Liquid electronics

Just published in one of the world's most prestigious chemistry journals, the *Journal of the American Chemical Society* (JACS), young researchers at The Wark™, Drs Mani Paneru and Craig Priest, are part of the new breed of innovative thinkers at UniSA, spearheading world-class research led by Dr Rossen Sedev and Laureate Professor John Ralston.

Right now they are exploring the way tiny droplets "dance" to electrical signals when attached to electrodes, work that could improve a range of electrical and biomedical devices.

Dr Priest says most people reel at the thought of letting their electronic devices get wet – but it is that combination of water and electronics, known as "electrowetting", that they believe may change our view of the world.

"If you've ever noticed a bug or blade of grass magnified in a rain drop, then you already know that a droplet makes a perfect lens," he says.

"What is special about electrowetting is that the droplet shape can be switched in an instant to focus an image, or do a variety of other interesting things with liquids in small devices."

Dr Priest says research into why droplets dance the way they do has been a focus for UniSA researchers for many years with outstanding success in uncovering special properties of droplets.

Now they've discovered that a new type of liquid can enhance the effects, having implications for existing and new applications.

"We think future electrowetting devices might be better off using liquid salts or 'ionic liquids' which are neither water nor oil but instead are like melted table salt, even at room temperature," Dr Priest says.

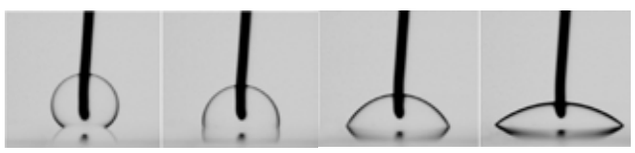
While researchers around the world have long been interested in these unusual liquids, electrowetting them was undertaken first at The Wark™ by Laureate Professor John Ralston and Dr Rossen Sedev.

Using ionic liquid boosts the electrowetting effect to achieve extreme changes in droplet shape.

Recent efforts by Dr Mani Paneru, a PhD graduate from The Wark™, demonstrated the largest changes ever reported and showed that the whole process can be switched repeatedly.

Dr Paneru also studied how fast these liquids can respond to the electric field and the effect of contamination by water on their performance.

The results showed that the reaction of a low viscosity ionic liquid is very fast – several milliseconds – and largely unchanged by water, which is expected to make the design of future devices from mobile phone cameras to a range of biomedical devices, easier and cheaper.



Ian Wark Research Institute explores the way tiny droplets "dance" to electronic signals.

Why mozzies have multiplied

An explosion in mosquito numbers this year isn't just an annoyance, it's a health hazard. **Dr Craig Williams** from UniSA's Mosquitoes and Public Health Research Group explains the combination of environmental factors that make this mosquito season the worst for spreading disease in decades, and the straightforward steps that stop mozzies in their tracks.

Dr Craig Williams
Senior Lecturer in Biological Science, UniSA

It's been a massive year for mosquitoes. Higher than average rainfall across most of the country has caused a dramatic jump in numbers. The mosquito monitoring season, which runs from September to May, shows the population is ten times larger than any other time in recent history. While mosquito numbers typically surge in two or three years out of every ten, we are currently at the absolute upper end of any busy season. The cooler summer months and high rainfall brought about by the La Niña weather pattern have created perfect breeding conditions for mosquitoes.

You may notice you are getting bitten more than usual, which is an annoying and significant effect of a large mosquito population, but of greater concern is the people who get diseases from these bites. Common mosquito-borne diseases found in South Australia are those caused by Ross River and Barmah Forest viruses, which cause arthritis-like symptoms and fatigue and usually last for a few weeks. We don't get transmission of Dengue Fever down here like they do in Queensland, but there is some history here of Murray Valley Encephalitis, a potentially fatal brain infection not reported in South Australia since the 1970s. All the environmental indicators point to an outbreak of mosquito-borne diseases this season, including risk of the first human cases of mosquito-transmitted encephalitis for more than 30 years.

But while lots of rainfall and lots of mosquitoes usually go hand in hand, there are other factors heightening the risk of disease transmission. Almost all the diseases you can catch from mosquitoes in Australia involve other animals in the disease transmission cycle. Female mosquitoes pass on disease through their saliva, which they inject into a person's bloodstream to stop the blood from clotting as they suck it through their proboscis. This can only occur if the mosquito has previously bitten an animal, usually a kangaroo or bird, which already has the disease. This process is a normal part of native disease ecology and usually ticks along at a very low rate, but when you get more animals breeding because of increased rainfall and availability of feed, more mosquitoes, and enough people who haven't had the disease before and aren't immune, then you start to see outbreaks of human disease. And that's what we're seeing now.

"Fortunately it's very easy to avoid being bitten. Wearing good repellent and dressing sensibly will stop mosquito bites."

At UniSA's Mosquito and Public Health Research Group, a part of the Sansom Institute, we monitor mosquito numbers and species across the State and have recently developed software that uses mathematical models to determine areas most at risk of mosquito-borne disease, and the likely incidence of infection. This information is passed on to local and state government to inform health policy and mosquito management.