

# Research News

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## Researcher working behind the screens

BY SEAN MOORE  
Research Promotion

More liquid crystal displays populate the planet than humans, yet few understand how they work, so few can improve them, but luckily, chemist Torsten Hegmann can do both.

He is a leader in understanding how certain nanoparticle composites can improve the properties of liquid crystal mixtures used in liquid crystal displays (LCDs). His research was recently on the cover of the journal *Advanced Functional Materials* and you can read more about future publications at [www.home.cc.umanitoba.ca/~hegmann/](http://www.home.cc.umanitoba.ca/~hegmann/)

There are a few types of LCDs, each making use of different liquid crystal molecules and mixtures. Most liquid crystal molecules used are rod shaped and prefer to neatly align in manners specific to the display medium they find themselves in. And all respond to electric fields.

Most displays, such as computer screens and televisions, are backlit. Each screen is divided into picture elements called pixels. Each pixel has its own transistor and is covered with the liquid crystal mixture as in active matrix displays.

The backlight shines through a pixel when the liquid crystal molecules occupying it are turned "on", which occurs when an electric field causes the molecule to change its alignment. When no field is present, the liquid crystal molecules found in certain

expensive televisions align in a vertical fashion. An applied electric field jerks them into a horizontal array.

Vertically aligned, the liquid crystal is "off" and lets no transmitted light pass from behind. Horizontally switched, a "passageway" opens and the light streams forth hitting what's called a colour mask. The precise positioning of the liquid crystal film determines how much light transmits through this mask, so improved control of the array will improve the qualities of the display. Hegmann has learned to do just that.

Hegmann's lab is investigating how new nanoparticle composites can help improve the properties of displays and he has so far examined gold and silver nanoparticles with a core measuring one to five nanometers. And as in many other aspects of life, gold trumps silver.

By introducing gold nanoparticles, Hegmann can manipulate the alignment of the liquid crystals, tune their temperature and alter their electric field response all while using less voltage. Indeed, a gold nanoparticle (the larger size works best) reduces the threshold voltage to about 60 per cent. By putting different hydrocarbon chains on the particle's surface the required voltage can be further reduced to about 15 to 25 per cent depending on the temperature.

"That's a massive reduction in threshold voltage," Hegmann said.



Photo By Sean Moore

Chemist Torsten Hegmann studies how certain nanoparticle composites can improve the properties of some liquid crystal mixtures.

The larger gold nanoparticles work well because they can be charged like a capacitor. When added to the liquid crystal mixture, most metal nanoparticles get expelled to the interface and along the way they manipulate the alignment of the liquid crystal. The gold bit then sits by the electrodes and "soaks up" charge. This, Hegmann believes, creates a stronger local field without the addition of more power.

Hegmann is also working with quantum dots made of Cadmium telluride; they are luminescent,

their emission wavelengths can be controlled by the quantum dot size and coating, and they too can reduce threshold voltage. Since the backlight consumes most of a display's energy, luminescent nanoparticles would be a boon to industry.

"Ultimately, we're trying to get to the point where a company can come to us with a liquid crystal mixture and we, having gathered fundamental knowledge on many different nanoparticles, can tell them which particle would work best."

## Chatelaine influencing the gender gap?

BY SEAN MOORE  
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We're not there yet.

In the 1970s the feminist movement's flame burned bright, but still it did not illuminate enough – the gender equality gap was not closed. Today, the feminist flame only flickers and gender inequality remains.

So what kindling will reignite social change: a change in the law, or a change in the discourse?

Associate Dean of Law, Lorna Turnbull, is trying to shed some light of her own on this question. She's particularly concerned with "motherwork", which she says recognizes the gender specificity of the work involved in looking after dependents.

"My interest is from a legal point of view," Turnbull said. "How do the laws we have create the space for doing that work, and how do they help set up the reward systems that help make that work valuable or invaluable? How do we fit caregivers into a society that is market based?"

The World Economic Forum's

2007 Global Gender Gap Report, which measures gender inequalities in such things as women's literacy rates, earnings, health and political presence, ranked Canada as 18th in the world, behind countries like Latvia and Sri Lanka.

Women are predominately burdened with motherwork; some men may be, but rare is the case. So to understand how laws and ethos interact, with a goal of understanding what brings about social change, Turnbull is examining various discourses.

She looks at legislative discourses, things like the Income Tax Act and Employment Insurance Act. And she examines the discourse of the legislators themselves, which she garners from Hansards.

Although dull bedtime reading, Hansards provide contextual insights. For example, the family benefit – an allowance for mothers – passed in the Commons not out of concern for a mother's economic equality in the 1920s, but because businesses didn't want to raise the minimum wage paid to the predominantly male workforce.

A recent focus of Turnbull's and



Photo by Sean Moore

Law's Lorna Turnbull examines gender-based legal issues by studying various forms of discourse, even *Chatelaine* magazine.

her three research students' attention, however, is *Chatelaine* magazine. This magazine has been the repository of popular discourse on Canadian women's issues since it began publishing in 1928.

Turnbull's lab has sifted through nearly 100 years worth of magazines, storing anything – advertisements, editorials, articles, novellas, pictures – that depict mothering or the work of

care giving.

She has since developed a large database of the messages conveyed through *Chatelaine* magazine. This data is sorted into six categories: mother as an autonomous agent; how mother is trained to properly rear her children; mother's role in family decision making; how blame for, say, a child's delinquency is assigned to the mother; how marginalized mothers are portrayed; mothers' social activism.

"I'm trying to see if there is any connection at all between the issues being expressed in the popular discourse and what the law was doing at the time," she said.

"What does this tell us about any changes we want to bring about now? My sense is that things don't change until there is a certain level of grassroots concern; it is not enough to have an enlightened legislator who wants to write a wonderful law.

"I don't know whether that's true and this study won't ultimately prove it, but it might give us some insights into this chicken-and-egg problem of social change."

## Bringing Research To Life

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by the Office of the Vice-President (Research)  
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