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# A SUPER RETURN FOR SUPERHERO SCIENCE AND TECHNOLOGY

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In 2017, I established the open access journal *Superhero Science and Technology* to provide researchers with a unique publishing medium to share their scientific findings with a diverse readership. In modern popular culture, superheroes are commonplace thanks to a host of successful TV series and films, and the reinvigorated interest in the source comic books. The high box office figures alone are testament to the popularity of the genre, which looks set to continue with a large number of films and TV series planned for the next decade.

As part of my science communication activities, I regularly use superheroes to bridge the knowledge gap between the scientific community and the general public, an approach that has proven quite effective [1]. In my opinion, the superhero genre ideally suited to pique the interest of the general public in science. By writing a paper for this journal, it is my hope that researchers will also realise the effectiveness of superhero-based analogies for the communication of their research.

## RECALLING THE FIRST ISSUE

In 2018, the first volume of the journal was published, and contained a rich variety of scientific disciplines that referenced a host of superhero characters, both well known and obscure [2]. Papers addressed topics such as 3D printing technologies for an Iron Man suit [3], how marine antifreeze proteins protect the Winter Soldier's body during cryopreservation [4], the secret to breathing in the shrinkable Wasp suit [5], and the dos and don'ts with regards to radiation exposure in healthcare inspired by the Hulk and the less-known Marvel character Radioactive Man [6].

Some of you may be wondering why there has been a period of over two years between issues. As a new journal, the hardest part is to entice authors to submit papers for consideration in the first issue. As part of journal policy, we do not use mass solicitation e-mails to coerce researchers to submit papers to the journal. This would be a disservice to the underlying aims of open science, the journal, and TU Delft Open Publishing. There are far too many solicitation e-mails in circulation, with many of them being generic and impersonal. I receive such e-mails every week, and I must admit they are quite annoying.

Hence, for the first issue, I approached members of my academic network about writing papers for the journal. Fortunately, I was met by enthusiastic responses, which resulted in three of the four papers of the first issue.

One paper – the publication by Anne Staples and Maxwell Mikel-Stites on the shrinking technologies

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for the Wasp suit – came about thanks to a chance meeting that I had with Anne at the American Physical Society (APS) March Meeting in Los Angeles, CA in March 2018. We met in the media coverage centre as we were both given the opportunity to speak to the press about our work. During our conversation, Anne told me about her work on insect respiratory network-inspired microfluidic devices. Almost immediately, I suggested that she could connect her work to potential breathing issues that the Wasp and Ant-Man may experience when they are the size of insects, or smaller. The rest is history. Anne and Maxwell's work on the Wasp and Ant-Man subsequently led to a presentation at an APS meeting in November 2018 [7] and received international press coverage.

## PAPERS IN THIS ISSUE

The papers that make up this issue came about in a more organic manner. Two papers come about after the lead authors approached me by e-mail with regards to publishing in the next issue of the journal, while one paper is the result of some incredibly innovative work by two high school students based in Den Haag, the Netherlands. I had the opportunity to see the students present their work in 2019 and immediately suggested that they could publish a paper on their work.

Added to that, the three papers cover the three core STEM subjects – biology, physics, and chemistry – while concurrently introducing computer programming, engineering concepts, and fabrication processes.

The first paper comes from Sangjin Ryu *et al.* from the University of Nebraska-Lincoln, USA and focuses on super robots, powerful robots that feature as superheroes in science fiction and Japanese animation series (ANIME) [8]. In the paper, the authors apply aerodynamic and scaling laws to figure out how fast Evangelion – gigantic cyborg-type robots – can actually run. Many may not have considered such characters to be part of the superhero, but they exhibit many of the attributes associated with superheroes or even technologies developed by Tony Stark in the Marvel Cinematic Universe (MCU). At the end of the paper, the authors also propose how ANIME figures can be used in STEM education, which is something that I wholeheartedly support having previously written a number of papers on the use of superhero characters in STEM education [9-14]. Enjoy stepping into the world of ANIME superpowers with this excellent paper.

The second paper is based on the amazing final project work of two high school students – who are now undergraduate students at Delft University of Technology. Beau van der Meer and Jip Harthoorn built a prototype projectile device based on electromagnetic coils [15]. The authors compare their device with the Gatling gun of the War Machine suit – the exoskeleton worn by Colonel James Rhodes in the MCU. The authors do not promote the use of this technology for use in projectile devices, and later in the paper speculate on how a larger-scale device could be used for the benefit of society.

The final paper of this issue is the first paper in the journal that focuses fully on a villain. In this case, Bas G.P. Ravensteijn, Jose R. Magana, and Ilja Voets use Thanos, the ultimate MCU supervillain, to introduce the field of colloidal science [16]. For Ilja, this is her second paper in the journal as she was also a co-author on the paper related to marine antifreeze and the Winter Soldier [4]. It can be argued that the Winter Soldier is also a supervillain, but he has taken a heroic turn in recent MCU films. The paper takes the reader on a Thanos-inspired journey through colloidal science and matter manipulation, something that Thanos could easily achieve in *Avengers: Infinity War* [17] when he had the Infinity Gauntlet. This paper is a must-read for expert or novice colloidal scientists alike.

## REMEMBERING CHADWICK BOSEMAN AND CALL FOR PAPERS

This issue is being published during the COVID-19 global pandemic, which has claimed the lives of

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more than 1 million as of the end of September 2020. In many countries, casualties have included healthcare professionals who contracted COVID-19 while trying to ease the suffering of others. I think it's important to point out that the true heroes – the true superheroes – are the healthcare professionals seeking to help so many at such a testing time.

In late August, we were met with the sad news that Chadwick Boseman passed away. He had been ill for a number of years, yet kept his condition and treatment secret from all but his immediate family. For the fans of the MCU, the loss of the actor who portrayed the superhero T'Challa (Black Panther) so excellently in four MCU films, including the seminal and culturally significant 2018 film *Black Panther* [18]. Wakanda and its associated technologies can act as a powerful foil for science communication, particularly with regards to chemistry as already demonstrated in a recent paper by Sibrina Collins and LaVetta Appleby [19]. I am hopeful that I will receive papers pertaining to Wakanda and the adventures of Black Panther and Shuri for consideration in a future issue of *Superhero Science and Technology*.

Finally, I would like to encourage you – the scientific researcher, the engineer, the superhero fan, or all of the above – to submit articles for consideration in the upcoming issues of Superhero Science and Technology. In addition, if you have an idea for a publication but you need some advice about developing your article idea, please contact me. I would be very happy to speak to you about your idea and offer suggestions as to how it can be transformed into a paper that aligns with the aims of the journal. You can follow the progress of the journal and the release of upcoming issues at the journal website and on the journal's Twitter account (@SuperSciTech).

I hope that you enjoy reading the latest issue. Always think super!

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