## Grand Challenges Bio-inspired Monitoring and Warning Systems for Earthquakes

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Earthquakes are extremely lethal in part because they cannot be predicted. Furthermore, early warning systems for earthquakes remain a difficult technology to implement in practical settings. To save human lives, new sensors for development of bio-inspired early detection system for warning of eminent earthquakes are a primary interest for future Taiwan-US collaborations.

The biological structures and mechanisms that contribute to the exceptional hearing and sensing abilities of animals such as frogs, fish, lizards and snakes, among others, will be explored to create novel sensors that can be used for early detection systems for earthquakes. For example, it is widely known that animals exhibit unusual activities proceeding major earthquakes. Ultimately, we hope that an understanding of animal detection and recognition mechanisms will eventually help in the development of bio-inspired sensors for earthquake monitoring and warning. We will emphasize mechanisms and modeling of biological detection of information that can be used in warning of eminent seismic events in lieu of (and as a complement to) research on prediction of seismic events. Several challenging topics include:

- Studying and mimicking exceptional hearing mechanism of animals to provide insight into the design of a sensor to detect infrasound for frequency below 20 Hz. For example, elephants use infrasound waves for communication over extremely long distances (*e.g.*, over hundreds of kilometers). Frogs and fish are also endowed with impressive low frequency detection mechanisms.
- 2) Other animals such as lizards, snakes, and birds will likely provide clues for mimicking their abilities to sense and detect a major earthquake and to provide a few extra seconds (perhaps minutes) warning people to seek safety from the arriving earthquake.