A private researcher's struggles against research fraud. I. A case study

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This is the first of two papers about a case of mechanical engineering research fraud. The fraud is described in this paper and will disturb many readers. The second paper, to be published in a subsequent issue of the JOURNAL, is far more positive and presents transferrable lessons learned from the author's experiences as a victim of fraud. The PedSALi project aimed to develop a "smart" car bumper that was soft for pedestrian leg impacts but stiff for collisions with other vehicles. It was during work on this project that the fraud was conceived. The project partners were Dow Chemicals, the University of Manchester and the author, who was the inventor of the smart bumper design and owned the patents. A successful project outcome offered the strong possibility of all new motor vehicles sold in Europe from 2005 onwards being fitted with smart, pedestrian-friendly bumpers. Unfortunately, unease about the author's pending fame and fortune as the inventor resulted in the project being sabotaged and ending in failure. This failure, which may have cost lives, threatened to damage the European reputation of British science. Parts of the British research establishment were drawn in to hiding the fraud, with the UK Research Integrity Office (UKRIO) playing a significant rôle.

Key index words and phrases: shock absorbing liquid, SALi, PedSALi, research integrity, research fraud, UKRIO

1. *S*hock-*A*bsorbing *Li*quid (*SALi*): an invention that triggered research fraud

Mechanical engineering is a mature branch of applied science. Consequently, it is characterized by steady evolutionary progress, rather than big theoretical breakthroughs and paradigm changes. However, what it lacks on the discovery front it makes up for with opportunities for invention. One key difference between an invention and a discovery is that inventions are more likely to bring riches and popular acclaim to the person who makes the breakthrough. Envy of these rewards for invention probably lies at the heart of the fraud to be described.

In the summer of 1986, the author decided to celebrate his fortieth birthday by using one of the recently invented mountain bikes to bicycle off-road across the UK, from Land's End to John o'Groats. For the first half of his journey he used foam-padded biking gloves, and for the second half gel-padded gloves. Neither type proved to be completely satisfactory for absorbing the vibrations and coping with the frequent falls resulting from his poor biking skills. So, on his return home he experimented with foam-plus-gel combinations, eventually developing a radically new mechanism for absorbing impact and vibration energy, which he referred to as shock-absorbing liquid (SALi) technology (Fig. 1).

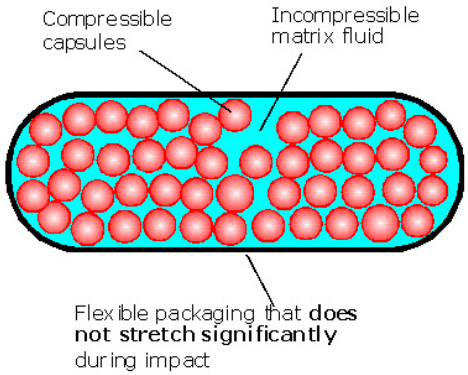

Figure 1. The essential features of a SALi-based impact protection cushion (originally published on the Cheshire Innovation website "What is SALi?" page [1]).

Early experiments carried out using a ballistic impact rig [2] indicated that SALi-filled packages offer superior impact protection properties compared with alternative materials such as elastomeric foams, but only if the SALi packaging does not stretch significantly under impact. Elastic packages that stretch during impact render the SALi ineffective. The employment of low-stretch packaging is important to note because one of the frauds to be discussed below involved the mischievous use of elastic packaging to create a false impression that SALi is ineffective.

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2. The limitations of private research

Companies usually develop new impact protection products in two stages to keep costs down. Computer simulations are used during the first stage to predict the optimum design. Promising designs are subjected to real impact tests during the second and more expensive stage. This posed problems for SALi-based product development because the very properties that made SALi so effective, also made it complex to model. It meant that new computer models and new categories of impact data were required for the computer simulations [3].

The author's "garden shed" testing equipment would have been state of the art two centuries ago, but was completely inadequate by today's standards. He spent ten years living frugally, building up the funds required to allow him to work full time developing his invention in collaboration with a well-equipped university. During those pre-internet years he spent most Saturday mornings in a patent document library studying the latest patents to ensure that his invention was novel.

By 1996 he had accumulated sufficient funds to give up paid work as a physics teacher. He started working full time developing his invention in collaboration with the mechanical engineering department at the University of Manchester. Initially he had a student rôle and had ambitions of gaining a PhD. He was made a research fellow when SALi brought funding into the University and he signed a royalty-sharing agreement. The development of SALi required specialized mechanical engineering expertise and, as the author's background was in physics, he was heavily reliant on his (younger) research supervisor for guidance.

SALi gained considerable media attention after winning a prize at an international inventions fair. This included magazine articles about the merits of using SALi in car bumpers.

3. The SALi research fraud stage

Following early television and other media interest, there was light-hearted talk at the University about the author wining fame and fortune for his invention. Unfortunately this caused a relationship problem, with the author, plain Mr Courtney, gaining more attention than his research supervisor, who held a doctorate. The relationship deteriorated further when engineers from four other universities and several industrial companies visited the University to discuss the invention. Eventually, lack of support from his supervisor resulted in the author abandoning his early plans to gain a PhD. There were only two people within the University who had the specialist engineering knowledge Courtney required, his supervisor and the head of the supervisor's research group, Prof. W. Therefore, the author had no choice but to work with these people.

In spite of these problems, SALi was slowly developed with the assistance of a mathematics lecturer and engineers from the sister university in the same city. Basic experimental results were obtained using a test rig design suggested by the maths lecturer. The author then became a visiting lecturer at the sister university. Tensions further increased because the two universities were moving towards amalgamation. The early experimental results were of a sufficiently high quality to merit publication. Five journal papers were written [4–8], but the author's supervisor used blocking tactics to prevent publication of three of them [6–8]. These unpublished papers would subsequently turn out to represent a serious loss because they related to the author's 1980s' smart car bumper designs.

Earlier experiments at home had led the author to realize that a SALi-filled car bumper would have responsive or "smart" impact energy-absorbing properties, allowing it to be stiff for impacts with other vehicles but soft for pedestrian leg impacts. This smart behaviour is due to the fluid nature of SALi, which is trapped under the impact zone of the bumper in collisions with other bumpers or street furniture but it can flow to the sides of the impact zone during impact on a narrow human tibia (shin bone). This reduces the stiffness of the bumper for tibia impacts. As a small child's tibia is narrower than an adult's the bumper is even softer for small child leg impacts.[1] Testing this design at home would have been painful and unreliable but it was relatively straightforward in an engineering laboratory equipped for impact research.

Around this time, the EU Commission published a draft directive requiring all new cars sold in EU countries from 2005 onwards to be fitted with soft, pedestrian-friendly bumpers. But the car makers objected because their customers wanted stiff bumpers to protect vehicle bodywork in minor crashes. This disagreement became known as "the conflict of stiffness problem". The author found himself in the happy position of being able to offer a smart bumper design that appeased both parties.

When the Automotive Division of Dow Chemicals read about the author's smart bumper design in Auto Express magazine [11], they flew a senior executive over from Detroit to meet him and his supervisor. This resulted in the PedSALi collaboration between the author (under his Cheshire Innovation trading name), Dow and

[1] This "smart" behaviour is explained in greater detail on the author's PedSALi web page [9].

the University [53]. The named University collaborators were the author's research supervisor and Prof. W. The Dow executive predicted that the author could earn between £30 million and £90 million in royalties by 2015, depending on whether the SALi-based bumpers were restricted to European markets or adopted worldwide.

The author's motivation for inventing is to work for the common good of humanity. One of his ambitions was that the University would become a research hub, developing a range of life-saving applications for SALi. He therefore voluntarily signed a royalty-sharing agreement with the business arm of the University: he granted them 50% of future royalties on all SALi inventions, with the other 50% being intended for developing his other humanitarian inventions, the most important of which was his low carbon footprint power generator [10].[2]

The author's (unpaid) researcher status at the University meant that he was still answerable to his supervisor. The supervisor was then named as the Principal Investigator for the PedSALi university research. The University received £212,000 EPSRC funding for its contribution to the work. The UK government Department for Transport (DfT) appointed the author as the lead partner [12], who was awarded £44,000 (in fact he only claimed £29,831, which will be explained in full later in the paper). The author's appointment caused problems: as far as the DfT was concerned he was in overall charge, but his supervisor was the university Principal Investigator and had the final say on EPSRC-related matters.

The following four years were characterized by research obstruction culminating in project failure. There was no alternative solution to the conflict of stiffness problem and the stringent EU pedestrian protection standards were abandoned. But there was still some hope as the possibility of their implementation in 2012 was reserved.

4. The government welcomes association with good research but distances itself from the bad

At the beginning of the project it looked as though PedSALi would make an important contribution to improving European road safety. It received a positive citation in Parliament [13]. But when it ended in failure and the University declined to investigate the evidence for research fraud, the lead partner's Member of Parliament took the evidence to the Minister for Science. The Minister acknowledged, "This matter falls within my portfolio", but added, "I am unable to comment or intervene in this matter". He passed responsibility for investigating the author's fraud claims back to the University.[3] In fact, the UK system of governance would collapse into criminal chaos if government ministers really were unable to comment or intervene when presented with evidence of public finance fraud.

5. Early examples of low-integrity SALi research

Detailed evidence of the research fraud is published online as "The PedSALi project" [9]; here are a few highlights:

- The difficult relationship the author had experienced with his supervisor meant that he never acquired the advanced engineering skills needed for the university PedSALi research, hence a research assistant needed to be appointed.
- The PedSALi collaborators needed to act swiftly because there was only a four year interval between the project receiving approval and cars fitted with pedestrian-friendly bumpers being required for sale in Europe. Yet there was an eighteen month delay before the university research started.
- The university research assistant appointed was an intelligent Chinese national. Unfortunately, he had poor spoken English skills; during his telephone job interview, nobody but the Principal Investigator could understand him. His appointment was only approved by Dow Chemicals and the author on condition that £1,000 of the EPSRC funding was used to pay for his enrolment onto an accelerated English speaking course. The author, as the lead partner, provisionally booked him on to such a course at Fielden Park College. However, he did not in fact receive the tuition because the university Principal Investigator refused to release the funding [17]. The subsequent verbal communication difficulty caused problems because all of his early discussion contributions had to be made via the Principal Investigator. There was also a six month delay in the release of funding for the purchase of a desktop computer for the research assistant.
- The actual research problems started when the Principal Investigator instructed the research assistant to build a test rig that was incapable of reaching the EU Directive crash test speed [14]. The drop height needed to be 6.1 metres in order to reach the required leg impact speed of 40 km/h. However, the rig was

[2] For proof of the royalty-sharing agreement see Appendix 5, [9].
[3] The Minister's letter that denied ultimate responsibility for investigating evidence of public finance fraud is reproduced in Appendix 6, [9].

built only 3.0 metres high. The author eventually overcame the problem by using shock cord (bungee jumping) elastic to convert the test rig into a giant catapult [15] (but in a journal paper published three years later, the Principal Investigator claimed the credit for the catapult design [16]). After solving the impact speed problem, the modified test rig was supposed to be used to determine the core characteristics of SALi samples (i.e., sets of data about the energy dissipation provided by unit cells of SALi material during an impact event [3]), which were required by Dow for use in their computerized crash simulations. The University experimental design superficially looked impressive, but on closer inspection defied the laws of physics [13, 16]. The research assistant was a skilled engineer who understood that he was being instructed to do bad research, but he had to rely on the Principal Investigator to speak for him. This was unsatisfactory because the Principal Investigator was the person instructing him to do the bad research.[4]

- The assistant started to display signs of clinical depression (e.g., spending long intervals looking at a computer screen when it was not switched on—Appendix 2 in [17]). As the lead partner, the author felt obliged to support him. After futile appeals to the Principal Investigator and Prof. W, he requested a meeting with the Head of Engineering at the University. In order to emphasize the seriousness of the situation, he warned the Head of Engineering in writing that matters were "on the verge of going horribly wrong" [18]. But the Head avoided a meeting and the problems became worse. During the following months there were puzzling criminal activities. Two boxes, each containing a cubic metre of research materials supplied by Dow, disappeared from University premises and the research assistant's family suffered ten attacks on its temporary home close to the University. In spite of this, the Principal Investigator and Prof. W refused to call in the police and the incidents were hushed up [9].[5]

6. CrashSALi: a second research project

SALi Technology was a potentially multimillion pound income generator for the University thanks to the 50:50 royalty sharing agreement. The author and the Principal Investigator held regular business meetings with staff at VUMAN, the business arm of the University, but the author's pending beneficiary rôle upset the Principal Investigator. The business manager in charge of commercializing SALi found it necessary to ban the Principal Investigator from the meetings because of his agitated behaviour, which inflamed matters in the laboratory.

The PedSALi project fell ever further behind schedule and the possibility of project failure had to be factored in to the business plan. A second engineering research project, named CrashSALi, was set up in order to keep the SALi research moving until the two universities amalgamated. The author was in charge of the finances and a professor from the sister university acted as a consultant. Industrial innovation funding had to be applied for as the author was not employed by the University; this would enable him to have financial control, with the downside that he had to make a financial contribution of 25% to the research.

Unfortunately, the way in which the University operated meant that Courtney's academic supervisor still had the final say on the CrashSALi experimental work [19]. Although there was tension between them, the two projects proceeded in parallel for some months.

7. The PedSALi research assistant resigns

The distressed PedSALi research assistant resigned after sixteen months.[5] This development was kept secret from the project partners until a few days before he flew home to China. Both the author [20] and Dow [21] complained about this deception. The response from the University was to appoint an "independent person" to arbitrate between the two parties, namely Dow and the author on the one hand, and the Principal Investigator and Prof. W on the other. However, as documented [9], the arbitration led to the University seizing control of the PedSALi and CrashSALi projects.

For example, the CrashSALi research assistant that the author was part funding was persuaded to take over as the new PedSALi research assistant, but the author was not informed until it was a *fait accompli*. When he complained about this, he was effectively stripped of his power over the CrashSALi project by being ostracized and intimidated so that his complaints could not be discussed. When he complained about intimidation at a formal PedSALi meeting, the "independent person" responded: "I was not intimidating. When I give people a real bollocking, they don't know what has hit them for two days."[6]

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[4] Vince Gill, Ian Knowles and David Rowe were members of the DfT who attended the quarterly PedSALi meetings. They witnessed the Principal Investigator having to speak on behalf of the research assistant.
[5] Written verification of the attacks is contained in the research assistant's subsequent resignation letter.
[6] Witnesses: Representatives of the DfT.

8. How EPSRC and other funding bodies were tricked

There was a second and more serious consequence of the University appointing a biased individual in the guise of an "independent person", supposedly working to improve relations with the industrial partners. After a minuted meeting with the Principal Investigator and Prof. W (which neither the author nor a Dow representative attended), the "independent person" sent copies of the minutes to EPSRC and other funding providers. The minutes contained false information about Dow's requirements, namely, "It was agreed that the use of a *textile 'containing bag'* around the Covelle bag should not be investigated further since this is not acceptable to Dow" [22]. This short and innocent-sounding statement led to the PedSALi project being sabotaged because the outer *textile* '*containing bag*' was the low-stretch packaging that was essential for the SALi bumper to work (Fig. 2).[7]

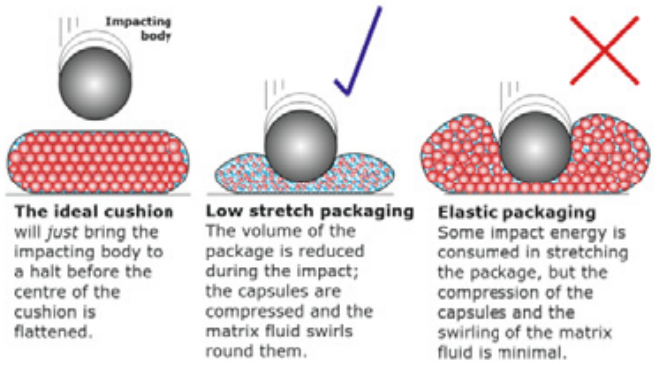

Figure 2. Correct packaging is a vital part of SALi Technology. (originally published as Fig. 2 in [1]).

The "independent person's" mischievous behaviour led Dow to check his background. It was discovered that he was, in fact, collaborating with the Principal Investigator on two important funded projects around that time (see Appendix 3 in [9]). Following this discovery and the false statement made about their requirements, Dow's interest declined and their representative stopped attending project meetings (the PedSALi formal meeting minutes sent to EPSRC verify Dow's withdrawal).

The author was now left isolated and the bad research using elastic packaging proceeded. There was no honest excuse for this change of research plan. The Principal Investigator and Prof. W were both aware of the importance of correct packaging. The Principal Investigator was the second author on all of the present author's journal papers [4–8], and Prof. W provided public evidence of his knowledge of SALi when he appeared in a BBC Radio 4 programme, *Science in the attic—Bill Courtney, Inventor* [52].

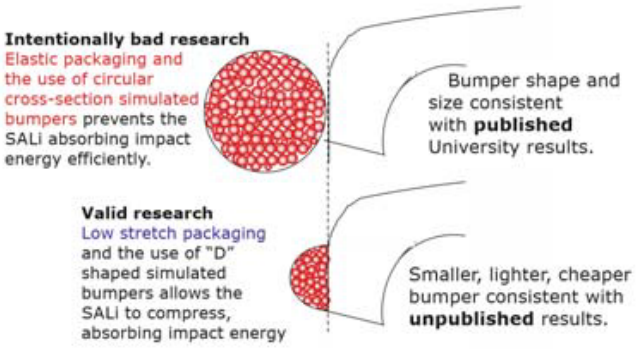

Figure 3. The bad published [23, 24] research (with impractical circular cross-section car bumper models) was done by the second research assistant. The good (valid) unpublished research was done by the first research assistant (originally Fig. 4 in [9]).

The first research assistant produced valid research results a week before leaving. He used low-stretch "D"-shaped packaging [25]. These valid results were presented in an internal report for the partners and funding providers, but they were never published externally by the University. However, six years later similarly valid experiments were done at Cardiff University and the results were published [26].

The invalid research was written up and presented at two research conferences in the USA (Fig. 3). The authors included the Principal Investigator, Prof. W and the "independent person" [23, 24]. The lead partner only discovered that the fraudulent research had been presented in the USA when he received a confidential tip-off from inside the University.

Copies of the misleading research papers [23, 24] were presented to EPSRC as part of the end-of-project submission. EPSRC were also falsely informed by the University that Dow had examined the research evidence and concluded that SALi-filled bumpers were inappropriate for their commercial needs: "In March 2004, Dow Automotive made a review and decided that SALi-based bumpers would be too expensive, too heavy and too complex to make in comparison to foams. Thus, Dow Automotive stopped its involvement in the project" [27].

This review did not take place. It was technically impossible because:

(i) Invalid bumper research using elastic packaging had been undertaken.

[7] Witnesses: Representatives of the DfT were present at the subsequent PedSALi quarterly meeting (9 September 2003) when both Dow and the author complained about Dow's requirements being falsified.

(ii) The University had sent Dow implausible core characteristic data that violated the laws of physics. As a consequence, Dow had not been able to carry out computer modeling of human leg impacts on SALi-filled car bumpers.

During the five troubled years of the PedSALi project (2000–2005), nobody from EPSRC contacted Dow or the author to hear their side of the story, nor did they visit the University to find out what was going wrong. Had they been more diligent, the EPSRC would not have been so easily deceived.

9. Contemporaneous fraud on the CrashSALi project

The author was ostracized by his University engineering colleagues because of his complaints about the laws of physics being violated and the misleading use of elastic packaging. Consequently he was excluded from having any form of influence over the CrashSALi project, even though he was financially responsible for it [9, 19].

A key part of the CrashSALi project was to test a prototype SALi-based car suspension unit (Fig. 4) using materials recommended by the Malaysian Rubber Producers' Research Association (MRPRA).

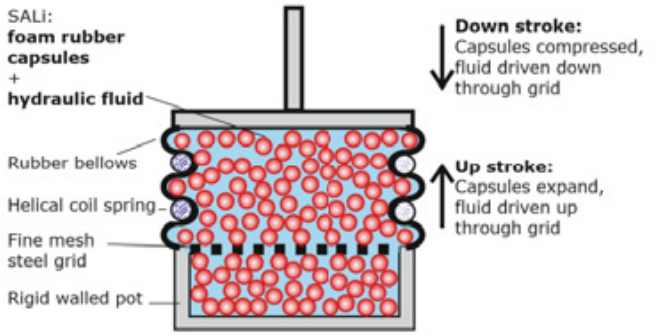

Figure 4. The diagram shows a prototype SALi-based car suspension unit. MRPRA supplied the foam rubber for the capsules and emphasized that it was vital to use hydraulic fluid as the liquid component. This suspension unit should have been tested over several thousand compression cycles to mimic real life car suspension usage. A commercially successful suspension unit according to this design would have been a significant revenue generator for the University under the terms of the royalty sharing agreement (originally Fig. 1 in [19]).

On reading the CrashSALi project report it was clear to the author that the terms of the contract had not been met: The wrong materials had been used and the wrong type of testing done—poor quality expanded polystyrene beads had been used instead of the high quality foam rubber supplied by MRPRA, and corrosive engine oil had been used instead of hydraulic fluid (cf. Fig. 4).

However, the effects of using the wrong materials did not show up in the test data because a trick was used: the PedSALi drop test rig was used for a *single impact test* instead of carrying out a run of several thousand cyclical tests using an oscillating load.

The CrashSALi report was annotated by the present author to explain its failings and then returned to the Vice-Chancellor of the University. The author refused to approve the payment of public funds for the CrashSALi contract until the contractually agreed research had been done. He also recommended that the Vice-Chancellor should seek the opinions of the business manager who had suggested the CrashSALi project and the Professor of Engineering at the sister university who had acted as the project consultant, but neither were consulted (both left the University shortly after amalgamation).

The university researchers had now wittingly completed two flawed projects: CrashSALi and PedSALi.

These parallel frauds created a new difficulty. If the researchers were to agree to do the CrashSALi work correctly they would also have to face up to the flaws in the far more important PedSALi work, where millions of pounds and thousands of European lives were potentially at stake. The dilemma was resolved by using threatening tactics instead of doing the CrashSALi work correctly. The University engaged its solicitors, Eversheds, to intimidate the authors into approving payment for the bad CrashSALi research.[8]

This intimidating use of solicitors to coerce the author into handing over taxpayers' funds for bad research was illegal. The law is quite clear about this [31]:

> Harassing a person to commit criminal fraud in order to obtain a financial gain is classified as "blackmail" or "demanding money with menaces." This is a criminal offence and carries a maximum prison sentence of fourteen years.

Evidence of this blackmail attempt was presented to senior university personnel on several occasions. These people included: (i) the University Registrar in 2007 and 2008 [33]; (ii) the Vice-President, Innovation and Economic Development in 2007 [17]; (iii) the Chairman of the University Institute for Science, Ethics and Innovation in 2008 [33]; and (iv) a Formal Enquiry Panel in 2009 [17]. The enquiry panel was also made aware that the pressure to collude in committing financial fraud had taken a heavy toll on the author's health, especially his eyesight.[9]

When the author sent Eversheds evidence that they had been employed on false pretences by the University their threatening letters ceased. The author tried to find

[8] A sample demand letter from the University solicitors Eversheds is reproduced as Appendix 3 in [19].
[9] Supporting evidence is published in Appendix 3 of [19].

out how the highly regarded international law firm Eversheds had been tricked into acting unethically by the University, but his Freedom of Information requests to the University for its correspondence with Eversheds were rejected [17].

10. Good SALi research at other universities

Several UK universities, including UMIST, Cranfield, Reading and Cardiff have done limited-scope but high-quality research into SALi technology. Good work has also been done (without the author's agreement) in China.

10.1 Good PedSALi-type work at Cardiff University

In the aftermath of the PedSALi failure, a mechanical engineer at Cardiff University recognized the potential lifesaving benefits of smart SALi-filled bumpers. He was also aware that the EU had only *postponed* its pedestrian safety requirements, while reserving the possibility of their implementation in 2012. Working on a very limited budget, he supervised small scale experiments on simulated SALi-filled bumpers. The results were encouraging and the work was presented at an automobile engineering conference in Stuttgart [26].

10.2 Good CrashSALi type-work at Cardiff University

The SALi suspension unit experiments were done correctly by undergraduates at Cardiff University (Section 8 in [29].) After a lapse of several years, during which funding was scarce, this has recently been taken forward as a PhD project at Cardiff.

10.3 Plagiarism by proxy?

A Cardiff student made an intriguing discovery as he was carrying out his background literature search. He found that one of the Principal Investigator's overseas research colleagues had been doing very good SALi car suspension experiments and had used valid tests and materials [28]. This was all completely unknown to the present author.

The Chinese work was done at Nanjing University and somehow the author's unpublished car suspension unit designs had fallen into the hands of a foreign engineering competitor. Subsequent literature searches revealed evidence of two more papers relating to the author's patented SALi invention coming out of China [55, 56]. However, following the author's complaints to Nanjing University and the editor of [28], publications ceased. The evidence suggests that Chinese industrial espionage was unlikely; it is more probable that innocent Chinese researchers were led into committing unintended plagiarism. The Chinese work appears to have started around the time that the author was ostracized for refusing to collude in hiding the PedSALi research fraud.

11. The formal enquiry stage

The author had been working on SALi technology since 1986 and had invested his retirement savings in its development; he was determined to expose the SALi research fraud and restore the good name of his invention. After writing sixteen letters to the Vice-Chancellor and other senior staff, the University finally agreed to hold a Formal Enquiry into the author's allegations of research and financial fraud.[10]

The enquiry process was based on the United Kingdom Research Integrity Office (UKRIO) Code of Practice for the Investigation of Research Misconduct [30]. The screening process passed smoothly, but problems emerged at the formal enquiry stage.

The Formal Enquiry Panel consisted of two senior members of staff of the University and a member of the UKRIO Advisory Board. The author's evidence implicated three people in professional misbehaviour: (i) the Principal Investigator; (ii) Prof. W, who was aware that bad research had been done using elastic packaging; and (iii) the "independent person" who sent false information to the funding bodies, implying that Dow insisted on elastic packaging being used.

In reality, the formal enquiry process was manipulated so that it was invalid. The Principal Investigator was used as a scapegoat and the other two people were allowed to speak as "independent witnesses" on his behalf. The Formal Enquiry Report acknowledges the present author's protests about the use of a scapegoat: "Mr Courtney refused to sign the summary of the complaint to confirm it was an accurate record of his complaint. His reasons for this were that he believed that the University was 'grooming Dr— as a scapegoat' " [32].

The following information is required in order to understand why this flawed enquiry continued under protest from the author: In 2008 Dr David Kidd of EPSRC had reviewed the author's evidence of university research fraud and proposed holding an EPSRC enquiry into the case. His proposal was shelved, however, when the University decided to hold its own enquiry. This meant that the University had to press ahead with its Formal Enquiry in spite of the author's objections, in order to prevent Dr Kidd's EPSRC enquiry being resurrected.

[10] Details of the sixteen complaint letters are provided in [1] in the section headed "October 2008".

A second manipulation of the enquiry process occurred when two genuinely independent witnesses were *not* called upon to give evidence. They were the VUMAN business manager (who had had to ban the disruptive Principal Investigator from her meetings) and the professor from the sister university who had acted as a consultant for the CrashSALi project.[11]

After over a year, the Formal Enquiry Panel concluded: "The Panel found no evidence of research misconduct on the part of Dr— and did not uphold any of the allegations related to this contained within Mr Courtney's complaint. The Panel make the following recommendations to the Deputy President of the University:

"1. That the University should look carefully at the rôle of honorary staff and ensure that their rights and responsibilities are clearly stated in a contractual agreement.

"2. That the University should seek to restore Dr—'s reputation if it has been damaged by the complaints that Mr Courtney has made against him over the years.

"3. That the University should seek to ensure that the papers blocked by Mr Courtney are duly submitted for publication and any unpublished results are allowed to be published without such blockages in the future."

The third recommendation is particularly disturbing because the author owns SALi intellectual property rights and the Formal Enquiry Panel usurped them. The University investigated SALi under licence, but the licence had expired [54]. One of the author's complaints was that after the expiry date bad SALi research that threatened the reputation of his invention had been done at the University.[12] The Formal Enquiry Panel was now encouraging the University to breach the author's rights and publish this damaging work. An enquiry panel including an advisor from the UK Research Integrity Office should not be encouraging the University to breach intellectual property law in this way.[13]

In order to justify the recommendations, several violations of the truth were required. These violations are discussed in detail in later correspondence between the EPSRC and the present author [33]. Sections 12 and 13 give two illustrative examples of how the Panel manipulated the truth in order to reach its dubious conclusions.

12. An alleged three stage fraud

This example has been chosen because it shows how hiding research fraud can become contagious. It involved two countries and had three distinct stages. The Formal Enquiry Panel only became contaminated at the third stage.

12.1 The first stage, involving the university PedSALi research workers

In October 2007, the Principal Investigator, Prof. W and the "independent person" published a journal paper purporting to describe a method for determining SALi core characteristics [35]. But the method was futile because it violated Newton's laws of motion. It is difficult to understand why the authors risked their reputations in this way. The author had warned them on several occasions that their reasoning actually violated scientific laws that had been trusted for over three hundred years. These violations were not obscure and would be obvious to most intelligent students studying physics at pre-university level (such as GCE 'A' level in the UK).[14]

Apart from the violations of the laws of physics, the two most serious flaws in this paper were:

(i) The authors had plagiarized the present author's work on test rig design by claiming credit for his catapult upgrade.

(ii) They had distorted the present author's own published research results in a manner that made his good results look bad.

This is the gist of their distortion: the present author had published evidence that SALi-type materials recovered quickly after absorbing compression energy. This allowed them to cope with several impacts in rapid succession [4, 5], which was an attractive feature to Dow as it would allow a SALi-filled car bumper to meet the draft EU Directive's "rapid recovery" requirements. But the authors claimed that the present author's work had revealed the exact opposite properties. They wrote, "Once the beads are compressed, they hold their shape and recover very slowly" [35].

12.2 The second stage, involving an American journal publishing house

The University carried out SALi research under licence from the present author and he had contractual rights to oppose damaging publications [53, 54]. The paper [35] was published in an American Society of Mechanical Engineers journal, by when the present author was ostracized by his colleagues. He only became aware of the publication after receiving a discreet tip-off from inside the University. After identifying nineteen serious

[11] Further details can be found in Appendix 2 [9].
[12] Section 6, 'April 2008' in [1].
[13] The present author's patent portfolio is listed on the "What is SALi?" web page [1].
[14] [34] is an example of a warning letter sent to the university researchers, the EPSRC and others.

flaws in the paper, Courtney complained to the editor of the journal, who passed his complaint on to the publisher in New York. Approximately half of the flaws were violations of the laws of physics and other mistakes that should have been spotted at the peer review stage.[15] After 23 e-mails over 14 months, the publisher finally concluded that "for legal reasons" he could not subject the present author's criticisms to peer review. He suggested instead that the University should deal with the problem.[16]

The paper had been an online publishing success. It was number one in the electronic publication charts in October 2007 and was still in the charts four months later. (The October chart is reproduced online at [16].) This implies that the paper influenced many researchers and presumably was a good income generator for the publisher. But the American Society of Mechanical Engineers should not be generating income by publishing dubious research, and then refusing to investigate expert complaints about it.

12.3 The third stage, involving the Formal Enquiry Panel

The Formal Enquiry Panel bent the truth and passed the problem back to ASME instead of examining it. This is how they did it.

The present author had provided the Formal Enquiry Panel with information about his dealings with the ASME journal and evidence of why the paper was flawed [16]. But the Panel refused to examine the evidence. They used the implausible excuse that

> If Mr Courtney disagreed with the results, he should have pursued the accepted practice in the academic community of writing to the editor of the journal and presenting a rebuttal which, like the original paper, would be presented for peer review before being published. The Panel did not uphold this allegation [32].

Innocent report readers such as the EPSRC would conclude that the present author had failed to act in the accepted professional manner. The innocent reader had to take everything on trust because the Report was devoid of references, footnotes, appendices or other scholarly aids to fact-checking. This raises questions about the quality of formal enquiry report-writing that was acceptable to the UKRIO advisor on the Panel. These questions will become important later (Section 18).

13. An example of alleged fraud involving a ghost technical committee

This second example is chosen because it demonstrates the confidence with which the Formal Enquiry Panel manipulated the truth.

The Formal Enquiry Report included the following passage:

> Mr Courtney had promoted SALi technology as showing a stress–strain curve of an "Ideal Shock Absorbing Material" and stated that there were indications that SALi behaves like that. Prior to PedSALi and CrashSALi, no tests had been carried out using displacement sensors, so stress–strain characteristics could not have been obtained. The results that were generated by the PedSALi and CrashSALi projects did not back up the Complainant's beliefs about the ideal behaviour of SALi. The results were scrutinized by the Technical Committee of 6 engineers (Prof. Jan Wright, Dr John Turner, Dr Eugenio Toccalino, Dr Xinqun Zhu, Dr George Georgiades and Dr Oyadiji) of more than 120 man-years of engineering experience [32].

The findings of this "Technical Committee of 6 engineers" were extremely convenient for the Formal Enquiry Panel because, at a stroke, they eliminated the need for the Panel to investigate most of the evidence that the author had presented to them. Once again, the innocent reader had been misled: the Technical Committee *never existed* and its supposed *findings* were illogical to any intelligent person familiar with the PedSALi project. Note, especially, that:[17]

(i) Multiple Freedom of Information Act requests to the University have failed to unearth any evidence that the Technical Committee ever existed. There are no written records and no e-mails referring to meetings being held.

(ii) The supposed members of this Committee included the three people who the present author asserts had committed fraud. Other claimed members were the first research assistant who went back to China almost two years before the "Committee" supposedly met, and a representative of Dow Chemicals who has provided a written statement that he was not a member of the Committee [37].

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[15] The obvious mistakes that should have been spotted at the pre-publication peer review stage are highlighted in an annotated version of the paper published online at [16].

[16] The correspondence is reproduced online at [36].

[17] A far more comprehensive discussion of the deficiencies in the Formal Enquiry Report can be found in a written dialogue between the present author and the EPSRC that took place five years later when the EPSRC reopened the case [33].

(iii) The PedSALi project had appealed to Dow and won EPSRC funding because the present author had published preliminary evidence [4, 5] that a SALi-filled bumper had "smart" properties; i.e., it would offer *a range* of different stress–strain curves, depending on the type of impact (low stiffness for leg impacts, high stiffness for impacts with other vehicles). However, according to the fictional Committee, for some perverse reason the present author was promoting his technology as having a *single* stiffness that met all needs.

(iv) The Panel wrote, "The results that were generated by the PedSALi and CrashSALi projects did not back up the Complainant's beliefs about the ideal behaviour of SALi."

This was a double deception of the reader: the present author did not hold such silly beliefs; and the results generated by the PedSALi and CrashSALi projects were meaningless.

(v) The Panel was presented with good SALi research papers from Nanjing [28] and Cardiff [26] Universities, which were in line with the present author's true beliefs about how SALi behaved. *But there are no references to these good research papers anywhere in the Panel Report*.

(vi) The author's own experimental evidence to support his true beliefs had also been written up in three planned journal papers [6–8], but publication had been blocked by his supervisor. This blockage formed one of the author's complaints to the Panel but is not referred to in their report.

14. Evidence of financial fraud

(i) During the course of the PedSALi project several meetings should have been held at Dow's UK headquarters, at which would have been discussed how Dow was building on the University research results. But as the University failed to deliver any valid research results to Dow the meetings were cancelled. Nevertheless, the University claimed EPSRC funding for attending them.

(ii) The PedSALi project should have culminated in a seminar for European car-makers where a smart bumper that met their needs would have been unveiled. No such seminar was held because the PedSALi project failed to generate any valid research results. But the University still claimed expenses for holding the seminar.[18]

The author suspected financial fraud after being tipped-off that the University had been paid in full for its PedSALi research and that the Principal Investigator had been promoted. He attempted to obtain details of the financial claims from the University using the Freedom of Information Act, but his efforts were unsuccessful [17]. He eventually obtained the evidence he required to expose the financial fraud from EPSRC. A surprising side benefit of receiving the PedSALi documents from EPSRC was that he discovered that Dow was referred to as the sole partner, with the author having been airbrushed out of both the proposal and final submission forms submitted to EPSRC. There was a five-year gap between these two documents, which provides evidence of the fraud as a well-planned, long-term strategy.[19]

These unjustified expenses claims were a double deception of the EPSRC: they created a false impression that there had been effective collaboration with Dow and that the PedSALi project had been successfully rounded off with a seminar for European car-makers.

Documentary proof of the fraudulent expenses claims was presented to the Enquiry Panel. They were also presented with evidence that information about a key witness to the fraud, namely the author, had been airbrushed from the claims document. In order to make it absolutely clear to the Panel that fraud had been committed, the author presented them with evidence that, as the lead partner, *he had declined to claim* the £10,161 expenses he could have claimed for these fictional activities.

The author's evidence of financial fraud was dismissed by the Panel. They argued that making claims for undelivered activities was not fraudulent because EPSRC guidelines had not been breached. This excuse was implausible because:

(i) Financial fraud is covered by English criminal law not EPSRC guidelines;

(ii) Airbrushing details of a witness to the financial fraud from the EPSRC claims form was dishonest.

15. Humanitarian consequences of hiding research fraud

The aim of the PedSALi project was to create a car bumper design that would allow European car-makers to meet the pedestrian-friendly bumper requirements that had been scheduled for introduction in 2005. Dow predicted that improved pedestrian safety standards in Europe would drive up standards in the rest of the world within a few years. As a multinational company, they were keen to exploit this massive commercial opportunity.

The opportunity faded when Dow lost its trust in the University and the PedSALi project collapsed. However, there was still some hope that SALi-based bumpers could

[18] The relevant section of the University financial claims form is reproduced in Appendix 3 of [9].
[19] The airbrushed documents are reproduced online at [12].

be used to reduce pedestrian injuries because the EU only postponed its draft directive, with a view to possible implementation in 2012.

As discussed in Section 10.1, engineers at Cardiff University had done small-scale but high-quality PedSALi-type research and published their results in 2009 [26]. Cardiff applied for EPSRC funding to carry out full scale car bumper tests in anticipation that the Formal Enquiry would deliver an honest report. The present author was named as a consultant for the project (Cardiff University EPSRC application reference: EP/I02990/1). But the Formal Enquiry Report cleared the University at the cost of tarnishing the present author's professional name and that of SALi Technology. Some weeks after the EPSRC received its copy of the Report, the Cardiff University funding bid was rejected.

According to the World Health Organization, 270,000 pedestrians are killed on the world's roads each year. Many more pedestrians survive but suffer painful, life-changing injuries [38]. This toll could be reduced, although by no means eliminated, if all motor vehicles were fitted with soft, pedestrian-friendly bumpers.

16. Attempts to have the Formal Enquiry Report retracted

The University Research Integrity Office had overseen the Formal Enquiry process. It had been involved in setting up the dubious scapegoat investigation and was aware that the present author disagreed with this scapegoat strategy. Therefore, there was little point in appealing to the same Integrity Office for the Report to be retracted. Hence, the present author stepped outside the academic system and made a complaint to the UK Information Commission. He argued that the University had created and distributed false information about him and that this was a breach of his rights under the terms of the Data Protection Act [39]. The Information Commission responded that the case was too complex and costly for them to investigate.

Three years earlier the University had set up an Institute for Science, Ethics and Innovation; its website states, "The Institute will examine the ways in which science is used in the 21st century, to evaluate possible or desirable changes and to consider the forms of regulation and control of the process that are appropriate or required" [40].

The present author wrote to the two most senior members of the Institute requesting that they investigate an enquiry panel fraud originating within their own University Research Integrity Office [41]. However, instead of doing so, they passed the request on to the Research Integrity Office at the heart of the problem. The University Research Integrity Office responded by refusing to examine the evidence because the author had not submitted his objection within ten days of receiving his copy of the Report. This was a mere procedural excuse because the author had submitted his objection to the scapegoat strategy even before the Report was published (Section 11).

The author continued his attempts to get the University to re-examine the findings of the Formal Enquiry Panel during the following two years but never achieved success. For example, on two occasions he submitted a testimony to the Institute for Science, Ethics and Innovation in the hope of shaming its twenty members into action. The second testimony was sent a year after the first when new evidence became available. Initially, the second testimony failed to reach any of the intended recipients, possibly because the author's normal e-mail address had been blocked. He solved these e-mail reception problems by changing his username to "SaveBritishScience"! But no member of the Institute for Science, Ethics and Innovation ever responded [42].

No doubt the members of the Institute for Science, Ethics and Innovation consider themselves as defenders of research integrity. However, this case study suggests that when university reputation is involved, peer loyalty trumps commitment to research integrity.

17. An appeal to the United Kingdom Research Integrity Office (UKRIO)

The evidence of formal enquiry panel fraud should have been a matter of concern to UKRIO because the Enquiry Panel included a member of the UKRIO Advisory Board [32].

In August 2012 the author had written to the UKRIO requesting an investigation into its own rôle in the enquiry process. But his request led to nothing; he was informed that UKRIO investigations were carried out by volunteers, and no volunteers were interested in taking up the case [43].

18. EPSRC casts doubt on the Formal Enquiry findings

In spring of 2015 the EPSRC reviewed the author's evidence of PedSALi research and subsequent formal enquiry fraud. This resulted in the EPSRC writing to the University, calling on it to hold a fresh enquiry [44]. Following several reminders from Courtney, the University finally responded by declining to hold a fresh enquiry. They argued that the UKRIO representative on the Panel was satisfied with the conduct of the original enquiry; therefore, it must have been satisfactory.

UKRIO is widely seen as the most trusted defender or research standards in Britain. Hence, after seeking legal advice, the EPSRC accepted this excuse and subsequently withdrew its call for the University to hold a fresh enquiry [58].

19. A second appeal to UKRIO

The University had relied on the UKRIO brand name to claim integrity for the formal enquiry process on earlier occasions and the author had anticipated it being used again. He had taken the precaution of writing to UKRIO in July 2015, suggesting for the second time that it should re-examine its rôle in the university enquiry process. However, the UKRIO dodged this challenge to the integrity of one of its advisors by saying it would hold an internal investigation if called upon by the University or the EPSRC—which did not happen.

This meant that, once again, the author was trapped between two bodies who were feeding off each other for an excuse. Firstly, the University was refusing to carry out an investigation as requested by the EPSRC; it claimed that that the formal enquiry process was beyond reproach, because a trusted representative of UKRIO was involved. Secondly, UKRIO was declining to investigate the author's evidence that the representative could not be trusted because the University had not requested an investigation.

The UKRIO is a registered charity set up for the purpose of defending research integrity. This aim is set out on its website: "Our aim is the more systematic and visible promotion and demonstration of integrity in research" [51].

But this aim contradicts the author's experience. Thanks to the involvement of UKRIO, he had been left helpless as a victim of formal enquiry fraud. His next step was to complain to the Charity Commission, presenting evidence that UKRIO was acting in a manner that diminished research integrity, while creating the illusion it was defending it [57].

Once again, the UKRIO avoided an investigation into its own integrity by persuading the Charity Commission that the author's case was void. Using the Freedom of Information Act, the author was able to discover how this was done. UKRIO successfully argued that the PedSALi Formal Enquiry had taken place before its charitable status was registered in April 2012. Here is an extract from an e-mail from the CEO of UKRIO to the Charity Commission:

> The UK Research Integrity Office takes its legal and other responsibilities as a Registered Charity very seriously. We will of course co-operate with any enquiry you may launch in response to Mr Courtney's complaint, noting at the outset that it relates to matters which took place in 2008–2010, a number of years before the UK Research Integrity Office became a Registered Charity [59].

UKRIO misled the Charity Commission because the complaint was ongoing and the author's calls for an internal enquiry into the misbehaviour of their advisor were both made *after* charitable status was granted.

UKRIO seems to have manoeuvred itself into a position similar to George Orwell's *Ministry of Truth*. It may be the most powerful body in the UK for influencing standards of research integrity, but its status is such that it can ignore questions about integrity within its own ranks.

The author went back to the University again. This time he alerted individual members of the University Senate that research integrity was being ignored within their own institution [45], but not one member replied.

Shortly before UKRIO held its annual conference in May 2016, the author wrote to the UKRIO Trustees (where their e-mail addresses were accessible) and all universities subscribing to the UKRIO. Seventy eight personalized letters were sent. The recipients received evidence that UKRIO had become involved in *hiding* research fraud instead of *exposing* it. He appealed for the integrity issue to be discussed at the conference. This did not happen. A month later, he wrote to the seventy eight trustees and university subscribers again, summarizing the evidence of UKRIO collusion in hiding research fraud. The recipients were also reminded that pedestrian lives had been put in jeopardy as the price for saving the face of British science. He called for UKRIO to be reformed. But his call appears to have gone unheeded [46].

Currently, universities are subscribing to a research integrity office that provides false comfort that all is well with the integrity of British science. The British taxpayer and others who fund our universities deserve better than this.

20. Placing the author's evidence in perspective

The reader is encouraged to develop a balanced understanding of this case study by requesting comments from the CEO of the UK Research Integrity Office and the President and Vice-Chancellor of the University involved. Contact details for these organizations can be found in references [51] and [49], respectively. The reader is also encouraged to test the author's evidence for accuracy and context validity by going back to the primary source documents held by the University and the EPSRC. Details of how to do this using the Freedom of Information (FoI) Act can be found in [9].

As a registered charity, UKRIO is not bound by the FoI Act. However, institutions such as the University and

Charity Commission that are covered by the Act are obliged to release copies of their correspondence with UKRIO.

21. Current state of development of SALi technology

The author receives a steady trickle of enquiries relating to potential applications for SALi technology. For example, in the last three months he has received proposals for using SALi in earthquake protection systems, baby car seats and impact protection for horses' legs. However, technical development is currently on hold until funding can be found to carry out the core characteristics research correctly [3]. In the meantime, patent protection has been maintained by the granting of two new patents. These relate to a novel shear-thickening version of SALi inspired by the structure of Roman arch bridges [47], and a SALi-based car suspension that converts vibration energy into electricity [48].

Four technical developments suggest that the time is right for renewed interest in SALi-based "smart" car bumpers than reduce pedestrian impact injuries. These are: (i) the increasing number of accidents involving pedestrians distracted by using mobile devices; (ii) reduced audio warnings for pedestrians from quiet, battery-powered vehicles; (iii) unease about the safety of driverless cars [9]; (iv) graphene, which was not commercially available at the time of the PedSALi project, would be the ideal low weight, high strength packaging material for SALi-based car bumpers [60].

22. Conclusion

In total, the author has written to about 180 individuals in the science establishment to alert them to the SALi research, and formal enquiry panel and UKRIO misdemeanours, but invariably members of the science establishment have kept their heads down instead of responding. On an institutional basis, the author or his Member of Parliament has written to: successive Vice-Chancellors and other senior staff; the University Institute for Science, Ethics and Innovation; the University Senate; the UK Minister for Science; the UK Department for Transport; the UK Foreign Office Chief Scientific Adviser; Universities UK; EPSRC; trustees of UKRIO; subscribers to UKRIO; the UK Parliament Science & Technology Committee; the UK Parliament Trade & Industry Committee; the Department for Business, Innovation & Skills; the Charity Commission; the Information Commission; the Royal Society; the Campaign for Science and Engineering; Sense about Science; the Council for the Defence of British Universities; the UK science media; Retraction Watch; RoadPeace; Liberty; NESTA; and "celebrity" scientists —but only when they have been using their celebrity status to make exuberant claims about the integrity of the scientific method. Hyperlinks to copies of correspondence with many of the above can be found on the "What is SALi?" web page [1].

Earlier studies, especially the seminal paper by Fang [50], suggest that issues of research integrity are a worldwide and growing problem. It would be invalid to conclude from this case study that the UK university research community is in any way exceptional. The author recognizes that in spite of the current problems, British science is still world-leading. The paper to be published in a subsequent issue of the JOURNAL will present a different angle: drawing on his experiences as a victim of research fraud, the author will set out a series of draft proposals for Britain to become the world leader in establishing new standards of research integrity.

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[20] Many of the following references are hyperlinked web pages. The recommended starting point for a web-based search is ref. [9].

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