

## THE SENIOR COLLEGE MESSENGER

Issue 26: December, 2023

*This is an organ for members of Senior College to submit short articles that share news, letters to the editor, reactions to the program and anything that they feel will be of general interest. Its regular appearance will allow for an exchange of opinion of topics of interest to the members. In particular, it would be interesting to record reactions to the talks, colloquium topics and books discussed.*

*Please submit contributions to the editor, Ed Barbeau at [barbeau@math.utoronto.ca](mailto:barbeau@math.utoronto.ca)*

### THE SENIOR COLLEGE PETER RUSSELL SCHOLARSHIP

Last year, funds, matched by the University, were raised to support a student at UTSC working in the area of Lifecourse, Aging, and Retirement. Soon, the first recipient will be announced.

It would be wonderful if **two** students could benefit from this award. Further donations are invited. Please go to the Senior College website and click on the *donate* button. Tax receipts will be issued by the University of Toronto.

### CLIMATE RESILIENCE AND SUSTAINABLE HEALTH CARE

On **Friday, December 1** between 12:00 and 12:45 pm, there will be an online session entitled *Healthy planet, healthy lives: climate resilience and sustainability in health care*. The University of Toronto Alumni Association invites you to attend this *Temerity Medicine Talk*. The Globe and Mail's André Picard joins a panel of experts to discuss what our health care system can and must do now.

For further information and to receive the link, register at

<https://secureca.imodules.com/s/731/form-blank/index.aspx?sid=731&gid=45&pgid=21610&cid=35694>

This is one of the events posted on the CURAC website. For others, go to <https://curac.ca/committees/lll-committee/lll-calendar/>

### INVITATION TO SUBMIT ARTICLES

The editor, Professor Gheorghe-Andrei Dan, of the Bulletin of the European Association of Professors (EAPE) is soliciting articles. The focus for submissions is “less the scientific and art expert papers, and more a holistic, philosophical approach, a translational route into the diversity in unity of humanity”. If you are interested in finding out more about this, you can contact Professor Dan at [andrei.dan@gadan.ro](mailto:andrei.dan@gadan.ro) or obtain a copy of instructions for authors from Ed Barbeau, the editor of the Messenger. While the deadline for the December Bulletin is December 6, submissions for later issues are welcome.

You can download past issues of the Bulletin from the website  
<https://europemeriti.org/index.php/en/eape-publications>.

### REMINDERS OF PREVIOUS ANNOUNCEMENTS

1. Fellows, please check your listing at

<https://www.seniorcollege.utoronto.ca/about-us/fellows-list-2>.

Contact the Registrar, Jonathan Dostrovsky ([j.dostrovsky@utoronto.ca](mailto:j.dostrovsky@utoronto.ca)) if any changes are necessary.

2. Those wishing to participate in the research project *Testing a New Approach to Monitoring Mild Cognitive Impairment and Mental Health in Older Adults in a Community Setting* conducted by the Sheridan College Centre for Elder Research, in collaboration with the Ontario Brain Institute, Winterton Labs and Soul Machines should get in touch with Isabel Paniak at [isabel.paniak@sheridancollege.ca](mailto:isabel.paniak@sheridancollege.ca) (416-894-7027).

Visit CER Website and CER Facebook page for more information.

### IN MEMORIAM

John Wilfrid Hunt (d. October 21, 2023; aged 93 years)

Professor, Department of Medical Biophysics

Donald Mackay (October 30, 1936 – October 20, 2023)

Professor, Department of Chemical Engineering and Applied Chemistry

### CALENDAR OF COMING EVENTS

Events marked with **F** are for fellows and external fellows. Registration a few days ahead is necessary for each event. This can be done in response to a weekly email from Senior College to its members that describes the events or by going on line at [www.seniorcollege.utoronto.ca](http://www.seniorcollege.utoronto.ca).

*Talks: Wednesdays 2-4 pm* (Zoom and in person at the Faculty Club)

January 10: Max Friesen, *Climate change threats to the Arctic heritage record*

January 17: Kristin Andrews, *All animals are conscious: a new premise*

January 24: Kevin Edmunds, *Haiti, popular democracy and colonial interventions*

January 31: Jane Rylett, *Impacts of Canada's changing population dynamics*

February 7: James Hunter, *White collar crime: an investigator's perspective*

February 14: John Gardner, *Camino de Santiago: a pilgrim's journey*

February 21: Dan Drucker, *Changing health outcomes for diabetes or obesity* (**Starts at 1:30**)

February 28: Celia Smith, *Arts, culture and creativity in a time of change*

March 6: Morgan Barese, *Smartphone intervention to enhance memory*

March 13: Caryl Clark, *Labours of love: resurrecting Haydn's Orfeo*

March 20: Matti Siemiaticki, *Cost overruns and delays in mega-project delivery*

March 27: Jesse Billett, *The lost chants of Anglo-Saxon England*

April 3: Raphael Newman, *The work of art in the age of neural machine translation* (**Zoom only**)

*Book Club: Mondays 2-4 pm (Zoom only) (F)*

December 4: Jennifer Raff, *Origin: a genetic history of the Americas* (2022) (Leader: Susan Pfeiffer)

January 8, 2024: Kevin Rudd, *The avoidable war: the dangers of a catastrophic conflict between US and Xi Jinping's China* (2022) (Leaders: Max Nemni, David Milne)

February 5: Alistair MacLeod, *No great mischief* (1999) (Leader: Meg Fox)

March 4: Ed Yong, *An immense world: how animal senses reveal the hidden realms around us* (2022) (Leader: Sara Shettleworth)

April 1: Willaim Carlsen, *Jungle of stone: the extraordinary journey of John L. Stephens and Frederick Catherwood and the discovery of the lost civilization of the Maya* (2017) (Leader: Jim Gurd)

May 6: Siddhartha Mukherjee, *The song of the cell: an exploration of medicine and the new human* (2022) (Leader: William Logan)

June 3: Helen Macdonald, *H is for Hawk* (2014) (Leader: Peter Alberti)

July 8: Alex Ross, *The rest is noise: listening to the twentieth century* (2007) (Leaders: Linda Hutcheon, Michael Hutcheon)

### Aftermath

While the problems in the International Mathematical Olympiad may be hard, the solutions may involve some pretty elementary mathematics. Here is a case in point. Let  $A$  be the number  $4444^{4444}$ ; this is the product of 4444 factors, each equal to 4444. This is a very big number. Imagine it written out, and let  $B$  be equal to the sum of its digits. Then let  $C$  be the sum of the digits of  $B$ , and finally, let  $D$  be the sum of the digits of  $C$ . Candidates are required to find out what  $D$  is.

The obvious approach (work out the multiplication, add the digits, *etc.*) is clearly impractical. Not enough time is available (the contest last  $4\frac{1}{2}$  hours), and if you make a slip along the way, then all is lost). So solving the problem requires some guile.

With the ingredient of adding the digits, many student will think of the technique of *casting out nines*. Readers might not have been taught this at school, but I am willing to bet their parents and grandparents were. In order to check on the results of an arithmetic operation, pupils were told to find the digital sum of the numbers involved. To get this, add the digits, then add the digits of the result; keep doing this until you get a single digit. For example, the digital sum of 397 is the same as the digital sum of  $19 = 3 + 9 + 7$ , which is the digital sum of 10, which is 1. The digital sum is the remainder when you divide the number by 9:  $397 = 9 \times 44 + 1$ .

To check an arithmetic operation, the idea is to perform the same operation on the digital sums of the numbers involved; the digital sum of the result in both calculations should be equal. If they are not, a mistake has been made. For examples,  $397 \times 645 = 256065$ . The digital sums for 397 and 645 are respectively 1 and 6. Their product is 6, which is the digital sum of 256065.

So the candidate will realize that  $A, B, C, D$  all have the same digital sum, and so the same remainder upon division by 9. Now 4444 has the digital sum 7, so  $A$  and  $7^{4444}$  have the same remainder upon division by 9. Since  $7^3 = 343$ , with digital sum 1 and  $4444 = 3 \times 1481 + 1$ ,

$$7^{4444} = 343^{1481} \times 7$$

has the same digital sum as  $1^{1481} \times 7$ , namely 7. So  $D$  is a number that is 7 more than a multiple of 9.

This narrows down the search, but we need more information. When you add the digits of a number, particularly a large one, you get a much smaller number. So, if we can get an upper estimate for the number of digits in  $A$ , we can use the fact that none of these digits exceeds 9 to get an upper estimate for  $B$ . Since  $4444 < 10000 = 10^4$ ,  $A$  is less than  $10^{4 \times 4444} = 10^{17776}$ . We conclude that  $A$  has few than 17777 digits, so that  $B$  is less than  $9 \times 17777 < 10 \times 20000 = 200000$ .

$B$  is a number with no more than 6 digits, each no greater than 9, so  $C$  must be less than 54. The largest sum of digits you can get for any positive integer up to 54 is 13 (which is the sum of the digits of 49). Therefore  $D$  is less than 14. So we are looking for a number less than 14 that leaves a remainder 7 upon division by 9. Only one number raises its hand, and that is 7 itself. Therefore  $D = 7$ .

The pleasure of the hunt is in the chase. If we simply wanted the answer, a modern computer could calculate it in a trice. A simple pocket calculator with a logarithm button could enable us to determine exactly how many digits  $A$  has; it has 16211 digits, since  $4444 \log 4444 = 16210.70788$ . The comeliness of this problem lies in the fact that its apparent mundane complexity can be sidestepped by an elegant combination of simple elements. This is art of a different sort.