Moved by music
How music affects mind and body

- Music and emotions
- Evolution of music
- Music and medicine
- Creativity and music
It is hard to imagine a world without music. Most of us hear some form of music every day. It is a popular leisure activity and it accompanies many of the most significant points of our lives: our infancy, our marriages, our funerals. It is a powerful trigger of emotional memories. Often, we can tell the story of our lives in songs and music. Even so, music remains one of life's great mysteries. How can it have such a powerful impact on us? What exactly is it for? When in human history did it appear and why? Do other animals experience music? And what exactly is music anyway?

Music always involves combinations of pitch, timbre, rhythm, loudness, tempo, melody and harmony. These elements can be combined to create a big diversity of music – from African drumming to Johann Sebastian Bach, from throat singing to Razorlight.

Harmony in my head

In the inner ear, the cochlea converts sound waves into the language of the brain; nerve impulses. Within the organ of Corti, tiny hair cells in the basilar membrane detect sound vibrations. Inner hair cells convert mechanical stimulation to an electrical signal. Their deformation opens ion channels, triggering a series of cellular events that ultimately generates an action potential in the auditory nerve. Because of the structure of the basilar membrane, different parts of the cochlea respond to sounds of different pitch. At one end the membrane is narrow and stiff and vibrates in response to high pitches. The other end is wider and more flexible, responding to deeper sounds. But information doesn’t just flow one way. The brain can send signals that sharpen up responses of hair cells, so we can concentrate on specific aspects of sound in complex environments.

Wired for sound

The brain has a complex interconnected set of pathways for processing music. Brain imaging shows that music perception involves a wide range of brain regions. Many are specialised: music evokes happiness and joy, for example, leads to increased activity in a network including the evolutionarily ancient emotional areas of the brain.

The experiences of people with brain damage, often from injury or stroke, tell us about how the brain understands music. For example, people with damage to a particular region on the right side of the brain can no longer tell whether a pitch changes to a higher or lower note. As a result they cannot perceive a tone’s ups and downs over time – its melodic contour. There is overlap between music perception and other brain functions, particularly music and language. For example, anomalous or unexpected events in both music and language are detected by similar brain regions.

Pixels and pitches

Our brains recognise octaves as special. ’Happy Birthday’ is a well-known tune, written surprisingly recently (technically, it is still in copyright). As with all songs, if its notes are all raised by an octave (or multiple octaves) it remains instantly recognisable. A much smaller shift in frequency, if it does not match an octave, has a much more dramatic impact on melody and makes the tune harder to spot. People with our brains have an innate ability to spot the fact that notes an octave apart are the same. This capacity is even present in unborn infants, whose heart rate changes when they experience novel sounds. An octave shift, though, has a relatively small effect on heart rate.

Perhaps even more remarkably, other primates share this ability. Rhesus monkeys trained to distinguish ’same’ from ’different’ can spot the similarity between different versions of ’Happy Birthday’ (and other simple songs) but only when they are played an octave apart.

Talking loud and clear

How are music and language related?

Music and language have much in common. Both depend upon the brain’s perception of structured sound input. Links between them are the reason behind the idea that the brain has specific ’modules’ for decoding music, distinct from those that handled language. In reality, the lines between language and music are not always clear cut. ’Talking’ and ’singing’ use the same neural systems, but reading music sets off in a different direction. Yet music and language do share some common ancestry, particularly in the early humans chat or sing round the campfire. One possibility is that rhythm and early motherese-like communication provided a common foundation for both language and music.
In the mood

The power of music is extraordinary. It can inspire, excite and influence our mood profoundly. It can send chills down our spines and raise the hairs on the back of our necks.

How can something as simple as a coordinated set of noises have such dramatic impacts on our mind and body?

More controversially, perhaps, music is often used deliberately to modify human behaviour – building on a long history of manipulation by music.

Second that emotion

Emotion is fundamental to the musical experience.

Music can trigger powerful physiological responses.

Music can elicit a remarkable range of emotions, from elation to the deepest distress. As well as affecting our physical response, it also has characteristic effects on the body.

Music can alter the 'thrills', 'chills' and 'shivers'. Heart rate and skin conductance may change. The hairs on the back of our neck (and elsewhere) really do stand up.

These effects arise from the action of hormones, triggered by signals from structures such as the hypothalamus.

Emotions are associated with activity in a network of brain structures. Music is very good at stimulating activity in these areas – a sign of the tremendous emotional impact of music.

Interestingly, emotional reactions seem to be an innate aspect of music perception. Dissonance, combinations of notes that clash with one another, is distressing. The phenomenon is often exploited by composers: a controlled change from dissonant to consonant tones is appreciated as a resolution of tension in diverse cultures from Hindu to Western.

The 'Devil's interval' – two notes three tones apart (e.g. C and F sharp), played simultaneously or one after another – automatically induces a feeling of dread.

In medieval times it was considered evil and banned. More recently, it has been a staple of horror films and heavy metal (though it also appears in West Side Story and the theme to The Simpsons).

The link with emotions also explains why music is so good at conjuring up memories. In particular, one region of the prefrontal cortex responds both to familiar music and 'autobiographical' memories (those most relevant to us as individuals).

Listening to a song heard on a first date can thus call up powerful recollections of excitement (or embarrassment).

Interestingly, this is one of the last areas to be lost in Alzheimer's disease, suggesting that music could help people to retrieve personal memories even at late stages of disease.

Music activates areas of the brain such as the insula, which seems to maintain a sensation that affects our whole body. Music thus conveys a feeling of 'body'.

As any Hollywood soundtrack composer knows, music can be used to manipulate people's state of mind.

Emotions are associated with activity in networks of brain structures. Music is very good at stimulating activity in these areas – a sign of the tremendous emotional impact of music.

Music can be as powerful as a drug. It can send chills down our spines and raise the hairs on the back of our necks.

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Music thus conveys a feeling of 'body'.
**Things can only get better**

What does it take to be a good musician? Is it all down to natural talent or can everyone become a virtuoso, given the chance? And once learned, do musical skills help us in any other way? Perhaps they could be applied to help heal the sick. For centuries music was seen as integral to the healing arts. Now, it is beginning to make a comeback – though hard evidence of benefits is scant.

Day after day

Is musical ability something you are born with or does it come with practice?

Could anyone, given the opportunity, become a concert pianist or are there a select few with the potential to excel? Could anyone, given the opportunity, become a concert pianist or are there a select few with the potential to excel? Is it all down to natural ability or does it come with practice?

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**I can make you feel good**

**What role is there for music in modern medicine?**

Music has been marginalised in medicine. Now, though, many doctors are arguing for its wider therapeutic use.

Not surprisingly, given its power to influence mood and behaviour, its most popular uses are for psychological and psychiatric disorders, as well as neurological conditions and pain control.

Music has proven valuable in situations likely to promote anxiety, such as children’s medical and dental treatment (right) and cervical cancer screening. Other well-established uses include interventions for people with chronic pain or terminal illness.

But the effects are often not great and may not be long-lasting: in a recent study of keyhole surgery, surgeons who played a musical instrument were significantly faster at suturing than those who did not.

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**I feel fine**

Music has a long history in the healing arts.

In ancient Greece, Apollo was the god of both healing and music. Music was seen to be a powerful influence over people.

It was divided into three forms:

- **Phrygian**: stringed, martial music
- **Dorian**: solemn and slow, noble and pious
- **Ionian**: joyful

The meaning of these terms has changed somewhat since then.

Internal balance of the four bodily humours (black bile, yellow bile, phlegm and blood) was seen as particularly important, an idea that survived until modern times. Music could exert its influence by acting on the humours.

Music was thought to be detected in the ear by animal spirits, which transmitted reverberations through the body in the bloodstream. The 17th-century German physician Althanasius Kircher illustrated the concept by showing how music affected vessels filled with different kinds of fluid, representing the different humours.

As more mechanistic views of nature developed, the German scientist Herman von Helmholtz linked the physics of sounds and the anatomy of human hearing. He proposed reasons for perceptions of consonance and dissonance and later showed how several physiological factors were affected by various aspects of music (pitch, loudness etc.).

Music therapy has often been applied in mental health. In the 18th century, the singing of the castrato Farinelli reputedly brought King Philip V of Spain out of depression, and a daily dose of singing kept him well until his death ten years later. As treatments of mentally ill people became more humane in the late 19th century, music sometimes formed part of therapy – either listening or music making.

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**Rock me Amadeus**

Does music make you smarter?

In 1998, the Governor of the US state of Connecticut, Lowell Weicker, declared that all American children should be given a tape or CD of classical music. He believed in the ‘Mozart effect’ – that listening to classical music could boost your brainpower.

In fact, Miller was overstating the case. Listening to Mozart or the more stimulating music such as Bach or Vivaldi does appear to improve spatial reasoning – people got better at solving mazes and – only for about ten minutes after their dose of culture.

And not everyone is convinced that Mozart is anything special. Some argue that the effect is simply down to mood and arousal. One study found a Mozart effect in young children listening to pop music. It’s also been seen in rodents navigating mazes. The biggest effect, though, has probably been on sales of Mozart’s ‘Sonata for Two Pianos in D Major’ (K. 448).

Yet there is a widespread belief that music is good for the brain. There is evidence that learning to play an instrument can enhance abilities in other areas – the transfer effect. For example, some mathematical reasoning comes more easily to the musically trained child. Other skills such as reading, motor coordination and conceptual reasoning also appear to be improved by musical education.

Despite the enthusiasm of some parents to be for bombarding their babies with Mozart while in the womb, there is little evidence that any benefits result.

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**Crazy**

Tarantism is a peculiar chapter in the story of music and health.

In regions of Italy and Spain during the 16th and 17th centuries, some women periodically fell into a stupor from which they could be roused only by music. The condition was commonly blamed on the bite of a spider (though not the tarantula of popular imagination). Musicians travelled the countryside trying different instruments and songs to raise the ‘tarantati’. Rapid repetitive tunes with increasing tempo would bring patients to a dancing frenzy, often lasting several days.

Thereafter, they would spontaneously dance whenever they heard a ‘tarantella’ (below).

Many composers have drawn upon the Tarantella in their works, and it also appeared in The Godfather and inspired the tripe (‘Tarantellegno’) in Harry Potter and the Chamber of Secrets.

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**Simply the best**

What does it take to be musically gifted?

Slice open the skull and a neuroanatomist could instantly spot signs of a professional musician. Musicians typically have an enlarged corpus callosum – the cable that passes from one side of the brain to the other. Certain areas of the cortex would also be well developed, particularly those dealing with sound, motor coordination and hand–eye coordination.

A violinist’s brain might show enhanced grey matter in the motor areas specifically associated with the fingers of the left hand (used for fingering). He or she might also show greater activation in auditory areas in response to violin tones than to trumpet tones.

There is also evidence that musicians use their brains in a different way, engaging a more ‘analytical’ strategy than non-musicians when listening to melodies.

So musicians’ brains are different. Studies are now underway to see how the brains of musicians change as they go through their training.

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**Franz Mesmer (from whom we get the word mesmerise and, indirectly, hypnotism) developed a form of therapy that aimed to improve the flow of ‘life forces’ (‘animal magnets’) through the body, often using a glass harmonica in his therapies. The French King Louis XVI ordered a high-level enquiry – which included Antoine Lavoisier, Ignaz Sulzer and Benjamin Franklin – into Mesmer’s claims. They found no evidence for Mesmer’s supposed new fluid.**

**Harry Potter and the Goblet of Fire**

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**In the late 19th century, music sometimes formed part of therapy – either listening or music making.**
The times they are a-changing

What is the point of music?

Perhaps the biggest mystery in music is what it is actually for. A classical evolutionary perspective would argue that, as a seemingly innate aspect of human behaviour, music must have some purpose – provide some kind of survival advantage. But how would musical ability have helped our ancient ancestors? Perhaps instead it is an evolutionary quirk, a by-product of our advanced brains?

I heard it through the grapevine

Why did music evolve?

There are two ways to explain the evolution of music. The first, the adaptationist view, is that music must serve some purpose that has led to its selection. An alternative argument is that it has no direct purpose itself but is a by-product of some other human capacity (see below).

If we assume music has some survival value, what might that be? Charles Darwin suggested sexual selection might be at work. Good singers or musicians might be signalling their fitness to potential mates. Alternatively, music might be a by-product of some other human capacity that has led to its adaptationist function (see below).

There is some evidence to support this idea (such as the renowned success of pop stars at attracting mates). More recently, symmetry – generally thought to be a sign of “good genes” – was found to be associated with an attractive voice. On the other hand, music is typically a group activity, and associated with rituals rather than courtship.

The alternative view is that music acts as a bonding agent and emerged as part of the development of social groups. Among primates, humans are intensely social; much of our success has relied on our ability to coordinate our actions and communicate our state of mind to others. A coherent collaborating group would have been able to hunt better, see off enemies and protect vulnerable infants.

Eat to the beat

Stephen Jay Gould popularised the idea that not all features of an organism are necessarily adaptive (as classical Darwinian thinking would maintain). He used the analogy of “spandrels” – the spaces between the arches in cathedrals, which served no structural function but were often filled with paintings by artists. They may have looked stunning but they were only there because a cathedral needed arches to stop it falling down.

The writer Steven Pinker describes music as “auditory cheesecake”. We never evolved to find cheesecake tasty – it taps into our innate fondness for energy-rich foods.

She bangs the drums

When did music first appear?

Music is a part of essentially all human cultures, suggesting that it is very ancient and evolved early in human history. Early music may have relied on the human voice or basic percussion using natural materials. Some ancient artefacts may have been used to generate sound, but the earliest unambiguously musical instrument is probably a flute discovered in Germany, which is about 35,000 years old.

Bone flutes 8000–9000 years old have been found in China and play notes in ancient Chinese musical systems. Two 4000–5000-year-old marble statues show that well-developed musical forms had developed by the late Stone Age. They show a flute player and a musician playing a triangular lyre or harp. By the time documented civilisations appear, all have well-defined musical traditions.

What is the point of music?
Sound of the crowd

Music may be near-universal but people's musical experiences may differ greatly. Some people may experience musical hallucinations in music that is obvious to others. Some may experience music constantly playing in their head while a few even 'see' music. Understanding how unusual perceptions come about can reveal much about how the brain interprets music.

Bring the noise

Not everyone can hold a perfect tune. Some can't but don't really care, while some – tone- or tune-deaf people – can't actually tell they are out of tune. True tone deafness (or amusia) affects about 5 percent of the population. Generally, people with amusia cannot perceive music normally because of an underlying deficit in processing pitch and melody. It seems to be linked to characteristic brain abnormalities, including fewer 'white matter' connections between different areas of the brain. Some people with amusia still enjoy music. For others, though, music is just a cacophony – as one person put it, "like pots and pans falling on a stone floor". Amusia may develop after head injuries or strokes, but in most cases people are born with it.

Perception of a bum note triggers two characteristic types of electrical activity in the brain. Interestingly, one of those signals is also seen in tone-deaf people, suggesting that their brains have spotted the discordant note even though it does not register consciously. Less often, people with amusia can hear tones but cannot hear anything in a sequence of notes – a melody, for example, only the ability to distinguish timbre. Some specifically cannot perceive dissonant tones. Interestingly, these people do have lesions in the brain area involved in emotional judgements.

Now you're gone

Loss of hearing is an occupational hazard for musicians – and a problem for those who listen to them.

Loudspeakers and amplified music have increased many people's listening pleasure, but at considerable cost. High-volume music may be pleasurable at the time but it can store up problems for the future. The main problem is that sounds are detected by physical deformation of fragile hair cells, which can be damaged by loud sounds. The hair cells, in most people, the auditory nerve transmits signals from the ear's hearing apparatus to sound-processing areas of the brain. In people with certain forms of synaesthesia, however, these connections seem to take detours. As well as hearing music, they may also 'see' it or 'taste' it. Sound-related synaesthesia is relatively common. Musical sounds generate distinctive visual experiences. Particular notes may be associated with specific colours. Nikolai Rimsky-Korsakov is said to have had synaesthetically colour-music associations. Likewise Liszt would startle orchestras by asking: "Gentlemen, a little blue, if you please!"

A study in Wales found that the condition tended to affect older people with hearing loss. They experienced all kinds of sounds, from 'Three Blind Mice' to 'Don't Cry for Me Argentina', though hymns were particularly common among the religious. It appears that songs from the past, with a deep emotional connection, are those that bubble up in the brain.

Say hello, wave goodbye

Musical interests can fade away – or suddenly appear.

In 1980, legendary jazz guitarist Pat Martino had an apple-sized knot of blood vessels removed from his brain. The operation was a success but left Martino with severe amnesia. He had no memory of his past life as a guitarist. Later, he picked up the guitar again and gradually revived dormant musical skills. Car accidents and strokes can also instantly destroy someone's musical appreciation – or a highly specific aspect of it. Bizarrely, some people actually gain musical obsessions and skills after brain damage. In his book Musicophilia the neurologist Oliver Sacks describes how a man struck by lightning developed a consuming desire to hear and play music. He taught himself to play the piano and now composes music. A speculative idea is that damage to the brain is releasing (or 'enabling') a block on musical processing in the brain. Normally, the brain dampens down music networks as it has so many other tasks to attend to. If this inhibition is lost, music may flood the brain.

An echo of this may be seen in people with unusual mental abilities. Children with Williams syndrome are highly sociable and have a natural affinity for music (though not necessarily high ability). People with the condition have lost a set of genes on chromosome 7, and have characteristic abnormalities in brain structure. Even more extraordinary are musical savants, people born mentally disabled but with astonishing musical abilities. They can play pieces of music almost perfectly after hearing them only once. Musical savants are often blind and have perfect pitch.
Great composers and songwriters constantly innovate. But what do we know about human creativity and its application in music?

New forms of music are often in the vanguard of social change. Are they driving change or simply reflecting new ways of thinking and behaving? And how much are they influencing the way people act – perhaps in antisocial or undesirable ways?

She blinded me with science

What is this thing we call creativity and how does it apply to music?

All composers and songwriters are to some degree creative, producing novel works. But some are generally considered more innovative than others. Classical composers such as Mozart, Beethoven and Johann Sebastian Bach developed new forms of composition that profoundly influenced those that followed. Louis Armstrong pioneered innovations in jazz. Chuck Berry, some argue, invented rock and roll, while Roky and Others in New York created rap music.

Do these disparate individuals have anything in common? Some models of creativity emphasise individual personality traits – creative people may be more ‘complex’, in that they can hold apparently paradoxical views in their heads, or they may be better risk-takers, or less worried about upsetting the status quo. Neuroscientific perspectives emphasise the importance of ‘divergent thinking’, opening up new possibilities rather than closing them down. The prefrontal cortex, the high-level ‘thinking’ area of the brain, may be particularly important. In a 2008 study comparing trained musicians and matched controls, the musicians showed greater divergent thinking and stronger activation in this region of the brain.

Other work suggests that the ‘emotional brain’ and dopamine-based reward pathways are also important. On the other hand, creativity does not operate in a social vacuum. The musical expression of creativity is rooted in the circumstances of people’s lives – be it Mozart’s hothousing in Vienna court life or rap pioneers’ urban New York. Igor Stravinsky, arguably the most influential classical composer of the 20th century, was part of a broader ‘modernist’ movement.

Rhythm is a dancer

Music is commonly accompanied by dance – indeed, the two may have evolved together.

Music and dance often go hand in hand and it seems likely that their origins are closely entwined. The brain’s locomotion systems and auditory systems clearly interact. When we hear a sudden noise, we may blink or jump without intending to (the acoustic startle response), which involves pathways running directly from the ear to the spinal systems controlling movement. Of relevance to music, babies listening to sick beat rhythms can perceive it as a march (three pairs of beats) or a waltz (two sets of three) depending on how they are bounced on someone’s knee.

Dance is often associated with rituals and plays an important social role. An attractive theory is that dance, like music, evolved to strengthen social groups. Music and dance would have provided a mechanism to reinforce group identity – and to impress potential enemies.

Kick over the statues

Music has been used both to suppress and to promote dissension.

Dictators have been quick to apply music to social control. Rousing anthems may be used to cohere populations. And anything seen as vaguely subversive has rapidly been banned. Nazi Germany had firm guidelines on the type of music that could be performed. Wagner, Beethoven and Bruckner were in; Mendelssohn, Mahler and Schoenberg (all Jewish) were out.

Conversely, it has also been a rallying call for dissenters. Folk music has often been a medium for commentary on social justice. In the USA, singers such as Woody Guthrie pioneered the modern ‘protest song’ during the Great Depression. Songs such as Billie Holiday’s ‘Strange Fruit’ highlighted racial prejudices. Later, ‘We Shall Overcome’ was also heard in Europe during the collapse of the Soviet Bloc. Particularly striking was the ‘Singing Revolution’ of Estonia, marked by public singing of patriotic songs, forbidden under Soviet rule.

You drive me crazy

Musical geniuses: are they all mad?

You drive me crazy

Anecdotally, there is a fine history of odd behaviour among musical geniuses. Mozart was renowned for his eccentricity and intense highs. The young Rossini was strangely productive, writing 39 operas by 20 (at his own request).

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Let’s talk about sex

According to a recent study, the average US adolescent hears around 80 references to sexual lyrics every day in music (depending on what type of music they listen to). In 278 of 2005’s popular US songs, more than a third contained references to sexual activity (often downgrading sex references). In this and another US study, published in February 2009, adolescents’ sexual behaviour appeared to be strongly influenced by their exposure to sexual lyrics.

You drive me crazy

A commonly hypothesised cause is bipolar disorder (manic depression), where individuals experience alternating periods of depression and intense highs. The young Rossini was astonishingly productive, writing 39 operas by 37 (but none thereafter), possibly driven by mania. German composer Robert Schumann attempted suicide and spent the last two years confined to a mental institution (at his own request).

Oddly, bipolar disorder and schizophrenia have a genetic component. Why are risk genes not eliminated? One possible explanation is that “mild” forms, associated with enhanced creativity, actually improve reproductive success. A recent study of UK poets and visual artists provided some support for this idea.

Creative people are more likely to act outside conventional norms of behaviour. On some measures of “anomality”, they rate as highly as people with schizophrenia. Ideally, they can channel this restrictive non-conformity towards positive ends. Unfortunately, with no suitable conventional norms of behaviour, on some occasions their heads, or they may be better risk-takers, or less worried about upsetting the status quo. Neuroscientific perspectives emphasise the importance of divergent thinking, opening up new possibilities rather than closing them down. The prefrontal cortex, the high-level thinking area of the brain, may be particularly important. In a 2008 study comparing trained musicians and matched controls, the musicians showed greater divergent thinking and stronger activation in this region of the brain.

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Later, music and dance were appropriated by ruling elites to reinforce social structures and promote conformity. Religious movements in particular have used music and dance as a form of group identity – from the hymns of Christianity, the Gospel music of Southern Baptism to the Islamic adhan (call to prayer). Music has a special place in Tibetan Buddhism. Monks use music to recite sacred texts and at various festivals.

Dance has tamed less well, suffering from its association with pagan rituals and entertainment. Even so, it remains at the heart of many religions, including strands of Christianity and Islam. In Hinduism, the entire universe is thought to have been conjured up through the dance of the Supreme Dancer, Nataraja. A version of ritualistic dance survives today in the form of South Indian Classical Dance.

Like the written word, song can communicate powerful ideas, but can also unite groups and appeal to deep emotional forces in a way that books cannot. Evolution has crafted our brains to especially predispose us to music – and performers tap into this primeval instinct to inspire, influence and inflame.
What does music mean to you? We asked three people with quite different experiences of music to reflect on their personal interests and perceptions of music’s wider role – and to share with us their ‘desert island disc’.

**Adrian North**

**What do you do?**

I’m a music psychologist and Director of Psychology at Heriot-Watt University, Edinburgh.

**How did you first get into music?**

I started playing the guitar at age ten and still play now, although I am absolutely terrible! A career as a musician was never possible.

**What part does music play in your life?**

While lots of music psychologists study the process of making music, I examine the listeners’ point of view. One thing I’m exploring at the moment is the potential negative effects of rap and heavy rock music on young people. I also research the use of music in commercial environments such as restaurants and shops, which is a multimillion-dollar worldwide industry.

My research means that I have become sensitised to the music that we hear around us, and I’ve realised how prevalent music is in our everyday lives. Also, I’m sure I’ll be monitoring what my son listens to when he’s older!

**Who has been the greatest musical influence on you?**

It has to be the Beatles: clearly the best band in the world! They had wonderful melodies combined with wonderful musicianship and wonderful lyrics. There’s also the cultural aspects: they were at the forefront of the change that showed pop music could be art.

**Why do we have music?**

It’s clear that people use music as a badge of identity, but they also use it as a medicine – dosing themselves throughout the day to get what they want from a situation. Just think of the kind of music used in gyms.

Posts and other technology are changing the way we use music. When I was doing my A-levels I’d walk around college with a bag full of cassettes, which still only covered a tiny proportion of my music collection. Now, people can take their entire collections with them. For many young people today, listening to music is a much more throwaway experience. There will be times when you really get into the music, but sometimes it’s just sonic wallpaper, on in the background.

**What’s your desert island disc?**

It has to be the Beatles: Magical Mystery Tour, the most tuneful.

**Troi ‘DJ Chinaman’ Lee**

**What do you do?**

I’m a DJ and events organiser who was born deaf. I founded www.deafave.com.

**How did you first get into music?**

When I was about ten I got my first Walkman. I’d put the headphones not over my ears, but over my hearing aids. People would look at me strangely, but that’s how I listen to music. I went to my first hearing rave when I was 17, and that really got me into the rave scene. I found that deaf people didn’t really understand raves though – it wasn’t in their culture.

When I was 20 I was involved with a pirate radio crew and got my first decks. A deaf guy was having a house party and asked me to DJ there. My cousin, a professional DJ, lived round the corner, so I got a wheelbarrow and loaded his speakers in. It was a great party and a turning point for my career. Afterwards, at deaf nights in the pub, people kept asking me when the next party was. I decided to host one for 700 and Deaf Rave was born!

**What part does music play in your life?**

For the last six years I’ve been putting on parties and raves for deaf people. Those events are really important as they give deaf people a chance to get out and socialise. Nearly everyone at the parties knows each other.

All people are welcome but I’d say around 95 per cent of people that come are deaf. There are different levels of deafness – some people have hearing aids or cochlear implants, but the majority don’t. Some parts of the parties could seem strange to hearing people, for example performers signing along to songs instead of singing them.

**Who or what has been the greatest musical influence on you?**

The people I grew up with made a massive impact. Musician-wise, it has to be Public Enemy and bob Marley.

**Why do we have music?**

I think it’s a way to bring us together. Other animals vocalise, birds sing. It’s all about finding a mate or warning somebody off, communicating really basic emotions. I think we use music to communicate too.

**What’s your desert island disc?**

‘Fattie Bloom Boom’ by Ranking Dread, a Jamaican singer who’s deaf now. I play it everywhere I go.

**Jennifer Rohn**

**What do you do?**

I’m a scientist studying the genetics of cell shape and movement at University College London.

**How did you first get into music?**

I started piano lessons when I was five years old and guitar lessons when I was eight. I also played trombone in a band and sang in choirs. I had always wanted to be a musician but I was interested in science too, so it was a struggle deciding what to do at university. In the end I didn’t get an opportunity to become a professional musician, and I loved science more. At university I fell out of music but started to get back into it when I began working as a scientist. I’ve recently joined a band called Frank-n-A-delic as the singer. We’re a bunch of ageing scientists, ex-scientists and publishers – all in our 40s.

**What part does music play in your life?**

I use it a lot in work. Science is quite laborious and there’s a lot of manual labour in my job – the mindless moving of small amounts of liquid from one tube to another. At those times I really appreciate music. Music is very important to labs and it’s hard to find one where there isn’t a CD player or radio on.

**Who has been the greatest musical influence on you?**

I like all kinds of music. Playing the piano, I was raised with classical music, but my Dad is very eclectic. He has a huge record collection and loves everything: country and western, jazz, classical. I like most things too, including pop music. The only stuff I don’t enjoy is some types of jazz and modern music. Music has to make me want to move around.

**Why do we have music?**

I think it’s a way to bring us together. Other animals vocalise, birds sing. It’s all about finding a mate or warning somebody off, communicating really basic emotions. I think we use music to communicate too.

**What’s your desert island disc?**

I’m a romantic; it would have to be ‘Woodface’ by Crowded House. It’s not fashionable but it makes me smile!

How exactly do deaf people experience music? Hear more about Troi Lee’s life and work at Big Picture Online.

www.wellcome.ac.uk/bigpicture/music
Music is part of all human cultures. It is thought to have appeared very early in human evolution. Music may have appeared before language but the relationship between the two is uncertain. Early music may have involved the human voice and rhythmic percussion using natural materials. Many animals make sounds with similarities to human music. The original purpose of music is not known for sure. Its evolution may have been driven by sexual selection or the benefits of group bonding. Alternatively, music may have no adaptive value but be a by-product of other human capacities.

Music has a number of distinct characteristics, such as pitch, timbre and rhythm. Music is processed in the brain by a number of interconnected areas. Damage to these areas can selectively remove specific aspects of musical appreciation. Music has strong connections to the emotional areas of the brain. Composers use music to manipulate listeners’ moods. Music was an important part of medicine for many centuries. Although music is now rare in medicine, it has been shown to be effective in some areas. Elite musical performance is primarily the result of intensive practice. Learning musical skills has spin-off benefits in some other areas. Rituals involving music are an important part of many cultures and religions. Music has been used as both a means of expressing social discontent and a tool to suppress dissent.

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Music is particularly effective at establishing group social identities. Musical preferences provide particularly strong insights into individual identities. Abnormalities in musical perception are seen in a number of conditions. Enhanced musical appreciation and, occasionally, musical skills are seen in some conditions. Musical creativity may be associated with particular unconventional ways of thinking.

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