Learning to read the waves

Tsunamis are one of the deadliest phenomena of the world’s oceans. Humboldt fellow Mohammad Heidarzadeh aims to understand them better – and to boost awareness about the threat they pose to the coastal communities.

“Unlike in many Asian areas bordering the Indian Ocean, there was a warning system installed and under operation in Japan when the tsunami occurred,” he explains. “TV channels broadcasted the evolution of the wave live. But many people died because they took the wrong measures after receiving the warning. For example, some were killed in their cars stuck in a traffic jam while trying to reach higher ground that was only a few hundred meters away, and they did not need to drive their cars to survive.”

Mohammad opines that an elaborate warning system is worth nothing if people are not trained to react suitably. “Although”, he adds, “one can say that that has only been the case in events, compared to other countries in the region”. Minutes before the 2004 Indian Ocean tsunami hit the coastline, the water withdrew hundreds of meters from the beaches of Indonesia and Thailand. Locals and tourists alike were fascinated and watched the natural spectacle instead of heading for higher, safer ground. “In my opinion, thousands could have saved their lives had they been better instructed before”, says Mohammad Heidarzadeh. Estimations are that when the wave receded, up to five minutes were left before a tsunami strike. Heidarzadeh’s interest in tsunamis and their effects is based on his profession. He is an engineer with special expertise for marine structures such as harbours, bridges, oil rigs and wave breakers. “I want to understand the different kinds of waves that can hit main-mast structures on the coast and on the water”, he explains. His focus is on ocean waves generated by seismic activities such as earthquakes, landslides or volcano eruptions under water. Computer-generated simulations help Mohammad to calculate different characteristics of waves, for example how the energy is distributed within them and how far they can travel. “The 2011 tsunami was caused by an earthquake which had its epicentre about 70 kilometers east of the Japanese coast. The wave travelled a distance of about 8,000 kilometers in 12 hours before killing one person in California”, the Iranian engineer recounts. “With more knowledge about the events and their effects, I hope that one day we can thoroughly improve the rescue installations and warning systems. Combined with computer simulations, the people in potentially endangered areas should be taught about this”, Heidarzadeh explains.

Mohammad Heidarzadeh was in Japan when a tsunami struck the country in March 2011. He investigates these natural disasters from an engineer’s point of view.

Fat as Foe?

Prof. Dr. Sebastian Zeißig aims to explore the molecular origins of inflammatory bowel disease to develop novel strategies for the treatment of this disease. Recently, he was awarded an ERC Grant for these studies.

"Inflammatory bowel disease affects many worldwide. An estimated 2.2 million people in Europe suffer from Crohn’s disease or ulcerative colitis, the two most common types of inflammatory bowel disease. Most of the time, a significant number of patients does not sufficiently respond to treatment. "Current medication fails in a substantial number of patients", explains Sebastian Zeißig, junior professor for Internal Medicine and member of the Cluster of Excellence "Inflammation at Interfaces". Moreover, the chronic inflammation of the intestine is not only associated with severe symptoms of these diseases, such as abdominal pain or diarrhoea, but also leads to significant medical problems, such as advancement of colorectal cancer."

"Researchers hope that insufficient medical results are that current treatment is largely based on broad and non-selective inhibition of the immune system, meaning, it suppresses reactions of the immune system to the substances that cause Crohn’s disease or ulcerative colitis."

"The efficacy of current treatment is limited as it targets final steps in disease pathogenesis instead of its origins", notes Zeißig.

"About ten years ago, scientists found out that immune cells that recognize and respond to lipids (fat) contribute to intestinal inflammation in ulcerative colitis, one of the two major forms of inflammatory bowel disease. Up to now, however, there has not been a possibility to develop sufficient models or even to categorise these lipids antigens. It is at this point that Zeißig wants to start his research. "We would like to start at the beginning and explore the molecular origins of inflammatory bowel disease as a basis for future development of novel therapies."

"The European Research Council (ERC) interest in this concept and awarded Zeißig’s project an ERC Starting Grant in the amount of 1.5 million Euros. For the next five years the young professor will have the financial means to produce results. “Over the next years, we will clarify which lipids are recognized by immune cells in ulcerative colitis and how they can be targeted,” says Zeißig. What sounds fairly simple in is in fact a labour of Hercules. “It is possible that we will detect several hundred or thousands lipids which serve as antigens to activate the immune system in inflammatory bowel disease”, says Zeißig. The methods to identify these lipids are therefore challenging. Samples have to be taken from inflamed bowel tissue, lipids are extracted, and then are analysed by mass spectrometry. "The methods are quite complex. There are only a few people in the scientific world who run such studies", states Zeißig. "Fortunately, a team at the Leibniz-Center Borstel is among those scientists and we will work together with us on these studies."

"Zeißig is referring to the Science Center Borstel of Kiel University. A part of this scientific institute is a part of Kiel University. “I am grateful for the scientific excellence and the superb infrastructure provided by the Cluster of Excellence, which allowed for these studies.”

Martina Schmiede: The topic internationalisation has finally reached Kiel University. People realize that it carries strategic weight. Especially in science, it has become more important to collaborate worldwide, because not every scientific institution is able to afford high-technology equipment. Also, an international orientation is important for students’ employability. If we want to reach a level of internationalisation in competence in all of the faculties, though, every institute and department has to define its own individual goals. How are you going to manage that successfully? All faculties are in the process of defining their specific objectives for internationalisation on the basis of nine university-wide goals.

Lately, more and more University services are being offered in English. The “unizeit” wanted to know what initiated this trend and asked Dr. Martina Schmiede, director of the International Center, about the University’s internationalisation efforts.

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Ain-Christin Winer