EMF Research Australia/ New Zealand

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Outline

- **Summary of research outcomes 1995 – 2008, Australia/New Zealand**
- **1990s: Research mainly 50 Hz; 2000s: mainly RF**
- **Australia: Government funding program for RF 1996 – 2009**
- **Australian Centre for RF Bioeffects Research (ACRBR)**
- **Australia/NZ: Interphone involvement**
- **Contributions to Dosimetry Research**
- **Role of Government Agencies**

50 Hz Studies: role of AESIRB

- **AESIRB = Australian Electricity Supply Industry Research Board – Related to Electricity Supply Association of Australia (ESAA). Funded 3 EMF projects**
- **Mainly funded more general electricity supply research, but 3 EMF projects were funded**
- **1. Repacholi et al. (~ 1993 – 'Adelaide Study'): Lymphoma in Eμ-*Pim 1* mice. 4 levels of 50 Hz MF (also +ve control). Outcome: No MF effect on lymphoma [Radiat Res. 149: 300 (1998)]**
- **2. Wood & Armstrong (1995/6): 50 Hz magnetic fields on human melatonin. Outcome: ~ 30 min delay in melatonin onset for some individuals [J Pineal Res. 25:116 (1998)]**
- **3. Wood (1997): Heart rate variability. No replicable changes [Med Eng Phys 21:361 (1999); Physiol Meas 27:73 (2006)]**
- **AESIRB no longer exists: was disbanded as ESI was privatised**

Adelaide study RF component

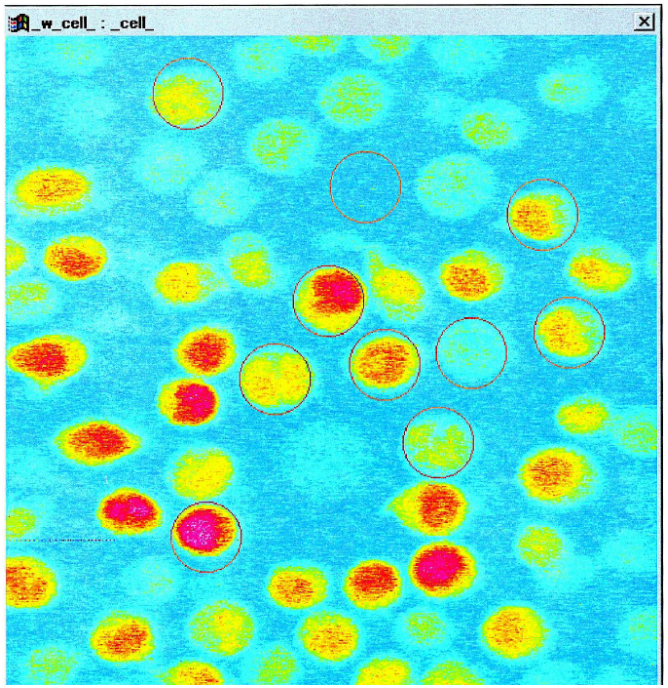
- **Funding: Telstra Research Laboratories (then: Government)**
- **Repacholi et al. GSM-type exposure; 30 min/day; Eμ-*Pim 1* mice (exposed/control 101/100). Averaged SAR 0.13 – 1.4 W/kg. Outcome: OR of 2.4 for lymphoma** [Radiat. Res. 147:631 (1997)]

The Sydney 'TV towers' study

- **Unfunded**
- **Hocking et al. Child Leukaemia mortality 2.3 (1.4 – 4.0) for 3 inner vs 3 outer Sydney municipalities, the former within 4 km of 3 TV transmitter towers.** [Med J Aust 165: 601 (1996)]

Swinburne University In-vitro study

- **Funding: Telstra Research Laboratories (then: Government)/ Swinburne Uni.**
- **Cranfield et al. GSM-type exposure; 30 min; Calcium levels and spiking pattern in leukaemic (Jurkat) cells. Averaged SAR 2, 10 W/kg. Outcome: NS overall** [Int J Radiat. Biol 77:1207 (2001)]



Government Research Funding

- **Electromagnetic Energy (EME) Program. Commenced 1996: due to finish 2009. Allocation: $A1M (€0.6M) pa**
- **Coordinated by the Committee on Electromagnetic Energy Public Health Issues (CEMEPHI). Has reps. from 2 govt. departments, the Australian Communications & Multimedia Authority (ACMA), and the National Health and Medical Research Council (NHMRC).**
- **1. Australian research program (managed by the NHMRC)**
- **2. continuing Australian participation in WHO's International EMF Project**
- **3. public information program (managed by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) to provide information to the public & media.**

Round 1 of NHMRC funding 1998

- **1. B. Armstrong et al. (1999-2004): Brain tumour in adults – Australian component of INTERPHONE** – initial funding for a pilot. Full study commenced in 2001
- **2. Stough & Wood (1999-2000): GSM emissions & neuropsychological functioning in human volunteers. Outcome: worse** reaction times & some measures of information retrieval, but **improved** speed of memory processing. **[Neuropsychologia. 44: 1843 (2006); Int J Radiat. Biol. 77:735 (2001) (50 Hz)]**
- **3. Sykes (1999): Pilot: DNA breakages in transgenic mice.** Outcome NS, so full study not commenced**.**
- **4. Vernon-Roberts et al. (Utteridge) (1999-2001). Repeat of Repacholi et al. study, but using 'Ferris Wheel'.** Outcome NS **[Radiat Res. 158: 357 (2002)]**

Round 2 of NHMRC funding 2001

- **1. Wood & Stough (2002-2004): GSM emissions & brain electrical responses and sleep patterns in human volunteers. Outcomes:**
- **Brain electrical responses to stimuli (Event-related Potentials, ERP)**
  - **Pilot study** (n = 12 subjects; auditory stimuli): **Reduced** response amplitude and latency to non-target and **increased** latency to 'oddball' target stimuli; **worse** reaction time performance **[Clin Neurophysiol 115: 171 (2004)]**
  - **Main study:** (n = 120 subjects; auditory, visual and cognitive task stimuli): **no significant changes** in ERP-related parameters. **[Bioelectromagnetics: 27:265 (2006)],** further analysis by Croft showed subtle changes **[Bioelectromagnetics: 29:1 (2008)]**
- **Sleep study**
  - (n = 50; polysomnography): REM latency **reduced** by 16%. EEG alpha power **enhanced** by 8% during 1st non-REM period. **[Neuroreport 16: 1973 (2005)]**
  - Overnight melatonin (metabolite) output (n = 55): Overall no change, but 27% **reduction** in normalized output pre-bedtime. **[Int J Radiat Biol 82: 69 (2006)]**
- **Methodological Issues:** Pickup of electrical noise by electrodes **[Med Biol Engng Comput 41: 470 (2003)];** electrode influence on SAR **[IEEE Trans BME54:914 (2007)]**

Round 3 of NHMRC funding 2003

- **Centre of Research Excellence in Radiofrequency EME. (Australian Centre for Radiofrequency Bioeffects Research) 5 years 2004-2008; $A0.5M (€0.3M) pa**
- **Participants (Institutions and Research Directors)**
  - RMIT University, Melbourne [Cosic; Molecular studies]
  - Swinburne U of Tech., Melbourne [Croft, (Exec Director); Human volunteer, Wood; Cell studies]
  - Monash University, Melbourne [Abramson; Epidemiology].
  - Institute of Medical & Veterinary Sci, Adelaide [Finnie; Animal studies]
  - Telstra Research Laboratories, Melbourne [McKenzie; Dosimetry].
- Website: acrbr.org
- **Part of brief: research program to be financially sustainable via other sources of income by end of period.**

ACRBR Highlights

- 45 Journal papers listed
- Animal studies (Finnie et al.): continued Adelaide II exposure system & archival tissue analysis: all NS
  - (2001, 2002) albumin leakage in BBB [Pathol. 33:338; 34:344]
  - (2005) c-fos in mouse after 30 min exp [Pathol. 37:231]
  - (2006a,b,c) albumin leakage & c-fos expression in fetal/neonatal brain BBB – whole gestation exposure [Pathol. 38:63, 262, 333]
  - (2007) c-fos in mouse – 2-year exposure [Pathol. 39:271]

ACRBR Highlights

- Epidemiology: Mobile Radiofrequency Phone Exposed Users Study (MoRPhEUS) (Abramson):
  - Cohort study of 317 12/13 y.o. school children: Study of phone use and ? a) delayed cognitive development, b) symptoms, impaired hearing or reduced blood pressure
  - Hardware Modified Phones [J Exp Sci Envir Epidem 18:134]
  - Future follow-ups in 5, 10 or 20 years
- Human Volunteer (Croft): repeat of Wood sleep study
- Dosimetry: separate slide

Interphone Involvement

- Australia, Sydney (M 825, F 839 = 1664)
  - B Armstrong, M Kilkenny, Sydney; G Giles, Melbourne; A Cook, Perth
- New Zealand, 9 cities (M 440, F 460 = 900)
  - A Woodward, Auckland; N Pierce, Wellington

Dosimetry: Telstra Research Labs

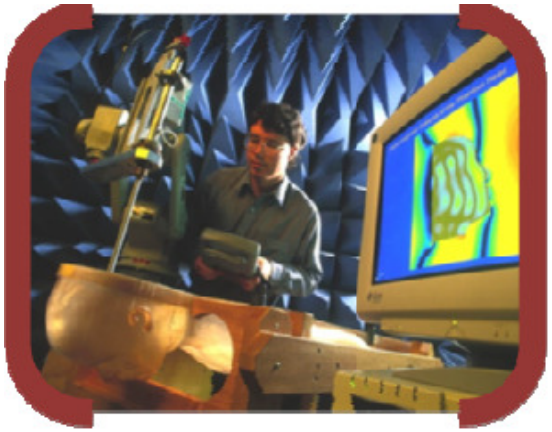
- Thermal/SAR modelling
  - Anderson & Joyner (1995) Phantom head – peak brain temp rise of ~ 0.1^0C [Bioelectromagnetics16:60]
  - [Anderson (2003)] Modelling of SAR in children & adult head: peak SAR in 4 y.o. raised by 30% [Phys Med Biol 48:3263]
  - McIntosh et al (2005) Head with metallic implant for exposure at occupational RLs: for SAR, ICNIRP compliant, but previous IEEE exceeded (for 2.1 – 2.6 GHz). [Bioelectromagnetics26:377]
  - McIntosh et al (2008) SAR & temp. changes near cochlear implant: compliant [Bioelectromagnetics 29:71]

Dosimetry: Telstra Research Labs

- **Exposure systems**
  - Anderson et al. (1998) Coaxial exposure system [Proc 2nd Intl BEM Conf. Lithgow & Cosic eds. IEEE]
  - Ferris Wheel used in Adelaide II experiments
- **EM Compatibility**
  - Iskra et al. (2007) GPRS & WCDMA on functioning of medical devices: little cause for concern. [IEEE Trans BME54:1858]

Telstra Research Labs now closed

- RF Lab now installed at Swinburne University



Government Agencies

- **ARPANSA**
  - **RF Standard published in 2002**
  - **Measurement services**
  - **Factsheets on RF devices and health:**
    http://www.arpansa.gov.au/RadiationProtection/Factsheets/index.cfm
- **New Zealand National Radiation Laboratory**
  - **Measurement services**
  - **Advice on Cell phones and cellsites:**
    http://www.nrl.moh.govt.nz/faq/cellphonesandcellsites.asp
  - **[RF standard: Standards NZ (1999): ICNIRP-based]**

Finally: Unfinished Business

- WHO Research Agenda – NHMRC projects for 2009
- A personal view - topics include:
  - Higher frequency ranges, including THz
  - Further work on the 'children's issue': cohort follow-up
  - In vitro/in vivo dosimetry – micro scale modelling, improved heat modelling & direct measurement of temperature
  - Antenna Near-field dosimetry
  - Risk perception
- Funding continuation in Austr/NZ: importance of maintaining industry 'arms length' process