



'My Synaesthesia'

Does synaesthesia run in the family?

Charlotte Hanson, Oxfordshire

"I am the only one in my family to have synaesthesia, so it was quite a strange experience to finally meet other synaesthetes at the UKSA meeting earlier this year!

I have known from an early age that I see words in colours and other people don't. My parents thought I was just playing a game when I told them that names had colours, until they realised that the colours were always consistent. But it wasn't until I was 14 years old, when my father read an article about synaesthesia in *The Independent*, that we had an explanation for my 'coloured hearing'. My parents find my synaesthesia amusing and interesting but have very little concept of what it really means. And my husband just thinks I'm weird!"

Julie Roxburgh

"My family seems to be full of synaesthetes! My grandmother, my mother, my cousin, my brother my son and my granddaughter are or were synaesthetic like me. We spent many happy hours arguing about the colours of the days of the week etc, the sound of traffic lights and the shape of the siren in my childhood."

Kirsty Tansey

"I remember telling my mum that Tuesday was yellow, Wednesday was orange, etc. when I was about 4 years old, and mum said that it was different colours for her, so I just thought everyone saw things as colour."

As far as we know, none of our close relatives experience this, and mum doesn't see names & places as colour as I do. Not sure if my young children have it - they didn't seem to understand the concept when I asked them. (My husband thinks it's spooky and doesn't like me talking about it!)"

Brigitta Lock

"I am the only one in my whole family who has synaesthesia, i.e. seeing all letters and numbers in colours - I have been aware of it since I was a small child, but never mentioned it to anyone because of course I thought everyone has it. It was only when I saw an article about it in *The Times*, years ago now, that I realised it was something special. So parents, uncles, aunts, nieces and nephews, children, no-one else has it!"

Zanna Voysey

"In my family, there are hints of synaesthesia in every female on my maternal side, although it has expressed itself strongly only in me. My cousin has coloured weekdays and my aunt has a mind's-eye calendar, while my mother has a 3D calendar 'landscape' in differing shades of grey. My cousin's synaesthesia only became apparent when I noticed her picking consistent colours for M,T,W, F and S (the initials of the week days) from a heap of fridge magnets! My mother similarly only began to notice her own version when I attempted to describe my own, and still finds more facets each time we mention it. Even though I experience all of my relatives' hints of synaesthesia, they still think I'm mad when I go on to describe the colours and 'depths' of numbers, names, places, musical notes etc.!"

Olaf Cuthbert

"I have a son and four daughters. Only the eldest daughter (aged 50) is a synaesthetic and I only recently found this out! She has two sons but I don't know about them. I have a feeling my mother (who was an artist) may also have been one but never thought to enquire whilst she was still alive"

Jane MacKay

"My sister is a synaesthete. Though not knowing about synaesthesia at the time, we remember that as very young children we used to argue about the colours of our days of the week, hers being quite different from mine. For example, her Wednesday was a murky green and mine was lemon yellow. Her colours used to get 'shinier' and more vivid as she approached the weekend days. I saw colours and patterns for my days e.g. Friday was, and still is, black and white squares. I don't remember my sister ever talking about patterned days. We both see numbers as coloured too, and months of the year, but I don't think my sister sees music, as I do."

Maiila Hollow

"My father also has Synaesthesia. Our experiences do not vary much, although we don't see exactly the same colors. I didn't know what it was until now. He knew because he was a doctor, but he didn't know I had it, and I didn't know it was anything. I have told others, and my Mother does not have it, and my brother doesn't either. It seems to be in the Native American bloodline of my family."

Judy Forrest

"I discovered that my 25 year old daughter had synaesthesia after attending the first London meeting two years ago. I'm a grapheme-colour synaesthete and was having my usual unsuccessful attempt at describing the condition - "Friday is reddish-brown with a marble texture - same colour as eight..." - that sort of thing, evoking a politely glazed expression on the face of the listener. I then told her that some people at the meeting saw months of the year as objects in space, an experience that I couldn't grasp. She perked up: "Oh, I have that - some of the months are curved in front of you and some behind and ... I can't really describe it." That's the thing about synaesthesia; unless you can paint it, like Jane MacKay, you can never describe it."

Jane Page

"My sister has synaesthesia as well as myself. My parents did not and my children do not. We compared the colours of letters when we were children and assumed the rest of the world saw them coloured as well!!! - Until in our teens when we spoke to our parents and friends about it!! My sister and I do not have the same colours."

Thanks to everyone for their contributions, sorry we were not able to include them all! In the next issue – Do you see numbers, letters or time arranged in a pattern or space? Please submit your answers to: Newsletter.UKSA@hotmail.co.uk

NEXT ISSUE

Next time we will be looking at the relationship between synaesthesia and spatial patterns. These can include calendar forms or number lines and they can vary greatly in their shape, colour, movement and the way they are 'accessed'.

If you would like to contribute to this or a future newsletter please write to us at: UKSA, PO Box 6258, Leighton Buzzard, LU7 0WP

Or email: Newsletter.UKSA@hotmail.co.uk

I would also be very interested to hear what you would like to see covered in future editions. Please submit your contributions or suggestions by 15th Dec 2006 if for inclusion in the next issue.

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Uk Synaesthesia Association NEWSLETTER

WELCOME

Hello everyone

Firstly, I would like to say a warm welcome to James Wannerton as the new President of the UKSA and a big thank you to Athene for all her hard work as the previous President!

You can read all about James and the latest news for the association on page 2.

Now to this issue of the newsletter, where we are looking at another of the topics that came up several times at the AGM back in April –synaesthesia as a hereditary condition.

On this page, Kylie Barnett gives us an introduction to this theory and the possible reasons why it is believed that synaesthesia is passed on through family members. David Eagleman from the University of Texas talks us through his research on the genetics of synaesthesia, and his findings so far on trying to identify which gene(s) might be responsible for the condition.

We also hear your opinions and experiences on whether synaesthesia runs in your family – and how its form can vary greatly in each person – in the 'My Synaesthesia' section on the back page. And member Catherine Bailey tells us about her family of synaesthetes via a school article her brother wrote over 30 years ago!

I hope you find it an interesting and enjoyable read!

If you would like to contribute to a future issue or you have any suggestions for themes or topics that we could cover, you can find our contact details on the back page. Please keep your contributions coming!

Best wishes,
Victoria Edmonds, Editor

Synaesthesia: Is it in the genes?



If you have synaesthesia you might be surprised to learn that it can be an inherited condition. It may also surprise you to learn that while you may experience the most common form of synaesthesia, that is, linguistic-chromatic synaesthesia (where stimuli such as letters of the alphabet, numbers, days of the week etc induce colour) – that your mother might have an entirely different form. For her, the taste of cauliflower might induce triangular shapes or alternatively listening to the Beatles might evoke turquoise ripples and spirals flecked with gold. Hypothetically, synaesthesia can involve any of the senses including vision, hearing, taste, smell or touch. One of the current challenges in the field of synaesthesia research is to determine how these different types of synaesthesia are related.

The fact that synaesthesia runs in families is well-documented and the first familial cases were described by Sir Francis Galton in 1880. He points out that in the case of "colour peculiarities ... the effects of heredity are strongly marked". Two recent studies of linguistic-chromatic synaesthesia reported the incidence of synaesthesia within families. One study was conducted in Australia and one in the United Kingdom and both contained large numbers of synaesthetes. 36% of Australian (Rich et al., 2005) and 44% of English (Ward & Simmer, 2006) synaesthetes report that they have at least one other family member with synaesthesia.

If you have spoken to other synaesthetes, you will know that the experience of synaesthesia varies greatly between individuals. Not only are two synaesthetes likely to hotly debate the colour of "Monday", they may also experience the colour of Monday in different ways. For example, so-called 'projector' synaesthetes experience colour projected into external space, while for so-called 'associator' synaesthetes the colour is in the 'mind's eye'. Synaesthetes also differ in regards to the number of stimuli that induce synaesthesia. Some people experience colour only in response to letters and numbers, while others may experience colour in response to letters, numbers, days, months, names, music, pain ... For some synaesthetes colour is evoked only when they hear an inducer, for others it is evoked when they see the inducer, and for others it is evoked only when they imagine an inducer. One might ask: why do individuals experience synaesthesia in such different ways?

Synaesthesia is considered rare (although prevalence estimates seem to be constantly rising) and previous studies have focused on the most common type of synaesthesia (linguistic-chromatic synaesthesia). Our aim was to study the genetics of synaesthesia in the Irish population. We were

particularly interested in whether different types of synaesthesia run in different families and if a genetic explanation might exist for individual variability. We recruited synaesthetes using a series of national and local newspaper articles, radio interviews, and a website. We asked participants whether any of their relatives has (or had) synaesthesia and if so what type. We also screened as many family members as possible. 42% of probands (the first synaesthetes within a family to contact us) reported at least one other family member with synaesthesia and a number of families contained multiple family members with synaesthesia.

We found that not only could an individual experience two different types of synaesthesia (e.g. coloured letters and coloured pain) but very different types of synaesthesia, such as linguistic-chromatic and taste-shape synaesthesia could occur in the same family. However, in most families only one type of synaesthesia was present. This was the most common type: linguistic-chromatic synaesthesia. Yet even within these families, there were differences. For example, associator and projector synaesthetes co-occurred in families. This means that while you may experience colour for letters projected into external space, your sister might experience her colours in the 'mind's eye'. Members within a family were no more likely to agree on colour associations for particular letters of the alphabet than unrelated synaesthetes. Even identical twins could not agree on a coloured alphabet! Finally, we found that while some family members might experience synaesthesia for only a small number of inducers, other members might experience synaesthesia for a large range of stimuli.

It is interesting to note that we found several cases where reported 'non-synaesthete' relatives did in fact have synaesthesia. In most cases this was because an individual assumed that because they did not have coloured letters or numbers they did not have synaesthesia, when in fact they had, for example, coloured music and personalities for numbers. This suggests that previous estimates of the familiarity of synaesthesia may have been too conservative. Approximately half of the synaesthetes in our sample do not have a family member with synaesthesia, suggesting that synaesthesia can be developmental, without being inherited. The fact that different types of synaesthesia can run in the same family does however suggest that different types of synaesthesia might be associated with a common genetic mechanism. While a 'gene' for synaesthesia remains elusive, it is possible that such a gene (or genes) is involved in determining the way the brain is wired.

By Kylie Barnett

Association News



UKSA President, James Wannerton writes:

Welcome to the autumn 2006 edition of the UKSA Newsletter. It gives me great pleasure to introduce myself as the new President of the UK Synaesthesia Association and I'd like to take this opportunity of thanking Athene for all her hard work on behalf of the UKSA during her term in office. As your President I will be doing everything I can to raise the profile, expand the membership and further the aims and objectives of the Association. More about that later. To begin, here's some background information about myself.

I'm a lexical-gustatory synaesthete – many spoken or written words produce vivid sensations of taste on my tongue. I first became involved on the research side of the condition back in 1997 following contact with the American psychology professor Dr Peter Grossenbacher, the synaesthetic artist Carol Steen and the neurologist and author Dr Richard Cytowic. Realising that there was some serious research being carried out I spent the next few years talking about synaesthesia to anyone who would listen. This persistence led to an appointment with David Parslow of the Institute of Psychiatry in London at which point I was beginning to have some serious reservations as to where all this was leading! However, subsequent fMRI scans confirmed that what I was experiencing was real and since 2001 I have been involved with various synaesthesia research projects here in the UK under the intense, exploratory gaze of Jamie Ward and his team at the University College London and Dr Julia Simner at Edinburgh University which has led to some interesting and enlightening discoveries about the condition as I experience it. During the course of this research I have had the good fortune to have met a whole host of dedicated and committed professionals who have taken synaesthesia out

from behind the closed doors of University psychology departments into the mainstream and I myself have also contributed to a number of media projects (some good, some bad and some downright terrible!) with the dutiful intention of helping the condition to become better known. I can remember only a few years ago that any internet search for the term "synaesthesia or synesthesia" would return maybe 10 or 12 entries. Now it's over one million! The thanks for this increased awareness must go to all the scientists and researchers and indeed synaesthetes themselves who have openly talked about their perceptions and added further credibility to what is now a medically recognised bone fide condition with very exciting future implications as regards our understanding, development and constitution of that complex thing - the human mind.

The Association has a busy period ahead as we strive to become registered as a charitable organisation and endeavour to augment and develop ties with similar Associations around the world. We will also be looking at energising and expanding the member's website and increasing the Association's presence on the Internet as well as investigating ways of giving the membership more for their subscriptions.

On behalf of the committee, I hope you find this latest UKSA newsletter informative and interesting. If any of the membership has opinions or comments they would like to make, please get in touch! We are always on the lookout for members who feel they would like to become more involved and wish to contribute to the Association and its aims.

If you are interested in getting involved please contact us at the usual address – details are on the back page.

Letters

Member Catherine Bailey writes:

"My brother, Michael Crick, wrote an essay on the subject of synaesthesia in our family back in 1973/74 whilst he was a sixth former at school. When he wrote his essay he was not aware that what he was talking about was what is nowadays referred to as "synaesthesia". In those days it was not a recognised condition or, if it was, probably only within the scientific community. Nevertheless, his essay is interesting, particularly his analysis of the similarities and differences between his family members (including myself and my two triplet sisters) in their

colour associations with days of the week. I'm not sure I agree with all of Michael's conclusions, but the days of the week chart is interesting isn't it? (Perhaps we all have "blue" Mondays because none of us like Monday mornings). I am sister no1 in the chart. My colours for the days of the week haven't changed in 30 years or so."



Michael Crick is now a journalist, biographer and broadcaster. An extract from his sixth form essay is below:

ASSOCIATIONS OF COLOUR

"On my mother's side of the family everybody sees the days of the week as colours. Here is a table in order of age, the eldest at the top:"

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Grandma	Silvery Grey	Blue	Emerald Green	Yellow	Ice Blue	Orange	Dark Green
Great Aunt	Gold	Blue	Brown/Yellow	Red/Brown	Light Yellow	Silver	Dark Yellow
Mother	Chestnut	Blue	Red	Yellow	Green	Orange	Brown
Me	Yellow	Blue	Light Green	Dark Green	Orange	Yellow	Brown/Black
TRIPLETS	Sister 1	Orange	Dark Blue	Pink/Black	Dark Green	Light Blue	Light Yellow
	Sister 2	Dark Green	Light Blue	Green/Yellow	Dark Brown	Orange/Yellow	Light Yellow
	Sister 3	Light Orange	Light Blue	Light Brown	Dark Blue	Grey Blue	Light Yellow

"One can see that on some days the colours are very alike and on others they appear to have no resemblance with each other whatsoever. Sunday is always a light colour, usually involving yellow. Monday is the most interesting day as everybody sees it as a form of blue. Everybody seems to be uncertain about Tuesday, Wednesday and Thursday, and many of the descriptions involve more than one colour. Perhaps this is because people do the same sort of things on each of these days and tend to mix them up. As we approach the weekend, Friday involves light yellowish colours. This is particularly noticeable in my sisters' case. All

three of them think that Friday is light yellow. They are triplets and sometimes have the same dreams, which makes the situation more interesting. Saturday tends to be a dark day.

Although I think that it is interesting to note the similarities, I also think it is interesting that only some people see coloured days of the week and that it seems to be hereditary. When asking these members of my family they immediately knew what I meant, whereas others were puzzled and thought I was mad."

The Genetics of Synesthesia David Eagleman PhD University of Texas



In 1883, Sir Francis Galton pointed out that synesthesia tends to run in families and suggested that the condition is heritable.

A century later, in 1989, in the first edition of *Synesthesia: A Union of The Senses*, Richard Cytowic examined the inheritance patterns of eight families and proposed that synesthesia is transmitted as a dominant trait. In 2005, Jamie Ward and Julia Simner examined the inheritance patterns in 72 families (of varying size) and came to the same conclusion.

So it appears that synesthesia has a genetic component – but we don't know what the gene is. And how does the expression of a tiny gene endow a brain with a different perception of the world? What protein might a synesthesia gene code for? Why does only a fraction of the population have synesthesia? Are some people silent carriers? What will the genetics tell us about the way non-synesthetic brains are wired? To answer these questions, my lab and others have been collecting families – and their DNA – to hunt down the gene(s) for synesthesia.

Crosstalk in the synesthetic brain

The most plausible hypothesis is that synesthetic brains differ from non-synesthetic brains because of an increased degree of cross-talk between normally separate brain areas. But how does a gene cause this increased crosstalk to come about?

More connections

The fetus makes two million synapses each second, endowing newborns with an excess of working connections between brain areas. The over-wiring hypothesis likens the synesthetic brain to a garden that is insufficiently pruned. A variant of this idea is that there is an increased outgrowth of neurons, like a garden steeped in Miracle-Gro. What both these ideas (insufficient pruning and increased growth) have in common is the idea that a synesthetic brain simply has more physical cross-wiring than a normal brain does.

Less inhibition

Although excess wiring has received the most attention, a second view, suggested by Peter Grossenbacher and Chris Lovelace, implicates faulty inhibition between brain areas. The idea is that normal brains have excitation balanced by inhibition, while in synesthetic brains the inhibition is not as effective. In this framework, the same cross-wiring exists in everyone; in synesthetic brains it is able to exert a stronger effect because it is not counteracted by inhibition.

Favoring this idea is the possibility that some forms of synesthesia occur in non-synesthetes under special conditions – for example, during meditation, states of deep absorption, the use of drugs such as LSD, or as they are falling asleep.

The idea here is that synesthesia runs on neural

connections that are anatomically present in everyone, but are usually silent.

Kevin Mitchell and I made a \$100 public wager at the 2006 UK Synaesthesia Association meeting. He suggested the gene generate more physical connectivity, whereas I put my chips on the disinhibition hypothesis, suggesting the physical wiring will be the same in everyone. The jury is still out; perhaps we can announce a winner at UKSA 2007.

Less plasticity

One other idea, suggested by Richard Cytowic and me in our upcoming book, is that synesthetic brains have a slightly reduced ability to modify a connection once it has been set. This means that once an initial letter-color pairing has been set (say, a child sees a physically red J), the association sticks despite subsequent exposures to other pairings (say, a green J seen later). For most people, being exposed to letters in many different colors will wash away any association, but not for synesthetes. Note that a consequence of this theory is that excessive exposure to fixed letter-color pairings should be able to induce synesthesia in any child's brain.

The Synesthesia Battery:

www.synesthete.org

Those are some possibilities for how the gene will work. But when we go after the genetic analysis, how do we make sure we have genuine synesthetes? To this end, we have developed the Synesthesia Battery – www.synesthete.org – a free website of online questionnaires and software tests for synesthesia. This website is designed to be used by individual synesthetes and the whole community of synesthesia researchers. Performance on the tests is quantified with a standard scoring system, immediately identifying genuine synesthetes. This has helped us (and others) to access, test and verify synesthetes around the globe.

Open question 1: which chromosome?

Many open questions remain in the search for the gene. While it has been suggested by Jamie Ward and Julia Simner that the X-chromosome may harbor the gene for synesthesia, data-in-progress from my lab (and I believe from Julian Asher's research as well) does not support this. Instead, there are hotspots in other places in the genome. In a few months we hope the location will be clearly identified.

Incidentally, we now know from Julia Simner and her colleague's random prospective study that male and female synesthetes occur in almost equal numbers. To my mind, this means that the historical debate regarding the possible lethality of the synesthesia gene to male embryos has been rendered obsolete.

Open question 2: who else harbors the gene?

The idea of localized genetic expression means this: if the gene for synesthesia is expressed in the areas for hearing and color, this results in

sound → color synesthesia, while if it is expressed in other sensory areas, then other types of synesthesia result. But what happens if this same gene is expressed in brain areas not involved with perception or sensation? What if it were to link brain areas involved in reasoning, planning or decision making? Would this lead to geniuses, artists, madmen? We do not yet know. But once we find the gene for synesthesia, we will look for who else carries it in the population. The synesthesia gene may be an attractive candidate for the neurological basis of highly creative people to see connections between seemingly unrelated things.

Open question 3: one gene or many?

We have been speaking as though synesthesia is caused by a single gene. But the single-gene idea could turn out to be wrong. Instead, there may be multiple genes all leading to the same phenotype. Or it could be that different genes correlate with different synesthesia types. In fact, since spatial sequence synesthesia is so much more prevalent than grapheme-color synesthesia (about 10% of the population versus 1%), this suggests the involvement of different genes for these two types.

Within the next six months our family linkage analyses should shed light on these questions. If multiple family trees all harbor the same genetic change, we will be able to announce the gene for synesthesia. Otherwise the road will be longer (but no less interesting), and we'll eventually announce a collection of genes.

So in the end, Kevin and I might both be right in our genetic guesses, and we'll buy each other a beer instead of exchanging \$100. Alternatively, we might both be wrong – the gene(s) may be something totally unexpected – in which case we'll still buy each other a beer.

Are you from a large family with several synesthetes in the tree?

To determine the genetic basis of synesthesia, I'm looking for families in which synesthesia runs widely through the tree. If you're synesthetic, does anyone else in your family experience synesthesia (any forms)? Parents, siblings, grandparents, aunts, uncles, cousins? The more blood relatives with synesthesia, the better that is for the study, even if they're quite distant relatives. If you are able to find other blood-relative synesthetes in your family tree, I would love to know about it. If you're wondering whether they are really synesthetic or merely trying to say something to please you or get you off the phone, run them through the Synesthesia Battery at www.synesthete.org. Thanks for contacting me at david@eaglemanlab.net if your family is large and contains verifiable synesthetes.

In my new book with Richard Cytowic, *Hearing Colors, Tasting Sounds: The Kaleidoscopic Brain of Synesthesia*, we discuss all these issues in greater depth. We hope the book will be on the shelves soon. If you're interested in these topics, please keep your eyes out for it.

