GAZI NON-IONIZING RADIATION PROTECTION CENTER (GNRK)
&
GAZI BIOPHYSICS DEPARTMENT

www.biyofizik.gazi.edu.tr www.gnrk.gazi.edu.tr

GAZİ UNIVERSITY
FACULTY OF MEDICINE
BIOPHYSICS DEPARTMENT
Ankara, TURKEY

- **GAZİ BIOPHYSICS has been carrying out studies on the biological impacts of Non-Ionizing Radiation – NIR EMF since 1989**

- **Our laboratory includes:**

  physicists, biologists, electrical engineers, all of whom are studying how living systems respond to EMF

- **Our research team includes**

  physicists, biologists, electrical engineers, physicians, biochemists, pathologists and veterinarians

- **GAZİ BIOPHYSICS is located in Ankara and have been supported by Scientific Research Funds of Gazi University and NATO STO**

- **GAZİ BIOPHYSICS is**
  Representative of Universities to NATO STO HFM since 2007,

  WHO International Advisory Committee member on EMF to WHO since 2001,

  Scientific Secreteriat Member of ICEMS since 2007

- We do expose animals and cell cultures to RF EMF including mobile phones

- We do clinical research on RF EMF

- We measure all kinds of EMF sources including cellular phones, base stations, transformers, high power lines, TV and radio antennas, Microwave ovens, Diathermy units, Wi-Fi's. MRI's, Radars under

Gazi Nonionizing Radiation Protection Center (GNRK)

GAZI NON-IONIZING RADIATION PROTECTION CENTER (GNRK)
&
GAZI BIOPHYSICS DEPARTMENT

www.biyofizik.gazi.edu.tr www.gnrk.gazi.edu.tr

RECENT RF STUDIES OF GAZİ BIOPHYSICS & GNRK

GAZI NON-IONIZING RADIATION PROTECTION CENTER (GNRK)
&
GAZI BIOPHYSICS DEPARTMENT

www.biyofizik.gazi.edu.tr www.gnrk.gazi.edu.tr

PREGNANCY STUDY

2007-cont.

- Totally 126 **adult, pregnant, and offspring** New Zealand White rabbits used in the study
  - 18 adults
  - 18 pregnants
  - 18 newborns (2 days old)
  - 72 offsprings (1-month old)
    - 36 female
    - 36 male

exposed to **1800 MHz** GSM modulated RFR (G2) (217 Hz, 20dBm, 14V/m) , **15min/day, 7 days, .**

- 1800 MHz GSM like signal formed by Signal Generator – (Agilent Technologies 8648C, 9 kHz – 3.2 GHz, Santa Clara, CA, USA) with an integrated pulse modulation unit and Horn antenna

- Horn antenna- Schwarzbeck, Doppelsteg Breitband BBHA 9120 L3F, 0.5 – 2.8 GHz, Schönau,Germany

- The generated power is controlled by Spectrum Analyzer- Agilent Technologies N9320A, 9 kHz – 3GHz, Santa Clara, CA, USA

- Measurement of the output radiation- NARDA EMR 300 and Type 26.1 probe (300 kHz - 40 Ghz)

Findings:

1800 MHz RF exposure: 15min/day, 7 days

- **Increased DNA base modification and free radical formation in brain tissue of non-pregnant adults**
- **Increased oxidative stress in liver tissue of non pregnant adults, pregnants and their newborns (2 day old)**

Oxidative stress damages tissues.

- Increased apoptotic cells-PROGRAMMED CELL DEATH- in the brain (neurons, glial cells) and eye (cornea, lens) tissues of adults, pregnants and newborns

- Increased DNA base modification in liver tissue of female infants (one month old)

RF exposed induced free radicals might lead to oxidative damage in liver, which in turn disrupts normal metabolism and physiology of liver tissue

•Guler G, Tomruk A, Ozgur E, Seyhan N. The Effect of radiofrequency radiation on DNA and lipid damage in non-pregnant and pregnant rabbits and their newborns, General Physiology and Biophysics, 2010, 29(1), 59-66.

•Tomruk A, Guler G, Dincel AS. The Influence of 1800 MHz GSM-like signals on hepatic oxidative DNA and lipid damage in nonpregnant, pregnant, and newly born rabbits. Cell Biochem Biophys (2010) 56:39–47.

• Güler G., , Tomruk A. , Ozgur E. , Sahin D. , Sepici A. , Altan N., Seyhan N. The effect of radiofrequency radiation on DNA and lipid damage in female and male infant rabbits. International Journal of Radiation Biology, 2012; 88(4): 367–373.

- Guler G, Ozgur E, Keles H, Tomruk A, Atalay Vural S, Seyhan N. Apoptosis resulted from Radiofrequency Radiatıon exposure of pregnant rabbits and their infants. Bulletin Veterinary in Pulawy 2011, 55; 127-134

- Kismali G, Ozgur E, Güler G, Akcay A, Sel T, Seyhan N. The influence of 1800 MHz GSM-like signals on blood chemistry and oxidative stress in non-pregnant and pregnant rabbits. International Journal of Radiation Biology, 2012; 88(5):414-9.

Female infants

- Decreased Outer Hair Cell Motility
- Decreased Distortion Product Otoacoustic Emissions amplitudes

Male infants

- Decreased Cochlear Activity,
- Decreased Outer Hair Cell Electromotility
- Decreased Distortion Product Otoacoustic Emissions amplitudes

- Muluk NB., Budak GG., Budak B., Apan A., Ozturk G.G., Seyhan N.. (2011). Distortion product otoacoustic emissions in infant, pregnant and non-pregnant adult rabbits: comparison for different stimulus levels. The Journal of International Advanced Otology, 7(102-110).

- Budak GG, Muluk NB, Budak B, Oztürk GG, Apan A, Seyhan N. Effects of intrauterine and extrauterine exposure to GSM-like radiofrequency on distortion product otoacoustic emissions in infant male rabbits.Int J Pediatr Otorhinolaryngol. 2009, 73(3):391-9.

- Budak GG, Muluk NB, Budak B, Oztürk GG, Apan A, Seyhan N. Effects of GSM-like radiofrequency on distortion product otoacoustic emissions of rabbits: comparison of infants versus adults.Int J Pediatr Otorhinolaryngol. 2009 Aug;73(8):1143-7.

- Budak GG, Muluk NB, Oztürk GG, Budak B, Apan A, Seyhan N, Sanli C.Effects of GSM-like radiofrequency on distortion product otoacoustic emissions in pregnant adult rabbits.Clin Invest Med. 2009 Apr 1;32(2):112-6.

- Budak GG, Muluk NB, Budak B, Oztürk GG, Apan A, Seyhan N, Effects of intrauterine and extrauterine GSM-like radiofrequency on distortion product otoacoustic emissions in infant female rabbits. Int. Adv. Otol. 2009; 5:(2), 209-217.

GAZI NON-IONIZING RADIATION PROTECTION CENTER (GNRK)
&
GAZI BIOPHYSICS DEPARTMENT

www.biyofizik.gazi.edu.tr www.gnrk.gazi.edu.tr

BLOOD-BRAIN-BARRIER (BBB) STUDY

900 MHz & 1800 MHz CW and GSM-like RFR (217 Hz, 577 µs pulse duration, 4.54 V/m) 20 min exp., (n=45 female young adult Wistar albino rats)

- **increased BBB Permeability in females for 900 MHz CW and GSM – like modulated RFR and 1800 MHz CW.**
- **No effect found for 1800 MHz GSM – like modulated**

SIRAV B., SEYHAN N.; Blood-Brain Barrier Disruption by Continuous Wave Radio Frequency Radiation, Electromagnetic Biology and Medicine, 29 (2): 215-222, 2009.

900 MHz & 1800 MHz, CW and GSM-like RFR (217 Hz, 577 µs pulse duration, 4.54 V/m) for 20 min exp., (n=45 male young adult Wistar albino rats)

increased BBB permeability in all exposed males.

SIRAV B, SEYHAN N (2011). Effects of radiofrequency radiation exposure on blood-brain barrier permeability in male and female rats. *Electromagnetic Biology and Medicine*, 30 (4)(253-260).

GAZI NON-IONIZING RADIATION PROTECTION CENTER (GNRK)
&
GAZI BIOPHYSICS DEPARTMENT

www.biyofizik.gazi.edu.tr www.gnrk.gazi.edu.tr

THYROID STUDY

900 MHz GSM Modulated RFR (217 Hz, 1.35 W/kg) 15min/day, 21 days

(n=30 male 2 months old Wistar rats)

induced hypothyroidism and caspase activation (indicator of apoptosis)

Meriç Arda Eşmekaya, Nesrin Seyhan, Suna Omeroğlu (2010). Pulse modulated 900 MHz radiation induces hypothyroidism and apoptosis in thyroid cells: A light, electron microscopy and immunohistochemical study.. International Journal of Radiation Biology, 86(12)(1106-16).

GAZI NON-IONIZING RADIATION PROTECTION CENTER (GNRK)
&
GAZI BIOPHYSICS DEPARTMENT

www.biyofizik.gazi.edu.tr www.gnrk.gazi.edu.tr

OXIDATIVE STRESS STUDY

900 MHz GSM Modulated RFR (217 Hz, 1.35 W/kg) 15min/day, 21 days

(n=30 male 2 months old Wistar rats)

oxidative damage in liver, heart, lung and testis tissues

M. Arda Eşmekaya, Çiğdem Özer, Nesrin Seyhan (2011). Effects of 900 MHz Pulse Modulated Radiofrequency Radiation on Heart, Lung, Testis and Liver tissues Oxidant and Antioxidant Levels. General Physiology and Biophysics, 30(84-89).

GAZI NON-IONIZING RADIATION PROTECTION CENTER (GNRK)
&
GAZI BIOPHYSICS DEPARTMENT

www.biyofizik.gazi.edu.tr www.gnrk.gazi.edu.tr

HAIR ROOT CELLS STUDY

Lai and Singh's study: (2.45 GHz RF , 2 h)

Single and double-stranded DNA breakage in rat brain cells

Gazi Biophysics's study: 900 MHz GSM Modulated RFR (217 Hz, 577 µs, 0.974 W/kg) for 15 and 30 min, human hair root cells,

Comet Assay Technique

Hair Roots plucked from the head area behind the ear used for the phone calls where maximum SAR measured

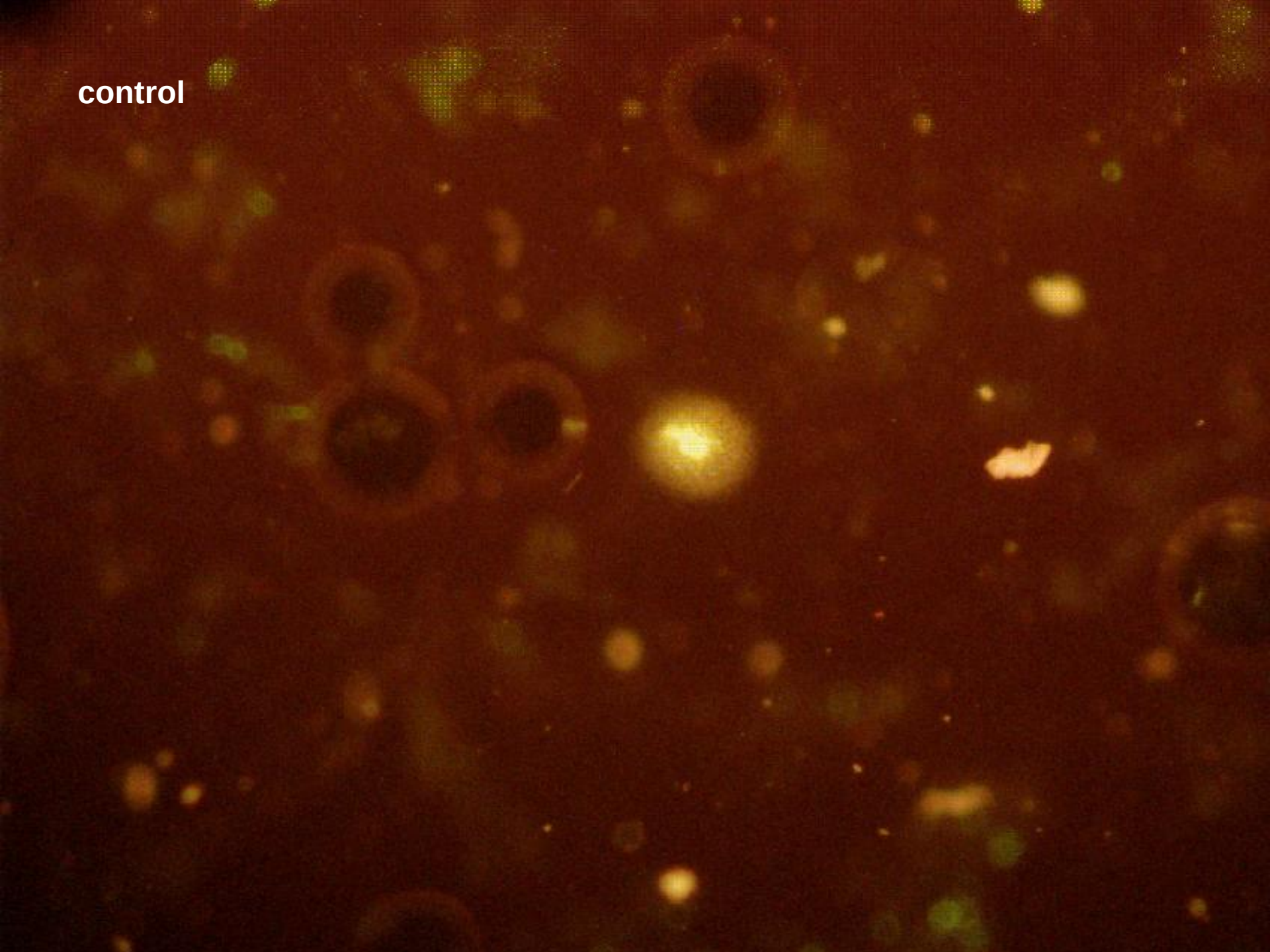
6 women, 2 men, 30 - 47 years old

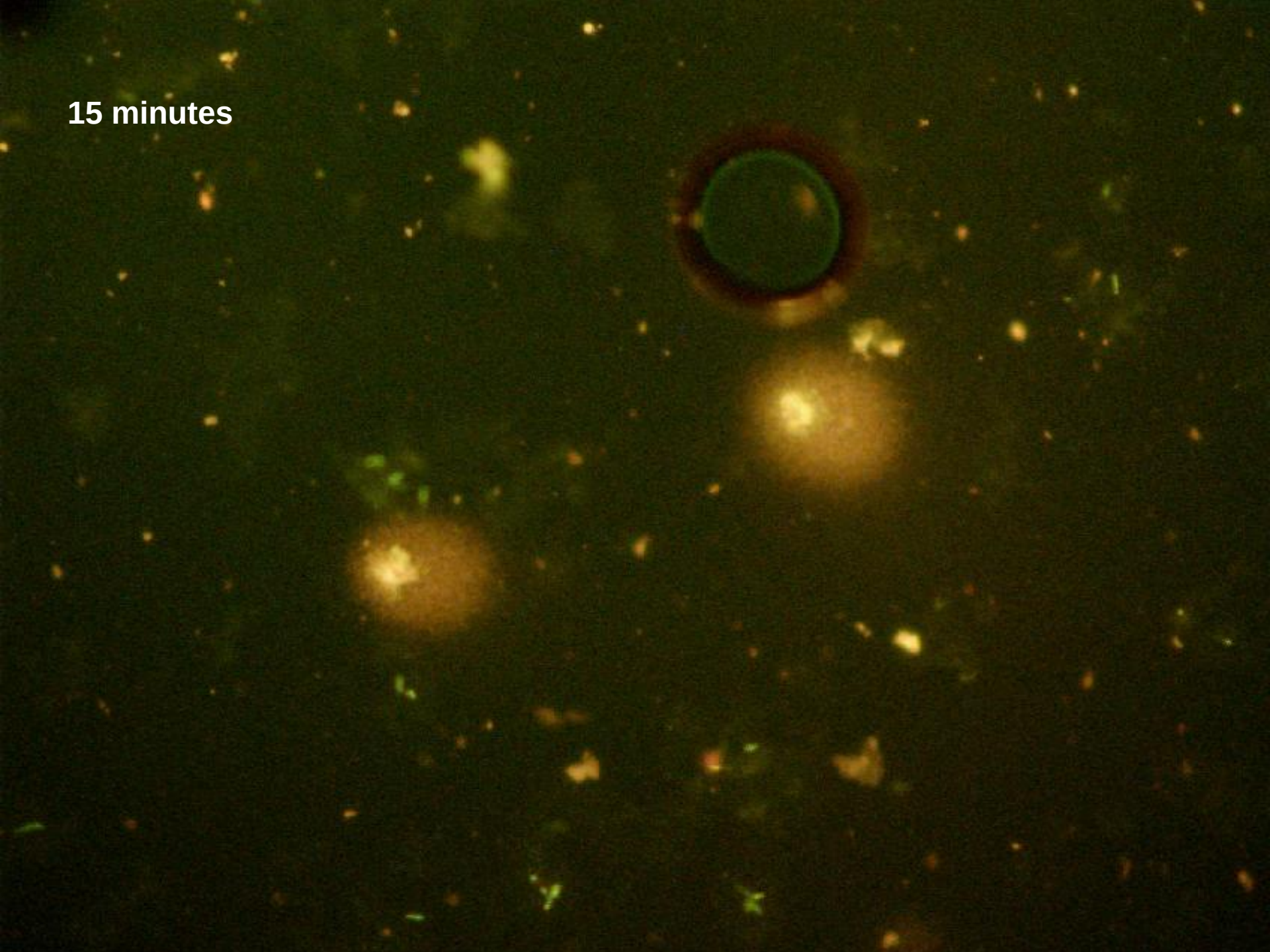
Single-strand DNA breaks found in the hair root cells

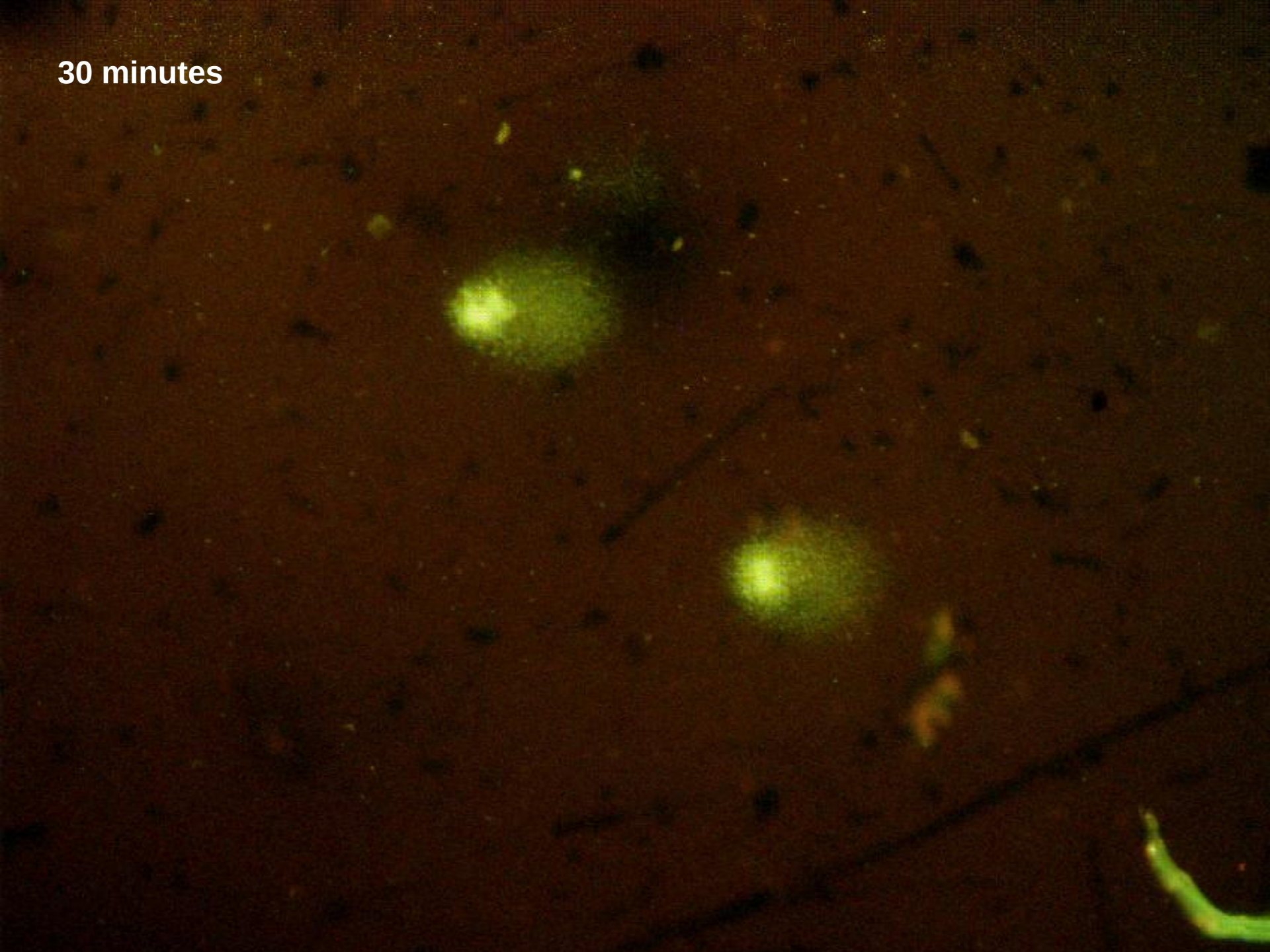
Lai, H. and Singh, NP., 1995: "Acute low-intensity microwave exposure increases DNA single-strand breaks in rat brain cells". Bioelectromagnetics 16: 207-210.

Lai, H. and Singh, NP., 1996: "Single- and double-strand DNA breaks in rat brain cells after acute exposure to radiofrequency electromagnetic radiation". Int.J. Radiation Biology 69 (4): 51 3-521.

ST Çam and Nesrin N Seyhan Single-strand DNA breaks in human hair root cells exposed to mobile phone radiation. Int J Radiat Biol 88(5):420-4 (2012)


control


15 minutes


30 minutes

GAZI NON-IONIZING RADIATION PROTECTION CENTER (GNRK)
&
GAZI BIOPHYSICS DEPARTMENT

www.biyofizik.gazi.edu.tr www.gnrk.gazi.edu.tr

BLOOD LYMPHOCYTES STUDY

1800 MHz GSM Modulated RFR (217 Hz, 0.21 W/kg) for 6, 8, 24 and 48 h (human peripheral blood lymphocytes)

- Inhibited cell proliferation
- Increased Sister Chromatid Exchange frequency

(indicator of DNA damage)

Meric Arda Esmekaya, Ebru Aytekin, Elcin Ozgur, Göknur Güler Öztürk, Mehmet Ali Ergun, Suna Ömeroğlu, Nesrin Seyhan (2011). Mutagenic and morphologic impacts of 1.8 GHz Radiofrequency Radiation on human peripheral bloodlymphocytes (hPBLs) and possible protective role of pre-treatment with Ginkgo Biloba (EGb 761). Science of the Total Environment, 410(59-64)

ON GOING STUDIES

- **Multifrequency EMF exposure**

  RF, 2100 MHz ; ELF, 50 Hz on the permeability of BBB in diabetic and non-diabetic rats

- **Skin hydoxyproline level in RF exposed (900 MHz) rats**

- **1800 MHz GSM-like RFR on the tendency of metabolism- related diseases of intrauterina and extrauterina exposed infant rabbits**

- **Intrauterine and extrauterine exposure to 1800 MHz GSM-like radiofrequency effects on blood chemistry and oxidative stress in infant rabbits**

- **2.1 GHz Wideband Code Division Multiple Access (W-CDMA) modulated RFR exposure for 4 and 24 h, in breast fibroblast cells**

Research Team

1. Gazi University, Medical Faculty

Biophysic Department

Prof. Dr. Nesrin SEYHAN
Assoc. Prof. Göknur GÜLER ÖZTÜRK
Dr. Elçin ÖZGÜR BÜYÜKATALAY
Res. Assist. Arın TOMRUK

Biochemistry Department

Prof. Dr. Nilgün ALTAY
Assoc. Prof. Aylin SEPİCİ DİNÇEL
Res. Assist Duygu ŞAHİN

Nanomedicine Research Laboratory

Gürer G. BUDAK, M.D., PhD

2. Ankara University, Veterinary Faculty

Biochemistry Department

Prof. Dr. Tevhide SEL
Dr. Görkem KISMALI

Pathology Department

Prof. Dr. Sevil ATALAY VURAL
Assist. Prof. Hikmet KELEŞ

Research Team

3. Hacettepe University, Medical Faculty

Biochemistry Department

Prof. Dr. N. Nuray ULUSU

Dr. Berivan TANDOĞAN

ENT Department

Assist. Prof. Dr. Bilgehan Budak

4. Kırıkkale University, Medical Faculty

ENT Department

Prof. Dr. Nuray BAYAR MULUK

Anesthesiology and Reanimation Department

Prof. Dr. Alpaslan APAN

GAZI NON-IONIZING RADIATION PROTECTION CENTER (GNRK)
&
GAZI BIOPHYSICS DEPARTMENT

www.biyofizik.gazi.edu.tr **www.gnrk.gazi.edu.tr**