

## **Hypothesis: Multiple Sclerosis High Frequency Regions Correspond to Zones of Increased Ionizing Radiation as Identified by NASA's SAMPEX Mission Which May Provide a Single Environmental Causal Factor.**

**By Scott Farmer**

**Astrophysical Background:** Electrically charged particles from the sun and space bombard the magnetic field surrounding Earth. Much of the earth is protected by the magnetosphere, but protons and electrons follow the magnetic fields to northern and southern regions where they are able to penetrate our atmosphere. NASA has studied ionizing radiation and the early Solar Anomalous Magnetospheric Particle Explorer (SAMPEX) investigated this phenomenon. The Proton/Electron Telescope on board measured this radiation and mapped its activity geographically. Refer to the article by Daniel N. Baker (Baker 1994 (key words: NASA, SAMPEX, radiation, Baker; click AGU Web site)) for more background and an image. An animated time lapse video is available at NASA (NASA SAMPEX (keywords: NASA, SAMPEX, PET, SVS, 1386; click SVS Animation 1386; click online movie to download)).

**MS Epidemiological Background:** The epidemiological study of MS has provided many clues about MS, but a single environmental agent binding the clues together has been elusive. Geographically MS high frequency areas are in northern and southern latitudes. For example in North America the range is 37 degrees N latitude to 60 degrees N latitude. In the south latitudes New Zealand and the southeast tip of Australia are at roughly high 30s to 45 degrees south latitude. Refer to the map at ([medlib.med.utah.edu](http://medlib.med.utah.edu) (key words: multiple, sclerosis, epidemiology; click Multiple Sclerosis, Epidemiology of...)) for a more comprehensive visual distribution. Also check the National MS Society ([www.nmss.org](http://www.nmss.org)) and Kurtze J F (Kurtze 2000) for more information.

**The Correlation:** Consider the energetic electrons as they are distributed into the earth's atmosphere. As shown in the NASA video and Dr. Daniel N. Baker's image, it forms a sort of "headband" around the top (and bottom) of the planet. The center of this band in the north is magnetic north, not the polar axis. Since magnetic north during 1994 was estimated by the Geological survey of Canada to be 78.3 degrees N, 104.0 degrees W, the band dips towards North America. Note that magnetic north changes and that the yearly drift is presently northward at a rate of 15km/year (Geological Survey of Canada 1998). Because of this dip southward in North America, 180 degrees around the planet would show an equal and opposite latitude shift. The southern region would mirror the northern region.

The distribution of MS in North America exactly matches the distribution of the ionizing radiation measured by SAMPEX. Extending this eastward it bisects Europe as it drifts into higher latitudes and out of southern latitudes. Since magnetic north is drifting northward the increase in European higher frequency

should be at the southern cusp of the band. North American higher frequency should drift northward at 15km per year out of more populated areas at the expense of less populated areas in the north. (LAI 1989). In the Southern Hemisphere the band falls mostly at sea except for the southeastern tip of Australia, the southern 2/3rds of New Zealand, the southern tip of Africa and southern South America. Note that a South Atlantic anomaly exists between the tips of Africa and South America because "the Earth's magnetic field is not centered perfectly" (Baker 1994). Japan falls outside of these bands. The Polar Regions are outside these bands too.

"Ionizing Radiation endangers humans because it is capable of breaking chemical bonds in tissue. The damaging power depends upon the amount of energy deposited per unit volume" (NASA Space Settlement). Ionizing radiation affects women twice as much as men and affects pre-adults more too. Fast growing tissues in pre-adults such as bone marrow and intestines are susceptible to damage. It is believed that MS gains its potential in humans during the ages up to 15 years. Women manifest MS at about twice the rate for men.

**Possible connection to disease potential:** By growing up in a region falling within these bands one endures increased long term exposure to ionizing radiation. Bone marrow and intestines are affected. Interestingly, out of about 83 studied diseases "only cancer of the colon was similar in geographical distribution and in the slight preponderance of females dying of the disease". (Wolfgang F 1975). The reduced function of the digestive system may lead to impaired defenses from cellular oxidative stress. The damage to bone marrow and possible immune function alteration was outside my studies but may be worth considering. Onset of MS might occur when together with this environmentally caused predisposition and other stresses such as child birth, poor diet, high emotions, high stress, heat, toxins and so on, overwhelm the impaired ability of the body to control onset of oxidative stress and its damaging effects. Note that growing up in regions within these bands that are in rain shadows and therefore more arid may afford less filtering of damaging particles and therefore explain even higher frequency rates in regions like Alberta and Saskatchewan.

**Why light skinned peoples?** The incidence of MS leans heavily to those with lighter pigmentation. A study titled "Melanin decreases clastogenic effects of ionizing radiation in human and mouse somatic cells and modifies the radioadaptive response" concludes "adaptive response can be prevented by a radioprotector such as melanin, and melanin is capable of completely removing low dose radiation effects. (Mosse 2000). This could explain why darker-complected peoples living within this band manifest MS at vastly lower rates than lighter-complected peoples growing up side by side.

Please feel free to share your thoughts, criticisms and comments. Only by sharing our knowledge and ideas will we defeat this disease.

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**References:**

- Baker, D.N., Mission Investigates Radiation Arriving at Earth, *Eos* Vol. 75, No.11, March 15, 1994, pp. 130-1.
- Geological Survey of Canada, Tracking the North Magnetic Pole, [www.geolab.nrcan.gc.ca](http://www.geolab.nrcan.gc.ca), 1998.
- Kurtzke, J. F., Multiple Sclerosis in time and space—geographic clues to cause, *J. Neurovirl.* 2000, May 6 Suppl 2: s13440.
- Lai, S. M., Zhang, Z. X., Alter, M., Sobel, E., Worldwide trends in Multiple Sclerosis Mortality, *Neuroepidemiology*, 1989, 8 (2): 56-67.
- Mosse, I., Kostrova, L., Subbot, S., Maksimenya, I., Molophei, V., Melanin decreases clastogenic effects of ionizing radiation in human and mouse somatic cells and modifies the radioadaptive response, [link.springer-ny.com](http://link.springer-ny.com) Issue 1 (2000) PP 47-52.
- Multiple Sclerosis: Epidemiology of Multiple Sclerosis, World Distribution of Multiple Sclerosis. [medlib.med.utah.edu](http://medlib.med.utah.edu) (a map).
- The National Multiple Sclerosis Society Information Center and Library, *Multiple Sclerosis Information Sourcebook*, 2000, Epidemiology.
- NASA, SAMPEX- A synoptic view of Earth's Electron Radiation Belts: North Pole Energetic fluxes from PET, [SVS.gsfc.nasa.gov](http://SVS.gsfc.nasa.gov).
- NASA, Space Settlements: A Design Study, Chapter 2, appendix B, Ionizing Radiation in Space, 1975, [lifesci3.arc.nasa.gov](http://lifesci3.arc.nasa.gov).
- Wolfram, F., Similar Geographical Distribution of Multiple Sclerosis and Cancer of the Colon, *Acta Neurol Scand*, 1975 Oct; 52 (4): 294-302.