Contents

Acknowledgments

TNS BMRB would like to thank all members of the Royal Society of Chemistry who helped with this research offering their opinions, experience and providing feedback in all stages of the research.

We would particularly like to acknowledge the contribution of Mark Lorch, Suze Kundu, Jamie Gallagher, Peter Hoare, Elizabeth Stevenson, Stephen Ashworth, and Matthew Hartings.

We would also like to thank all the members of the public who took part in this research.

Context of the research

Though there has been much research conducted into public attitudes towards science, little data exists about their attitudes towards chemistry. Anecdotal evidence suggests that there is low public awareness and recognition of chemists' work and the integral role chemistry plays in society and the world. To successfully engage with the public, science communicators need to know whether this is true and, if so, what might be driving it.

The Royal Society of Chemistry commissioned TNS BMRB to conduct this research to provide well-grounded, robust data on the public's relationship with chemistry in the UK. This programme of research aimed to:

Understand "where people are" now – by providing quantitative research to benchmark current public attitudes, awareness, interest, exposure and engagement towards **chemists**, **chemistry**, and **chemicals**
Explore what drives people's views – by capturing holistic, rounded qualitative insight about what underlies public responses
Identify windows of opportunity and 'hooks' to capture the public imagination
Use evidence to produce guidance on opportunities and challenges in communicating chemistry to the public

Research methodology

The research comprised several stages, outlined below:

The second workshop, lasting 2 hours, explored how the participants' views had progressed, and how they might shift further. After an initial discussion on the homework task we held a 'carousel' exercise, where we asked participants to examine five 'information stations' around different themes that were identified through the scoping stage and in discussions with the Royal Society of Chemistry. These covered different themes often used in activities with the public and ranged in tone, level of content, and media typology, in a range of formats such as mini-articles, leaflets, comic strips, posters and videos. The themes included: everyday chemistry (e.g. cooking, inspiring chemistry (e.g. comets); history of discoveries and chemistry heroes (e.g. the discovery of the contraceptive pill); myth-busting on chemicals (e.g. information on food additives); a day in the life of a chemist (e.g. what do chemists do).

Participants spent time at each station, recording what they liked most/least, what stood out to them and why, and the extent to which information changed their views about chemistry. Participants started at different tables and moved through the materials through different routes, to counter the impact of any ordering effects. Participants then discussed in a group the kinds of activities they felt they would likely engage with the most, designing their own chemistry TV programmes, public events and articles.

Vox-pops

Analysis

Analysis of research data

All qualitative interviews and workshops were audio recorded, and researchers made detailed notes of each. Materials created by respondents during the

Chapter 1: Science and the Public

What do we know already about public attitudes to science, and how does this relate to attitudes to chemistry? In this chapter we set the context for this research, exploring the current state of the evidence on public attitudes to science and chemistry. Starting with public views about science and scientists, and the degree to which we can assume overlap of these views with chemistry, we will then explore findings from the literature[9] on specific responses to chemistry, chemists and chemicals, conducted as part of the scoping stage of this research. Finally we will draw on the views of some of the members of the Royal Society of Chemistry themselves, in terms of their expectations of public perception of chemistry, their goals and aspirations in relation to future understanding of and engagement with chemistry, and their views on what successful public engagement could achieve.

Public engagement with science

As public engagement with science has become an increasingly pertinent issue for government, industry and the scientific community, there has been progressively greater investment into research programmes to try to understand public attitudes. Much of this investment has sought to understand public support or opposition to

Seven-in-ten (72%) agree that it is important to know about it in their daily lives, compared with 57% in 1988.[10]

Belief in the positive impact of science is greatest when in reference to health and medicine. At least half of people in Europe expect that, 15 years from now, science and technological development will have a positive impact on health and medical care (65%), education and skills (60%), transport and transport infrastructure (59%), energy supply (58%), protection of the environment (57%), fight against climate change (54%) and quality of housing (50%).[11]

Looking at the UK, views of scientists are also positive – scientists in general are trusted, respected and thought to have an interest in societal good:

Nine-in-ten (90%) think that scientists make a valuable contribution to society
Eight-in-ten (83%) agree scientists want to make life better for the average person
Nine-in-ten (90%) trust scientists working for universities to follow any rules and regulations[12]

However, science is not without its controversies, and more negative or ambivalent views are also uncovered in relation to specific issues like GM food[13] or nuclear energy.[14]

There are also concerns about the pace of change in science and government's ability to control it: two-fifths agree that the speed of development in science and technology is too fast to follow (42%) and means that these developments cannot be properly controlled by government (41%). Over half (55%) said people should not tamper with nature.[15]

While scientists are among the most trusted professionals in the UK[16] people sometimes mention some potentially negative traits: public trust in scientists outside the academic context is lower than the rate quoted above, with only 60%

---

[10] Ipsos Mori (March 2014) Public Attitudes to Science available online at https://www.ipsos-mori.com/Assets/Docs/Polls/pas-2014-main-report.pdf
[11] TNS Opinion & Social (October 2014) Public Perceptions of Science, Research and Innovation, Special Eurobarometer 419
[12] Ipsos Mori (March 2014) Public Attitudes to Science available online (as above)
[13] https://www.food.gov.uk/science/research/ssres/foodsafetyss/gmfoodpublicattitudes
[14] https://www.ipsos-mori.com/researchpublications/researcharchive/3284/British-public-split-on-nuclear-power.aspx
[15] The Office of Science and Technology and the Wellcome Trust (October 2000) British Attitudes to Science, Engineering and Technology available online at

saying they trust scientists working for private companies, raising questions about their independence in regards to funding and industry. Scientists are also deemed likely to be poor communicators (40%), or to be secretive (50%).[17] Qualitative research has uncovered a perception that scientists are occasionally viewed by the public as 'not quite like us' – meaning that they perhaps operate to a different moral code, driven by a desire to discover and create without considering the consequences. 56% of people agreed that scientists seem to be trying new things without stopping to think about the risks.[18]

Chemistry and chemists can arguably hold claim to some of these well-studied and established perceptions of science and scientists. We cannot assume that the same set of attitudes would be consistent for chemistry as it is unclear to what extent the associations with science in general can be attributed to particular branches or disciplines.

Public engagement with chemistry

We conducted a review of the existing literature that looked specifically at chemists, chemistry, and chemicals. While there are numerous opinion pieces from scientists on these topics, there is a relatively low level of recent primary research with the public in this area, and limited independent reports written by non-scientists.

Chemists

The chemistry community often highlights the disconnect between chemists' self-image and their public image: whereas chemists saw themselves as entrepreneurial, environmentally conscious, good citizens and social benefactors, and creative[19] there was an expectation among

pollutes the environment,

Views from the membership

We conducted telephone interviews, online qualitative research and two surveys with members of the Royal Society of Chemistry t

Chapter 2: Public attitudes to chemistry

Key findings:

Overall, people were positive about the impacts of chemistry and believed it to be beneficial to society. However, they also expressed neutrality about chemistry: they did not see it as personally relevant and lacked concrete examples of its applications; finding it much easier to specify and visualise negatives or stereotypes.

The lack of associations and emotional neutrality is indicative of a void in people's engagement with chemistry, arguably caused by:

- Lack of [illegible]

Figure 2.1: Feelings towards chemistry (%)

Q.4B Which of the following describes how you feel about chemistry? Base: All respondents (2,104 UK adults 16+) Multi-coded

Figure 2.2: Engagement/interest in chemistry (%)

Q.4A How engaged or interested are you with chemistry? Base: All

There were some differences by age. People aged 65 and over were more likely than average to agree that the benefits of chemistry outweigh any harmful effects (68% compared with 59% on average). Young people aged 16-24 held more neutral views, with around a third (36%) stating that they neither agree nor disagree with the statement compared with around a quarter (27%) overall.

Similar trends by age were found in the 2014 Public Attitudes to Science Survey (PAS),[28] in response to a similar question about science. If we look at the trend for how attitudes to science have differed since 1988 by generation, we see that people's attitudes do not simply change as they get older. Rather, attitudes are strongly linked to the era we Tm( )Tj8mr

Tc 0.001 -wete]TJasl4(er.28 0 T( )T.41(o4 l2J0 Tc 0 Tw -16.07 -1.38 Td(s)Tj0.002 Tc

Table 2.6: Whether chemistry is seen as part of the problem or solution in…

	Whether part of the problem or solution (on a scale of 1-5, 1 being only the problem and 5 only the solution)	%

views. Though reliance on school examples is common when asking the public to discuss science,[33] it is the absence of other examples, not only top-of-mind but through further discussion, and general impassiveness that indicate an over-reliance on this association.

When asked unprompted people's top-of-mind associations with chemistry related primarily to school or teachers (21%), science (16%), and chemicals or chemical elements (14%), medicine (8%) and drugs (6%), and lab equipment such as Bunsen burners and test tubes (6%), many of which are arguably images and symbols from school experience (table 2.7). This was confirmed in the qualitative workshops, where respondents described how they had imagined the school laboratory setting in order to come up with associations with chemistry.

Table 2.7: Top-of-mind associations with chemistry

Associations (mentioned by at least 3% of the sample)	%
School/teacher	21
Science	16
Chemical(s)/elements	14
Medicine/Medication	8

Chemistry at school

The survey findings suggest that people have mixed feelings about the chemistry that they learnt at school, with a quarter (25%) agreeing that school had put them off chemistry.[34]

Figure 2.8: Whether agree/disagree that school put me off chemistry

Findings from the 2014 PAS suggest public views held about science and school are in line with our findings about chemistry with 24% of people agreeing that school put them off science more generally. Women tended to have a more negative experience, with 28% agreeing that school put them off chemistry, compared with 21% of men. This is perhaps reflective of gender differences in relation to science as figures from the 2014 PAS show that women are also more likely than men to say that school put them off science (30% versus 17%)

We also asked how useful chemistry learnt at school is seen to be in people's lives. Overall three in ten (31%) agreed that the chemistry learnt at school has been useful in everyday life, while 45% disagreed (21% neither agreed nor disagreed and 5% said that they did not know).

As found previously there were some gender imbalances with men more likely to agree than women (47% compared with 35%). Young people aged 16-24 were more likely to disagree than average (51% versus 45%) although perhaps this could be reflective of the shorter time they have had to put learnings into practice or that they are still in education.

To place these findings into context it is useful to review answers to similar questions asked in the 2014 PAS in relation to science and maths. Half (51%) thought that the science learnt at school has been useful in everyday life; a third

[34] Figures in figure 2.8 for those who agreed that school put them off chemistry do not add to 25% due to rounding (10.4% strongly agree and 14.1% tend to agree).

(33%) disagreed. People were even more positive about the maths they learnt at school, with three quarters (76%) saying it had been useful in their everyday lives, and only 16% disagreed.

Confidence with chemistry

In our qualitative workshops people described how their negative or neutral experience at school resulted in

Table 2.11: Comparative characteristics of chemistry and science

Chemistry	Science
Intimidating, hard to understand, would feel ignored "You wouldn't dare to touch anything"	Welcoming, friendly "I think it's more sociable in the science room…I think it will have more sociable people"
Serious	Fun
Methodical, repetitive work	Active, discovery, exploration
Chemistry not involved in the end product	Applied to the world
Quiet, silence, concentration	Busy, excitement, buzz
Inaccessible, hard "I feel we can relate to science a little bit more, surrounded by animals, plants, whereas in the chemistry room they're doing experiments, you need to be someone of a certain profession or qualified"	Open to non-experts "you don't have to have a science brain to understand what's going on"
Work going on in the background, 'behind closed doors'; hidden or secretive	Accessible to everyone
Microscopic, can't easily see what's going on	Visual, demonstrable

I

“[There’s] nothing really relating to humanity about it.

Figure 2.12

Those who recognise the importance of chemistry in their daily lives are more likely to feel informed than those who do not, (53% compared with 24% respectively), however there is still a large proportion of people who recognise the importance of chemistry but do not feel informed about it.

This gap is also apparent in other research as similar findings were identified in relation to science more broadly in the 2014 PAS. In this survey 55% of people said

Table 2.13: Current sources of information about chemistry in everyday life

Sources (mentioned by at least 10% of the sample)	%
TV news programmes	44
TV other programmes	33
Product packaging	27
Online newspaper or news websites	22
Friends, family or work colleagues	17
Social media (Facebook, twitter, other social networking sites) or Blogs	16
Radio	15
Science magazines or Books	15
Print Tabloid newspapers (e.g. The Sun, The Mirror, The Daily Mail)	14
Print Broadsheet newspapers (e.g. The Guardian, The Independent, The Times, The Telegraph)	13
Visiting a science museum or attending public lecture	10
None of these	14

Q.10 From which of these, if any, do you hear or read stories about Chemistry in your everyday life? Base: Half sample (1,053 UK adults 16+) Multi-coded

In our qualitative workshops, respondents almost universally described a scarcity of media encounters with what they would recognise as chemistry – beyond news stories about drug development, vaccines, and advancements in findings cures for diseases.[42] This arguably demonstrates the limited ways in which participants were thinking about what 'counts' as chemistry – and though they may have been encountering chemistry-related news stories or programmes,[43] they were not necessarily recognising them as such.

> "We know we're just gone for the stereotypes, but that's all you get on TV. It's BBC news, that stock footage of petri dishes and microscopes and the centrifuge. The BBC isn't going to bother sending a camera crew every time."
> (Newcastle, Wave 1)

[42] Fieldwork was conducted in November and December 2014, when there was high media coverage of the Ebola outbreak.
[43] See chapter 6, which describes the qualitative workshops where participants were shown videos of chemistry careers, which were met with surprise and in some cases scepticism that these examples were about chemistry, rather than 'mechanical engineering' for example.

We also asked where they would go if they wanted or needed to actively seek out information about chemistry in their everyday life. **While people tended to hear and see information currently through more traditional medial sources, they were more likely to actively seek out information online.** Four out of the top five answers given were online: Google (48%), websites of research institutions or universities (18%), science books/magazines (13%), Wikipedia (13%) and online newspapers (13%).

Table 2.14: Sources of information would use to actively seek out information about chemistry in everyday life

Sources (mentioned by at least 10% of the sample)	%
The internet generally – e.g. Google or another search engine	48
Websites of research institutions or universities	18
Science magazines or books	13
Wikipedia	13
Online newspaper or news websites	13
Websites of chemical companies/pharmaceutical or other businesses	13
TV news programmes	11
Friends, family or work colleagues	11
Product packaging	10
TV other programmes	10

Q.11 If you needed or wanted to find information about Chemistry in your everyday life where would you go to actively seek information? Base: Half sample (1,053 UK adults 16+) Multi-coded

Qualitative findings from the 2014 PAS support the finding that people tend to use the internet to actively seek out information, in relation to science information more generally. The use of the internet to actively seek out information was also documented in the 2013 Wellcome Trust Monitor, which found that TV and newspapers were the most common passive sources of information on medical research while the internet was more commonly used when people were actively looking for this information.[44]

[44] Wellcome Trust (May 2013) Wave 2 Tracking public views on science, biomedical research and science education available online at

Trust in difference sources of information varied with the most trustworthy being Science museum/ festival/lecture (79%), science magazines or books (74%) and research institutions/universities (74%).

Tabloid newspapers (50%) and social media (47%) were more likely to be classed as untrustworthy. For many sources there was some ambiguity, particularly Wikipedia and social media. A quarter of people (25%) stated that they did not know how trustworthy Wikipedia is and the same proportion (24%) did not know how trustworthy social media is.

Table

organisations or charities	Untrustworthy	21
	Don't know	21
Websites of chemical companies/pharmaceutical or other business	Trustworthy	56
	Untrustworthy	24
	Don't know	20
Wikipedia	Trustworthy	48
	Untrustworthy	27
	Don't know	25
Tabloid newspapers including online (e.g. The Sun, The Mirror, The Daily Mail)	Trustworthy	36
	Untrustworthy	50
	Don't know	14
Social media (Facebook, Twitter, other social networking sites) and blogs	Trustworthy	29
	Untrustworthy	47
	Don't know	24

Q.12 How trustworthy do you find ... as a source of information on chemistry in your everyday life? Base: Half sample (1,053 UK adults 16+)

Findings from the 2014 PAS survey suggest that people have ongoing concerns about the reporting of science, with seven in ten (71%) agreeing that "the media sensationalises science", however half (52%) think that the information they generally hear about science is generally true. Qualitative findings from the 2014 PAS highlighted that some people believed that Wikipedia science articles were usually written by lecturers, so could be considered trustworthy, While others treated it with suspicion. There are several on-going research projects looking at how much Wikipedia is perceived as a reliable source of information,[45] especially on health-related subjects and future findings will help to better understand the issue of trust in Wikipedia. In general few participants were found to trust social media sites as sources of science information and, in our qualitative workshops, respondents discussed perceptions of media 'scaremongering' in relation to chemicals – this is described in more detail in chapter 4.

[45] See: Trevena, L. (2011) WikiProject Medicine, BMJ 2011;342:d3387, accessed online at http://www.bmj.com/content/342/bmj.d3387 and Cancer Research UK https://meta.wikimedia.org/wiki/Research:Wiki4HE

When asked where a chemist might work, three-quarters (76%) of respondents said a pharmacy, with one-in-four (25%) mentioning only pharmacies, and 31% mentioning only pharmacies or hospitals. The dominant image of the chemist is a pharmacist, and beyond this still has strongly medical and pharmaceutical connotations.

Figure 3.2: Top of mind perceptions on where a chemist might work (top 7 answers given)

At this point of the survey to try to overcome this strong association between "chemist" and "pharmacist", the interviewer provided a short explanation[46] to frame the chemist as a scientist that uses their knowledge of chemistry in their work.

Opinions about chemists were highly positive, with 95% saying they thought chemists made a difference in the world, 93% saying they were honest, and 88% that they were approachable. This counters chemists' expectations as only 20% of them thought the public would view chemists as approachable. As mentioned above for these results we need to take into account the fact that respondents were likely to conflate chemists with pharmacists.

[46] After being asked in the public survey where chemists work they were read the following

language flagged scientific content as “not for me.” The sense of an informational gulf between self and science therefore had a mutually reinforcing relationship with a social gulf between self and science. Scientific information was seen as so complex that those who comprehended it must be an entirely different category of person.[48]”

While these feelings can be applicable to many sciences and to some extent to science at large, they may be particularly amplified in relation to chemistry, a discipline that many viewed as particularly difficult. In the qualitative workshops, respondents described how chemistry required a particular kind of intelligence, given its abstract and complex nature. Chemists were described as clever to the point of fastidiousness, having a particular capacity and inclination for lists, order, and complexity – at the expense of sociability or relatability. These views reflect and are bound up in perceptions of chemistry, and it is clear that the conception of chemistry and chemists-as-scientists are mutually reinforcing for the public.

> "[Chemists] are quite insular; you tend to think of them in a lab, not going out, unlike scientists."
> (Birmingham, Wave 1)

In the survey, chemistry was deemed a ‘hard science’ in terms of how scientific it was compared to other disciplines (see figure 3.4). Though this isn’t a qsa7a8.ts8(mnrn)-6(o)-4(n)8

Figure 3.4: Scientific rating of disciplines (by the public and by Royal Society of Chemistry members/employees)

Public Survey Q.7A How scientific do you think ... is? Base: All respondents (2,104 UK adults 16+)
Member Survey Q5. How scientific do you think ... is? Base: All respondents (450)

Chemist profession

Though in-depth discussion and prompting, people were surprised and interested to learn of the range of industries that chemists might work in beyond the broad range of 'research projects', primarily encompassing pharmaceuticals/medicine, and to some degree for food or agricultural companies.

> "I never would have thought that chemistry affects this industry. I'm surprised that they're not making tablets."
> (Southampton, Wave 1)

After watching videos depicting chemists in a range of industries, there was initially some scepticism that the jobs depicted were in fact related to chemistry, as they were seen as falling more into alternative professions, such as mechanical engineering, or biology. For others, the videos challenged their views and broadened the fields in which they could imagine chemists working.

> "I don't think of that being chemistry; I associate cell level analysis with biology, he's a biochemist."
> (Lontrtad

viewing jobs in chemistry as interesting and only 13% viewing chemistry as a dying industry. Similar findings were seen in the 2014 PAS – 73% agreed that jobs in science are very interesting and only 13% agreed that science is a dying industry in the UK. Younger people aged 16-24 were less likely than people aged 45 and over to agree that jobs in chemistry are interesting (54% and 66% respectively). This counters the expectations of chemists we interviewed, as only 27% thought the majority of the public would agree that jobs in chemistry are interesting (figure 3.6).

Figure 3.5: Public perceptions of chemists and jobs in chemistry

Q.6 I'm now going to read out some statements about chemistry, for each one please could you tell me the extent to which you agree or disagree? Base: All respondents (2,104 UK adults 16+)

Figure 3.6: Public perceptions of jobs in chemistry compared to expectations

Public Survey. Q.6 I'm now going to read out some statements about chemistry, for each one please could you tell me the extent to which you agree oisagree? Base: All respondents (2,104 UK a 0n(u)-12(l)-3(t)-12(s)-10(1)-4(6)-1(+)]TJ0.0

A substance that is synthetic, or man-made
A substance that is p

While not directly comparable, this data can be looked at in relation to data from the Flash Eurobarometer 361,[53] where seven-in-ten (69%) respondents said that it is not possible to eliminate chemical substances from our daily life while (29%) said that it is possible to do so. It is somewhat difficult to interpret these results, given the latter response could mean either:

a) everything is composed of chemical elements, thus they are unavoidable, or
b) the use of synthetic chemicals is so widespread as to be unavoidable.

People expressed more ambivalence in their responses to the idea of the relative safety of natural/synthetic chemicals with 15% stating that they did not know which were safer. While most (67%) agreed that chemicals can be natural (that is, disagreeing that all chemicals are man-made), two in five (40%) said natural chemicals are safer than man-made chemicals.

Table 4.1: Questions about chemicals

Statement

Figure 4.2: Whether agree/disagree that natural chemicals are safer than man-made chemicals

Q.13_03 Can you tell me the extent to which you agree or disagree with the following statements? Natural chemicals are safer than man-made chemicals Base: All respondents (2,104 UK adults 16+)

Certain groups within the population were more likely to agree that natural chemicals are safer than man-made chemicals. Women were more likely than men (44% and 37% respectively), ethnic mthn-4(s)-7l]TJw k5(0)-12(4)ica[hat naturhemi4%ie moe ed0(t)1(

discourse and thinking. In the qualitative workshops, there was a strong and commonly held view that synthetic chemicals were necessarily less safe or more toxic than natural ones, and emotional push back against statements to the contrary. A few respondents did not feel as strongly that synthetic chemicals were definitely dangerous, and expressed resignation and mild indifference to their use in everyday products – though still maintained they were different in kind to natural

Across the groups, the themes that emerged were:

> ‘Everyday’: in cleaning products and cosmetics, etc.
> ‘Big’ technologies: Nuclear weapons, fracking, solar energy
> ‘Scary’: weapons, suspicious, controversial, unseen or hidden, dangerous
> Negative applications/impacts: entering the food chain, environmentally unfriendly, animal testing, processed foods, GM food, misuse
> ‘Experimental’/research: animal testing; Botox; medicinal chemicals; pesticides; GM food
> Positive: for a purpose, useful, critical/necessary, essential, enhancing, fundamental, regulated
> The future: out of mind, progress, short term good, unknown

Chemicals were primarily evaluated on whether their application was being used for social or environmental ‘good’ on the one hand, and whether there were unknown risks or consequences on the other. Though there was some wariness among respondents about the uses of chemicals in certain ‘hidden’ industries, in general people were fairly neutral about the use of every day chemicals.

> "When you talk about chemicals and testing it becomes hush hush...they keep it all closed doors...people's perceptions of it are so varied because we don't understand the end game".
> (Birmingham, Wave 2)

> “It goes without saying that chemicals are part of food, with GM products. Now I wouldn't say so much that it bothers me, it being in food, because I think, people need to eat…and me personally, I’d rather have food that didn’t go off straight away, than worry about organic.”
> (Southampton, Wave 2)

People recognised that chemicals were ‘fundamental’ and useful, though were generally unspecific about what these positive applications were beyond medicines and drug research.

There were also some more strongly negative views, particularly in relation to chemicals that were encountered or potentially eaten every day. Respondents felt they as consumers were unable to control how these chemicals were used, or properly understand the attendant risks, for example with some food additives or pesticides. This was a highly emotive area for some.

Feeling informed

Respondents spontaneously said that they recognised widespread 'media scaremongering' about chemicals, inconsistencies in advice about certain products or foods, and as a result generally disengaged from the issue. In the qualitative workshops, respondents said that chemicals were not a pressing area of concern for them, and not something they had thought about much before, or explicitly sought information about.

> "It's not realistic to worry about chemicals in everyday life.'
> (Southampton, Wave 1)

> "If it's blown up in the media, then you might worry about it but everyone's so busy doing things what they are every day you don't think what role science plays in your life."
> (Birmingham, Wave 1)

Given the nature of media coverage, however, people felt they did not have adequate information about chemicals to feel informed. Further, they felt it would be difficult for them to make decisions on the safety of certain chemicals as they would not possess the requisite knowledge, and that even scientists were unsure about the long-term impacts of some substances. During discussion, respondents said they did not feel that informed about chemicals, that they did not get trusted information about chemicals, with their information sources being the media, mainly news, and packaging and food labels.

> "How can you know the long term effects, no one really knows do they?"
> (London, Wave 1)

In our public survey, just over half (54%) of the UK public felt informed about chemicals in their daily lives, with one in ten (9%) feeling very informed and 45% feeling fairly informed.

Individuals with a lower social grade (C2DE) were more likely than those with a higher social grade (AB) to say that they do not feel informed about chemicals in their everyday lives (46% and 37% respectively).

People were more likely to feel informed about chemicals than chemistry more widely (54% compared with 41%). Although this is perhaps to be expected given the scope of chemistry is broad-ranging.

Findings from the Special Eurobarometer 461 highlight that the UK public feels relative well informed about the health impact of chemicals used in everyday products. Only 33% said that they lack this information. UK responses were among the lowest and lower than other country like Sweden (56%) and Greece (49%).

Chapter 5: Segmentation: how different people think differently about chemistry

To examine differences in attitudes beyond simple “bivariate” relationships (e.g. differences between men and women), TNS BMRB carried out a factor and cluster analysis of the responses to a number of key attitude statements on the quantitative survey. This is a statistical technique used to segment the population into distinct clusters of people who have similar attitudes to chemistry (more details can be found in the technical report).

It is worth noting that this is a purely attitudinal based segmentation and while we do still see some demographic differentiation falling out naturally, this is less dominant. Although this means the segments are less easy to identify with a traditional demographic route they have clearly defined attitudes and can help guide differential communications development and messaging.

The cluster analysis identified five distinct clusters. The chart below shows the proportion of the UK population that belongs to each cluster:[57]

Figure 5.1: Segmentation

The rest of this chapter provides a description of each cluster. Where relevant, we have included some quotes from the qualitative research.

[57] 69 cases were excluded from the segmentation clusters – 46 cases were excluded because they said ‘don’t know’ to all statements in Q8 & Q13 and a further 23 were deleted because they had more than 6 ‘don’t know’ responses at Q6.

Segment 1: Detached from chemistry

This is the smallest cluster, forming 14% of the total sample. Members of the detached from chemistry cluster are defined by their lack of interest in chemistry and scientific developments. They tend not to identify any benefits brought by chemistry and do not feel that it is important to know about chemistry in their daily lives.

Attitudes to chemistry

The detached from chemistry are less likely to understand or see the benefits of chemistry. They are least likely to agree that:

> It is important to know about chemistry my daily life (25% agreeing compared with an average of 57%)
>
> The chemistry learnt at school has been useful in my daily life (10% agreeing compared with an average of 32%)

Seeing or appreciating little personal benefit from chemistry, they are also less likely to make a positive connection between chemistry and well-being. In this segment only one in five (20%) said that they thought chemistry had a very positive impact on well-being compared with an average across all segments of 45%.

Along with the neutral about chemistry cluster, the detached from chemistry do not feel well informed about chemistry (75% said that they do not feel informed compared with an average of 57%) and are the least likely out of all of the groups to be interested in scientific developments (23% compared with an average of 67%).

This low level of interest is perhaps not surprising given this group struggles to appreciate the benefits of chemistry. This cluster also shows a lower-than-average interest in chemistry, with the lowest level of reported interest across all of the nine topics tested. The highest level of interest was seen in what chemists are doing to develop new drugs, understand our bodies and brains and other breakthroughs in medical science – although this was still substantially lower than average (26% were interested compared with an average of 76%).

It is not surprising therefore that when the detached from chemistrytog(T)-2dhTw 5.d d5verctre o

Segment 2: Interested in chemistry

The interested in chemistry cluster (22% of sample) is defined by high levels of engagement and interest in chemistry. They are the most likely segment to have studied science and/or be scientists and/or know or work with scientist.

Attitudes to chemistry

This cluster has very positive attitudes towards chemistry and they appreciate the benefits it brings to society. They are the group most likely to agree that:

> It is important to know about chemistry my daily life (85% agree compared with 57% overall)
>
> The chemistry learnt at school has been useful in my daily life (70% agreeing compared with 32% overall).

The interested in chemistry believe that chemistry has a very positive impact on well-being. Six in ten (60%) gave a very positive score (5) when asked what impact they thought chemistry had on well-being compared with an average of 45%.

The interested in chemistry are confident talking about chemistry in their daily life (63% feeling confident compared with 26% overall) and school did not put them off chemistry (87% disagreed that school put them off chemistry compared with an average of 52%). They also feel well informed about chemistry (80% feeling informed compared with 42% overall).

They are also the cluster most interested in scientific developments more broadly (92% versus 67% overall) and are interested in finding out more about a wide range of different aspects of chemistry.

Their interest perhaps reflects their relatively close proximity to chemistry/science in their lives. They are more likely than average to have chemists or scientists among their relatives, friends and family or to work with them (45%, versus 26% overall) and to have studied chemistry/science to at least A Level (44%, versus 21% overall).

As you might expect the interested in chemistry have higher levels of engagement than all other segments (36% gave a high score, of 8-10, compared with 14% overall).

They are more likely to say that chemistry makes them feel excited (25% versus 11% overall) or happy (38% versus 20%) and less likely to feel bored (1% versus 10%), confused (3% versus 11%) or neutral (38% versus 52%). This group is also most likely

Demographics

This group is slightly less well educated than the overall

Segment 4: Suspicious of chemistry

The suspicious of chemistry segment (20% of the sample) are less likely to see the positive impact that chemistry has on well-being. However they feel fairly to well-informed about chemistry and are interested in finding out more about specific developments – particularly those that have a direct impact on them personally. They are also the group most likely to have a preference for natural rather than man-made chemicals.

worth noting that a few people in this segment (6%) said that chemicals make them feel angry.

It is possible that people in this group are just generally more worried about a wide range of issues (for example other research[59] has shown that tabloid newspaper readership is linked to higher levels of worry about crime).

Demographics

The suspicious of chemistry are slightly more likely to be aged between 35 and 44 (21% compared with an average of 16%). They are less likely to be from an affluent social class (AB) – 14% compared with 23% overall and are slightly more likely to be from social grade D (18% compared with an average of 14%) – otherwise they are fairly evenly spilt across social grade.

They have a higher than average representation of people from ethnic minority backgrounds (24% compared to 14% on average).

Media

The suspicious of chemistry have relatively average levels of trust for all sources of information about chemistry/chemicals although they are slightly more trusting than average of tabloid newspapers (49% trust tabloid newspapers compared with 35% on average). This is reflected in their newspaper readership as the two most common papers they read regularly are the Sun (15%) and the Daily Mail (15%).

[59] Office for National Statistics (March 2015) Crime survey for England and Wales Chapter 2: Public Perceptions of Crime available online at http://www.ons.gov.uk/ons/dcp171776_399681.pdf

The segmentation shows that while the proportion of the population that feels most disengaged, uninterested and uninformed about chemistry is smaller than imagined, it does exist. The data shows that these views are at least in part driven by poor experiences of being taught chemistry at school, prompting, for some, feelings of **inferiority** and **insecurity** in relation to the subject. Overcoming these feelings will require demonstrating ways of engaging with chemistry that are dissimilar to chemistry at school, showing it is not just for experts and scientists, and maximising accessibility by boosting the confidence of a wary audience.

Another perception challenge to overcome, though much more subtle, is that chemistry is viewed as.

Aspirin and the discovery of the contraceptive pill

However there were mixed views in response to materials that tackled misconceptions about chemicals through rationalistic arguments – many people disagreed with statements contradicting things they strongly felt to be true – for example, that synthetic chemicals are as safe as natural ones. In some cases it raised suspicions about the implicit motivations of trying to sway their views, in others it activated underlying insecurities and confirmed their suspicions that they were ‘not clever enough for chemistry’.

> “The chemists are trying to justify the man-made and destructive element of chemistry.”

Everyday personal communication is a very important channel of communication that and if chemistry is to become part of a public narrative communicators should work to make it more part of their everyday narrative, not just in formal outreach activities. More insight on how to get started and communicate chemistry can be found in the communication toolkit at **rsc.li/pac**

The right balance of science

There was relatively strong resistance to the inclusion of ‘too much science’ in

school – that's what put me off, but I've got some interest in it now." (Newcastle, Wave 2)

Although neutrality is not as difficult to challenge as outright negativity, it is still an active state, and people will need a credible reason to move beyond it. This will mean providing concrete examples, but also, demonstrating why chemistry matters and what people might gain from finding out more.

CASE STUDY: American Chemistry Council and Ogilvy US

The American Chemistry Council (ACC) membership commissioned Ogilvy to develop a communications campaign, aiming to change public perceptions of the chemical industry: and challenge ideas that its prohat Amrer2(l)q ittt(i)--3()1(h)

Objectives for chemistry communication

Wholesale overhaul of the public image of chemistry, chemists and chemicals is not a realistic or achievable goal, as demonstrated by the multi-million dollar campaign outlined in the case study below. However, there are clear areas of overlap between chemists' goals, and what the public is interested in/receptive to, that could help shape future communication.

In the scoping phase of the research members described their ideal outcomes for successful public communication of chemistry, which were that the public would be inspired and excited by chemistry, would recognise the extent to which it is all around them, and would not be afraid/wary of chemicals.

Table 6.1

We hope that this research on public attitudes to chemistry will help members of the Royal Society of Chemistry and others interested in communicating chemistry to the public to better understand their audiences.

For more information about the research, visit **rsc.li/pac**

For more information on how the Royal Society of Chemistry is supporting its members to engage with people visit **rsc.li/outreach**