

## Report on Science Week at Christ Church South Yarra

**Dr Trevor Finlayson\***

During May, while my wife, Jill, and I were holidaying in South America and were able to read our email in our hotel in Cusco, Peru, I picked up one from Father Richard in which he asked if I should be willing to represent our Parish at “Science Week At the Cathedral” (or “SWAC”, as it has become known). Since I had nothing else in my diary for the two dates which were mentioned for the commitment, namely 15<sup>th</sup> June for a preliminary meeting at St Paul’s concerning the event and 15<sup>th</sup> August for the Cathedral event itself, I replied in the positive and suggested that following our return to Melbourne on 4<sup>th</sup> June, I should meet with him to discuss exactly what was to be involved in “SWAC”. I should add that “SWAC” was scheduled to occur in the middle of National Science Week, 13<sup>th</sup> to 19<sup>th</sup> August.

As is now “history”, by the time of our return to Melbourne and the availability of a time to meet with Father Richard, he had already become heavily involved with his forthcoming commitments to the Diocese of Gippsland so there were few opportunities for a meeting. However, we did exchange a few ideas as to how Christ Church might acknowledge National Science Week and the aims of “SWAC”, following Choral Evensong on 17<sup>th</sup> June, by which time I had attended the meeting with other parish, “SWAC” representatives at the Cathedral on Friday, 15<sup>th</sup> June and had heard of what was likely to happen in other Melbourne parishes during National Science Week. One of Father Richard’s suggestions was that, since our Parish School had opened a new science laboratory in January of this year and it had not been used extensively for the promotion of “science” amongst the students, then it might be a positive development to use this laboratory to promote some “science” with the students.

At the time, this was just a “Father Richard suggestion” but it was followed with another one, namely, that I might liaise with Mother Linda in her capacity as School Chaplain, to discuss more concrete ideas. Needless to say these discussions took place and I am grateful to Mother Linda for her most positive approach to the promotion of National Science Week amongst her students.

National Science Week here at Christ Church consisted, firstly, of a session on Monday, 13<sup>th</sup> August, to each of the two Grade 5 classes, during which we endeavoured to convey to the students what we can learn about certain aspects of human behaviour by observing some of the physics of magnetism and magnetic force fields, including the complexities of the magnetism of our Earth. We achieved this via both simple and slightly more complex demonstrations of magnetic lines of force, of magnetic induction and of studies of the earth’s magnetic field and its variation with time.

The demonstration which fascinated the students most was an old-fashioned “egg timer” which could be positioned on a base in which there was a small magnet and of which the upper bulb contained iron filings which were allowed to fall into the lower bulb either as a conglomeration of particles or, relatively slowly as individual particles, allowing them to adopt the “influence” (or force field) of the underlying magnet, as in the accompanying picture. It just so happened that there was a most important point to be made about certain aspects of “human behaviour” that could be illustrated by this demonstration, since during the week prior, there had been “mass disorder” by a gang of youths in a suburb of Melbourne,



“disorder” which may not have occurred from the youths as separate individuals.

Although the class period was only of 30-minutes duration, each one ran a little over time, given the extent of questioning by the keen, young students. Indeed, a question towards the end of the second class as to “Whether scientists believed in God,” provided Mother Linda with further thoughts for what she was planning to focus on for the whole School Community during their regular Chapel Service on the Friday of National Science Week.

For this Service, Mother Linda had chosen a suitable reading from the Book of Job, (Ch 38, vs 1-33) where the Lord challenges Job on the origins of the World. An appropriate hymn for the service was ably led by Michael Fulcher’s Chapel Choir (“From Thee all skill and science flow (AMNS 286, Tune: Kingsfold)) and Mother Linda’s Homily encouraged the students to think as follows.

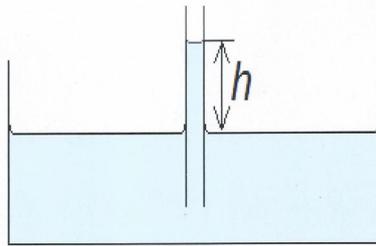
“We are in Science week and here is an opportunity for us to embrace the facts of Science and hold them alongside the mystery that is God. Science doesn’t discount God, science gives us knowledge of the world and encourages us to question and wonder how unseen and unfathomable realities, suggest God as a powerful life force in our universe and beyond. We don’t have to make a choice between science and God, we can believe in both science and God.”

On that note Mother Linda introduced me to offer some science to the students and we had agreed that I should introduce them to capillary forces which strongly influence not only many aspects of our own living bodies but also the plants and flowers which abound in nature. To achieve this aim, I had set up a demonstration involving two glass sheets clamped along one edge and also clamped along the other edge but here the two sheets were separated by a wire of about 1mm diameter. The result was a wedge between the glass sheets (see figure below) which were standing in a dish of water coloured with cooking dye. As a result, the locus of the capillary force on the water between the two glass sheets which proves to be an hyperbola, could be observed. While this capillary action was coming to equilibrium, I explained via a very simply demonstration involving an artist’s brush dipped in and out of water, the physical basis for capillary forces, namely surface tension. (Pictured)



Mother Linda had insisted when we had discussed this demonstration in preparing for the School Service, that there were some bright, mathematically minded students within the School and therefore that I should show the students the proof of the hyperbolic shape taken up by the coloured water between the sheets of glass. Hence, I showed the following as two

For a single capillary tube:



Two forces act on capillary column.

(i) Force of gravity, **downwards**:

$$mg = \rho Vg = \rho \pi R^2 hg$$

where  $\rho$  is density of liquid column,  $V$  its volume,  $R$  radius of the column and  $g$  is gravitational acceleration.

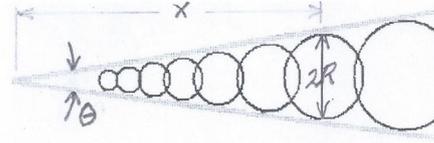
(ii) Force due to surface tension, **upwards**:  $2\pi R\gamma$

where  $\gamma$  is surface tension for water on glass.

Thus  $\rho \pi R^2 hg = 2\pi R\gamma$

and  $h = \frac{2\gamma}{\rho g R}$

For a wedge of capillaries, consider capillary of radius  $R$ , which has height,  $h$ , and is at distance,  $x$ , from point of the wedge which is angle,  $\theta$  radians.



$$2R = x\theta$$

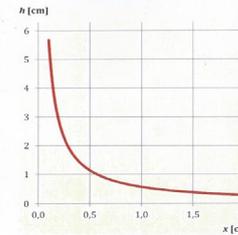
$$R = \frac{x\theta}{2}$$

So substituting in previous equation for  $h$ , we have,

$$h = \frac{2\gamma}{\rho g \frac{x\theta}{2}}$$

$$h = \frac{4\gamma}{\rho g \theta} \frac{1}{x} = \frac{\text{const}}{x}$$

which is the equation to an **hyperbola**.



images.

As a final thought for the students Mother Linda asked me to suggest how capillary forces are important for our lives, in addition to the illustrations within the Church which we had already discussed such as plants yielding flowers, candles burning, tear ducts, etc. I responded via medications prescribed by a Doctor to treat a particular human ailment where the medication could not reach the site of the ailment in our body were it not for the capillary forces which act throughout our blood system.

In addition to these activities here at Christ Church during National Science Week, I also attended the SWAC function at St Paul's on the Wednesday of National Science Week (15<sup>th</sup> August). This proved to be a most fascinating event involving a Q&A panel comprising Associate Professor David Graydon, Head of Biomedical Engineering, University of Melbourne, Dr Felicity Fury, Consulting Engineer, Dr Grace Lidgerwood, Centre for Eye Research Australia, University of Melbourne, Dr Mark Edwards, Coadjutor Bishop, Melbourne Catholic Archdiocese, Dr Alan Gijbers, Head of Addiction Treatment at the Royal Melbourne Hospital, and chaired by Mr Tim Thwaites, Science Writer and Broadcaster. The quite searching questions on the theme of "Game Changers" were fielded by the secondary school students in attendance. The questions from the students were really quite searching such as:

"How does authority dictate the advancement of science?"

"How does human nature stand in the path of science?"

"What is the importance of science to everyday people?"

"To what extent are there risks and benefits of Game Changers?"

"How are our values reflected in what we label as Game Changers?"

"How do ethics and morality affect the scientific journey?"

"What is going to be a game changer in the future?"

While the discussions around these questions from the panel and expertly mediated by the Chairman, the disappointment for the day was the poor turnout of students with just 36, comprising a group of about 20 from Wesley College and just small numbers from Sienna College and Overnewton.

\* Dr Finlayson is a parishioner of Christ Church South Yarra.