MedNeuro

Charité NeuroScience

a newsletter brought to you by the International Graduate Program Medical Neurosciences

June 2014 - Volume 07, Issue 02

The Neuroscience of Love

Love is More than just a Kiss

This is the title of the current – and for months now – number one most downloaded article of the journal Neuroscience reflecting an overwhelming interest of mankind in this topic. This prompted us to investigate the neuroscientific perspective on love and all of its facets.

Love is in the issue, everywhere I look around. Have you ever wondered about the magic of love at first sight or the craziness of fresh lovers who seem to wear rose-colored glasses all the time? Why do animals and men experience romance and well-being especially during spring time? Why don't we bump our noses when we kiss each other? Can you really win someone's heart by cooking good food? How long do newlyweds keep off the pounds?

We bring to light neuroscientific answers to some of these world-changing questions. The sober truth, believe it or not: it is all just biology. Read about the chemistry of love and how different hormones are involved throughout the course of a relationship. Still not convinced? Check out how love evolved and the differences between men and women. Modern research techniques such as functional magnetic resonance imaging tell us which brain areas are involved in love, and eye tracking reveals the truth about what people look at in their potential mate.

Romance not sufficing, we describe different forms of love in this issue, ranging from paternal love, promiscuity and monogamy to love between spousal caregivers and Alzheimer's disease patients. What is the basis for altruism and narcissm and why do some victims develop feelings for their aggressor? Some people develop delusional beliefs that others fell in love with them. Is love like an addiction and how does depression influence our personal relationships? Does watching pornography change your brain?

A highlight in this issue is our own first "scientific" study among Berlin neuroscientists where we investigated the relationship of gender and career stage on mate selection. You'll never guess what is most important to neuroscientists when choosing their partners!

New article formats this issue; read a short story on Pride and Pain, and in our newest format – "Perspectives in Neuroscience" – we critically discuss advances in neuroscience research. Furthermore, a conference report and our proven and tested 'Brain in Press' await you.

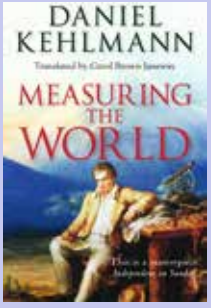
Last but not least, we cannot pull off the frequent flyers' metaphor again for many reasons. Yet we are happy to welcome three new members to the writers' room: Carla Wood, Bettina Schmerl and Judith Houtman.

Enjoy reading!

– Marietta, Editor-in-Chief

Contest

We are always interested in including your contributions. You can submit anything you see fit on the topic of neuroscience. Send us your most exciting microscopic pictures, or a creative photo, thoughts on neuroscience or self-written poems – whatever comes to mind! The best contribution will be published and rewarded with the book "Measuring the World" by Daniel Kehlmann. So, what are you waiting for? Start the engine of your mind and get going! Trust us, it is worth participating! Send your contribution to cns-newsletter@charite.de to win "Measuring the World".
Deadline for submission for the next issue: July 31, 2013.
This issue's winner is Andreas Antonios Diamantaras who contributed two great articles titled, "Brain Activity in Love" and "Rules of Attraction". Thank you very much for your contribution.



The Evolution of Love

Let me tell you about the birds and the bees. And the flowers and the trees. And a thing called love… But hey … what is LOVE, except for the most popular topic of song lyrics?

What is Love?

The urban dictionary gives the following definition: "Love is nature's way of tricking people into reproducing" [1]. Hm… why didn't we just continue to be self-copying RNA as described in "The Selfish Gene" by Richard Dawkins, or simply procreate by cell division [2]? The clue is that sexual reproduction brings enormous advantages in terms of fitness: Mutations occur naturally in every organism all the time. Some may be harmful, some without impact and others may be highly beneficial. Maybe a mutation in a structural protein could give a protist sturdier ciliaries, allowing it faster movements and a great advantage in escaping predators. However, only the individual carrying the mutation will benefit from it unless it is shared. And basically, sexual reproduction is nothing else but sharing your genome with someone else. This someone will not benefit in person, but his and your offspring will. Thus sharing is caring. But does caring equal love?

I'm Too Sexy…

In general, mating means higher cost for an individual at first, but pays off with increased fitness of its progeny and gene propagation. But of course, not every individual wants to mate with any other. Hence, mating strategies developed to maximize benefit. Mating strategies vary in complexity: a pretty straightforward strategy is to release attractive molecules to acquire a random partner. However, the more costly the reproduction itself, the more prudence in partner choice is advised. The decision about a partner is usually made by the female, thus males of many animal species have developed specific attributes and/or courtship behaviors that may not serve any practical purpose other than attracting a female's attention and influencing her choice.

Birds give great examples of this: peacocks grow their beautiful and immense tails to impress females. These have no use other than to signal "I am so fit and healthy, I can afford an entirely useless, giant plumage!" (see also 'You Have Beautiful Eyes, Hundreds of Them' on pp. 14). Similarly, bowerbird males construct little lodges from sticks, grass, and leaves, which they even decorate with flowers, shells, and other colorful and shiny things they collect. If the lodge is impressive enough and the female decides to mate, they entirely abandon the lodge to build a nest suitable for breeding elsewhere.

Humans, too, possess attributes that serve reproductive rather than survival purposes. Compared to other primates, humans have features such as "concealed ovulation, extended female sexuality when not fertile, large visible breasts even when not lactating, large spongy boneless visible pensises relative to body size even when not sexually aroused, relative hairlessness that reveals skin quality, full lips that may mimic female genitalia by exposing skin that simulates mucosal membranes", as discussed in detail by psychologist Lawrence Josephs [3].

You and Me, Forever

But mating alone does not yet guarantee successful procreation. A lot of further effort needs to be invested by parents to actually ensure the survival of offspring, especially in higher mammals. For humans, this can be up to twenty years! For this purpose, nature developed strategies beyond the "hit and run" approach to make mating partners cooperate until their progeny can survive on its own. Bonding mechanisms cause partners to team up and cooperate until descendants can survive independently [3,4]. This may lead to monogamy (or serial monogamy) as a favored type of relationship.

Nowadays, psychologists discuss compassion, a feeling most of us would also associate with love. Compassion also developed to ensure survival chances for vulnerable offspring because it motivates individuals to join forces and cooperate for the sake of their progeny [5]. Even early evolutionists such as Darwin considered what he called "sympathy" to be one of the strongest human instincts.

While all of this totally makes sense, it does not really fit our modern-day definition of "love". Maybe, it is more appropriate to talk about the psychological term "romantic love". Psychologist James Leonard Park provides a sarcastic explanation of romantic love as a hoax or urban legend [6]. Indeed, considering archeological finds from the beginning of mankind, there is evidence for different forms of courtship behavior and for the concept of marriage, i.e. partnership between man and woman in order to maintain monogamy and raise children. Still today across the globe, people get married for practical reasons only, without any romantic consideration. Where does romance come into play then? Apparently, it is the relatively modern invention of medieval troubadours and minstrels in France [7]. Since then, European culture has spread all over the world, the newly invented concept of romantic love has entered folk psychology and is ubiquitous in songs, novels, television, and movies. Cultural imprinting, one could say.

Source: www.flickr.com/photos/kriebel/2248592706/

You Drive Me Crazy

Nonetheless, most of us have experienced romantic love, and it is commonly perceived as an altered state of consciousness or "the only socially accepted form of madness" [8]. Not only because of these definitions, involving consciousness and insanity, psychologists and neurobiologists began to explore what underlies romantic feelings in the brain. Even though research has so far correlated brain regions and autonomous nervous system activity with feelings of love and identified some brain chemistry that elicits affection, science is far from answering the question: What is love?

It's good to know that instead, there are plenty of songs still to come that can tell us the answer! ***(bs)***

References

[1] http://bit.ly/1fTAtUl
[2] Dawkins, "The Selfish Gene", Oxford University Press, New York, 1976
[3] Josephs, Am Acad Psychoanal Dyn Psychiatry, 2010
[4] De Boer, Neuroscience, 2012
[5] Goetz, Keltner and Simon-Thomas, Psychol Bull, 2010
[6] http://bit.ly/1mHJD9x
[7] http://bit.ly/1g2veC6
[8]http://bit.ly/1nnGFXd

Love is Chemistry

source: clipartlog.com

Though my chemistry classes were never that exciting, people keep saying "love is chemistry". Does this imply love can be separated into understandable steps and then produced according to a protocol as long as we have the right ingredients? Will we soon be able to develop love potions?

Oxytocin and Vasopressin

The most important ingredients in love chemistry are hormones. They are behind all emotions and also regulate our feelings of love and attachment. Oxytocin and vasopressin are the most prominent hormones implicated in pair-bonding and love, not just between partners, but also between friends, or mother and child [1]. Production of oxytocin, nicknamed the "cuddle and trust" hormone, is initiated by caressing and cuddling and is responsible for the pleasant feeling and comfort this gives us [2]. Principally, oxytocin triggers the muscular contractions required for birth and milk release during lactation, thereby also creating unconditional maternal love. Mothers who have had a caesarian section have, especially in the beginning, a weaker instinct for the cry of their child compared to mums who gave birth the natural way, initiated by oxytocin [3] (read more on maternal love in this issue's 'of Mothers, Methylation and Modernity' on pp. 8). Vasopressin plays its principal role in cardiovascular function and maintains blood pressure [4]. It is however also known as the attachment hormone. It is more important in males; while their oxytocin production is lower than in females, they use this hormone for pair-bonding instead [2,5].

Oxytocin and vasopressin induce dopamine release, making love a rewarding experience

Pair-Bonding

Both hormones are produced by the paraventricular and supraoptic nuclei of the hypothalamus and released into circulation by the pituitary gland, where they will then look for their respective receptors [6]. There are three different types of vasopressin receptors and one type of oxytocin receptor discovered thus far. The vasopressin receptor 1a (V1a) as well as the oxytocin receptor are present in many brain regions associated with love, including the dopamine reward system [7]. This means that at least part of the effect of oxytocin and vasopressin is dopamine-dependent. Research in prairie voles, small monogamous mammals that are used as the animal model for attachment and love, shows that the distribution and density of these receptors play an essential role in pair-bonding [8]. There are also some differences in the effect of oxytocin and vasopressin found in prairie voles. Oxytocin has anxiolytic and stress-reducing effects, and induces partner-bonding in females. Vasopressin on the other hand increases fear and stress responses, and induces partner-bonding in males [2]. This is also true in humans, and it has been suggested that it originates in prehistoric parent-child bonding, where mothers cared and fathers protected against danger [5] (see also "Mono or Poly? Which is our Nature?" on pp. 9).

Dopamine

When binding to the dopamine reward system, oxytocin and vasopressin induce dopamine release, making love a rewarding experience [9]. Dopamine production as well as expression of dopamine receptor 1 (D1) or 2 (D2) in the nucleus accumbens determines the exclusiveness of pair-bonding. Stimulation of D1 induces neuroplasticity and reward-related learning and memory, and blocks the formation of pair-bonds in prairie voles. D2 expressing neurons on the other hand project to the ventral pallidum, which integrates information from the D2-positive neurons with information from the vasopressinergic system to activate neuronal networks that aid in the formation of pair bonds [10]. In prairie voles, D1 expression is up-regulated after the first bonding has taken place, preventing promiscuous behavior [11].

First Phase Hormones

Decreases in serotonin levels are also related to love, especially the rather manic and obsessive behavior during the first phase of romantic love [1]. After this first phase in the relationship serotonin levels recover to normal levels again (see also 'The Course of True Love Never Did Run Smooth' on pp. 5). Norepinephrine [12], cortisol and testosterone [2] levels are also especially important in this first phase.

All in all, many different hormones play an important role in love and how we experience our relationships. However, their effects are not just dependent on hormone levels, but also on number and distribution of receptors. This ensures that the chemistry behind love cannot be summarized and generalized into one protocol, but is an individual mixture.

So, unfortunately, chemistry lessons will stay rather static and not so exciting; love potion brewing is not yet ready to be taught in the classroom. ***(jh)***

References
[1] Zeki, FEBS lett, 2007
[2] De Boer, Neuroscience, 2012
[3] Weisman, Arch Wom Ment Health, 2010
[4] Earley, Ann N Y Acad Sci, 1966
[5] Mieras, Liefde, 2010
[6] Debiec, FEBS lett, 2007
[7] Bartels, Neuroimage, 2004
[8] Insel, Proc Natl Acad Sci U S A, 1992
[9] Young, Nat Neurosci, 2004
[10] Edwards, Nat Neurosci, 2006
[11] Aragona, ILAR J, 2003
[12] https://uberdionysus.livejournal.com/267831.html

ProWi+ Study about Success Factors in Career Development of Junior Scientists in Germany

German-speaking postdocs and PhD students who will finish their PhD in 2014 are asked to participate in the ProWi+ Study. The aim of the study is to define key factors that lead to healthy and successful career development for young scientists in Germany. The study will follow-up participants throughout the next two years and will be carried out online. Further information: http://www.prowi-studie.de/

The Course of True Love Never Did Run Smooth

The Nature of Relationships from a Scientific Perspective

Analogous to a river current, the character Lysander in William Shakespeare's "A Midsummer Night's Dream" understands romantic love as a dynamic power that always finds a way to overcome obstacles, is not straight-lined and alternates between phases of high and low current.

If you peek into your own relationship(s) or those of friends, you might also recognize that there are some differences in behavior depending on the duration of the relationship. And that many of them, unfortunately, do not have a happy ending, as reflected in a divorce rate > 50 % of marriages in Western societies [1]. Within this article, we will take a closer look at the different phases of relationships, their neurobiological correlates, and key factors of fulfilling long-term relationships.

Phase 1: Falling in love

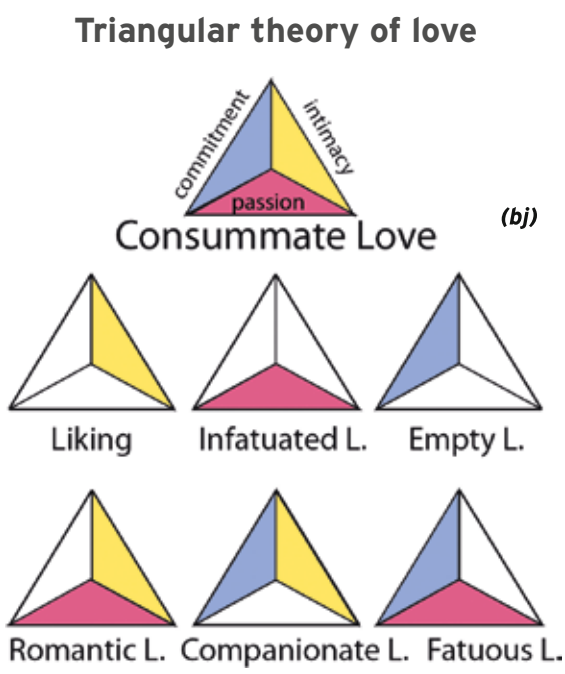
What is often referred to as the first phase of a relationship is a period characterized by high passion, a rapid rise in intimacy and increased commitment [2]. Elevated cortisol levels help in overcoming initial neophobia [3] and make this phase a stressful period full of excitement and attachment. As serotonin levels are inversely correlated with those of corticosteroids, serotonin is depleted. Testosterone levels show a gender-specific difference at the beginning of a relationship as they are decreased in men but elevated in women [2]. Reduced activity in different brain areas is observable, for example in the frontal cortex, which explains why people who are in love are not able to judge their partner's character honestly [4] (see also "Through Rose-Colored Glasses" pp. 16). This phase usually lasts for half a year.

Phase 2: Passionate love

The second phase is a more settled phase dominated by feelings of safety, calmness, and balance that lasts several years. Passion remains high while intimacy and commitment rise. Testosterone, cortisol, and serotonin levels have returned to normal [2]. The key players of this phase are oxytocin and vasopressin as they are responsible for the formation of strong long-term pair-bonds [2] (see also 'Love is Chemistry', in this issue).

Phase 3: Companionate love

Over the years, intimacy and commitment grow, whereas passion decreases. Compassionate love is a "warm" love that is more similar to intimate friendship than to a couple in the first phase, where physical attraction and desire are more prominent [2]. The essential hormones are also oxytocin and vasopressin, restating and maintaining the pair-bond between a couple [5]. The transition from passionate to compassionate love is a critical point in the course of a relationship; when passion has decreased and intimacy is also low, commitment may be all that is left. This is referred to as "empty love" [6] and is usually not sufficient for the continuation of a relationship.



Breaking up

If a relationship comes to an end, it is usually experienced as an unpleasant event, with increased levels of stress hormones [2]. Recent studies of brain activity patterns found increased activity in areas active during choices for uncertain rewards and delayed responses, reflecting a common feeling of uncertainty about the future [7]. Rejected individuals showed a decreased activity in brain networks involved in the onset of major depression and also showed depressive symptoms, suggesting that the grieving period following a break up might be a major risk factor for clinical depression [8].

Based on the aforementioned three components "intimacy", "passion", and "commitment", Sternberg postulated the "triangular theory of love" in 2007. Basically, this theory correlates combinations and intensities of the distinct components with different experiences of love (see figure). He hypothesized that love progresses in predictable ways and that all couples experience love in the same patterns [6]. Also, a long-term relationship would be more likely to develop when more than one component is experienced. The complete form of love, also referred to as "consummate love", thereby arises from a strong expression of all three components and is theorized to be that love associated with the "perfect couple". According to Sternberg, these couples will continue to have great sex fifteen years or more into the relationship, they cannot imagine themselves happier over the long-term with anyone else, they overcome their difficulties gracefully, and each delights in the relationship with the other. A state that sounds desirable. But Sternberg also points out that maintaining this state is highly dependent on a successful translation of the components into action and that consummate love may not be permanent [6].

All in all, it seems that a fulfilling long-term relationship is not accomplished by just finding "the one". It is rather a co-operation between two passionate and highly motivated partners working together. If this co-operation is based on trust and respect, if problems are solved diplomatically and if progress is evaluated from time to time, it can result in something really great and satisfying. ***(bj)***

References
[1] Kalmijn, Popul Stud, 2007
[2] De Boer, Neuroscience, 2012
[3] Marazziti, Psycho Endo, 2004
[4] Volz, Curr Opin Neurol, 2006
[5] Starka, Prag Med Rep, 2007
[6] Sternberg, Triangulating Love,2007
[7] Fisher, J Neurophysiol, 2010
[8] Stoessel, Neuropsychobiology, 2011

Brain Activity in Love

By Andreas Antonios Diamantaras,
Master's Student Medical Neurosciences

Love. Love for God, for wife, for family, for food, for art. The most important aspects of our lives are defined by this strongest of all emotions. Yet we seem unable to define it properly, leading eventually every discussion about it to, at best, a compromise. Is love a mere secretion of chemicals in the brain? And if so, what are the differences between the various forms of it that we experience? Understanding the biological basis of love is a prerequisite to addressing these issues, and recently a lot of scientific research has been directed towards this topic.

The Arrows of Love

As expected, a variety of neurotransmitters are involved in the generation of this unique experience. In particular, waves of dopamine secreted by the hypothalamus flood the brain and recruit certain areas causing a feeling of euphoria and jubilation. At the same time, the neurotransmitter serotonin is depleted, causing the obsessive behavior often described in people who are in love. This association stems from the observation that patients with obsessive-compulsive disorder have similar low serotonin levels. Vasopressin, a hormone associated with aggressive behavior among males, and oxytocin, responsible for the contractions during labor, have also been shown to increase when in love [1]. The above changes have been documented specifically for "romantic" and "maternal" love, indicating a close relation between them and constituting a possible parallel to Freud's Oedipus complex.

The Coordinates of Love

These hormones and neurotransmitters exert their activity in a plethora of specific brain areas, including the medial insula, anterior cingulate cortex, hippocampus, striatum, and hypothalamus. This activity can be roughly summarized as the activation of the subcortical dopaminergic reward-related system and the areas that it projects to. In a parallel manner, brain areas such as the frontal and prefrontal cortex, amygdala and temporal poles are deactivated [2].

The known functions of most of these areas are consistent with the description of the feelings we experience when in love. For example, the striatum is associated with rewarding feelings and is activated by dopamine – so are the insula and the anterior cingulate gyrus, responsible for mediating emotions and somatosensory integration. On the other hand, the frontal and prefrontal cortex where logical planning and decision making take place are deactivated, partly explaining the irrational behavior and lack of judgment seen in many people that are in love. The parietal cortex and parts of the temporal lobe, linked to negative feelings and depression, are also deactivated [2,3].

On the other hand, the role of the amygdala, a known regulator of fear, is not as simple. Vasopressin and oxytocin seem to exert opposite actions on the activity of the amygdala, increasing and decreasing it respectively, with the effects of the latter prevailing eventually and leading to an experienced lessening of fear [1].

Are there indeed Different Forms of Love?

Although "romantic" and "maternal" love and sexual arousal share common features in brain activity, there are crucial differences that distinguish them. In the case of maternal love, there is a stronger activation of the brain areas responsible for face recognition, consistent with the need to recognize quickly one's child's facial expressions and act accordingly. Another region that was found to be activated only in the case of "maternal" love is the periaqueductal gray matter, an area involved in endogenous pain suppression.

Moreover, activation of the same hypothalamic regions has been documented in the case of sexual arousal and "romantic" love, but not in the case of maternal love. In all forms of love, however, the activation of the subcortical dopaminergic reward-related brain system and the deactivation of cortical areas that lead to an impairment in judgment is similar and pronounced, indicating the common aspects they share [3].

The Functional Role of Love

As pragmatic and harsh as it may sound, from an evolutionary point of view, love serves very specific purposes and its intensity as an emotion is totally justifiable. The strong activation of the reward systems that strengthen the bonding between the couple, and between the mother and the child, ensures the unity of the family, increasing their survival chances in a demanding environment [3].

Source: http://www.normalityfactor.com/2012/02/

Even the irrational behavior that makes a man defend his partner if a threat is presented, and a mother thoughtlessly sacrifice herself in order to protect her children, could be interpreted in the same way.

Looking in the Mirror

Although we sometimes regard love as a feeling over which we have no control, fMRI studies suggest otherwise. Cortical areas, such as the angular gyrus, that control complex cognitive behaviors such as social cognition and self-perception are activated even when we are presented with implicit love stimuli, suggesting that love is also a cognitive process.

The mirror neuron system consists of neurons that are activated by the execution and the observation of object-related movements and normally participates in the perception of our surroundings and our actions. This system has been postulated to additionally mediate emotion recognition and social cognition. Located mainly in the insula and anterior cingulate gyrus, areas also activated during the experience of love, it has been suggested that mirror neurons facilitate the understanding of feelings and the prediction of the intentions of others, also providing feedback for the generation of our own feelings [4].

In other words, love is a mutual feeling that gives positive feedback to itself; we need to feel loved in order to feel love in return and vice versa! No matter how logically we try to approach love, using strict scientific terms, in the end love conquers all!

References
[1] de Boer et al, Neuroscience, 2012
[2] Ortigue, J Sex Med, 2010
[3] Zeki, FEBS Lett, 2007
[4] Ortigue, Med Hypotheses, 2008

Rules of Attraction

By Andreas Antonios Diamantaras,
Master's Student Medical Neurosciences

What is the reason that men and women differ so significantly in their behavior and their views when it comes to matters of love and relationships? Why is it, if the two sexes are meant for each other, often so difficult to co-exist in the context of a relationship or a marriage?

The Psychosocial Perspective

According to the biopsychosocial model, the social environment and the psychology of the two sexes, in combination with the biological background, contribute to the behavior they manifest when they are sexually mature. From the perspective of evolutionary psychology the between-sex differences in humans can be traced back to primeval times, when the pressure of a different physical and social environment pushed them to assume different social roles that eventually led to the development of different psychology. As reproductive status was an important parameter during this time, the two sexes adjusted their behavior in order to ensure better survival and reproductive success. Therefore the females developed traits and skills that increased the survival of their offspring while males were less concerned with reproduction [1]. This, however, does not mean that the sexes have stopped evolving since then. On the contrary, the results of the radical social changes that have occurred in the last few centuries can be seen in the psychology of both sexes. In principle, in society, the sexes will assume the roles in which they have a better chance of succeeding, and in turn they will further develop social skills that will ensure their success in the given social position.

In the context of psychological studies, participants were asked about the desirability of certain characteristics in a prospective husband or wife. The results showed that physical appearance and earning potential were valued more by males and females respectively, consistent with the aforementioned theory [2]. Another study investigated in more detail which physical features men and women found attractive in a long- and short-term partner. Interestingly enough, first in preference was "Body, build" for both sexes, but in the second and third position were the "Mouth, smile" and "Height" for women and "Face" and "Eyes" for men. Moreover, both sexes prioritized the physical characteristics of their short-term partners over those of their long-term ones [3].

Male and Female Brain Areas of Love

The role of biological background must not be neglected in any case, as it provides more concrete evidence on the matter. Differences in the "rules of attraction" between males and females have been documented by the different activity rates of certain brain areas during "romantic" love. In particular, a stronger activation of the areas that integrate the visual stimuli was recorded in males, signifying their focus on physical appearance. Females, on the other hand, seem to focus more on social status as witnessed by activation of brain areas associated with attention and emotion. These different patterns of activation could indicate, in accordance with the theory of evolutionary psychology, the priorities that each gender has for the formation of a family, namely, the young and healthy woman that is more likely to bear offspring for the male and the security and resources that a man should provide for the female [4].

During sexual arousal as well there seem to be functional differences between the two sexes, as an fMRI study found greater activation of the hypothalamus in men compared to women when they were shown erotic films. In addition, sex drive, defined as the desire for sexual gratification, seems to be related to circulating levels of testosterone in both sexes, and more specifically to the balance between androgens and estrogens. The disruption of this balance during the menstrual cycle in women results in an increase in the sexual drive. In both sexes, a decline in sexual activity occurs with the decrease in androgens during aging [4].

Gender Differences in Animal Studies

Further evidence supporting the biological differences comes from animal studies. Differences in the hormones promoting attachment in prairie voles have been proposed. In particular, vasopressin and oxytocin were found to be more important for males and females respectively. Additionally, gender differences in the types and distribution of hormone receptors were found in the same species [5]. In another study, social interaction with rats of the opposite sex led to a different response to stress stimuli between male and female rats. Male rats that were housed with female ones showed reduced stress levels compared with male rats that were bred in isolation after exposure to the stress stimuli, while for the females such a difference was not found [6]. The different way male rats experience social interaction with females, as a means of relieving stress, suggests the use of different strategies for managing stress that possibly apply also to the early stages of romantic love.

Albrecht Dürer (1507) – Adam und Eva, Prado museum, Madrid

This combined evidence illustrates the presence of meaningful sex differences that stem from biological, social and psychological variations. Further investigation of these topics could have significant applications for resolving the relationship and sexual problems that many couples face.

References

[1] Eagly et al, American Psychologist, 1999
[2] Buss, BuJ Cross Cult Psychol, 1990
[3] Li and Kenrick, J Pers Soc Psychol, 2006
[4] Fisher et al, Philos Trans R Soc Lond B Biol Sci, 2006
[5] Lim et al, Neuroscience, 2004
[6] Westenbroek et al, Horm Behav, 2005

Of Mothers, Methylation and Modernity

Motherhood is both a blessing and a curse. Although many of us may have suffered through screaming toddlers and thought wistfully of a reptile laying its eggs and carrying on with life, it is hard to deny that raising young has many evolutionary advantages. Even though some of the problems of motherhood (i.e. resource allocation) seem like timeless biological conundrums, other complications have come to light more recently. In the year 2014, no one will deny that a mother's actions, especially during pregnancy, can have profound impacts on her offspring. This has been strongly shown in meta-analyses pertaining to, for example, alcohol intake during pregnancy. However, once the baby is born, teasing apart nature and nurture becomes more difficult with every passing year. Furthermore, not all actions can be quantified as simply as exposure to a substance. In fact, one of the most hotly debated topics in developmental neuroscience is... well... love. While, from reading this issue, one might conclude that maternal affection can shape the brain through regulating levels of neurotransmitters, the truth is in fact a great deal more complex. Furthermore, the place of motherly love in neuroscience has changed dramatically over the last century, enmeshing cultural values with neurobiological understandings of behavior.

The world of the 1940s and 50s was a very different place, yet sadly, scientists at the time grappled with many of the same neurological questions that we do today. In 1943, Leo Kanner first described a disorder labeled "Infantile Autism", better known today as Autism Spectrum Disorder (ASD). Along with his clinical observations of the children themselves, Kanner noted what he called a "genuine lack of maternal warmth" among their parents. He believed that a lack of affection on the part of the mother (and sometimes father) might have been the underlying cause of ASD, which eventually became known as the "refrigerator mother theory" [1]. The idea of this theory, that children were shut off from loving warmth (as in an emotional fridge), gained traction with frustrated doctors and therapists unable to provide more satisfactory explanations. With the strong, normative family values of the time, this climate (if you will forgive the pun) of blame persisted and went unchallenged into the late 1960s. At its peak, Bruno Bettelheim, one of the strongest advocates of the theory, set up a clinic for children in Chicago to receive a "parentectomy" [2]. However, in the mid-1960s, patient advocacy movements began to doubt whether unloving mothers were the cause of ASD. By the 1970s, feminist movements and declining reliance on psychoanalytic explanations helped push the refrigerator mother theory out of fashion [2,3]. While neurobiologists began to track down new contributors to autism such as genetics, researchers on parental affection focused their energies on less disease-causative phenomena, such as the evolution of coping styles over the life course. However, motherly love was not to slip out of the neurobiological spotlight for long...

In 2004, a group from McGill University led by Michael Meaney dropped an epigenetic bombshell. Using licking and grooming behavior as a proxy for affection in rats, they discovered that pups of attentive mothers had better-tuned stress responses than adults. It turned out that maternal attention could upregulate DNA methylation, leading to a host of epigenetic changes in the body's response to cortisol and other stress hormones [4]. These findings were seized upon by the press, trumpeting headlines such as "Motherly Love Coddles The Brain" [5], and heralding a new era of linking maternal love with children's outcome. Meaney himself has been quick to caution against over-zealous interpretations of these findings, noting earlier papers that showed that providing "neglected" pups with an enriched environment could partially counter the effects of the methylation [6]. However, the flood gates were already opened, and every year, more papers are published on the epigenetic effects of a mother's love on the brain and other structures.

Although it may be easy to fall back on the stereotype of the uncaring mother of the refrigerator theory days, many scientists have begun to examine what makes a parent motivated to interact with their child. The field is still young, but combinations of neuroimaging and neurotransmitter-sampling studies have shown many similarities between motherly and romantic love. At the most basic level, caring for a child appears to rely on complex interactions between

Source: Flickr, Britt-Marie Sohlström

dopaminergic reward-related and oxytocin-responsive structures in the brain. Neglectful mothers, both human and animal, show blunted responses to child-related cues, while their babies may grow up deficient in the oxytocin [7]. In many ways, these findings lead to more questions than answers. Can a mother (or father) be "naturally" unloving, and if so, should they be responsible for changes in a child's brain? Does the state (or medical authority) have a role in guaranteeing affection for every child? And finally, how much are our conceptions of love and responsibility caught up with our own temporal and cultural biases, as those seen in hindsight with "refrigerator" mothers?

In conclusion, the importance of motherly love has seen a dramatic about-face in the last 50 years, and continues to be an intriguing area of research. While the exciting findings of the last decade may provide hints about the importance of nurture in development, our assumptions about motherhood may still be deeply entwined with cultural ideas about care and affection. Understanding how maternal affection shapes the brain, therefore, will be a difficult task, but doubtless have profound implications for understanding child development and societal support. ***(ch)***

References

[1] Kanner, Am J Orthopsychiatry, 2011
[2] Herbert et al, Scientific Review of Medical Practice, 2002
[3] Smith et al, Am J Mental Retardation, 2008
[4] Weaver et al, Nat Neurosci, 2004
[5] Bredy et al, Neuroscience, 2003
[6] Ehrenberg, Science Now, 2004
[7] Strathearn, J Neuroendocrinol, 2011

Mono or Poly – Which is our Nature?

By Ana Luisa Piña, PhD, Group Leader at Experimental Neurosurgery

Monogamy occurs in only 3-5 % of all 4000 mammalian species. Humans, although basically polygamic, have evolved a strong tendency to (serial) monogamy due to reinforcement by cultural factors [1,2].

Formation of pair-bonding (selective affiliation between adult mates) is associated with vasopressin (affecting male reproductive and social behaviors), oxytocin (promoting maternal nurturing and sexual receptivity), and dopamine, (involved in sexual motivation, reward, and pleasure).

Vasopressin receptor V1a plays a role in pair-bonding and social behavior in the monogamous prairie voles and the closely related, solitary and polygamous, meadow voles. In male prairie voles, both vasopressin and dopamine act in the ventral forebrain to regulate pair-bond formation. V1a is expressed at higher levels in monogamous compared to promiscuous voles, whereas dopamine receptor distribution is relatively conserved. Using viral vector V1a gene transfer into the ventral forebrain, partner preference formation was increased in the socially promiscuous meadow voles. When vasopressin binds V1a in the ventral forebrain, the neural reward system is triggered [3].

In humans, variation in the *RS3 344* section of the V1a gene was linked to how men bond with their partners. Men can have one, two, or no copies of *RS3 334*. The more copies, the worse men scored on a measure of pair-bonding. It is not exactly clear how multiple copies of *RS3 334* affect expression of V1a and intimate relationships. In some animals, it is proposed that the brain has two motivational systems: one for reward, the other for social perception. In prairie voles, receptors for both systems sit on adjacent cells. Thus, social activity is highly rewarding, leading to monogamy [4].

In humans, certain variants of dopamine receptor D4 are associated with infidelity. In cases of casual sex, the risks are high, the rewards substantial, and the motivation variable: all elements ensure a dopamine rush [5].

At this point, it is not possible to confirm a cause-and-effect link between sexual behavior and genetic traits. However, genetics and epigenetics seem to play a role in how we behave and in decisions we make in couple bonding.

References
[1] Schuiling, J Psychosom Obstet Gynaecol, 2003 December
[2] Schuiling, J Psychosom Obstet Gynaecol, 2003 March
[3] Lim et al, Nature, 2004
[4] Wallum et al, Proc Natl Acad Sci U S A, 2008
[5] Garcia et al, PLoS One, 2010

Take Care, Give Love

Love is a many-splendored thing. Painters, poets, and philosophers have tried to describe its power, the compelling and healing effect it can have on you and the ones you love. It turns out they may be right about the healing part. A new study suggests that mutual feelings of intense love and compassion between individuals with Alzheimer's disease (AD) and their spousal caregivers may have a positive influence on their well-being.

Patients with AD generally need long-lasting and exhaustive assistance in their everyday life. In most cases, close friends or family members take on this responsibility and find themselves confronted with severe emotional and physical distress. Their well-being has yet to be studied in detail. In one study, however, scientists assessed feelings of compassionate love, appraisal of the care-giving role, perceived burden and depressive symptoms of caregivers in 58 married couples (> 70 years old) using different scale-based questionnaires at two time points; at baseline and one year later. Patients were well enough physically and mentally to secure reliable reporting of their feelings. They found that the level of love felt by caregivers was likely to be equally reciprocated by their ill partners. A higher level of mutual love in turn decreased the psychological burden of the spousal caregivers and positively influenced how the caregivers felt about their role. Feelings of obligation, guilt, and overwhelming self-sacrifice were outweighed by the benefits caregivers experienced by being compassionate toward, and receiving gratitude and tenderness from, their sick spouses. Surprisingly, depressive symptoms remained unchanged, despite higher levels of compassionate love between both partners. More love and a deeper sense of closeness and empathy can still cause the caregiver to feel depressed and helpless watching their partner "waste away", according to the authors.

Source: Modified from http://en.wikipedia.org/wiki/Alzheimer%27s_disease

Although the cross-sectional study design does not allow any direct causal inferences and the sample mostly consisted of female caregivers, these findings may help identify appropriate caregivers who, through their compassionate love, are more resilient to the burdens associated with such care. Further interventions that increase love and understanding between both groups could be established to reinforce the beneficial effect of love on the psychological well-being of both patients and spousal caregivers. ***(le)***

Reference
Monin et al, Gerontologist, 2014

In Search of Cupid – Erotomania

Phantom Lover Syndrome

Source: My Phantom Lover by Janet Hetherington (Comics Collection) – Arrow Publications

According to the Merriam-Webster dictionary, a crush is defined as "a strong feeling of romantic love for someone that is usually not expressed and does not last a long time". But what happens when a crush goes too far? Erotomania or De Clerambault's sydrome is what we have! Although named after the French psychiatrist, G.G. de Clerambault who first delineated its features in 1942, early descriptions of the syndrome date back to Hippocrates [1].

Erotomania is a rare psychological disorder that is marked by the delusional belief of a person (usually a woman) that a man, typically of higher social, political or economic status, is in love with her [2]. Usually, the woman has had little or no contact with the man and the man is in some way unattainable either because he is married, has no personal interest, or is sometimes even dead.

Two forms of the disorder have been identified so far [2]: Primary erotomania is characterized by delusions unaccompanied by hallucinations. The illness is clearly defined, the onset sudden and the course chronic. These patients are classified into a so-called fixed group where delusions remain unchanged over a period of years. Secondary erotomania on the other hand is usually associated with other psychoses – most commonly paranoid schizophrenia. These patients fall into the recurrent group who are less psychiatrically ill, but have intense delusions that are short lived. Patients with the disorder usually have a family history of psychosis, leading psychiatrists to suspect a genetic component.

Traditionally, the prognosis and response to treatment is poor. The disorder is overlooked because it is often associated with other well-known psychiatric disorders like schizophrenia, bipolar disorder, and major depression. Treatment involves low-dose neuroleptics and antipsychotic medications. This is sometimes coupled with electroconvulsive therapy for temporary relief of the delusions along with psychotherapy and an adjustment of socio-environmental factors. The success of treatment depends on the co-occurrence with other disorders and the type of erotomania. Although some patients have been cured completely of their erotomanic symptoms with the antipsychotic pimozide, the two longest reported unimproved cases have now been followed up for over 37 and 40 years [2]! ***(arm)***

References
[1] Rather, The Wellcome Historical Medical Library, 1965, pp 169-184
[2] Jordan et al, J Natl Med Assoc, 2006

Stockholm Syndrome: A not-quite love story

Source: http://enekiedis.deviantart.com/art/Stockholm-Syndrome-289579204

Love is complicated. While many may spend a sleepless night worrying about finding "the one", getting together with "the wrong one" can be just as problematic. When taken to the extreme, developing romantic feelings for an inappropriate mate can be confusing, or even dangerous.

Stockholm syndrome is used to define a cluster of symptoms related to inappropriate feelings from a victim towards an aggressor. Within this framework, "positive" actions of the abuser such as withholding abuse are interpreted as signs of love and affection, and the victim begins to develop empathy toward their captor. The name stems from a famous case in the 1970s, a hostage-taking at a Swedish bank in which the victims developed close bonds with their captors and eventually defended them in court [1,2]. Since then, many more cases have been documented, including many linked to forms of domestic and childhood abuse. Though rare, this syndrome has appeared to capture the public imagination [2].

More formally, Stockholm syndrome forms a part of "Complex post-traumatic stress disorder" [2].Unfortunately, information about its neurobiological correlates is lacking. Evolutionary psychologists have written extensively about Stockholm syndrome, explaining it as an adaptive mechanism to avoid social strife. The story goes like this: a prehistoric woman is kidnapped from her clan, and must survive to protect her children. Making friends, or better yet, a sexual connection with the abductor provides a higher likelihood of survival, and this type of coping strategy is carried on to the next generation. It's an imperfect story, yet similar types of submissive behavior may be observed in primates or other animals [3,4].

While important for understanding the nature of Stockholm syndrome, these "just so" stories from the animal kingdom are still a long way away from explaining its neurobiological correlates. If nothing else, however, it shows us just how easily (and frighteningly) our feelings may adapt to life-threatening situations. Somewhere between "heart" and "mind", there is still so much to discover and understand...***(ch)***

References
[1] Bejerot, "The six-day war in Stockholm", The New Scientist, 1974
[2] Fitzpatrick, "Stockholm Syndrome", Time, 2009
[3] Carson and Price, Aust NZ J Psychiatry, 2007
[4] Speckhard et al, Traumatology, 2005

Altruism or Do a Good Deed Every Day

Who does not know this phrase, either from daily practice or as a boy scouts motto? The concept behind this is called altruism. It can be defined as any kind of action performed by an individual for the benefit of others, without receiving benefit oneself. However, in ethics and psychology, it is under debate whether true altruism exists. While this seems to be an ambitious discussion, we should consider what motivates someone to act altruistically. A study about the motives of blood donors revealed that 'impure altruism' determines their volition to give blood. The authors report the subjects' motivation, ranging from feeling good about oneself, through increasing their relatives' chances of receiving blood when needed, to a distrust in others to donate blood [1]. Given that human altruistic behavior benefits the person itself by eliciting a nice feeling, it seems as though mankind may not be eligible for altruism. So what about nature? What about worker bees, bearing sterility for the benefit of their queen, or even myxomycota, single-celled fungi which may sacrifice themselves in unfavorable conditions to enable others to release spores [2]? Yet, a closer look shows that worker bees' sterility and the fungus suicide favors their kin, and thus themselves, in terms of spreading their own genes. Hence altruism always indirectly favors the fitness of the altruist's genes, as popular biologist Dawkins cynically argues [3].

Altruistic behavior can be observed in children, who are not fully socialized, at a very young age. Thus true altruism may exist – albeit only in toddlers – indicating a strong genetic tendency [4]. Indeed, researchers found correlations of certain genes with altruism. In particular, genes influencing the action of oxytocin seem to influence altruistic traits [5]. Apart from genetics, researchers found neurobiological correlates of altruism. They report that increased gray matter volume in the right tempoparietal junction and its activity as well as greater relative left over right frontal activity are associated with altruistic behavior [6,7]. However, it is as difficult to grasp altruism in the brain as it is as a concept. Nonetheless: Do a good deed every day! ***(bs)***

References
[1] Evans and Ferguson, Vox Sanguinis, 2014
[2] http://bit.ly/1h7x8Q1
[3] Dawkins R (1976) The selfish gene. Oxford University Press, New York
[4] Baschetti, Med Hypotheses, 2007
[5] Israel et al, PLoS ONE, 2009
[6] Schunk et al, Neuron, 2012
[7] Huffmeijer et al, Cogn Affect Behav Neurosci, 2012

Mirror Mirror on the Wall… – An Insight into Narcissistic Personality Disorder

Having a conversation with a person with an inflated ego is always a very tiresome experience. We are constantly pushed into praising the other person, for criticism is not well received and often disregarded. Narcissism refers to the pursuit of gratification from the egoistic admiration of one's own physical or mental attributes. Narcissistic personality disorder (NPD) is characterized by a lack of empathy as well as a need for admiration and a pervasive pattern of grandiosity [1]. It has prevalence rates of up to 6 % in the general population and pathological narcissism is considered a severe mental disorder, associated with significant functional impairments [2].

What Leads to NPD?
Although it is difficult to pinpoint a single cause for the disorder, it is thought to result from extremes in child rearing. On the one hand, it could arise from excessive pampering. On the other, neglect, abuse or trauma inflicted by the parents or other authority figures during childhood could also lead to narcissism, which is usually evident by early adulthood. As a consequence, narcissistic individuals always need people around them, as their entire sense of self-worth is dependent on the admiration of others.

The Neurobiology of Narcissism
From a neurobiological perspective, studies with people suffering from NPD have led to interesting findings. Ritter et al. showed that patients with NPD had severe deficits in emotional empathy although they had intact cognitive empathy. Emotional empathy requires subjects to rate how much of the emotion in a picture they feel when they view an emotional picture, while cognitive empathy is determined by asking subjects to infer the mental state of a person in the picture [3]. Another study using functional magnetic resonance imaging found that healthy subjects scoring high on a Narcissism Inventory also showed significantly decreased activation during an empathy task, especially in the right anterior insula [4]. Psychotherapy and medication are the currently available treatment options. Identifying the feelings of vulnerability and impaired self-reflection as the core features of the disorder can lead to better psychological treatments. ***(arm)***

References
[1] American Psychiatric Association, 2000
[2] Stinson et al, J Clin Psychiatry, 2008
[3] Ritter et al, Psychiatry Res, 2011
[4] Fan et al, Psychological Medicine, 2011

CNS Newsletter Poll: Mate Selection in Neuroscientists

Who we choose to fall in love and start a family with has gathered considerable interest over the past few decades. The common perception is that men and women prefer different characteristics in their potential mates. The two principal theories contesting these different preferences are based on perspectives drawn from the study of evolution and social structure.

The evolutionary (Darwinistic) perspective assumes that successful mate choice behaviors continue to influence current mate selection because the behavior led to continued existence and prosperity of the human species [1]. Sex differences between men and women have evolved because they have historically faced different environmental and social pressures [2]. The parental investment model proposed by Trivers in 1972 further suggests that this is because men and women differ in the level of parental investment required to ensure the survival of the species. Thus, their mating behaviors evolved accordingly. While women invest extensive physiological resources in producing offspring, men invest more outside resources beyond the act of conception [3].

In contrast, the social structure perspective proposes that sexually differentiated mate selection results from contrasting social positions that men and women have historically occupied within society [2,4]. These types of societal constraints and gender expectations still persist. In an attempt to maximize resources, women who are delegated to roles of less power and resources seek out these characteristics in potential mates. They can offer commodities such as physical beauty, fertility, and sexual pleasure that are desired by men [2,4,5].

Both hypotheses are supported by ample evidence that can be reviewed in Shoemake 2007 [6].

Here, we used a short online poll to investigate possible sex differences and differences associated with career stage regarding mate selection of Berlin neuroscientists.

The survey comprised three questions: 1) "What is your gender?" 2) "What is your position in neuroscience research?" 3) "What are the first four qualities you look for in a partner?" Categories were the following: age, cleanliness, ethnicity, financial security, intelligence, kindness, nerdiness, physical attraction, religion, sense of humor, social status, trustworthiness, and other. The survey was prepared on surveymonkey.com and sent to the Berlin Neuroscience community via mailing lists of Medical Neurosciences, Mind and Brain, Bernstein Center for Computational Neuroscience as well as the forum of the staff of the Department of Experimental Neurology. Answers were collected between April 28 and May 2, 2014.

126 responses were collected for the poll. One response had to be excluded since no answers were given to the questions. Out of the 125 answers, 62 participants were male, 61 female, one preferred not to answer and one chose "other". Of the remaining 125 participants, 23 were students, 58 PhD students, 5 technicians, 20 postdocs, 4 group leaders, 10 professors, and 5 other (Fig. 1).

Neuroscientists Look for Intelligence, Physical Attraction Rates Only Third

Overall, intelligence (88.6 %) was the most frequently reported quality that respondents looked for in their partners, followed by sense of humor (74.0 %), physical attraction (68.3 %), trustworthiness (60.2 %), and kindness (58.5 %) (Fig. 2). All other options had less than 10 % votes, except for other (11.4 %): age (8.1 %), social status (7.3 %), cleanliness (6.5 %), nerdiness (5.7 %), religion (3.3 %), financial status (2.4 %), and ethnicity (1.6 %).

Male and Female Neuroscientists Desire Similar Qualities in their Partner

Both male and female participants rated the same top five qualities. The only differences across gender occurred with respect to physical attraction and sense of humor. For men, physical attraction was the second most frequent criterion, whereas only about half of the participating women reported it (80.6 vs. 55.7 %, $\chi^2(1, N=123)=8.81$, $p=0.003$). Sense of humor was significantly more preferred by women compared to men (82.0 vs. 66.1 %, $\chi^2(1, N=123)=4.01$, $p=.045$).

Neuroscientists Look for the Same Qualities Independent of Career Stage

Due to the low responses from technicians and 'other', we did not include these groups in the analysis. The responses from group leaders and professors were grouped for the same reason. All four groups – students, PhD students, postdocs, group leaders/professors – rated the top five qualities – intelligence, physical attraction, sense of humor, trustworthiness, and kindness – almost equally frequent. The more advanced in their career stage, the more important their partners' intelligence was rated by neuroscientists. Interestingly, postdocs rated physical attraction substantially lower than the other three groups, while they rated kindness substantially higher. Postdocs also had the highest score, even if not as pronounced, for trustworthiness and sense of humor. Only group leaders/professors rated social status as a quality of high importance. A Pearson's chi-squared test was performed and no relationship was found between career stage and any of the mate selection criteria investigated in this study.

Discussion

We discovered that male and female neuroscientists have similar mate selection criteria which differ only when it comes to physical attraction. Intelligence was found to be the most frequently reported criterion. A relationship between career stage and mate selection criteria was not found.

In our study, we found intelligence, physical attraction, sense of humor, trustworthiness, and kindness to be the five key attributes both men and women look for in their mate. This goes in line with the immense amount of literature on mate preference that generally indicates a preference for intelligence, emotional stability, honesty and trustworthiness, an exciting overall personality, and – of course – a physically attractive appearance [7].

Interestingly, our study suggests that neuroscientists rate intelligence as the most important factor in their partner – or at least, that is what we would like to believe. According to the matching hypothesis, people are more likely to form and succeed in a relationship with a partner who is equally socially desirable, which often refers to physical attractiveness [8]. On average, women tend to be attracted to men who are taller than they are and vice versa. While men want women with full breasts and lips, low waist-hip ratio, and a young appearance, women prefer men with broad shoulders, narrow waist, V-shaped torso, and masculine facial dimorphism. In addition, both seem to be attracted by a symmetrical face [9-11]. Even when on a purely platonic level, it was shown that people – especially men – tend to be drawn to others that they perceive as similarly attractive [12]. And sure, you probably know one or two successful couples where both partners are not necessarily attractive to the same degree. In this case, the less attractive partner possesses compensating qualities such as status and wealth [13]. Yet,

it is not entirely surprising that intelligence is highly ranked. It was previously shown that people unconsciously attribute positive characteristics, e.g. intelligence, to physically attractive people [14]. This association was found to be stronger for men compared to women [15]. Prokosch and colleagues proposed a general fitness factor (f-factor) where intelligence and physical attractiveness are positively correlated because both reflect the quality of the genes and developmental stability [16].

Surprisingly, social status was ranked very low in this study, and only group leaders and professors seem to have a preference for it. According to the literature, women have a substantial preference for high social status and wealth [17,18]. In a large US study, men and women were asked how willing they would be to marry someone who possessed a variety of characteristics. While men were significantly less willing than women to marry someone who was "not good looking," women were significantly less willing than men to marry a partner who was "not likely to hold a steady job" and who "would earn less than you." However, they showed that both characteristics matter to men and women – just to a different degree [19].

We did not find a relationship between career stage and any of the mate selection criteria investigated here. Yet, group leaders and professors tend to pay more attention to social status. We can only speculate that being a neuroscientist or a researcher in academia favors a certain kind of person (which would also explain the lack of gender differences). Why postdocs, in particular, ranked physical attraction much lower than the other groups and tend to value sense of humor, kindness, and trustworthiness more, we'll leave up to your imagination.

What you think your partner should be like and how your beloved turns out to be might be completely different. That's love!

Limitations of this Study

This study is greatly limited by the short online poll and low number of respondents. A more detailed study on the mates and reproductive success of Berlin neuroscientists would provide a deeper insight on the actual selection criteria and evolutionary fitness of neuroscientists.

Acknowledgements

We would like to thank Anna Pajkert for helping with the statistical analysis of the data. ***(mz)***

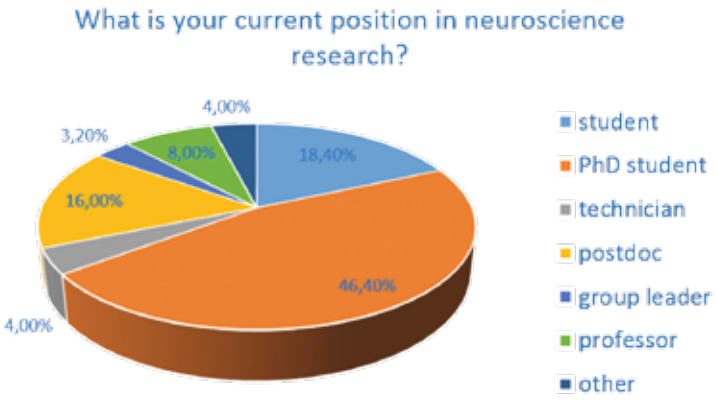


Figure 1: Sociodemographic distribution of the participants

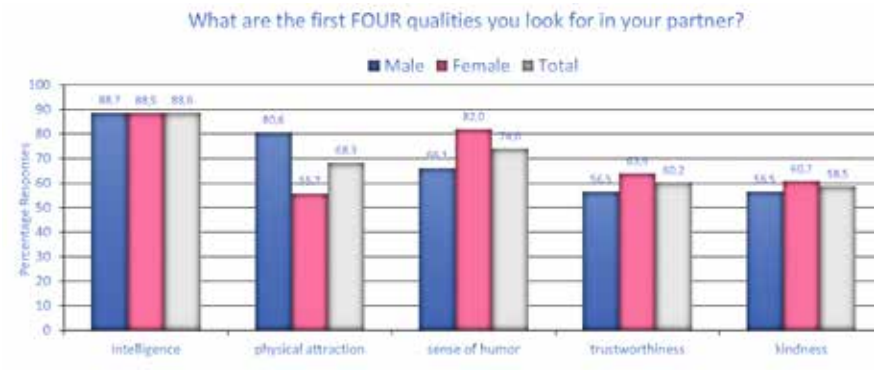


Figure 2: Gender differences in mate selection

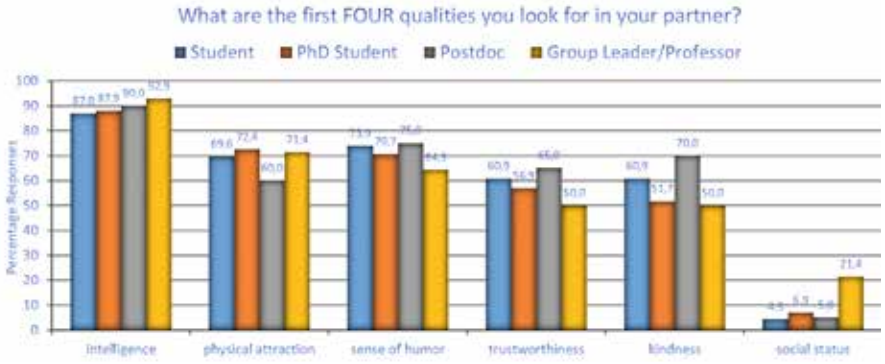


Figure 3: Career stage and mate selection

References

[1] Kenrick, Advances in Experimental Social Psychology, 1994
[2] Eagly and Wood, American Psychologist, 1999
[3] Trivers, "Parental investment and sexual selection", in Campbell, B. (Ed.), Sexual Selection and the Descent of Man (pp. 136-179). Chicago: Aldine, 1972
[4] Howard et al, J Pers Soc Psychol, 1987
[5] Buss and Barnes, J Pers Soc Psychol, 1986
[6] Shoemake, J Scientific Psychol, 2007
[7] Regan, "The Mating Game. A Primer on Love, Sex, and Marriage", Chapter 1: "Mate Preferences", 2nd Edition, California State University, Los Angeles, 2008
[8] Feingold, Psychol Bull, 1988
[9] Perrett et al, Nature, 1998
[10] Nettle, Proc Biol Sci, 2002
[11] Glassenberg et al, Arch Sex Behav, 2010
[12] Feingold, J Pers Soc Psychol, 1990
[13] Myers, Social psychology, New York: McGraw-Hill Higher Education, 10th ed., 2009
[14] Dion et al, J Pers Soc Psychol, 1972
[15] Kanazawa, Intelligence, 2011
[16] Prokosch et al, Intelligence, 2005
[17] Buss and Schmitt, Psychol Rev, 1993
[18] Feingold, Psychol Bull, 1992
[19] Sprecher et al, J Pers Soc Psychol, 1994

You have Beautiful Eyes, Hundreds of Them!

Avian Eyetracking Shows Peahens Checking Out Males' Train Feathers

What do people look for in a partner? Many of us would love to know what aspects of our appearance are of most interest to potential mates. Well, we could start by posing the question 'What do people look at in a partner?' After all, what the eye does not see, the heart does not grieve over or in this case throb for.

This is one of those research questions, however, where straightforward questionnaire data are likely to raise suspicions. How many people are going to admit that they look straight at someone's buttocks or cleavage? Eyetracking, on the other hand, can reveal a great deal about what people attend to, and has delivered such edifying conclusions as: Men seem to like to assess each other's crotches [1]; women check each other out as much as they do men [2]; and men look longer at larger breasts (even when controlling for the larger area of the visual field they occupy) [3].

A recent novelty, however, is the application of eyetracking to the romantic interests of birds. And no better bird to begin with than the peacock, famous for its eye-catching train of iridescent feathers, rattled in mating displays. Of course, in the animal kingdom it tends to be the women who do the ogling, so a recent study tracked peahens' eye movements while the males strutted their stuff [4].

The peahens were not especially impressed, spending less than a third of their time even looking at the male at all. Nor were they interested in everything he had to offer. The upper train, where most of the eyes are located, was of relatively little interest. Instead, the females' gaze lingered on the lower train, which they scanned from side to side in a way that suggests they were assessing its symmetry, an important feature in sexual selection [5].

Picture reproduced with permission from Yorzinski et al, J Exp Biol, 2013

So how can we make sure our next date results in love at first saccade? The authors offer a somewhat disheartening speculation. Briefer viewing times may indicate simply that a trait is much easier to assess. Peahens may look less at train eyes simply because it is very easy to see whether a male has fewer than required, and he may then be rejected without further ado [6]. ***(lt)***

References
[1] http://bit.ly/NCem7I
[2] Rupp and Wallen, Horm Behav, 2007
[3] Gervais et al, Sex Roles, 2013
[4] Yorzinski et al, J Exp Biol, 2013
[5] Moller and Thornhill, Amer Nat, 1998
[6] Dakin and Montgomerie, Anim Behav, 2011

Love at First Sight

By Rick Cornell Hellmann, PhD Student Medical Neurosciences, AG Spinal Cord Injury

The idea of love at first sight has been around since the times of Plato and has since been promoted by western media [1], but does it really exist?

We define romantic love as a state where one experiences strong loyalty, trust, tolerance, physical attraction, and empathy toward someone [2]. However, many of these emotions require a long time to cultivate. This would contradict love at first sight. If "falling in love" is a continuous process as the "falling" implies, then it could also be defined as a strong readiness or certainty to develop those emotions.

The two-factor theory of emotion proposes that both physiological arousal and cognitive label are the basis for emotion [3]. As such, an increased pulse from climbing stairs might be interpreted as fear or love depending on the emotional cues present in the immediate environment; for example the person or task waiting at the end of the stairs. A study along those lines asked people before and after a rollercoaster ride to rate a photograph of a person from the opposite gender. After the ride, the participants rated the same photograph higher in terms of attractiveness and desirability to date [4].

Upon first encounter, there are a few key features which determine whether we find a person attractive. These include waist-to-hip ratio (of optimally 0.7 for women) and facial symmetry, preferably a face similar to our own [5]. Other factors require some closer observation: middle finger length, lung volumes, and metabolic rate [5]. Human fMRI studies on loving couples have revealed the brain areas activated when pictures of their partners were shown [6]. Areas involved in sight recognition and love were dopaminergic (e.g. the putamen and caudate nucleus), associated with reward, and also areas involved in somatosensory integration. Incidentally, there is a striking overlap with brain regions activated by euphoria-inducing drugs such as cocaine. The amygdala, on the other hand, deactivates the brain areas responsible for the condition of love causing depression and emotional stress or, in this case, a broken heart.

So, what about you? Have you seen love at first sight?

References
[1] http://tinyurl.com/lxk9h2v
[2] http://tinyurl.com/lqekluu
[3] Khan, Physiol Psychol, 1962
[4] Metson and Frohlich, Arch Sex Behav, 2003
[5] http://tinyurl.com/kvmzuva
[6] Ortigue et al, J Sex Med, 1999

Head-Turning Asymmetries during Kissing

Did you know that there is a name for the scientific study of kissing? It is called Philematology, from the ancient Greek word philos = earthly love. Scientists found out that we use up to 34 muscles for intensive kissing, that kissing increases levels of endorphins and dopamine, and that we exchange as many as 10 million to 1 billion bacteria during kissing (don't worry, 95 % of them are not pathogenic for immunologically competent people). You might be aware of that, but have you ever wondered why you nearly never bump your partner's nose or head when you kiss?

Onur Güntürkün observed 124 kissing pairs in public spaces in three countries and documented that 65 % turned their heads to the right and only 35 % to the left, resulting in a 2:1 ratio for right-kissing [1]. Where does this head-turning asymmetry come from? Is it due to brain laterality or due to a motor bias?

Romantic Theory about the Influence of Emotion

One hypothesis is that head-turning asymmetry during kissing is linked to brain laterality. In popular psychology the left hemisphere is often said to be involved in analytical thinking, whereas the right hemisphere processes emotions. At least for posing behavior in portraits, it was shown that the emotional context has an effect on lateralisation bias. In emotive conditions, individuals show the left cheek, i.e. turn the head to the left, whereas when posing for an impassive scientific portrait they show the right cheek [2]. Is head-turning to the right during kissing, like posing behavior, also influenced by the emotional context?

To study the association of right-kissing and emotions, subjects were asked to kiss a life-sized doll head without emotion. The right turning ratio was compared to that of kissing couples. The results showed a similar right turning ratio for both the doll kissers and the couples. As no preferential difference between kissing couples and doll kissers was observed, the emotion theory was dismissed. Kissing the doll does not involve emotions like kissing a partner, but the head-turning ratio was still similar [3].

Reappearance of a Neonatal Right-Side Preference

Another possible explanation for the preference of right-kissing is the persistence of a motor bias seen in neonates: During the final weeks of gestation and during early infancy, most humans have a preference for turning the head to the right. This motor bias persists into adulthood and has effects on various asymmetries. The preferential head turning direction in infants can even be used as prediction for later handedness [4]. However, the prevalence of right-handedness is 8:1 [5]; thus not consistent with the 2:1 kissing ratio for the right side observed by Güntürkün. Thus, the kissing asymmetry is not a simple result of right-handedness. If the asymmetry during kissing is caused by a motor bias, how is it related to handedness and other lateral preferences?

To test whether head-turning preference is related to other lateral preferences, the handedness, footedness, and eye preference of volunteers who were asked to kiss a symmetrical doll face were determined. The study revealed that right-kissers were more likely to be right-handed and right-footed than left-kissers [6]. This relation could not be shown for eye preference, but as the data structure was the same the authors speculate that their questionnaire was not detailed enough. However, the study showed that head-turning preference during kissing is indeed due to a motor bias and related to handedness and footedness.

Dominance of Right-Kissers

As kissing always takes two and both kissers are always influenced by the partner's head-turning preference, scientists were interested in what happens if a right-turner kisses a left-turner. Therefore Van der Kamp and Canal-Bruland analyzed the consistency of the head-turning bias in kissing by using a doll head rotated in different orientations that were either compatible or incompatible with the participant's head-turning preference. In the study, right-kissers were more likely to persistently turn their head to the right even if the doll's head was turned as if kissing on the left side [7]. Because the head turning bias among right-kissers is stronger than among left-kissers, two people with different head-turning preferences are more likely to turn their heads to the right during kissing. Furthermore, the results support the hypothesis that behavioral asymmetries are stronger for individuals with a lateral preference pattern for the right than for the left side [8].

In conclusion, the observed asymmetries during kissing can be explained by a motor bias rather than by the emotive context. ***(cb)***

The Kiss, a marble sculpture by Auguste Rodin in the Musée Rodin, Paris showing a couple turning their heads to the right during kissing

References

[1] Güntürkün, Nature, 2003
[2] Nicholls et al, Proc Biol Sci, 1999
[3] Barrett et al, Laterality, 2006
[4] Michel, Science, 1981
[5] Corballis, Psychol Rev, 1997
[6] Ocklenburg and Güntürkün, Laterality, 2009
[7] Van der Kamp and Canal-Bruland, Laterality, 2011
[8] Searlman and Porac, Brain Cogn, 2003

Through Rose-Colored Glasses

Reduced Cognitive Control in Lovers

By Ann-Christin Ostwaldt, PhD Student Medical Neurosciences, AG Academic Neuroradiology

Photo: D Sharon Pruitt

People who fall in love tend to adopt curious and nerve-racking behaviors: they think and talk about nothing else but their lover and seem unable to concentrate on simple daily tasks. It is as if they see the whole world through rose-colored glasses.

For a neuroscientist, this sounds a lot like impaired cognitive control. It has even been suggested that these behaviors resemble those of patients with obsessive-compulsive disorder [1]. How unsurprising then, that groups of neuroscientists set out to examine this more closely! The group of van Steenbergen et al. [2] studied the effect of passionate love on cognition in 43 students (23 girls, 20 boys) who had recently become involved in a romantic relationship. To test how 'in love' the participants were, the Passionate Love Scale was used (yes, such a scale really exists). For assessment of cognitive control, the flanker task and a Stroop task were performed – both tests measure the ability to filter out distracting and irrelevant information and therefore require cognitive control. Before taking the tests, the participants were asked to imagine romantic events with their lovers and listened to love-related music to elicit a "romantic" mood.

The authors were able to show that higher scores on the Passionate Love Scale were associated with an increase in the interference effect on the two cognitive tasks. This effect was independent of gender and not influenced by self-reported affect. Thus, the study showed that cognitive control really is impaired on a measurable level in the initial phase of passionate love. In other words: The rose-colored glasses are real!

Reduced cognitive control has been associated with increased impulsivity in some models and can also be observed to a similar extent in addicts [3]. So from a neuroscientific perspective, passionate lovers in the early phase of their relationship seem to resemble high-impulsivity addicts with obsessive-compulsive disorder.

Luckily, for us, this does not last forever. When a passionate relationship evolves into a more committed long-term relationship, cognitive control becomes increasingly important and is eventually reestablished [4].

References
[1] Tallis et al, Psychologist, 2005
[2] van Steenbergen et al, Motiv Emot, 2013
[3] Burkett & Young, Psychopharmacology, 2012
[4] Pronk et al, J Pers Soc Psychol, 2010

Is it Hot in Here or is it just Spring Fever?

As the sun returns, flowers bloom and birds sing, spring fever coaxes us into feelings of well-being and romance. The transition from winter to spring clearly affects our daily lives with warmer weather and longer days, but this phenomenon is not as simple as it may seem.

Not only does our environment change and affect our behavior, but our bodies and brains change as well. The change in day length in spring is sensed by the areas of the brain that control our circannual rhythm, largely under the control of the suprachiasmatic nucleus that receives light information from the retina [1]. Even so, animals kept in constant lifelong light-dark cycles still display a seasonal rhythm of a 365-day cycle. This shows that some of these mechanisms are genetically hardwired, regardless of environmental cues such as day length [1].

Such circannual genetic programs, light-stimulated or not, regulate seasonal fluctuations in hormones such as melatonin, thyroid hormone, and vitamin D [1]. These signals tell the body that spring is the time to be energetic, eat well, and find a mate while the days are long and food is plentiful [4]. In other words they give us that feeling of 'spring fever'. The spike in the conception rate during the summer months is evidence to this phenomenon [2], which may reflect that springtime is the season to become healthy for a summertime conception and also for birthing in the following year [2]. Sperm counts have also been observed to spike in the springtime [3], further contributing to this lusty time of year. The revitalizing energy often associated with spring may be linked to our seasonal rhythmicity as well, as thyroid hormone, which controls our energy homeostasis, increases during long photoperiods [4].

From an evolutionary perspective, it makes sense for our behaviors to change with the seasons in a way that promotes survival, such as birthing children at a time of the year with more food and warmer weather and having the energy in the spring to prepare for the upcoming winter. Although the evidence for the culmination of seasonal fluctuations into a 'spring fever' is still largely anecdotal, research on this topic is highly pertinent to a variety of scientific questions in topics such as fertility, obesity and seasonal affective disorder, which may be greatly affected by circannual rhythms. ***(cw)***

References
[1] Dardente et al, Front Endocrinol, 2014
[2] Nicholson, Scientific American, 2007, http://bit.ly/1hiuYim
[3] Andolz et al, Int J Androl, 2001
[4] Murphy and Ebling, J Thyroid Res, 2011

Just Can't Get Enough: On Love and Drugs

Considering that it plays such a major role in our lives, love can be a tricky phenomenon to define. It comprises a mixture of different emotions that collectively show remarkable similarities with another indistinct, incompletely understood phenomenon: addiction [1]. Especially noticeable in the works of Shakespeare, the metaphorical – the literary – connection between love and addiction is familiar to us all, and seems to be rooted in truth.

On a behavioral level, both love and addictive substances incite us to seek more (positive reinforcement) and to avoid the unpleasant effects of their absence (negative reinforcement). Therefore, people go to great lengths (and make substantial sacrifices) to maintain their romantic and drug-related habits. Lovers are often intensely focused on one another, and can experience cravings and a loss of self-control – features highly specific to addiction [2]. When terminated, love and substance abuse alike can lead to harmful consequences such as depression and suicide [3].

Neurobiological parallels between these two phenomena also exist and involve brain regions responsible for the recognition and response to rewarding stimuli. Romantic love affects dopamine release from the brainstem's ventral tegmental area, a key motivation and reward region. This in turn influences the nucleus accumbens, which modulates how rewarding a stimulus is perceived, and is a fundamental structure involved in substance addiction [4].

However, this evidence alone is insufficient to classify love as an addiction, because all reinforcing stimuli activate the reward system and can lead to the aforementioned behaviors. Addiction is a disorder of adaptation, where modifying the use of the stimulus to the circumstances becomes difficult. Actions are automatic and independent of context, and attempts to cease use require considerable, stress-inducing effort. This may occur in some, though not all, romantic relationships. Do these represent pathological love or true love? Is there a difference?

"If music be the *food* of love, play on,
Give me *excess* of it; that *surfeiting*,
The appetite may *sicken*, and so *die*."

First line of Shakespeare's Twelfth Night. Spoken by a man who is (apparently) in love, note the choice of words. ***(ak)***

References
[1] Frascella, Ann NY Acad Sci, 2010
[2] Fisher, Why we love: the nature and chemistry of romantic love, 2004
[3] Mearns, J Pers Soc Psychol, 1991
[4] Fisher, J Neurophysiol, 2010

Your Brain on Fire

He was the strongest of all the males and the most dominant. He walked around fearlessly and there she was, standing a few inches from him. She slowly approached him, her steps cautious and delicate. He turned towards her and was captured by her soft gaze into his eyes. But he was not impressed and left. By flirting with another male, she made him return quickly and forcefully grabbed her. This was a scene from a documentary on Love in the Animal Kingdom, showing the behavior of a female Gorilla seducing the strongest male Gorilla. Romantic love ensures that an individual favors only one partner to mate and reproduce [1]. But what if human beings are now being exposed to a different kind of seduction to which no kind of reality or love is related, a kind that stimulates their brains in an imaginary world of sexual pleasure, the world of pornography.

An article published in The Washington Post has reported that around 70 million visit porn websites each week and that most were under 18 [2]. The first problem is that adolescence is a transitional period with multiple changes occurring in the brain related to risk taking and reward. During adolescence, the prefrontal cortex is prewired to expect novel experiences that then lead to learning. Furthermore, the adolescent brain undergoes reorganization and refinement in the neural connections for motivation, emotion, and cognition, which make their brains prone to temptation until reasoning and pertinent decision-making are achieved [3]. But what if these maturing circuits and connections are being exposed to the wrong stimuli? With just a click, an explicit world of mostly violent sex is portrayed to a teenager. It is said that the brain is the biggest sex organ and this had first been proved when men with spinal cord injury developed erection and ejaculation even without feeling it [4]. Watching pornography leads to arousal, which has been associated with activity in limbic and extra-limbic regions of the brain involved with reward. But the biggest surprise is the plasticity involved with sexual arousal. DeltaFosB, important for dendritic plasticity, exerts its effects on mesolimbic reward systems in sexual and drug addicts through dopamine receptors in the nucleus accumbens [5]. Sex also causes an increase in silent synapses, an increase in NMDA/AMPA receptor ratio, leading to plasticity and learning when these synapses become unsilenced. This was especially relevant and long lasting in the nucleus accumbens afferents to prefrontal cortex, involved in Compulsive Sexual Disorder [6]. Novelty, arousal, and pleasure are all the gains of someone watching pornography. But as soon as the individual goes into the community and integrates, he is not satisfied by real sexual relationships and has a tendency to be more aggressive towards women [5]. So, consider an industry with revenues as much as $13 billion a year[7], crammed with violence and humiliation, mercilessly hijacking the maturing brains of adolescents. ***(ys)***

References
[1] Platek et al, "Evolutionary Cognitive Neuroscience", The MIT Press, 2006
[2] http://wapo.st/1nXV9Nc
[3] Bernheim et al, Front Pharmacol, 2013
[4] Bocher et al, Neuroimage, 2001
[5] Pitchers et al, J Neurosci, 2013
[6] Hilton, Socioaffect Neurosci and Psychol, 2013
[7] http://www. nytimes.com/2007/01/04/business/media/04porn.html

The Ups and Downs of Love: Bridal Weight Changes

By Ann-Christin Ostwaldt, PhD Student Medical Neurosciences,
AG Academic Neuroradiology

Source: http://en.wikipedia.org/wiki/File:Wedding_rings.jpg

For most couples, the wedding is the highlight of their relationship and it is THE big event in many brides' lives. All their friends and relatives are invited and the wedding album will be viewed for years thereafter. It is no wonder that brides aspire to look especially beautiful on this day and they often believe (or are told) that losing weight is absolutely mandatory. But do brides actually succeed in this endeavor? And how lasting are wedding-related weight changes?

From the study of an Australian research team [1], 343 brides-to-be were asked about their weight and related information on average 11 months before their wedding. The brides were questioned again one month pre-wedding (available for 130 women) and six months post-wedding (available for 112 women). Around half of these women reported that they wanted to lose almost 10 kilos before their big day. The authors showed that 47 % of the brides did actually lose weight up until one month prior to the wedding – but on average only 3 kg! The remaining, either gained weight of an average of 3 kilos (32 %) or did not show any weight changes at all (21 %).

Interestingly, those women who lost a lot of weight prior to the wedding had regained all of it (and more) 6 months after the wedding. The other two groups also gained weight, although significantly less compared to the women with pre-wedding weight loss. On average, women gained over 2 kg in the 6 months after their wedding day, which is probably not at all surprising. Wedding-related stress is reduced and the daily routines step in again, and with them the usual eating habits. Also, to some women the thought might occur that they have now "secured" a man, which might consequently diminish their motivation to work on their bodies.

All in all, one can say that pre-wedding weight loss is very short-lived. Therefore, dear brides and grooms: enjoy your wedding. For true love, a couple of kilos more or less should not matter anyway!

References
[1] Prichard et al. Body Image 2014

Neuroscience in Your Everyday Life

Why is it Again that the Way to a Man's Heart is Through his Stomach?

Providing someone (a man, as is suggested by the phrase) with good food increases the chances of winning his affections. Like most expressions, this contains a mixture of truth and falsehood.

The concept of reward plays a major role in romantic love. From a neurobiological perspective, food is also closely linked to the brain's reward pathways. Liking food (the hedonic aspect) and wanting food (the motivational aspect) activate the nucleus accumbens and ventral tegmental area respectively. A cocktail of neurochemicals such as dopamine, opioids, endocannabinoids, leptin, and insulin then mediate the rewarding effects [1].

Downstream pathways subsequently modulate cognitive processes such as memory, learning, and decision making [2]. Thus, what we eat can have profound effects on whether we perceive the circumstances surrounding the act of feeding positively or negatively. Although one study found that mice lacking endocannabinoid receptors (CB1) no longer responded to the rewarding effect of sucrose [3], the authors did not report whether these mice eventually found love.

Some foods are known to directly influence the reward pathways in a specific manner, similar to how psychoactive drugs act on the brain. Such aphrodisiacs (from Aphrodite, the Greek goddess of love) include chocolate, which contains substances that affect opioid and endocannabinoid neurotransmission, and nutmeg, which alters dopamine metabolism in the brain [4].

Despite the expression suggesting that food being the way to the heart is exclusive to men, there seems to be little biological proof of this. In fact, evidence suggests that females are more sensitive than males to the rewarding effect of endocannabinoids [5]. On a behavioral level, gender differences in characteristics that men value in women (and vice versa), for example taste in food, might also play a role. ***(ak)***

References
[1] Cota et al, Neuron, 2006
[2] Wise, Philos Trans R Soc Lond B Biol Sci, 2006
[3] Sanchis-Segura et al, Psychopharmacology 2004
[4] Melnyk and Marcone, Food Research International, 2011
[5] Cicero, Pharmacology Biochemistry and Behavior, 2003

Do you also sometimes wonder about the simple neuroscientific questions in everyday life, but don't really feel like looking them up right away? For questions like this, just mail us your question (cns-newsletter@charite.de) and Dr. Harebrained will give us his explanation in the next issue! Our next issues question: **Why is it again that we cry when we are sad?**

Killing me Softly

It is 6:45 am on a Wednesday morning and the daily routine, despite its deadly mundaneness, has to be resumed. Struggle is, after all, a tolerable necessity of life. "Mary, Can you please help me dress the kids for school?" said her husband. Mary opened her eyes and stared at him silently for a while; for several weeks, her eyes had lost their glow and were filled with desperate emptiness most of the time. He gave her an angry look and left. "What is wrong with you?" he yelled from the corridor. She laid quietly in her bed, the blanket hid her body and half of her face, her dull eyes half open and staring bluntly at the ceiling, her body in a relaxed state, almost like a dead being, and her mind as void as an infinitely isolated space. She was hit by a ruthless storm: depression.

Clinicians define depression as the lack of feelings of pleasure in response to normally pleasurable stimuli for a period of at least two weeks. We are beings in need of love and frivolously seek mates with whom sexual drive can be satisfied and security, attachment, and emotional union achieved. Love is a motivation, not a feeling, reported a study in 1995 because romantic love is associated with activity in the ventral tegmental area and reward system [1]. It drives human beings to survive and reproduce through increased testosterone levels [2]. Depression, however, is a recession of the soul and mind, a disorder that defies the laws of natural selection and creates miserable beings who have lost their sense of life.

A few days later, Mary's husband and parents decided that she urgently needed to see a physician. Her father got her out of bed after a long conversation during which she had not uttered a word. As he slightly lifted her up, he felt a fragile helpless creature between his arms. How lively she used to be and how detached from the world and herself she had become. After a session with the physician in which she cried for the first time in so long, she was diagnosed with severe depression.

A few weeks have passed and Mary is on antidepressants – but she remains different from who she once used to be. Early studies hypothesized that love is associated with low serotonin levels in the brain. This proposal was made on the basis that participants who reported being strongly in love had low levels of serotonin. Selective Serotonin Reuptake Inhibitors (SSRIs) are commonly used as antidepressants and despite causing improvement, they jeopardize the neural mechanisms for love as well as attachment and sexual drive. When you love someone, they become intensely attractive to you and your sexual drive increases because dopaminergic activity behind this love increases estrogen and testosterone levels increasing your sexual drive and these hormones also affect dopamine in return. Serotonin, however, suppresses all dopaminergic pathways as well as testosterone and norepinephrine levels [2]. And as such, patients on SSRIs report feelings of carelessness, detachment and reduced sexual arousal. A study conducted in 2009 reported that patients on SSRIs suffered from symptoms ranging from blunted emotions to no emotions at all. Some said they felt their emotions changed into words and have changed into something they think of but do not feel, while others reported that even though they knew what emotions to feel, their emotional responses were altered, and yet for others emotions felt fake [3].

From reduction of positive emotions such as happiness and excitement to reduced passion and attraction to others, SSRIs cause "blunted emotions" that patients recognize as purely the effects of the drug. Even the absence or reduction of negative emotions has been disturbing to some who had feel unable to cry or respond to situations appropriately such as with grief. But the list does not quite end here, SSRIs have left patients with changed personalities, some reporting that their personalities had left them "like a shell" and they either did not care or felt less sympathy for, and more detachment from, their families and their emotions. Like robots, they simply remained different and indifferent towards the world. Nevertheless, the effect of these side effects may become a serious problem as the rate of prescription of SSRIs increases. Studies have indeed shown that the total prescription of all antidepressants has dramatically increased between 1981 and 2000 by 353 % with SSRIs comprising around 81 % of the depression drug market[4]. Mary has to overcome her depression as well as recover her long-lost emotions in a lose-lose battle between depression and anti-depressants. But human beings, despite their weary struggle and determined attempts to survive, have surely come to discover the irreproachable beauty of survival through love. And so, hope remains. ***(ys)***

References
[1] Aron et al, J Pers Soc Psychol, 1995
[2] Platek et al, Evolutionary Cognitive Neuroscience, 2006
[3] Price et al, Br J Psychiatry, 2009
[4] Currie, Women and Health Protection, 2005

Open Positions for Master's and PhD Students

Type: Master's Thesis

Project Title: Go/ NoGo deficits in neurological and psychiatric patients: What do they tell about dysfunctions of basal-ganglia pathways?

Field of Research: Neurology, motor performance, basal ganglia

Starting Date: Immediately

Research Group: Andrea Kühn

Contact: henning.schroll@charite.de; cc: andrea.kuehn@charite.de

Type: Lab Rotation/Master's/PhD Thesis

Project Title: Characterize a new drug enhancer of the blood-brain barrier

Field of Research: Role of tight junctions in modulating blood-brain barrier function

Starting Date: Immediately

Research Group: Molecular Cell Physiology, AG Blasig, Leibniz Institut für Molekulare Pharmakologie (FMP)

Contact: PD Dr. Ingolf E. Blasig, 030-94793244 IBLASIG@fmp-berlin.de

Pride and Pain

It was an evening in an aristocratically elegant hall with golden ornamented ceilings covered with paintings of naked angels and seductive females, several crystal chandeliers hanging eloquently, surrounded by a golden halo of light reminiscent of antiquity, and ceramic tiles covering the floor with blue, green and brown. Everything in the hall – the air, the staring audience, the furniture, and the windows dressed with short delicate red curtains – was witnessing a melancholic concert for Claude Debussy.

Alexander, a young male in his early thirties with a dark brown trimmed beard and features of someone so distant no matter how close you get to him, sat in the third row directly opposite the primary violinist. He held a motionless upright seated posture with his head slightly tilted and his right arm relaxed on the arm of the chair. But beyond the immense artistically moving yet quiescent scene at the concert, another even more inspiring scene played in Alexander's head, deep within his memory.

He was now standing next to Aurora, a young lady who looked as inspirational as she indeed was. When he met Aurora that day, her golden brown hair smoothly held above her ears allowing her long neck and the slightly sharp features of her face to appear more prominent, he unconsciously stared at her with yieldingly sensible gazes overflowing with vulnerability, and his lips opened slightly in another failed effort to tell her she was beautiful. "We are never so defenseless against suffering as when we love" said Sigmund Freud. But as much as death is simply part of life, so is suffering perhaps part of humaneness.

They walked for hours aimlessly. She was courageous as well as strikingly sensitive, a beautiful combination seemingly present in only a few, or so thought Alexander. For a moment, they quietly stood by the lake. As he stood slightly behind her, wisps of her hair dancing with the partly cold breeze, his eyes examining her humble beauty admiringly, and the forces of gravity shifting him towards her uncontrollably, he thought of expressing his sincere emotion begotten from an unconscious bond that had been blossoming infinitely. She was like the colors of spring, so diverse and mesmerizing. And he was sincere and reluctant. He was scared and overburdened by so many fears of rejection and failure. "Why are you quiet?" said Aurora as she slightly turned towards him. A moment of truth and cowardice passed by him; his gaze went back and forth in anxiety. ***(ys)***

"It was good seeing you, Aurora"
She smiled and turned her head, "We have to go".

Open Positions for Master's and PhD Students

Type: PhD position

Project Title: Cognitive and Neural Dynamics of Memory Across the Lifespan

Field of Research: Neuroimaging (EEG and MRI), perception, attention, memory, lifespan developmental psychology

Possible Starting Date/Deadline for Application: Until filled

Research group: ConMem, Center for Lifespan Psychology, Max Planck Institute for Human Development

Contact: Dr. Markus Werkle-Bergner, werkle@mpib-berlin.mpg.de

---

Type: PhD position

Project Title: Characterization of newly discovered Volume-regulated Anion Channel VRAC (see Science, published April 10 as Science Express)

Field of Research: Electrophysiology and/or Cell Biology

Possible Starting Date/Deadline for Application: Immediately

Research Group: Department Physiology and Pathology of Ion Transport, MDC / FMP

Contact: Thomas J. Jentsch, Tel. 030-9406 2961 jentsch@fmp-berlin.de

---

Type: Lab Rotation/Master's Thesis

Project Title: Effects of thyronamines (TAM) and thyroacetic acid (TAC) metabolites on energy metabolism – mitochondrial function, Ca2+ – signalling, plasma membrane action

Field of Research: Thyroid hormone metabolism and action. Role of Ca2+ channels using high sensitive functional assays such as fluorescence calcium imaging and planar patch-clamping.

Starting Date: Immediately

Research Group: Experimental Ophthalmology, Experimental Ophthalmology, AG Josef Köhrle, Heike Biebermann, AG Stefan Mergler, Noushafarin Khajavi

Contact: Stefan Mergler, Tel. 030-450-559648 stefan.mergler@charite.de

---

Type: Lab Rotation/Master's Thesis

Project Title: Expression, function, and endogenous modulators of transient receptor potential channels TRPV1, TRPV6 and TRPM8 in gastroenteropancreatic neuroendocrine tumors (GEP-NETs)

Field of Research: Role of TRPs in neuroendocrine tumor cells using high sensitive functional assays such as fluorescence calcium imaging and planar patch-clamping.

Starting Date: Immediately

Research Group: Experimental Gastroenterology, Experimental Ophthalmology, AG Mathias Strowski, Carsten Grötzinger, AG Stefan Mergler, Noushafarin Khajavi

Contact: Stefan Mergler, Tel. 030-450-559648 stefan.mergler@charite.de

Erratum – Of Progress in Neuroscience and Unfulfilled Expectations

In 2004, a group of 11 neuroscientists published an essay on perspectives in neuroscience, titled "The Manifesto" [1], explaining the current state and possible future of neuroscience. First they present the latest findings in the field, including well-known limitation such as the poor resolution of functional MRI and the methodological difficulties of addressing neural function at a multi-cellular level.

The authors continue by explaining that how the brain works, integrates, perceives itself and plans is still hardly understood. Later, they switch from modesty to megalomania by predicting new psychotropic drugs and big progress in Alzheimer's and Parkinson's disease research. They expect science to explain cognitive and psychic activity by neurochemical and -electrical mechanisms within 30 years, thus solving the mind-brain problem, which reflects psychological and philosophical thought on the nature of mind (see our last issue).

Now, in 2014, a critical review on progress since then, titled "The Memorandum" [2], has been released by neuroscientists, psychologists, and philosophers. They were fairly harsh with neuroscience in general, and had stern words for the authors of "The Manifesto" in particular. The authors argued that neither limited time nor technical difficulties nor scarce funding underlay the lack of progress, but rather limited theoretical and methodological approaches. They maintain that the authors of "The Manifesto" relied on technical advances to assess the processes complexity of mind and brain instead of focusing on improving our understanding of what is happening all over the brain. Thus, the proposed theoretical neuroscience will develop only in the distant future. First, they suggested, interdisciplinary work should lead to systems science approaches, recruiting neurobiologists, psychologists, mathematicians, and computer scientists. Big projects like the Human Connectome and Human Brain Project will provide increasingly detailed brain descriptions, yet the authors of "The Manifesto", in their opinion, seem to mistake increased empirical detail for enhanced conceptual insight. Hence, the mind-brain problem cannot be considered solved at all! It is today only assessed to the point of description, not explanation.

Not much is left of the great promises of radical advance in AD or PD research. Neuro-prostheses or artificial retinas benefit very few patients, restoring function only rudimentarily. To conclude, 10 years were not enough to achieve the ambitious goals proposed in "The Manifesto". However, people in the field are starting to perceive their work as a part of a (much) greater whole. The first step to unravelling the brain's mysteries is to grasp the multi-level network mode of action. ***(bs)***

References
[1] http://bit.ly/1kinWWi
[2] http://bit.ly/1rPufXu

The Human Brain Project: An Epitome of Ambition

Over the past century, neuroscience has emerged as a distinct discipline aiming to unravel the inner workings of arguably the most complex and elaborate structure in the universe – the brain. Thus far, this has involved a largely reductionist approach – disassembling this intricate organ into simpler parts and processes in order to determine how each functions in both health and disease.

Lately, scientists have taken things a step further. Based on René Descartes' view that what is broken down during investigation must eventually be reassembled, the Human Brain Project (HBP) was devised [1]. This project incorporates data of all kinds from decades of scientific research with the purpose of creating a complete digital simulation of the brain by the year 2020.

What we already know about the brain will be gathered and used to make extrapolations about what we do not yet know – from the nature of consciousness to the pathophysiology of neurodegenerative diseases. Such a project requires a massive amount of computation – an exploit which may soon be possible with the aid of supercomputers. These colossal calculators are expected to handle millions of terabytes of information and contain software capable of simultaneously integrating molecular, cellular, circuit, and regional neuroscience data.

The idea for the HBP was conceived in the 1980s, but the initiative was boosted last year on account of a one billion euro award from the European Commission. What followed was a barrage of mixed emotions; excitement on the one hand and strong criticism on the other. Several notable scientists have denounced the project as being overly ambitious – at least in view of the funding available. A billion is undoubtedly a large number. Nevertheless, it may prove to be just a fraction of the money required. Perhaps more worrying is whether enough is currently known about the brain, how much of the data we have is reliable, and how information derived from non-human species can be interpreted and integrated into such a project.

Some critics have compared the HBP to initiatives such as the 'War on Cancer', which started over four decades ago and has yet to achieve its overarching goal of eliminating death and suffering due to malignant disease [2]. However, such projects are seldom completely useless – both failure and success can teach us a great deal. ***(ak)***

References
[1] Markram, Scientific American, 2012
[2] Kolata, New York Times, 2009

30th Annual Congress of the European Society for Magnetic Resonance in Medicine and Biology

Over the past few decades, magnetic resonance imaging (MRI) has become a crucial diagnostic modality in all fields of medical practice, as well as a valuable research tool, particularly in neuroscience.

In October 2013, I had the pleasure of attending one of the largest annual meetings of the MRI community: the 30th Annual Congress of the European Society for Magnetic Resonance in Medicine and Biology (ESMRMB). Held in the French city of Toulouse, the elaborate four-day event brought together a sensational mixture of clinicians, basic scientists, physicists, and radiographers from across the globe.

The conference consisted of a number of parallel sessions focusing on different anatomic locations and encompassing several medical and scientific disciplines. There was something for everyone – from ground breaking studies for experienced attendees to teaching sessions on MRI physics and sequence development for the relative novices.

The meeting also gave young researchers the opportunity to exhibit their work. I presented a study I had been involved with earlier that year (investigating the use of perfusion MRI in infratentorial stroke) as an electronic poster. I found this format, which spares one the cost and effort of preparing and transporting a paper poster, particularly convenient. Not only could images be shown at high resolution on a large screen, but the setup also allowed viewers to contact the authors and provided the authors with information on how often the poster was viewed.

For me, one of the highlights of the conference was the 'hot topic debate', which focused on the clinical relevance of resting-state functional MRI. Two renowned scientists – a radiologist and a psychiatrist – debated the past uses, misuses and future potential of this notorious technique. From both sides, the debate was rife with witty banter as well as a myriad of studies conducted on humans and animals (including the now infamous publication which showed brain areas 'activated' in a dead salmon – a prime example of how dependent the results of functional MRI are on appropriate statistical analysis [1]). Resting-state functional MRI being the topic of my master's thesis project, the hour-long session provided me with plenty of food for thought.

The next ESMRMB congress will take place in Edinburgh in October 2015. ***(ak)***

Reference
[1] Bennett et al, JSUR, 2010

Can Acupuncture Reverse Killer Inflammation?

By stimulation of specific nerves, acupuncture can promote the release of anti-inflammatory molecules to combat sepsis in mice. This study may foreshadow the incorporation of alternative medicine methods into conventional western practice. However, the use of research funds on alternative medicine investigation is not without controversy. ***(cw)***

Reference: Gary Stix: Can Acupuncture Reverse Killer Inflammation?, Scientific American Global RSS, http://bit.ly/1krPkWU

Master Monkey's Brain Controls Sedated 'Avatar'

Whether it provides hope for patients with spinal injury or a science fiction future of mind control, progress has been made in the use of implanted computer chips to control movement in monkeys. The neural motor commands of a 'master monkey' recorded by a brain chip implant were used to control the movement of a sedated 'avatar monkey' with implanted spinal electrodes. This creates a hardware bridge between brain and spine that may one day allow brain signals to circumvent injured portions of the spinal cord in order to alleviate paralysis. ***(cw)***

Reference: James Gallagher: Monkey's brain moves sedated avatar, BBC News, http://bbc.in/1mQhgmb

Are You Programmed to Enjoy Exercise?

There may be a large genetic component in exercise habits. Interbred sedentary rats show less activation of brain areas involved in reward reinforcement to exercise compared to interbred active rats, and this phenomenon is correlated with genetic changes that control neuron maturation. When sedentary and active rats are co-housed, the brains of the sedentary rats begin to resemble those of active rats. These findings propose that despite a genetic predisposition, a sedentary lifestyle may be overcome by environment. ***(cw)***

Reference: Gretchen Reynolds: Are You Programmed to Enjoy Exercise?, New York Times, http://nyti.ms/1ivaTo2

Map Of The Developing Human Brain Shows Where Problems Begin

Insight into brain development has some from the creation of a high-resolution map of genetic activation in the mid-gestation human fetal brain. This map uncovered new information about the time course of genetic activation in development, pathologies that may begin in utero such as autism and schizophrenia, as well as developmental differences between mice and humans that help explain why some brain drugs work in model experiments but not in the clinic. ***(cw)***

Reference: John Hamilton: Map Of The Developing Human Brain Shows Where Problems Begin, NPR, http://n.pr/1hjxXR4

Aktiv für Ihre Gesundheit
Machen Sie's wie Magdalena Neuner und halten Sie sich mit Bewegung fit. Die TK-Leistungen unterstützen Sie dabei. Zum Beispiel:

- **Sportmedizinische Untersuchung**
  Die TK erstattet ihren Versicherten 80 Prozent der Kosten
- **TK-FitnessCoach**
  Ihr persönliches Online-Fitnessprogramm

Nur zwei von mehr als 10.000 Leistungen der TK. Wir beraten Sie gern ausführlich.

Lutz Matuschke
Kundenberater
Tel. 030-400 44 8660
Fax 030-400 44 8600
lutz.matuschke@tk.de

www.tk.de/vt/Lutz.Matuschke

Jetzt wechseln und **80 Euro TK-Dividende** für 2014 sichern!

„Wer sich bewegt, gewinnt!"

Magdalena Neuner, erfolgreichste Biathletin aller Zeiten

TK
Techniker Krankenkasse
Gesund in die Zukunft.

MSc Admissions 2014

After the admission symposium took place in March, we are happy to announce that we offered admission to the top 15 candidates. Like last year, only two students are from Germany. Out of more than 350 applications, we had narrowed down the final shortlist to 70 candidates. We are already excited and look forward to the start of the semester in October.

New Ruling: Lab Rotations Abroad

Laboratory rotations taken abroad have to be approved by the office and the examination committee.

June	
1-4	German – Latin American Conference on Knowledge and Technology Transfer & Biotechnology and Life Science (http://www.uni-potsdam.de/delatec)
6-7	Gut-Brain-Axis – 2nd European Conference of Microbiology and Immunology (http://www.eucmi.com/)
6-8	Carnival of Cultures (http://www.karneval-berlin.de/de/english.175.html)
10-13	Molecular Insight into Muscle Function and Protein Aggregate Myopathies (http://www.musclepam2014.de/)
12-13	Berlin Neuroscience Forum (http://www.bnf-info.de/)
20	5th Scientific Symposium on Clinical Needs, Research Promises and Technical Solutions in Ultrahigh Field Magnetic Resonance (https://www.uhf-mr.de/2014/default.asp)
July	
10-15	Neurasmus Meeting 2014
September	
12-14	Entheo-Science Congress 2014 (http://entheo-science.de/en)
17-20	25th European Students' Conference (http://www.esc-berlin.com/)
25	28. Treffpunkt Medizintechnik "Biologisierte Medizintechnik" (http://www.healthcapital.de/tp-med)
October	
18-21	27th Congress of the European College of Neuropsychopharmacology (ECNP2013) (http://www.ecnp.eu/)
19-22	Annual Meeting of the German Society for Clinical Neurophysiology and Functional Imaging (DGKN) (http://www.dgkn-kongress.de)
29	World Stroke Day

January PhD Admissions

The Admission Committee meeting on March 11, 2014, admitted nine new PhD students joining our program. We warmly welcome: Luisa Hasam (Kovacs), Diana Hoffmann (Poulet), Judith Houtman (Heppner), Piotr Krzywkowski (Heppner), Apoorva Madipakkam (Sterzer), Aliénor Ragot (Holtkamp), Karl Schoknecht (Heinemann), Gülçin Vardar (Rosenmund) and Stefan Wendt (Kettenmann). Apoorva and Gülçin are sucessful applicants of last year's NeuroCure scholarships.

Neurasmus Meeting 2014

From July 10-15, Berlin will host this year's annual Neurasmus meeting. Besides board meetings, social events and a scientific program including presentations of Master theses have been organized by the Berlin students.

Neurasmus Graduations

The second cohort of the 2012 Neurasmus students will graduate this August in Bordeaux. Congratulations from Berlin! The 2013 students will leave Berlin for Amsterdam, Bordeaux, or Coimbra. We wish them all the best for their second year.

Berlin Neuroscience Forum (BNF) 2014

The biennial Berlin Neuroscience Forum is back this year! Starting on June 12, researchers and students have the possibility to present their scientific work. Read more on: http://www.bnf-info.de.

Imprint

Charité NeuroScience (CNS)
Corresponding Address
Charité – Universitätsmedizin Berlin
International Graduate Program Medical Neurosciences, Charitéplatz 1, 10117 Berlin
ralf.ansorg@charite.de, t: +49 30 2093-4585
f: +49 30 2093-4590

Contact
cns-newsletter@charite.de

Editorial Staff
Ahmed Khalil ***(ak)***, Apoorva Rajiv Madipakkam ***(arm)***, Betty Jurek ***(bj)***, Bettina Schmerl ***(bs)***, Claudia Bentz **(cb)**, Constance Holman ***(ch)***, Carla Wood ***(cw)***, Judith Houtman ***(jh)***, Laura Empl ***(le)***, Luke Tudge ***(lt)***, Marietta Zille ***(mz)***, Veronika Lang ***(vl)***, Yasmine Said ***(ys)***

Proofreading
Ahmed Khalil, Apoorva Rajiv Madipakkam, Constance Holman and Luke Tudge

Layout and Typeset
Viktoria Stoiser

Cover
Betty Jurek

Contributors
Ana Luisa Piña, Andreas Antonios Diamantaras, Ann-Christin Ostwaldt, Rick Hellmann