

Chapter 2

Stress and Music

Concepts and Mechanisms

Are there any theories that could explain why repeated exposure to music (or cultural experiences in more general terms) might influence our health? A common statement is that music is good for our health because it helps us relax. This might benefit health in some situations, but such simplistic explanations can only explain part of the potential health promotion effects of music. I do not think that modern man uses music mainly for relaxation purposes. Perhaps even quite to the contrary, in our modern era with emphasis on alertness, music is more often used as a central stimulant. In the chapter on individual singing, I will show that most people who sing regularly become both more relaxed and more alert after singing. This may seem like a paradox and does not fit the idea that most people may have about stress.

However, despite these reservations, let us start with the relaxing effect of music that many people have experienced. How does it influence health? If some kinds of music do reduce the feeling of stress in some situations, this might have a salutogenic effect (increasing positive factors) and also reduce adverse health effects of stress (decreasing negative factors). In order to discuss this, I have to introduce some basic concepts related to stress. If we do not decide what we are talking about when we talk about stress, the discussion will be confusing.

In physiology and medicine, the most frequent definition of stress is the one introduced by Selye (1956). According to Selye, *stress is a general activation reaction to a stimulus that could mean both a challenge (in a positive sense) and a threat (in a negative sense)*. The activation takes place because the body needs energy in order to manage the challenge or threat. Selye was discussing that of individuals of course react differently to the same stimulus, and that different stimuli induce different mobilisation reactions. But, still according to Selye, there is a common denominator in this mobilisation reaction and arousal. That common denominator is what he labelled stress. As we shall see in coming chapters, musical experiences can both reduce and amplify stress reactions. And this frequently occurs in real-life situations.

The importance of the surrounding factors is great, and this also means that it is difficult to isolate the “musical effect” on stress from other influences in real-life situations as well as from the influence of previous experiences with the same music.

Selye also applied a time perspective to the stress reaction with three phases, the *General Adaptation Syndrome*. The initial phase (arousal) is so rapid that the individual is not conscious of what happens—all of a sudden the body is mobilised without cognitive analysis. In the second phase (defence), the body prepares itself for fight in several ways (see below). In the third phase (exhaustion), if the stress situation lasts for a long time, the body is exhausted and not able to handle the situation as effectively as in the previous phases.

There is an intricate interplay between genes and environment when the type and intensity of the stress reaction is determined. In every moment, our biological programme determines how we react to a piece of music that we hear. The biological programme has been modelled by the experiences we have had previously in life and how they have interacted with our genes. This interaction means that some stress-related genes—for instance those who influence blood pressure elevation or activation of the immune system—become “activated”. This could mean that if one is forced to listen for a long time and continuously to a disliked piece of music, such stress-related genes become activated, resulting in amplified and more frequent biological stress reactions to this piece. Interestingly, however, there is also a corresponding positive possibility, the same genes can be deactivated by pleasant music! Activation and deactivation of genes are a relatively new scientific discipline, epigenetics. Even the chemical reactions mediating such processes are now being explored, and one powerful chemical tool is methylation and demethylation of genes (Szyf 2012). If we want music to have an influence also during other life situations (without music), we would require these music-related epigenetic mechanisms to spread to life in general and to be long lasting. This is, however, merely speculation. Epigenetics is a new research field.

Figure 2.1 summarises my thoughts about the interplay between individual and environment in the experience of music. There are always a number of stressors in the environment. These will be handled by the individual programme that is constantly changing as a consequence of gene–environment interactions. The musical stimuli are located to the left in the diagram. Every time we hear a piece of music, our biological programme will respond to it, resulting in behavioural (dancing, singing, drinking, eating etc.), psychological (sad, joyful, anxious etc.) and biological (hormonal, cardiovascular, immunological etc.) reactions. Behavioural, psychological and physiological reactions are mixed with one another. We are aware of some of these reactions, but we are also unaware of many of them. Professional musicians and dancers have trained their consciousness regarding what goes on in their mind and body when they listen to or perform music or movements. All reactions, also those that we are unaware of, are stored in the box labelled “previous experiences”. This could be regarded as a log book feeding our individual programme with impulses that constantly model the programme in order to make it adapted to our future music environment. The genes also contribute to the changes, but they do this in constant interaction with the musical experiences that we have in our life.

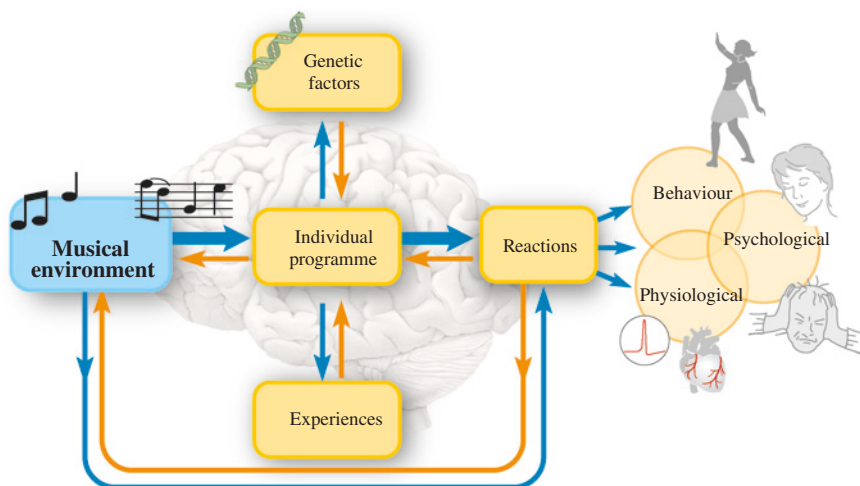


Fig. 2.1 Our biological programme. Every time we hear a piece of music, our individual programme responds behaviourally, psychologically and physiologically. These different kinds of reactions are mixed together. Genetic factors interact with our experiences. The connections are bidirectional. Some impulses influence the reactions without being an essential part of the music programme (such as vibrations). *Source* A. R. Kagan, L. Levi, T. Theorell

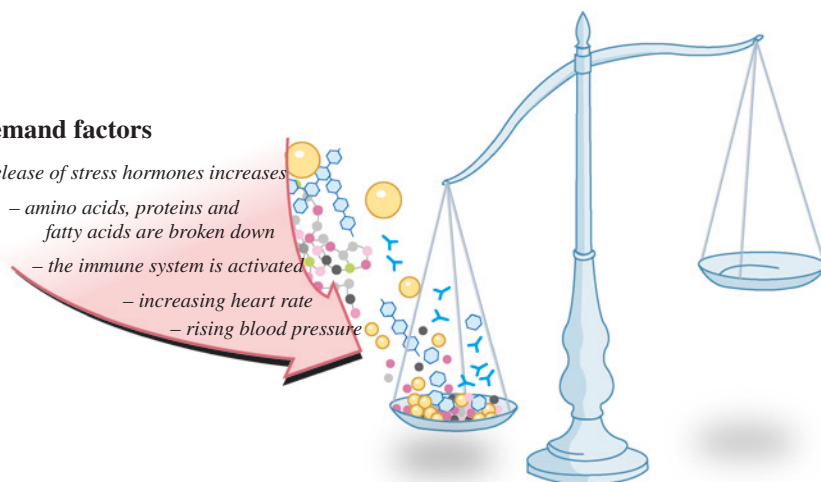
It is important to acknowledge that the lines between the boxes are bidirectional. Another important point is that some impulses related to the total experience but not directly music-related (such as vibrations and painfully loud sounds) can give rise to direct effects without passing the musical brain and the individual musical programme. Such processes, although they do not belong to the musical experience per se, could have strong effects on the individual's music programming.

All these reactions are stored together with the musical experience in the individual programme. This means that the reaction to the same piece will not be exactly the same when the individual gets exposed to it on subsequent occasions. Obviously, in addition, the reactions themselves may influence the musical environment. Perhaps the listener shouts aggressively at the person playing the music with the result that the music stops. If the listener shows enthusiasm, the music performance may be intensified.

The goal of the stress reaction is to prepare the body for mental and physical effort in conjunction with the challenge or threat. Energy mobilisation has the highest priority, and this means that fuel has to be provided for the expected energy-requiring work. This corresponds to increased blood concentration of free fatty acids and glucose. There are also a number of parallel effects that are important for the body in this situation, particularly if the situation is going to last for long. For instance, it is important to be insensitive to pain—if fighting leads to injury, the fighter should be able to disregard pain and continue fighting for as long as possible. For the same reason, blood coagulation is stimulated during acute stress—excessive

Demand factors

- release of stress hormones increases
- amino acids, proteins and fatty acids are broken down
- the immune system is activated
- increasing heart rate
- rising blood pressure



Picture 2.2 Negative stress. When the body is exposed to demands in everyday life, it is mobilising energy in order to manage the situation. Repeated such reactions without periods of rest can result in harmful processes, which are threatening the inner environment of the body. The mobilisation of energy becomes a threat. © Annika Röhl

bleeding should not weaken the body during the acute stress situation. In the same vein, some aspects of the inflammatory responses are weakened; swollen knees or muscles should not inhibit action. These types of reactions are phylogenetic which means that they have been inherited from lower animals and were of importance to the survival of human beings in the early history of mankind (Picture 2.2).

This way of reasoning can be applied directly to the use of music in the history of mankind. During wars, music has been used for arousal purposes—to increase the mobilisation of energy. The association between “strong” marches and aggression and hostile energy is evident. In line with my previous reasoning, soldiers should also not be disturbed by pain and bleeding. Research will be described in subsequent chapters illustrating that these kinds of reactions can be strengthened by aggressive war music.

We are mostly not aware of our bodily reactions to music, and accordingly, we may be unaware of the arousal effect—as adults, we have been taught to neglect it. Children are different. We had a very clear illustration of this in my family when we attended a performance of very old African war dances. As adults, we looked at this intellectually without awareness of any emotional reactions. Our three-year-old son, however, was very frightened. He reacted openly with fear—which is what these dances were intended to evoke. We were indeed looking at war dances, but we saw them merely as interesting cultural manifestations.

An additional concept is needed in the understanding of health effects of music. This relates to the body's capacity to restore and protect itself against adverse effects of stress.

Anabolism or Regeneration

Anabolism or regeneration refers to processes that stimulate the synthesis of proteins. This is central to restoration and growth of cells. Mobilisation of energy that was described above is partly in opposition to restoration and growth of cells. Intensive mobilisation of energy is associated with downplaying of anabolism and regeneration. This creates no problem when the stress periods are short. But anabolism cannot have low priority for long periods, because vulnerability to disease increases. The organ systems become fragile because there is constant break down of cells in the body, even during days when we are not making any efforts, so called programmed cell death (Horvitz 2003). These have to be replaced or repaired in anabolic activity. Conversely, if it is possible to stimulate anabolism by means of musical experiences, this could protect us against adverse effects of stress (Picture 2.3).

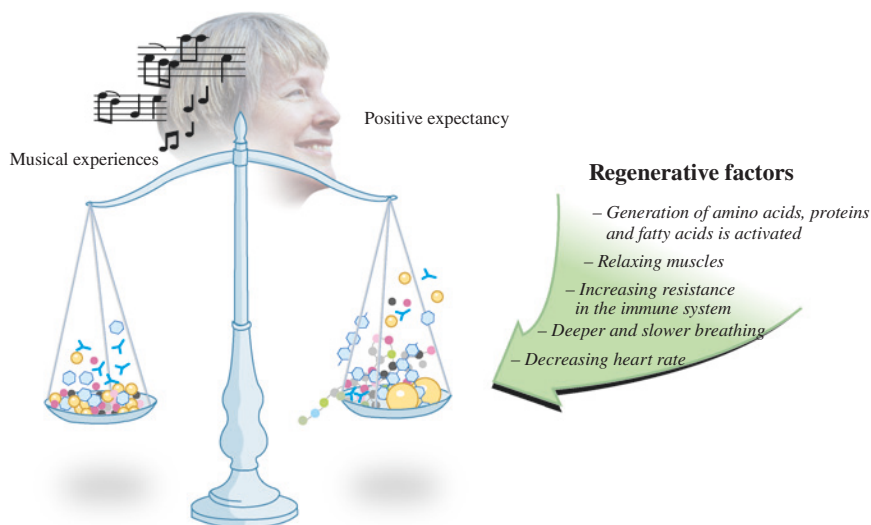
The basic discussion regarding stress concepts can be applied to the analysis of musical effects on health. Music may amplify feelings that we have, and it may also induce strong feelings. Thus, music can both accelerate and slow down processes in the body. Accordingly, it is no surprise that music can influence a wide range of bodily functions. So far I have discussed stress mainly in terms of biological functions. Psychological processes are parallel to bodily processes, however. The Swedish psychoanalyst Thorsten Sjöwall (1991) discussed psychological processes from a psychosomatic perspective. He used the same terminology as I have been using for the biological processes. He summarises by saying that the psyche, exactly like the body, thrives best when periods of energy mobilisation are interspersed by periods of anabolism.

In psychology, the counterpart of biological individual programme is *coping*. This is a very central concept in psychology and psychological stress research. It could be translated into “mastering problems”. Active coping entails an expectation that the individual’s acts will result in an improvement in the problematic situation. Listening to and performing music could influence coping in several ways, for example by infusing energy so that the individual gets the strength to deal with a problem or by facilitating new ways of thinking.

The health promoting effects we might get from regular, repeated musical experiences in everyday life could accordingly arise in three ways:

1. Inhibition of intensity and frequency of arousal reactions—music as a filter
2. Strengthening of anabolism/regeneration improving resilience in general
3. Improved coping patterns—New ways of thinking may lead to more positive expectations of successful coping.

The first mechanism implies that repeated musical experiences inducing a relaxed state occur so often that it causes a total reduction in aroused state over longer periods. This might be similar to the effects observed after periods of repeated meditation over longer periods. We know that this may induce long-lasting changes in the brain related to a lowered level of sympathetic arousal.



Picture 2.3 Health promoting effects. The balance can be resumed by strengthened regenerative processes. Repeated musical experiences can protect the body against harmful effects of repeated long-lasting demands. © Annika Röhl

The relaxation aspect of music is being exploited by a whole industry producing relaxing music.

The second mechanism is similar to the one operating in regular physical training, which is known to stimulate hormones that increase the body's ability to restore, repair and replace worn-out cells. Such processes have not been extensively studied in relation to musical experiences, but in the chapter about choir singing, a long-term experiment will be described, which examines the possible effect of singing in a choir on the production of a regenerative hormone.

The third mechanism has been discussed extensively in qualitative studies. For instance Gabriellsson (2011) has described strong musical experiences in 900 interviews. These interviews illustrate that strong musical experiences can change an individual's way of thinking about himself/herself dramatically and that this could change the life course. This will be discussed more extensively in the chapter about treatment. Another illustration is an experiment that was performed in northern Sweden (Bygren et al. 2009). Caregivers were offered the possibility to participate in a cultural activity experiment for employees. They were randomly allocated to either a control group or an experimental group. In the experimental group, the subjects were asked to participate in cultural activities once a week. They could choose activity from a menu including cinema, concerts, art exhibitions and choral singing. The activities took place once a week during two months. In the control group, the subjects had to wait until after the experimental period before they were allowed to take part in the cultural activities. The participants

in both groups were asked to fill in a questionnaire before and after the two months that the study lasted. The results showed that those who had participated in the cultural activities felt better physically and socially, and they also reported increased vitality during the study period. The design of that study does not allow us to draw any conclusions regarding specific effects of choral singing. The beneficial development in the experimental group was statistically significantly different from that in the control group where no such changes were recorded. In this case, one might say that the third mechanism has been operating—thinking along new lines.

The third mechanism implies that expectations for successful coping in stressful situations are improved. This requires that the cultural experience makes the subject re-evaluate important aspects of life and makes him or her feel that life can be reorganised. This is the basic thinking also behind music therapy. But it is also a fundamental aspect in the use of other cultural activities in the treatment of psychological states caused by traumatic events. The most extensively studied cultural activity from this point of view is creative writing. Pennebaker (1997) and Lumley et al. (2002) have described the therapeutic processes that start when subjects are allowed to spend one week under supervision writing about their own traumatic event(s). Such research has shown that the psychological state improves in most of the subjects and that immunological and other biological beneficial changes are also likely to take place. These only last for a couple of months, however, if no follow-up takes place.

If a cultural activity has a beneficial effect on a group of subjects, there may also be secondary effects on other individuals who interact with them. This has recently been shown in an evaluation of the use of an art intervention designed to increase empathy in middle managers. The intervention lasted for nine months, with group sessions once a month. Each session contained poetry reading with themes related to ethical and moral responsibility in crisis situations. The poems were interspersed with music that was selected specifically in order to amplify emotions or to support the participants emotionally. After each session, there were group discussions and in addition reactions were followed up in diaries. The evaluation was performed as a random-controlled study, which means that half of the studied managers were allocated to the art intervention and half of them to a more conventionally designed high-quality education programme with lectures and subsequent group discussions (Romanowska et al. 2011). Follow-up 18 months after start of the employees working for the managers in the two groups showed that the art intervention had been more successful than the other intervention. This was reflected among other things in a more beneficial development of the regenerative hormone DHEA-s in the employees working for the managers in the art intervention group. Thus, it is possible that a mixture of poetry and music may influence not only the listeners themselves but also their subordinates.

In later chapters, I shall describe more in detail how the two first mechanisms (reduction in arousal and stimulation of anabolism/regeneration) might explain health effects of music. In [Chap. 3](#), I shall discuss how music influences social interactions.

References

- Bygren, L. O., Weissglas, G., Wikström, B. M., Konlaan, B. B., Grjibovski, A., Karlsson, A. B., et al. (2009). Cultural participation and health: a randomized controlled trial among medical care staff. *Psychosomatic Medicine*, 71, 469–473.
- Gabrielsson, A. (2011). *Strong experiences with music: Music is much more than just music*. Oxford: Oxford University Press.
- Horvitz HR (2003) Worms, life and death (Nobel lecture)—review. *ChemBiochem* 697–711.
- Lumley, M. A., Tojek, T.M., & Macklem, D.J. (2002). Effects of written emotional disclosure among repressive and alexithymic people. In S. J. Lepore & J. M. Smyth (Eds.), *The writing cure: How expressive writing promotes health and emotional well-being*. Washington DC: American Psychological Association.
- Pennebaker, J. (1997). Writing about emotional experiences as a therapeutic process. *Psychological Science*, 8, 162–166.
- Romanowska, J., Larsson, G., Eriksson, M., Wikström, B.-M., Westerlund, H., & Theorell, T. (2011). Health effects on leaders and co-workers of an art-based leadership development program. *Psychotherapy and Psychosomatics*, 80, 78–87.
- Selye, H. (1956). *The stress of life*. New York: McGraw-Hill. ISBN 978-0070562127.
- Sjöwall, T. (1991). Psykosomatiska grundbegrepp (Psychosomatic basics). In J. K. Konarski-Svensson & T. Theorell (Eds.), *Psykosomatisk läkekonst (Psychosomatic medicine)*. Stockholm: Natur & Kultur Förlaget.
- Szyf, M. (2012). Mind-body interrelationship in DNA methylation. *Chemical Immunology and Allergy*, 98, 85–99.

Psychological Health Effects of Musical Experiences
Theories, Studies and Reflections in Music Health
Science

Theorell, T.

2014, V, 106 p. 17 illus., Softcover

ISBN: 978-94-017-8919-6