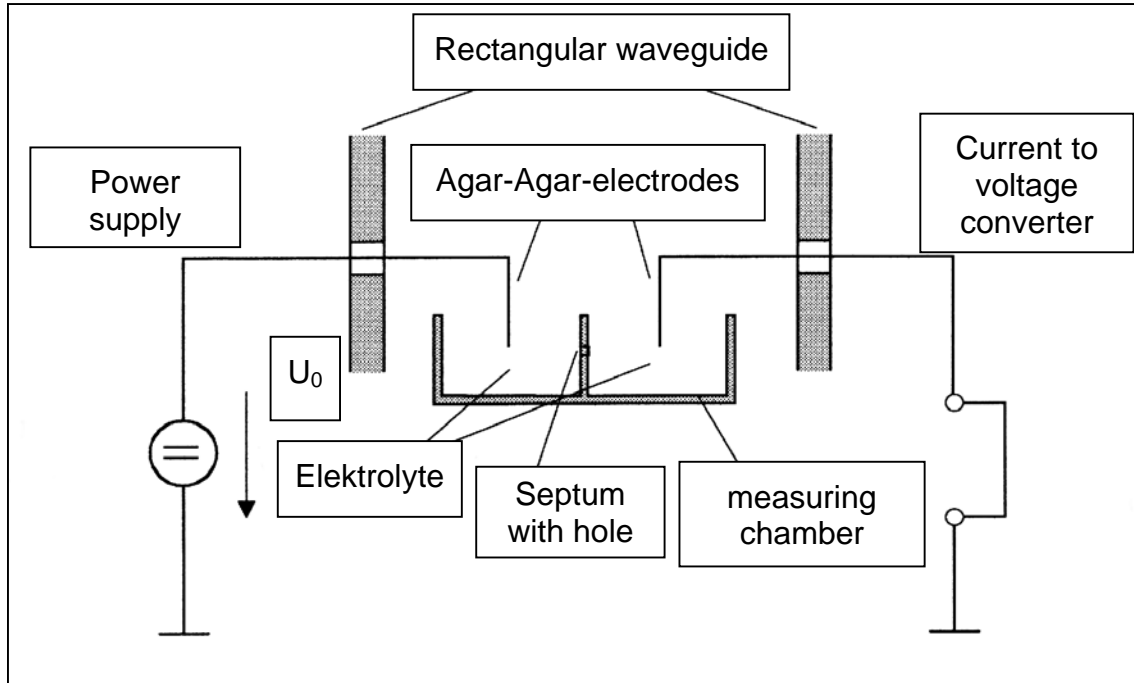


Arrows indicate direction of the signal flow



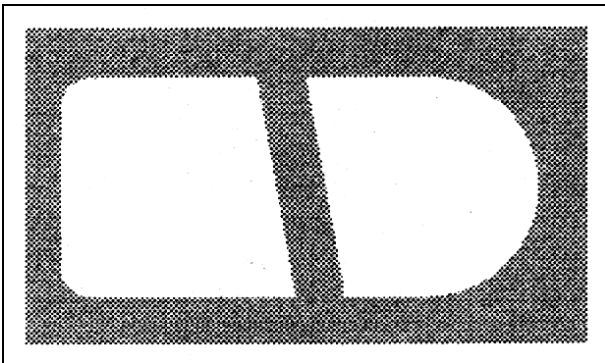
## Setup

Basic configuration and circuit diagram (side view)

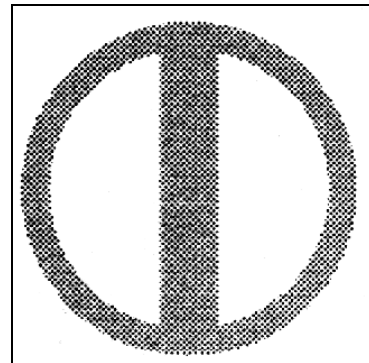


## Measuring chambers

Standard cuvette (top view)



Round cuvette (top view)



- Material: Plexiglas
- Septum with hole (50 -300  $\mu\text{m}$ ) segmenting the measuring chamber into two electrically isolated compartments
- Bilayer applied to one side of the hole
- Rotation of the measuring chamber enables orientation of the bilayer to the electrical field vector

## Publication

„Changes in electrical characteristics of lipid bilayer membranes induced by pulsed radio frequency fields.“

Linz, K.; Achenbach, F.; Detlefsen, J.; Helmiger, J.; Meyer, R. 1998:

