



Using Physics of Perfect Pancakes to Help Save Sight

Understanding the textures and patterns of pancakes is helping UCL scientists improve surgical methods for treating glaucoma.

The appearance of pancakes depends on how water escapes the batter mix during the cooking process and this varies with the thickness of the batter, according to new UCL research. Understanding the physics of the process can help perfect pancake making and gives important insights into how flexible sheets, like those found in human eyes, interact with flowing vapour and liquids.

Co-author Professor Ian Eames, Professor of Fluid Mechanics at UCL Engineering, said: "Pancakes come in many shapes and sizes and everyone has their favourites - some prefer a small, thick pancake with a smooth surface whereas others enjoy a large, thin crêpe with 'craters' and crispy edges. We've discovered that the variations in texture and patterns result from differences in how water escapes the batter during cooking and that this is largely dependent on the thickness and spread of the batter."

The study, published in *Mathematics TODAY*, compared recipes for 14 different types of pancakes from across the world including the Canadian ploye and Malaysian lempeng kelapa. For each, the team analysed and plotted the aspect ratio, i.e. the pancake diameter to the power of three in relation to its volume of batter, and the baker's percentage which is the ratio of liquid to flour in the batter, i.e. the thickness of the batter.

They found thick, almost spherical pancakes such as Dutch poffertjes had the lowest aspect ratio at 3, whereas large, thin French crêpes had the biggest at 300. The baker's percentage didn't vary as dramatically, ranging from 100 for thick mixtures (i.e. equal measures of flour and liquid) to 175 for thinner mixtures containing more liquid.

To explore how these ratios influence the textures and patterns of pancakes, the scientists made

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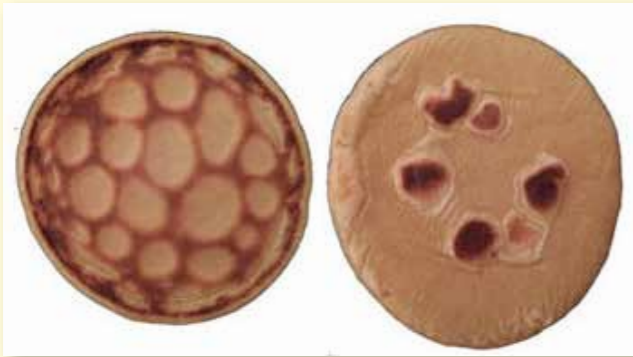


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batters with a fixed amount of flour and egg but different amounts of milk. Pancakes were made using the batters in the same pan, at the same heat and without fat. The scientists found that:

- Thick batters with a baker's percentage of 100-120 form pancakes with irregular craters on the bottom surface. Water vapours released during cooking get trapped, unevenly lifting the pancake from the pan. Islands form on top surface as the pancake isn't a uniform thickness (Pic 1).



- Thinner batters with baker's percentage of 175 form pancakes with an even colour on the bottom surface as water vapour is released smoothly from the base as it cooks. This effect is also seen in small pancakes irrespective of the thickness of the batter (Pic 2).



- The thinnest batters with a baker's percentage of 200-225 form pancakes with an even coloured bottom surface which is dotted with dark spots. Water vapours

escape smoothly across the bottom surface and through channels in the batter. The top surface of the pancake is uniform in colour but is pitted with tiny channels where the vapour escaped. It also has a distinctive dark ring around the outer edge where the batter was thinnest (Pic 3).



"We found that the physics of pancake cooking is complex but generally follows one of two trends. If the batter spreads easily in the pan, the pancake ends up with a smooth surface pattern and less burning as the vapour flow buffers the heat of the pan.

We found a thin pancake can only be created by physically spreading the batter across the pan and in this case, the vapour tends to escape through channels or diffusion," said co-author Yann Bouremel, UCL Institute of Ophthalmology.

"We work on better surgical methods for treating glaucoma, which is a build-up of pressure in eyes caused by fluid. To treat this, surgeons create an escape route for the fluid by carefully cutting the flexible sheets of the sclera.

We are improving this technique by working with engineers and mathematicians. It's a wonderful example of how the science of everyday activities can help us with the medical treatments of the future," said Peng Khaw, Director of the NIHR Biomedical Research Centre at Moorfields Eye Hospital and UCL Institute of Ophthalmology.



For New Readers

*To those of you who have joined **Glaucoma NZ** since the last issue of **Eyelights**, we welcome you!*

For your information here are some basic facts about glaucoma:

People of all ages can get glaucoma. There are different types of glaucoma, but they all involve damage to the optic nerve, the nerve of sight, which is at the back of the eye. Glaucoma is not curable. If you have glaucoma it must be monitored for the rest of your life. A family history of glaucoma means you are at much greater risk

of developing glaucoma. Current treatments for glaucoma aim to lower eye pressure.

Medication in eye drops can have side effects on other parts of your body. Tell your eye specialist if you notice any change in your general well-being since you started the eye drops.

If you have glaucoma tell your relatives, especially those close relatives like sisters, brothers and adult children. They have an increased risk of developing glaucoma so advise them to have an eye examination.

Glaucoma NZ is a registered charitable trust and receives no government funding. We rely solely on donations, sponsorship, grants and fundraising. All the information available to you from Glaucoma NZ is free.

To donate please go to donation coupon on back page of *Eyelights* newsletter, or online visit www.glaucoma.org.nz

People's Gait May Reveal Whether They Have Glaucoma

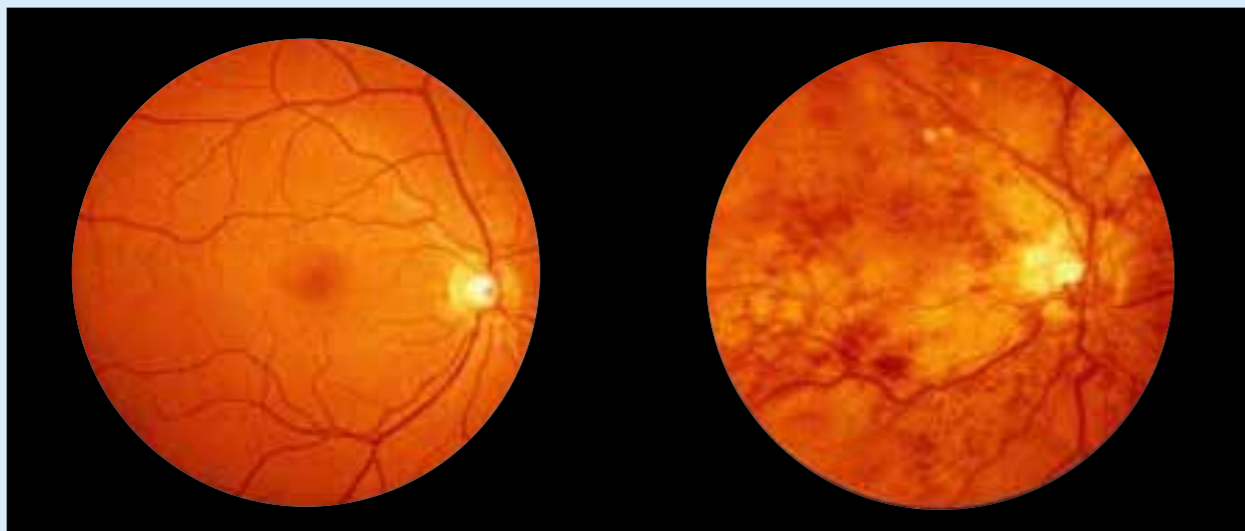
For people with glaucoma, walking isn't as easy as it once was. Even in the early stages of the disease, when vision hasn't yet deteriorated noticeably, glaucoma sufferers may walk more slowly, bump into things, stumble and sway.

Researchers at Washington State University School of Electrical Engineering and Computer Science have been using sensors in clinical trials to analyse people's gait. The trials are comparing the gaits of glaucoma patients with those of people in control groups.

The sensors are worn on special shoes and can detect the length and evenness of a step, as well as the equity between the feet. By detecting changes and abnormalities in the way a person walks, the analysis could provide an early indication of glaucoma's presence and could also prevent serious injury from falls.

The University of California, Los Angeles, is recruiting more participants in various stages of glaucoma for the next phase of the research.

Diabetes and Glaucoma



Normal

Diabetes

The relationship between diabetes and glaucoma can be controversial and confusing. First we must understand that there are two types of diabetes.

In type 1 diabetes (T1D), there is a complete loss of the pancreatic beta cells that make insulin. The profound inability to make insulin in T1D necessitates that nearly all patients with this condition be treated with insulin replacement therapy.

In type 2 diabetes (T2D), the cells that make insulin are not destroyed. In fact, T2D patients can typically make more insulin than patients without diabetes. When blood sugar levels are high, the secreted insulin is ineffective at lowering blood glucose levels, producing a state of insulin resistance. The treatment of T2D is often directed at lifestyle measures that reduce insulin resistance like diet and exercise, although some of these patients also require medications to lower blood sugar.

Secondly, we must understand that there are many different types of glaucoma so we must specify both the type of diabetes (T1D or T2D) and the type of glaucoma we are referring to when examining the relationship between diabetes and glaucoma.

One thing is clear, uncontrolled T1D or

T2D for a long enough period will lead to the development of diabetic retinopathy, consisting of leaking blood vessels and poor retinal blood supply that disrupts retinal function. Left unchecked the retina becomes starved for oxygen and develops new blood vessels (neovascularisation) and the stimulus for new blood vessel formation can travel to the anterior segment of the eye. This can trigger new blood vessel formation in the iris and drainage angle of the eye leading to elevated intraocular pressure (IOP), a condition referred to as neovascular glaucoma.

The real question is does T1D or T2D lead to other forms of glaucoma, particularly primary open-angle glaucoma (POAG), the most common form of glaucoma in the Western world? The relationship between T1D and POAG has not been thoroughly studied but it does not appear that T1D is a risk factor for POAG.

On the other hand there is evidence that T2D is a risk factor for POAG. A recent summary of the results of 47 studies that collectively included nearly 3 million people concluded, "diabetes, diabetes duration, and fasting glucose levels were associated with a significantly increased risk of glaucoma, and diabetes and fasting glucose levels were

associated with slightly higher IOP." Most, but perhaps not all the diabetic patients included in this summary analysis had T2D and most of the glaucoma was POAG.

Despite the rather convincing results taken from these 47 studies, there is some controversy. First, there is a concern that some of these studies are subject to detection bias. Simply stated, patients with diabetes are more likely to be under closer ophthalmic observation and patients under closer observation are more likely to have glaucoma detected.

It is difficult to find the "ideal study" of T2D and risk of POAG that follows patients over a long time period and that is free of this detection bias. In addition basic science literature suggests that retinal ganglion cells (the cells whose axons make up the optic nerve) might function better when blood sugar levels are higher.

To the former concern, it could be said that the relationship between T2D and elevated IOP is fairly strong, reproducible and not subject to detection bias. To the latter concern, it should be stated that one has to differentiate hyperglycemia (elevated blood sugar) from insulin resistance (an inability of secreted insulin to produce lower blood sugar levels). While hyperglycemia might make retinal ganglion cells function better in the short term, an insulin resistant state could ultimately contribute to glaucoma. The relationship between insulin resistance and POAG requires further study.

The bottom line is that if you have T2D you should work hard to reduce your insulin resistance. The health benefits of achieving reduced insulin resistance are innumerable and could include a more favourable intraocular pressure and reduced risk of primary open-angle glaucoma.

Source – Louis R. Pasquale, MD, FARVO – Assoc. Professor of Ophthalmology, Harvard Medical School.

Glaucoma NZ Professional Education Programme

Open for Enrolments!

- The online web-based Professional Education Programme is approved by the NZ Optometrists & Dispensing Opticians Board CPD Accreditation Committee for a maximum of **10.5 Clinical Diagnostic (CD) Credits**.
- The Programme consists of 7 cases – each with a case history, questions and answers for self-directed learning, followed by an associated web-based examination.
- Successfully passing all 7 cases awards the maximum of **10.5 CD credits**.
- While mainly directed at optometrists, the Programme is open to any of those in the field of eye health, including orthoptists, nurses and technicians.

For further information and enrolment options please visit www.glaucoma.org.nz.

Eyelights Advertising Opportunity

Would you like to advertise in our Eyelights publication. A unique opportunity to reach over 13,000 members of the public and eye health professionals nationwide.

Please contact Helen Mawn, phone 0800 452 826 or email info@glaucoma.org.nz for more information.

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Glaucoma New Zealand has been selected as HealthPost's Charity of the Month for April.

To purchase vitamins, supplements and skincare online from HealthPost go to www.healthpost.co.nz, select **Glaucoma NZ** as your preferred charity on the order confirmation page, after placing your order, and HealthPost will donate \$1 per order to Glaucoma NZ. In addition purchase any Clinician product and you will receive an extra 15% discount – just use the promo code **GNZ15OFF**. Valid 1st to 30th April 2016.

HealthPost is New Zealand's largest online supplier of natural health and skincare products, proudly based in Golden Bay. This family owned business has been sending natural health products around New Zealand and the world for over 25 years.

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Research was also undertaken on the impact of modern medicines on body processes and their contribution to these imbalances. The result - **the Clinicians product range of nutritional support, including not only general vitamin and mineral supplements, but also products for specific conditions including eye care and a Works With Medicine range.**

From 1998 Clinicians has been wholly owned by Douglas Pharmaceuticals; founded in 1967 by managing director Sir Graeme Douglas MNZM FPS.

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Alternatively phone our office **0800 452 826**, or email info@glaucoma.org.nz.

Beyond Glaucoma

Eye Floaters, Flashes and Spots

Eye floaters are those tiny spots, specks, flecks and "cobwebs" that drift aimlessly around in your field of vision. While annoying, ordinary eye floaters and spots are very common and usually aren't cause for alarm.

Floaters and spots typically appear when tiny pieces of the eye's gel-like vitreous (part of the eye between the lens and the retina, containing a clear jelly called the vitreous humour) break loose within the inner back portion of the eye.

When we are born and throughout our youth, the vitreous has a gel-like consistency. But as we age, the vitreous begins to dissolve and liquefy to create a watery centre.

Eye floaters can be clumpy or stringy; light or dark. They are caused by clumps or specks of undissolved vitreous gel material floating in the dissolved gel-like fluid (vitreous) in the back of the eye, which cast shadows on the retina when light enters the eye.

Some undissolved gel particles occasionally will float around in the more liquid centre of the vitreous. These particles can take on many shapes and sizes to become what we refer to as "eye floaters."

You'll notice that these spots and eye floaters are particularly pronounced if you gaze at a clear or overcast sky or a computer screen with a white or light-coloured background. You won't actually be able to see tiny bits of debris floating loose within your eye. Instead, shadows from these floaters are cast on the retina as light passes through the eye, and those tiny shadows are what you see.

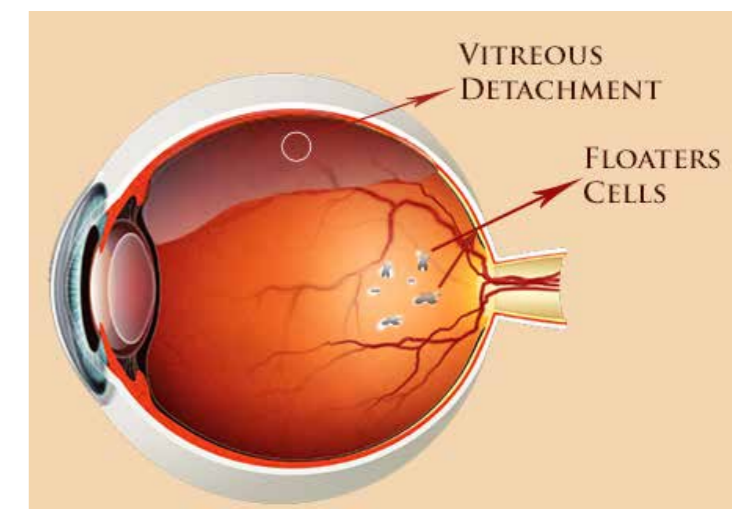
You'll also notice that these specks never seem to stay still when you try to focus on them. Floaters and spots move when your eye and the vitreous gel inside the eye moves, creating the impression that they are "drifting."

When Are Eye Floaters and Flashes a Medical Emergency?

Noticing a few floaters from time to time is not a cause for concern. However, if you see a shower of floaters and spots, especially if they are accompanied by flashes of light, you should seek medical attention immediately from an eye care professional.

The sudden appearance of these symptoms could mean that the vitreous is pulling away from your retina — a condition called posterior vitreous detachment — or that the retina itself is becoming dislodged from the inner lining of the back of the eye that contains blood, nutrients and oxygen vital to healthy function. As the vitreous gel tugs on the delicate retina, it might cause a small tear or hole in it. When the retina is torn, vitreous can enter the opening and push the retina farther away from the inner lining of the back of the eye — leading to a retinal detachment.

In cases of retinal tear or detachment, treatment must occur as soon as possible so that an eye surgeon can reattach the retina and restore function before vision is lost permanently.



New Year Appeal

WE NEED YOUR HELP to enable us to continue our vital work at the present level. Without additional funding the full delivery of our programmes and initiatives will be in jeopardy.

An estimated 68,000 New Zealanders over the age of 40 currently have glaucoma. 50% of these people don't know they have it.

We have reached thousands of New Zealanders with our nationwide programmes but there is still much more to be done.

Public Meetings	Workplace/Community Seminars
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Your support is important to us – we can't do it alone.

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