

24 SEPTEMBER 2009

## FRENCH STUDY UNABLE TO REPLICATE SALFORD BBB EFFECTS

FRANCE

Key words: RF, animal study, blood-brain barrier, BBB, replication attempt

Madison, Wisconsin---In 2003, Leif Salford and colleagues at Lund University in Sweden reported that they had observed an alteration in the blood-brain barrier (BBB) of rats 50 d after they had been exposed to a GSM-900 signal for 2 h. Several attempts to replicate the study have not been able to do so [see, most recently, RF Gateway archives: 11 Aug 2009]. A new study by French scientists was also unable to confirm Salford's results. The study was done by well-known EMF researchers including Philippe Lévêque of the University of Limoges, Bernard Veyret and Isabelle Lagroye of the University of Bordeaux, and first author Florence Poulletier de Gannes of Limoges.

### METHODS

The Salford study had several shortcomings, Poulletier et al. point out, including the use of rats of mixed ages and sexes, the use of cresyl violet to detect dark neurons, inadequate definition and description of the exposure system, and poorly characterized dosimetry. In their new study, the authors attempted to correct these deficiencies.

The study used 12-wk-old male Fischer 344 rats as did the Salford study. In groups of 8, the animals were either sham-exposed or exposed in a rocket-type exposure system with a loop antenna to head-only GSM-900 signals at either 0.14 or 2.0 W/kg as determined by FDTD calculations. The exposures were for 2 h and groups of rats were kept for either 14 or 50 d after exposure. In addition, 8 rats served as cage controls and 10 rats as positive controls treated with cold shock.

At the end of either 14 or 50 d, rats were sacrificed and the brains removed and fixed. All brains were coded to ensure blind analysis. Serial 10-microm sections from 3 sections of each brain -- frontal Z1, median Z2, and posterior Z3 -- were classified into the following regions of the cortex and hippocampus: the motor cortex (F1), medial forebrain bundle (F4) in Z1, retrosplenial cortex (M1), auditory cortex (M3), cortical amygdaloid nucleus (M4) in Z2, dorsomedial periaqueducal gray (P1), retrosplenial cortex (P2), and Pontine nuclei (P3) in Z3. Two slices per rat per region were analyzed.

In addition to using cresyl violet, as had Salford, Poulletier et al. used Fluoro-Jade B to determine the presence of dark neurons -- markers of neuronal degeneration. Fluoro-Jade B is "known to be more specific for degenerative neurons" than cresyl violet, according to the authors. Permeation of the BBB was measured by detecting the existence of endogenous albumin in the brain tissue via the indirect immunoperoxidase method. Lastly, apoptosis was detected in situ with a commercial kit based on the TUNEL assay.

Data were analyzed using the Kruskal-Wallis StatXact test and the Mann Whitney test.

### RESULTS

Cresyl violet staining was not able to differentiate RF-exposed, sham-exposed, or positive control samples. This shows, the authors say, "that cresyl violet is not a specific marker of dark neurons." In contrast, the

Fluoro-Jade B test showed a statistically significant increase in neuronal degeneration in the cold-shocked brains but found no differences between the RF-exposed and sham-exposed brains.

With respect to BBB permeability, Pouletier and colleagues observed no statistically significant albumin leakage after exposure to GSM-900 at either brain-averaged SAR. A significant increase in albumin leakage was seen in positive control rats compared to cage control rats.

“Not even a single apoptotic neuron was detected in any regions with any RF-radiation exposure condition tested,” the authors say, while a complete apoptotic population was seen using TACS-nuclease as a positive control.

“To conclude, our results are not in agreement with those obtained by the Salford group. We also conclude that, under our exposure conditions, GSM-900 RF radiation does not generate brain damage at levels up to the standard local exposure limit for the public. Our results, in agreement with the more recent data published by other groups in this field...indicate that the scientific basis for claims that short-term RF-radiation exposure, at levels relevant to mobile communications, damages the BBB is losing its credibility,” the French investigators say.

The research was funded by Bouygues Telecom, France Telecom R & D, and the French National Center for Scientific Research (CNRS).

**BIBLIOGRAPHIC INFORMATION:** Pouletier de Gannes F, Billaudel B, Taxile M, Haro E, Ruffié G, Lévêque P, Veyret B, Lagroye I. Effects of head-only exposure of rats to GSM-900 on blood-brain barrier permeability and neuronal degeneration. *Radiat Res.* 2009 Sep;172(3)359–367.

**REPORTED BY:** Teri Vierima, RF Gateway, [tvierima@rs-inc.com](mailto:tvierima@rs-inc.com)