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**Research project:**

**Influence of high frequency electromagnetic fields on DNA (at 4°C)**

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Duration: June 1996 – December 1996

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**Objective**

Investigation of effects of long-term RF-exposure on plasmid-DNA under DNA-conserving basic thermal conditions (4°C) to search for potentially harmful influences of RF-EMF on DNA material.

- Plasmid-DNA, isolated from E.coli bacteria ((K12) XL-1Blue, transformed with pBluescriptSK)
- Exposure 900 MHz (pulse modulation 2 Hz, 8.3 Hz or 217 Hz)

**Results**

- No damage of the DNA molecules emerging as single strand breaks or double strand breaks.
- The ampicillin resistance gene as well as the origin region of the plasmid remained biologically active.

**Exposure**

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Exposure parameters

Carrier frequency	900 MHz
Pulse modulation frequency	2 Hz, 8.3 Hz or 217 Hz (during 6-week experiments; successively used during the 18-week experiment)
SAR-value	5.93 mW/kg (39 mW/kg burst)
Electrical field strength	15.34 V/m (inside sample vessels)
Duration of exposure	1-6 or 18 weeks

Signal according to GSM standard (D-net)

Rectangular wave guide

**Statistics**

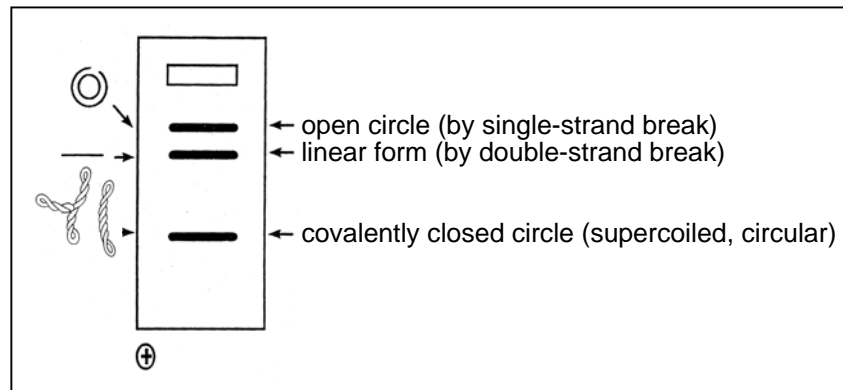
- Three 6-week-experiments, one long-term experiment (18 weeks).
- Analysis of two samples each (exposed and control) per week for each exposition pattern (week 1-6). During the 18-weeks long term experiment samples were taken every 3 weeks.



## Investigation parameters

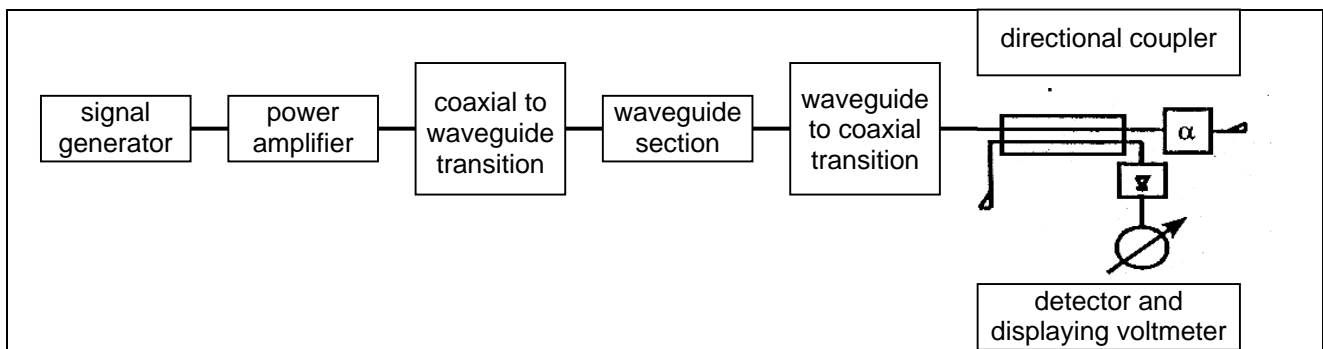
- Evidence of relaxed circular and linear DNA-molecules that emerge from single strand breaks or double strand breaks of the originally circular, supercoiled DNA. Agarose gel electrophoresis with direct comparison between exposure and control was used (no quantified evaluation).

Schematic picture of DNA-molecules on the agarose gel



- Evidence of other potential damages of molecules in transformed E.coli-cultures by comparison of the transformation rates of exposed and unexposed DNA-molecules.

## RF-Exposure system



- Amplitude modulated signals with 900 MHz carrier-frequency
- Burst length: 0.577 ms
- Pulse modulation frequencies: 2 Hz, 8.3 Hz and/or 217 Hz

## Publications

### „An RF exposure system for bacteriophage, DNA and growing bacterial cells.“

Hansen, V.; Ruger, W. 1999:

Electricity and Magnetism in Biology and Medicine; F. Bersani, ed.; Plenum Press; Seite 805-807

### „Exposure of bacteriophage, DNA, and growing bacterial cells to modulated electromagnetic radiation: No DNA damage for mutagenicity observed.“

Freyer, B.; Koch, H.; Hansen, V.; Ruger, W. 1999:

Electricity and Magnetism in Biology and Medicine; F. Bersani, ed.; Plenum Press; Seite 711-715