

Earthquake and plant root researches II

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It is my great pleasure to announce that the beginning of the year has seen four new papers posted on our website along with this letter. Hence, I start by expressing my gratitude to all authors for their contributions and to our managing editors for working very hard until the year's end, as well as by thanking our subject editors and reviewers.

I would like to pick up on some news from the end of 2012. I think that one of the most impressive pieces of news from 2012 is the awarding of the Nobel Prize for Physiology or Medicine to Drs. John Gurdon and Shinya Yamanaka "for the discovery that mature cells can be reprogrammed to become pluripotent." I think most basic biologists will agree with this choice. I would also like to mention another piece of good news, this time from an environmental view point, that although the first commitment period of the Kyoto Protocol, the only binding obligations on industrialized countries to reduce greenhouse gas emissions, ended on December 31, 2012, the United Nations Climate Change Conference (COP 18) held in Doha managed to launch a new commitment period, this one applicable for another eight years. I guess some may think it is too optimistic if I consider this as good news. On a separate note, I found that a unique clock called the Environmental Doomsday Clock advanced 22 minutes from 2011 to make its "time" now 9:23; this clock is an environmental version of the Doomsday Clock and is based on the result of a questionnaire on environmental problems and the survival of humankind (answers from 1,101 environmental experts of 88 countries reported by the Asahi Glass Foundation, <http://www.af-info.or.jp/en/questionnaire/clock.html>). No doubt, this is a bad news.

Looking back at the end of the year in Japan, it is funny to note that the prime minister has again just changed. Even though we started this journal in 2006 and all the starting members of the managing team and I still remain, our prime minister has been changing every year for seven consecutive years. During the House of Representatives election, we heard a unique word, "Sotsu Gempatsu." As "gem-

atsu" is the general term for nuclear power plants, this phrase basically means abandoning this form of energy. However, at the same time, it includes some additional nuances. "Sotsu" means graduation in Japanese. Thus, to me, the phrase somehow conveyed our emotional claim that we have learned a lot, maybe too much, from nuclear power technologies, and that it is time to say goodbye to it in order to move on to the next level. We know it is not an easy thing from an economical point of view, but we should remember that 30,000,000 Japanese people voted for parties who basically insisted on abandoning nuclear power as well.

I shall now get down to the main topic. The reason why I continue the same topic "Earthquake and plant root research" again this year is that I have been inspired by a review recently written by Dr. Peter Barlow (Barlow, 2012), one of our supervisors, about Dr. Hideo Toriyama's researches that are directly related both to plant roots and earthquakes (Toriyama, 1991). Dr. Toriyama reported his observations of the distinctive anomalous bioelectric potential of silk trees (*Albizia julibrissin* Durazz.) prior to 28 strong earthquakes. He summarized his observations over the period of 1977 to 1990 and classified three types of anomalous bioelectric potential in the trees; these potentials could be related to forthcoming earthquakes. I know earthquake prediction is a sensitive issue, which is obviously out of my area of expertise, and there seems to be an argument about the methodology employed in his measurements (Okamoto and Masaki, 1999). Nevertheless, I think I cannot depart from this topic without mentioning his study.

The underlying mechanism of his observations is not yet known at all. Dr. Barlow suggested that trees perceive subterranean electromagnetic emissions as well as charged ions produced by geochemical reactions induced under tectonic stresses. The latter mechanism, proposed in the case of animals (Grant et al., 2011), is as follows: charged carriers, released from the oxygen matrix of silicates within the Earth's crust, interact with ground water, thus creating H₂O₂

as well as enhancing the oxidation of organic materials, which are also released into the lower atmosphere.

Of the various diagnostic precursory phenomena of earthquakes, electromagnetic field variations and chemical processes are classified as secondary precursors (Rusov et al., 2006). Anomalous behaviors or responses of animals or plants are tertiary precursors (National Research Institute for Earth Science and Disaster Prevention, http://www.hinet.bosai.go.jp/about_earthquake/part1.html). Where is the front line of this area of research? Orihara et al. (2012) recently reported significant correlations between preseismic anomalous changes in telluric currents, or geoelectric potential difference, which may be one of these, I suppose. If so, validation of accuracy of such earthquake precursors has just begun, even at the secondary level.

Then, again, what about at the tertiary level? For example, the International Commission on Earthquake Forecasting for Civil Protection reported that there is no credible scientific evidence that animals display behaviors indicative of earthquake-related environmental disturbances that are unobservable by the physical and chemical sensor systems available to earthquake scientists (Jordan et al., 2011). There is no mention about plant behaviors. However, we cannot forget that each tree has quite number of roots underground and an individual root has sensitive biosensors, such as water sensors (Miyazawa et al., 2012) and gravity sensors (Wyatt and Kiss, 2013). What if the large amount of data collected by many silk trees are analyzed using a super computer such as the K computer (<http://www.aics.riken.jp/en/>)? This is my imagination on a New Year's Day, or my first dream of the New Year.

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Editor-in-Chief, Plant Root

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I. Karahara at Tateyama mountain range in Toyama

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