LIGHTNING DATA CENTER MINUTES
DECEMBER 11, 2009
ST. ANTHONY CENTRAL HOSPITAL, DENVER, CO
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Monthly Quote: "The cell is a machine driven by energy. It can thus be approached by studying matter, or by studying energy." Albert Szent-Gyorgyi, *Bioelectronics*, from p. 116 of Cross Currents, Robert O. Becker, M.D., 1990.

1. Meeting began at 11:50 AM and adjourned at 1:15 PM.

2. Members present: Cherington, Wachtel, Clark, Wells, Gift, Cui-Gift, Collier, Burrows, Nibbe. Stewart, Hodanish, and Yarnell. Clark moderated the meeting.

3. Steve Hodanish is working on a formal lightning paper, which he hopes to have published within the next 6 months.

4. Greg Stewart mentioned he would like to get more first responders to the meetings to get their stories on responses to lightning strikes.

5. Phil Yarnell gave us an update on the woman that was struck while on an archaeological dig in New Mexico. She is now starting to verbalize and is also starting to stand up. She still has some motor issues where her motions are exaggerated. She is also becoming more aware of herself and her surroundings.

6. Steve Clark presented an abstract from a paper entitled "On the Physics of the Interaction of Aborted Lightning Upward Leaders With Humans" presented at a 2008 joint conference of International Conference on Grounding and Earthing and the 3rd International Conference on Lightning Physics and Effects in Brazil. This paper suggests that upward streamers not attached to the main lightning channel are another mechanism for lightning injuries. This sounds exactly like what Ken Langford suggested in November's meeting regarding the injury to the man descending Quandry Peak. While I could not find the direct link to this paper, I did find a link to an 86-page PDF document, given below, which appears to be some of their earlier work. Paste it into your browser window. You should be asked if you want to LOAD or SAVE your document.
uu.diva-portal.org/smash/get/diva2:172155/FULLTEXT01

7. Sue Wiggins was presented with her annual card from the LDC for everything she does for us behind the scenes. Sue, on behalf of the LDC, Thank You for all of your work and help you have given us throughout the year.

8. Our featured speaker was the LDC's own Howard Wachtel, Professor of Neuroscience with the University of Colorado. His presentataion, entitled "Cellular Effects of Electric Current", was rich in both content and complexity. My weak note-taking cannot do justice to this topic, though I will do my best. To start, a single cell can be represented by drawing three concentric circles on a piece of paper to look like a dartboard. The bull's eye is the nucleus. The inner ring touching the bull's eye is the nucleoplasm. The outer ring, touching the inner ring, is the cytoplasm. The outside edge of the cytoplasm is the cell membrane. The cell membrane is a phospholipid layer, which acts like a capacitor in that it stores a charge. Holes in the membrane open and close, allowing ions, such as sodium, potassium, calcium, magnesium, chloride, hydrochloride, and phosphate, among others, to flow into and out of the cell. More specifically, these holes open and close in a sequence to allow the flow of specific ions at specific times and at specific equilibrium potentials. For example, potassium ions have an equilibrium potential of about –94 millivolts and sodium ions have an equilibrium potential of around +61 millivolts. It is this exchange of ions, starting at some point along a nerve or muscle fiber, and then propagating outward in both directions along the fiber, that gives rise to electrical impulses. These electrical impulses allow nerves to transmit and muscles to contract. In the heart, the duration of an electrical impulse, and hence, contraction, is about 0.3 seconds, with a voltage range from –90 millivolts to +50 millivolts. These contractions are regulated by the sinoartial node, which is the heart's natural pacemaker. The impulses spread out along the walls of the atria, which causes contraction. The key here is that the impulses are timed and flow across specific pathways to allow the heart to function properly. When the heart is subject to electrical shock, there are two main possibilities. The first is atrial flutter, where electrical impulses travel around the atria in a closed circle, usually with an accelerated heart rate. The second is atrial fibrillation (a-fib), where electrical impulses flow around the atria in irregular pathways, causing the heart to quiver. The heart must be "reset" using defibrillation devices with paddles placed on the chest – one slightly above the heart and one slightly below the heart. A massive flow of current is applied across the heart for a few milliseconds, which resets the heart and allows it to beat properly again. Finally, Howard pointed out that electric currents not sufficient to shock can interfere with the cell's ability to produce essential biochemicals and to maintain the cell's electrical equilibrium, which may lead to neurologic and physical problems. Howard, thanks for a great talk, and I hope I've done it some justice.

9. These minutes do not represent official positions of LDC or its members. They simply reflect the comments made at the meeting.

10. Next meeting: Friday, January 8, 2010 at 11:45 AM in the Main Auditorium at St. Anthony Central Hospital. Subject: TBA. Happy Holidays To All!

Respectfully Submitted,

Steven E. Clark, Consulting Meteorologist