The Brain on Wealth and Welfare

‘Money on my mind’ is not just the title of Sam Smith’s 2014 hit, it also happens to be the theme of our last issue for 2015. In this installment of the CNS Newsletter, we cover how poverty affects brain development, how we process rewards, why we gamble and of course, the latest buzzword – “neuromarketing”. As you flip through the pages, you will find out how a piece of paper has gained complete control of our minds and lives.

Can money really make you happy? You might be surprised after reading the articles on pages 12 and 13, which delve into the tricky relationship between wealth and happiness. Doing our own bit of investigation, we asked you what you would do if you suddenly came across a great deal of cash. Your answers (on page 19) made us laugh (and think) hard. Would money matter any more or less, if you lived in the happiest country in the world (see page 14)?

As the holiday season approaches, many of us will be hopping on airplanes to visit home or spend a relaxing winter break somewhere that gets more than seven hours of sunlight a day. In this issue, Dr. Harebrained explains why some of us have an irrational fear of flying and what the aviation industry’s latest plans are for their passengers.

Finally, we are very sorry to announce that we will be saying goodbye to our incredibly gifted graphic designer, Viktoria Stoiser, who has been with the CNS team since early 2011! For 19 fantastic issues, Viktoria poured her creativity and expertise into the CNS and is the reason our newsletter looks so professional today (her exquisite online portfolio is on www.viktoriastoiser.com). We cannot thank her enough for her efforts and wish her the very best for her future.

We will be giving the newsletter a new look and feel next year. Until then, we wish our readers a happy holiday season and see you again in 2016!

Ahmed Khalil and Apoorva Rajiv Madipakkam
Editors-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, 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 “The Emotional Brain”. So, what are you waiting for? Start the engine of your mind and get going! Trust us, it’s worth participating! Send your contribution to cns-newsletter@charite.de to win. Deadline for submission for the next issue: February 28, 2015.

This issue’s winner is Meron Marcos who wrote a thought-provoking piece about the distressing reality of monetary compensation in the life sciences (see page 9) ... Thank you very much for your contribution!
Money, Poverty, and Developing Brains
A Cow for a Banana?

Before money was invented, humans bartered: exchanged goods and services with each other.
- “I will give you 500 bananas for a cow”. These negotiations took time and lacked transferability and divisibility, making trade inefficient and not necessarily fair.
- “I will give you one banana for half a cow”. In order to facilitate trade, in China, ca. 1100 BC, small bronze replicas of goods were used as a medium of exchange. These then evolved into round metal objects: coins [1]. It was in Turkey, ca. 600 BC, that the first coin currency was minted, while in China, the transition to paper money had already taken place. In 1200 AD, the idea of paper money was introduced in Europe. And the chain reaction started: the first money transfer via telegraph in the 1860s, the first credit card in 1946, then online banking and recently, in 2014, the bitcoin [1]. So it goes: from tangible goods with intrinsic value to objects with conceptual value to the new era where value exists in the cyberworld.

Dr. Jekyll and Mr. Hyde
Money not only represents value, but is also unit to account, a medium of exchange, and its accumulation, in one way or another (income, assets, real estate, etc), results in material wealth [2]. Wealth, Dr. Jekyll, can only be understood in terms of its counterpart: poverty, Mr. Hyde. To assess these two states, socioeconomic indicators such as income, health, nutrition, sanitation, and education, are considered. But, what is poverty? Does poverty mean the same thing worldwide?

Poverty Has Many Faces
The concept of poverty and the factors that delineate it have evolved over the past few decades. A definition provided by the World Bank describes poverty as a “pronounced deprivation in well-being”, which involves low income and the inability to cover basic needs.

Yet, the way that poverty is regionally experienced depends on the social context, referring to how wealth distribution is perceived in a particular place. For example, a person could be considered impoverished if they cannot live up to their society’s standards. This is known as relative poverty [3]. In contrast, the concept of extreme poverty encompasses universal basic needs, such as food, water, sanitation facilities, shelter, health, education, information, and access to services [4].

Mr. Hyde and Cognitive Abilities
Worldwide 1.2 billion people live in extreme poverty [5], resulting in deleterious living environments and poor health [5]. Even though many aspects of human existence are hindered by poverty, special attention has been brought to the impact that socioeconomic adversity can exert on brain development and function, particularly in children.

Early life experiences are fundamental for neural development. Therefore, researchers have assessed the effects of poverty on children’s cognitive abilities, such as language, memory, and emotional processing [6]. These studies describe a lag in school performance (IQ tests scores, dropouts, years of education) in children coming from low income families [7, 8].

Parental Influence
Recently, an extensive study with 1099 participants evaluated possible associations between cortical development and two socioeconomic factors: parental education and family income. In this study, the authors performed structural magnetic resonance imaging analysis, assessments of genetic ancestry, and tests to evaluate working memory, picture vocabulary, and oral reading recognition.

Results show that higher parental education (number of years of study) is associated linearly with increased children’s total brain surface area. Differently, higher family income is associated logarithmically, so that one-dollar increments in the lower end of the spectrum of family income resulted in greater increases in brain surface as compared to the higher end [6].

The mechanisms through which socioeconomic status may be linked to brain structure remain unclear. However, factors such as family stress, cognitive stimulation, toxin exposure, and nutrition, could play a role in pre- and postnatal experiences, and might contribute to the observed differences in brain structure and cognitive development [6].

Wrapping Up
While socioeconomic disparities and poverty may have an effect on cognitive functions and brain development, they do not lead to an immutable trajectory [6]. Meanwhile, the first World Health Organization millennium goal is to eradicate extreme poverty and hunger. Whether poverty is an absolute determinant for brain development remains unclear, however, its effects are there for researchers to discover. Should we now consider poverty a medical problem?


Dr. Jekyll and Mr. Hyde, Chicago: National Prtg. & Engr. Co

Source: http://bit.ly/1OhRpEc

Luisa A. Hasam
PhD Student, AG Kovács
Processing that Money
Physiology and Pathology of Reward

Many brain structures are involved in reward processing. They interact in complex ways to help us assess the pros and cons of everyday incentives. When it comes down to it, money is nothing more than a reward. So what happens in the brain during reward processing? And can it go wrong?

The Cortico-Striatal Circuit
Reward processing can be divided into anticipation and consumption. When anticipating a monetary reward, the ventral tegmental area, through dopaminergic projections, activates the nucleus accumbens (Nacc). This alerts us that a reward may be in reach. The activation of the Nacc happens regardless of what type of reward a person might anticipate (e.g., money, social reward, etc). As such, the activation of the Nacc is considered a general reward predictor [1,2].

Things change once we obtain the money. Reward consumption leads to different patterns of activity according to the reward’s subjective worth. Rademacher and colleagues found that obtaining social approval activates the amygdala whereas monetary rewards activate the thalamus. Increases in subjective reward value increase thalamic activity. As such, the activation of the thalamus following monetary reward shows that we consider money more valuable than social appreciation [3].

Finally, the frontal cortex is involved in judging the obtained reward. It evaluates the outcome: was this a success or not, did we get the amount of money we expected? If behavior needs to be changed, the medial prefrontal cortex may send glutamatergic projections back to the Nacc and thus works as a “steering wheel” that directs and focuses our appetitive impulses [4]. If you zoom out, this shows that reward processing involves an entire brain circuit, the so-called cortico-striatal circuitry.

The Nacc – A Common Hotspot
Dysfunction in reward-processing abilities plays a role in various diseases, including pathological gambling (PG – see also Gambling Addiction – What’s The Deal? on page 5), attention deficit hyperactivity disorder (ADHD), and drug addiction. Interestingly, these share a common alteration – hypervigilance of the Nacc. Both drug addicts and patients with PG show diminished Nacc activity during reward anticipation. In children with ADHD, Nacc activation negatively correlates with the severity of ADHD symptoms [5,6]. This indicates that altered activity of the Nacc might be a common hotspot implicated in a large spectrum of disorders.

It would be nice and easy if one could link such disorders to dysfunction purely in the Nacc. However, we are talking about a circuit; the function of several brain areas involved in reward processing can therefore be impaired within a given disorder. In addition to Nacc dysfunction, drug addicts also display a less complex activation of frontal areas during reward evaluation. Areas such as the orbitofrontal and the prefrontal cortex both show low sensitivity to monetary rewards compared to healthy controls. This indicates that drug addicts also have a general disruption in their frontal neuronal networks, which is associated with impaired motivational perception and disrupted inhibitory control [7].

The Young Brain
Appropriate reward processing is not a stable and fixed ability with which we are born. In fact, distinct aspects of reward processing are modulated as we grow older. Bjork and colleagues showed that adolescents and young adults display differences in the initial reward processing steps. During anticipation of monetary rewards, adolescents show decreased activation of the right ventral striatum as compared to young adults.

This shows that adolescents have a differential motivational response towards rewards, by which they display a diminished ability in discriminating between non-incentive trials and high-gain trials. This hypo-functional activity reflects a circuit that still needs further development. The underdeveloped reward-processing circuit has been related to the risky behavior (“living on the edge”-kind-of-mentality) often seen in young people as well as increased vulnerability to substance abuse at this age [8].

Money on My Mind
So what can we take from this? Being able to rationally predict and assess reward is of immense importance, as deficits in this ability occur in several diseases. Nevertheless, an appropriate reward response is not something we are born with but rather something that is adapted with age. The steps in processing monetary rewards are not different from any other reward, yet the valuable aspect of money ultimately does affect other brain structures when compared to more “boring” rewards such as social appreciation. Together, this is rather astonishing, because even when looking into our neurobiology we cannot escape the fact that many of us indeed have money on our minds.

[8] Bjork et al., J Neurosci, 2004
What’s The Deal With Gambling Addiction?

Gambling represents a serious behavioral addiction that can wreak havoc on an afflicted individual's life. The picture is an infamously common one: a well-dressed, gutsy man sitting at a blackjack table, throwing in his cash, going in with everything... and losing. Is it the suspense, or the expectation of big fortune that fuels him? In any case, what is obvious is that gambling has become a problem, and a big one at that.

Pathological gambling (PG) refers to persistent and maladaptive gambling associated with devastating psychosocial and familial consequences that can culminate in suicidal behavior. Spanning both impulsive and compulsive qualities of gambling, PG is generally considered an impulse control disorder. Especially during periods of stress or low mood, the urge to gamble can be overwhelming. In the general population, lifetime prevalence may be as high as 5% and is often associated with significant psychiatric comorbidities [1].

The Usual Suspects

The neurobiological underpinnings of PG have been relatively well defined. PG, similar to other behavioral “addiction”, likely relies on both whole-brain as well as local abnormalities. In general, current knowledge holds that (pre)frontal areas serve to “modulate” affect and motivated behavior that are driven by subcortical regions, in networks that are more commonly referred to as frontal-striatal pathways. Imaging studies in patients with pathological gambling have shown widespread structural and functional disturbances in these pathways [2], supporting links between pathological gambling and deficit self-regulation.

Dopaminergic neurotransmission in the nucleus accumbens (see also “Processing that Money” on page 4) also comes to mind. The prediction of reward makes dopaminergic neurons in this highly plastic brain area fire. Predictably, PG has been associated with impulsivity and novelty seeking, two personality types that are also influenced by dopamine neurotransmission in reward-sensitive areas [3].

Other Neurotransmitters Implicated

Dopamine is not the only player on the scene of PG. For instance, the serotonergic system is well known for its modulation of impulsivity and personality. Glutamate and noradrenaline have also been implicated in PG. Downstream mechanisms rely especially on opioid transmission to mediate the subjectively rewarding properties of gambling.

Overall, candidate gene approaches have identified several dopamine- (DRD2-DRD4), serotonin- (5-HTTLPR) as well as glutamate- (NMDAR1) related genes in the pathogenesis of gambling. Unsurprisingly, PG runs in families.

DOPAMINERGIC DRUGS CAN CAUSE PATHOLOGICAL GAMBLING

In line with theories linking dopamine to misguided decision-making, 2–7% of patients on dopaminergic replacement therapy for Parkinson's disease (PD) develop PG [4]. Since dopamine is too big to cross the blood-brain barrier, its precursor molecule L-dopa is administered to boost dopamine synthesis in the central nervous system. However, the staggering association between dopamine therapy and PG is not well understood, since not every patient on this treatment becomes a pathological gambler. At least in PD patients, PG likely arises from abnormal reward-based learning and reduced impulse inhibition that occur in the framework of excessive dopamine signaling [4].

Treatment of Pathological Gambling

Many possible treatments have been suggested for those suffering from PG, yet evidence of their efficacy is mixed at best [5]. In general, patients receive either psychotherapy-based approaches or medication. For instance, behavioral therapy involves exposing patients to gambling-associated stimuli (such as an image of a casino or poker chip) and practicing strategies to reduce their urge to gamble. On the other hand, cognitive behavioral therapy tries to change a patient’s attitudes and beliefs surrounding gambling.

Conclusions

PG is a very serious mental health problem that is often attributed to character flaws and individual weakness. However, like all psychiatric disorders, upon closer inspection we see that it is a complicated condition – a consequence of detrimental learning experiences coupled with biological predispositions. Since efficacious treatment is still lacking, as they say, further research is definitely needed.

[1] Petry and Armentano, Psychiatr Serv, 1999
Neuroeconomics: How Our Brain Decides

We make decisions each and every day of our lives – be it choosing a restaurant or making major life-changing decisions. Neuroeconomics is a field of study that deals with understanding the human decision-making process, i.e. how a single choice is made from different alternatives. It combines different fields such as neuroscience, behavioral economics, and cognitive and social psychology to elucidate the interplay between economic behavior and neural mechanisms [1].

Rational Decisions

One of the major factors influencing decision-making is uncertainty. Many decisions such as gambling, betting, or investing in stocks, involve uncertainty or insufficient knowledge about how choices lead to outcomes.

Daniel Bernoulli in 1738 first proposed the Expected Utility Theory to explain decision-making under risk. He stated that decisions are determined by the overall utility value (risk or reward) of the individual options. For example, choosing to pursue a PhD in Neuroscience can either lead to a well-paying job as a professor or a lifetime of repaying debts. The alternative, getting a job right after obtaining a master's degree, also has an uncertain outcome – you could rise up the ranks at a growing pharmaceutical company or eventually be replaced by someone with more qualifications. The Expected Utility Theory states that we estimate the probabilities of each of these outcomes and decide for the option with the highest probability of a favorable outcome.

Cognitive reasoning, subjective biases, and emotions deeply influence whether our decisions are rational or not. There are several interesting theories on the importance of decision-making and rationality. One curious satirical paradox is called Buridan's ass paradox: an entirely rational donkey standing exactly between two equal stacks of hay will starve, since it cannot make a rational decision to start eating either one or the other!

Irrational Decisions

An alternative to the Expected Utility Theory used to explain decision-making under risk is called the Prospect Theory, proposed by influential economists Daniel Kahneman and Amos Tversky. When faced with a decision consisting of two options leading to the same outcome, this theory posits that the end result (the amount or probability of potential gain or loss) is irrelevant, it's the way the options are presented to us that determines our decisions. For example, many people avoid working overtime because they would have to pay more taxes – the benefit of making more money (after taxes) is nullified by the idea of "losing" money by paying taxes. This seems completely irrational, but keep in mind that, emotionally, losses affect us far more strongly than gains [2].

Making Up Our Minds

Various studies have shown the involvement of different parts of the prefrontal cortex (PFC) during decision-making. The PFC plays a role in reasoning, planning, and executing a course of action with the available information. Neurons in the orbito-frontal cortex, the part of the PFC that lies directly behind our eyes, are active when monkeys choose between two kinds of juice. The utility of the food items and the firing rate of the neurons are directly correlated, indicating that neurons make comparisons between different options so we can choose the one with higher value [3].

Another study suggested the engagement of two brain networks during value-based decision-making. One network evaluates the available options and the other, which provides cognitive control, maintains our focus on the goal despite distractions and guides us to ultimately decide. In situations involving known risk, the insular cortex is highly active. Also, the dopaminergic system is activated in cases where unexpected reward occurs [4].

Deciding to be Selfless?

In the context of cognition and decision-making, altruism remains a puzzling human behavior. From an evolutionary point of view, our brains have been designed for rational and sophisticated behavior in a competitive environment resulting in selfish benefits. Empathy and compassion are the main motivators of altruism. Nurses, teachers or care takers of disabled or elderly persons often tend to put the needs of their patients, students, and clients first. Fear could also be one of the driving forces behind altruism. For example, helping others could be a way of ego defense, to divert our attention from our own problems or anxieties. But irrespective of the motives, an altruistic act gives us a euphoric feeling or ‘helper’s high’ that leads to good mental health and greater longevity [5].

[4] http://ti.me/1WVu7h

Aarti Swaminathan
PhD Student, AG Schmitz


DECISION MAKING IS A RISKY BUSINESS!

HUMANS ARE LOSS- AVERSIVE
To Buy or Not to Buy
How Consumers Deal with Risk

“Risky” might not be the first adjective that leaps to mind to describe shopping, except perhaps in very extreme cases of fraud or debt. Certainly, excessive spending can cause damage, such as over-spending or buyer’s remorse. But what about the occasional purchase? Because of the large amounts of money at stake in the consumer goods industry, a great deal of research effort has evolved to understand how consumers make decisions about their purchases.

Studying Purchasing Decisions
Classically, the study of purchasing decisions has been the domain of economics. Economists study shopping as a problem of 1) the benefit that the purchase will be satisfying, 2) the cost of the item, and 3) the risk that the item will be flawed [1]. This risk can take several different forms depending on the purchase.

When economists study this problem, they present study participants with word problems that list out the cost of an item, the likelihood it is defective in some way (known risk), and the level of uncertainty about the purchase or ambiguity of the information. Subjects can then decide whether to purchase an insurance policy for their purchase with some cost. The amount of money the participant spends on insurance tells you something about how comfortable that research subject is with “risk” in their purchase [1].

For anyone who has regretted a purchase, it is easy to appreciate that this strategy has elements of the real thing, but does not always tell the full story. Indeed, several studies have shown that although people consider the risk of a bad outcome, they tend to prefer known risk to uncertainty, or to choose a riskier proposition when their information is incomplete [1].

Risky Choices
What the risk actually is may vary based on the type of purchase as well as the purchaser. In one study that focused on how the millennial generation of consumers evaluates risk in wine purchasing, the authors found that survey respondents between the ages of 21 to 29 were much more concerned about the potential risks of buying the “wrong” wine than older survey respondents [2]. Younger purchasers relied more heavily on the wine’s label and a display of any awards it won than their older counterparts to mitigate the risk of purchase and make their decision.

While a useful tool, surveying people about their purchasing habits can only go so far. In a more hands-on approach to the risk-benefit question, Knutson and colleagues from Stanford University tested the economics cost-benefit purchasing model using functional magnetic resonance imaging (fMRI) [3]. Their experimental paradigm used the Save Holdings or Purchase (SHOP) task, in which subjects were given USD$20 either to spend on items viewed in the scanner or to keep at the end of the task. Products shown to the subjects in the scanner were available at a 75% discount from their normal retail price to entice people to buy them.

The authors observed activations in the nucleus accumbens that correlated with product preference, while the medial prefrontal cortex and insula were activated in response to price information. Ultimately, activation in all three regions predicted the products that the participants purchased in the end. The nucleus accumbens activity predicted purchase from the moment the product’s identity was revealed, and the medial prefrontal cortex and the insula predicted purchase from the time point of the price information [3]. These data support the observation in economics that people have an immediate emotional reaction to potential costs and benefits from a purchase that later influence their decision.

The Real World
Although fMRI with actual purchasing takes the decision-making process to a closer level of realism than the classical economics survey studies, Dr. David Lewis of Mindlab International has taken the study of shopping out into the real world [4]. Dr. Lewis and his marketing research firm have conducted studies of shoppers using video glasses and physiological monitoring to follow people on an actual shopping trip through real stores at different price ranges, recording which products and visuals evoked a spike in both heart rate and brain activity, or a so-called “moment of euphoria”. Although these moments happen every few minutes, they do not necessarily correlate with the person’s expressed interest in the products [4].

Better understanding of these spikes of excitement and the way people weigh cost-benefit decisions while shopping is already changing the layout and design of retail stores. As neuroscience and the emerging field of neuromarketing delve deeper into how people make decisions, it makes you wonder what the stores of the future will look like!

Stock Market Psychology

You may not know it, but an entire psychological field seeks to understand the faulty decisions that often occur in the stock market. You probably think that such decisions are based on rational and critical evaluations of pros and cons. Well, not really.

Judgments made in the financial world are often heuristic and final decisions are rarely based on rationality. The decision to either buy or sell a stock can be blurred by cognitive illusions and altered by the person’s state of mind. Several types of decision-altering illusions exist. Two of them include Extrapolation and the Gambler’s Fallacy. Extrapolation involves giving recent events too much importance when making a decision about what might happen in the future, e.g., referring to previous stock market patterns and thinking they will stay the same. The Gambler’s Fallacy involves the incorrect prediction that a trend will reverse, e.g., anticipating that a good stock run will soon end. Extrapolation is seen in less experienced investors whereas more seasoned investors tend to be victims of Gambler’s Fallacy.

With respect to the state of mind, it eventually comes down to the prospect of either a profit or a loss. Humans are generally aversive to regret and loss. In fact, we are twice as sensitive towards loss as we are towards profit – a state of mind strongly driven by fear and anxiety [1]. This messes up our ability to make rational decisions.

Taken together, stock market psychology involves choices based on illusions and feelings. This approach is rather astonishing, given that stockbrokers juggle quite a lot of money on a daily basis. Nevertheless, making decisions in such an uncertain environment is a risky business. There is hardly any logical way to predict the outcome [2,3].


How Much Does a PhD in Neuroscience Cost?

A doctorate in any field is a significant undertaking both intellectually and financially. In recent years, the costs of PhD students are increasingly borne by the primary investigator as part of a grant proposal, while the number of graduate students supported by individual fellowships has remained relatively constant [1]. In the US for example, research grants funded about 40% of all biomedical sciences PhD students in the 1980s and this figure had risen to 70% by 2007 [2]. National Institutes of Health statistics also showed that very few PhDs in the US were funded out of pocket, with at least 96% of PhDs receiving full funding [2].

One aspect of neuroscience education cost that varies quite widely by country is the amount of money required for tuition. Based on a search of program websites, in the US, tuition can range from USD 30,000–80,000 for the duration of the program. Depending on how the university charges its students and the number of full time semesters required. In Germany, on the other hand, tuition from the university’s side can be as low as 200-300 euros per semester, and the bulk of the cost of a PhD is for the stipend/salary that pays living expenses and supports the student during the training period.

Comparing for example Germany and the US, the cost for the principle investigator is quite different because US tuition is two orders of magnitude higher! One might expect this to have a corresponding impact on the number of PhD students in the two countries, perhaps with fewer being accepted in the US where they are relatively more expensive. If anything, the trend is reversed. According to a 2011 article in Nature magazine, the number of PhDs in the US increased by 2.5% from 1998 to 2006, while the number of doctoral graduates in Germany remained virtually the same [3]. As neuroscience funding gets more and more competitive in both Europe and the US, while the numbers of scientists entering the pipeline increases, one wonders what the future will hold for the cost of a neuroscience PhD [4].


Lauren Elizabeth Mamer
PhD Student, AG Rosenmund

Henriette Edemann Callesen
PhD Student, AG Winter
Renumeration in the Life Sciences

Can I fuse my passion for research with a worthwhile and financially secure living? This is one of the most gripping questions that researchers at all levels face when becoming part of an ever-growing global academic elite of dynamic, aspiring scientists.

More and more countries of the OECD (Organisation for Economic Co-operation and Development) are building up their higher education sectors. Science doctorates, post-docs, and principle investigators are key factors for the generation of wide-scale economic growth [1]. However, the question arises as to how we compensate life scientists for their academic excellence.

Taking a closer look at the importance of salaries in neuroscience becomes even more crucial in the light of global ‘over-production’ of science graduates [1]. Nowadays, scientists are increasingly being exploited as a cheap working force derived from a never-ending fountain of highly-skilled doctoral students and post-docs, allowing countries to develop their higher education system and general economy by paradoxically investing as little as possible into compensation of academics.

Salaries in Europe and the USA
The Scientist’s 2014 web-based survey of compensation of life scientists gathered information from over 5334 individuals ranging from graduate students to professors in various life science sectors [2]. The survey revealed differences in income between different sectors, genders and institutions. European life scientists annually earn US$68,361 on average compared to US$99,011 in the US.

This regional discrepancy (in both academia and industry) is compounded by sector-specific differences in academia. Figures for academic neuroscientists in the US indicate an average salary of US$102,770, which is close to the average payment scale. Molecular biologists earn an average of US$77,970 and scientists working in drug discovery and development are more highly compensated – up to US$143,544.

Those working in academia make 30% less income in both Europe and the US compared to industry employees. Interestingly, researchers in the US working in specific areas in both academia and industry, such as genomics and biostatistics, had a 13% higher pay compared to the preceding year and compared to their colleagues in other disciplines. This indicates that employment in specific sectors with larger demand tends to be a ‘gold mine’ – that is, until the supply of new graduates reaches saturation. The vicious cycle continues because the demand for new graduates is being dictated by the amount of money (from research grants) available for paying them. This allows group leaders to recruit as much cheap labor as they want without considering the fact that not enough senior positions are available in the job market to keep these people employed in academia in the long-run [3].

Other fundamental factors affecting life scientists’ salaries are age and experience, consisting of a leap in salary by up to 20% for every additional 5 years of experience. Remarkably, gender is still another dismaying aspect of salary inequality in the life sciences in the highly-developed countries of the 21st century. The survey revealed that European male scientists in high positions earn up to US$13,000 more than their female counterparts – a situation which is even worse in the US, where the discrepancy can reach up to US$28,000 [2].

Intellectual Freedom vs. Lifestyle
Looking at future compensation in the life sciences, we will probably continue to face a rather grim picture of ‘brain drain’ from academia to other institutions or to countries with a smaller salary gap [4]. Insufficient compensation and/or insecure job positions currently discourage scientists from staying in academia (only 6% of PhD students do stay) [5].

Promotion of progressive PhD programs that equip researchers with transferable skills that can be applied not only in academia but also in the wider job market is nowadays a pivotal part of German scientific training [6]. This increases the chances of circumventing the bottleneck problem of occupational demand due to educational ‘over-supply’ of researchers that ultimately leads to dwindling salaries in the academic life sciences.

Academic scientists at all levels have to face the reality that salaries in the future will most probably continue being unstable and less lucrative than in other sectors. It remains the individual decision of every scientist as to how to weigh academic intellectual freedom with monetary compensation.


**Neuromarketing**

**Simple Sales Strategy or Brain Manipulation?**

When you go shopping, do you end up buying much more than you had planned? Our mind is active and receptive all the time to different auditory, visual, and even olfactory stimuli. Companies and sellers know exactly how to get our attention. Have you noticed for instance how you have to cross the entire store just to go to another floor or to reach basic items?

Marketing has always sought to understand not only the needs of consumers but also their preferences and emotions in order to improve advertising and sales. Given the difficulties that marketers have faced trying to measure our minds and especially our emotions, the new discipline ‘neuromarketing’ has emerged.

**Inside the Consumer’s Brain**

Neuromarketing is “a multidisciplinary field of research whose aim is to investigate the consumer’s reaction to advertisements from a neuroscientific perspective” [1]. In other words, neuromarketing applies specialized and well-known techniques in neurosciences such as electroencephalography, galvanic skin response, electromyography, functional magnetic resonance imaging, and eye tracking in order to measure and analyze emotion, attention, and the memory of consumers and try to unravel how our brains decide what to buy [1].

At least 70% of new products launched worldwide, tested by traditional techniques like interviews or surveys, fail within the first six months [2]. This happens because only 15% of our decisions are made consciously, whereas the rest is decided by our subconscious [3]. Neuromarketing seeks to be more accurate than traditional methods by measuring the unconscious and spontaneous reactions of the consumers when they are confronted with diverse stimuli.

**Neuromarketing vs Neuroeconomics**

Neuromarketing is often compared to and confused with neuroeconomics. While neuroeconomics focuses on individual and group choice, judgment, and decision-making, neuromarketing investigates how a distribution of choices can be influenced or shifted from one pattern to another [4].

This is where I start to wonder about the real purpose of neuromarketing. It is not any more about understanding our minds in order to satisfy our necessities, but about finding a way to manipulate our choices simply to boost consumerism. Neuromarketing is not necessarily intended to benefit the consumer by offering better products. Its main purpose is to enrich companies or sellers at the expense of the consumer.

**Neuromarketing’s Challenges**

Being a very recent discipline, while promising, it faces some challenges to overcome. First, implemented techniques require high cost equipment, which makes it unapproachable for small companies. Besides, these techniques can be also very invasive for the participants of the study.

Second, there are no defined standards yet for either measurements or analysis. Thus, any result can change based on the methods applied, measured parameters, and most importantly, the analysis of the data, depending on the scientist behind the research.

Personally, I think ethics is the major problem to be solved in neuromarketing. On the one hand, data is taken directly from our brain and I am not sure how comfortable people feel being literally “read”, particularly because this information could be used widely for many other purposes, besides sales, as you can imagine. On the other hand, neuromarketing techniques are closely associated with the manipulation of our brain and, as already mentioned, we – as consumers – don’t even benefit from it. Therefore, if this field wants to survive, grow and attract people, it should start redefining itself and offering a real contribution to society.


**Stipends for Masters and PhD Students**

Master’s and PhD students at the Humboldt University in the transition phase between the end of their master’s degree and the start of their PhD or who are about to complete their doctorate and wish to conduct a postdoctoral project are eligible to apply for the Humboldt Research Track Scholarship and Humboldt Postdoctoral Scholarship respectively.

**Humboldt Research Track Scholarship:** 800 EUR/month for up to six months. Further information: http://bit.ly/1KdRLrv

**Humboldt Postdoctoral Scholarship:** 1500 EUR/month for up to six months. Further information http://bit.ly/1Ly7nrQ

**Deadline:** January 15, 2016 for funding starting April 1, 2016

Laura Moreno Velasquez  
PhD Student, AG Schmitz

Source: Laura Moreno Velasquez
Berlin’s Neuromarketing Startups

Berlin is known as a startup factory, with many young businesses cutting their teeth here. With neuromarketing perhaps one of the youngest fields on the block, it is not surprising that it is well represented in this city.

Apple Emotions

When most people hear the term “neuro”, a pretty image of a brain with colourful patches pops into mind. Functional Magnetic Resonance Imaging (fMRI), otherwise known as “brain scanning”, has become the poster child for all things neuro, representing neuroscience’s sexy side in the public eye. That is marketing appeal just waiting to be tapped, and that is exactly what the startup INCORE has done.

They have capitalized on the appeal of fMRI by offering it as a neuromarketing service, proposing that market research on consumers inside the scanner will lead to a deeper understanding of how brands are perceived. With Dr. Simone Kühn of the Max Planck Institute at the scientific helm, they claim to “measure the unconscious emotional reactions of target groups” via fMRI [1]. They have done studies on brand perception of international giants such as Coca-Cola and Apple, with results suggesting that Apple users have an emotional reaction to the brand which is absent from Samsung users. Obviously, this is no cheap service, but perhaps the appeal of brain scanning will be strong enough to draw business in.

Measuring “Unconscious Emotions”? FMRI might be prohibitively expensive for most companies, but there are cheaper alternatives out there. Berlin seems to have an abundance of attention-modeling startups, offering scientifically grounded analysis of media design, such as websites, to improve layout and maximize profits. Attention determines where we look and for how long, and companies are obviously keen to get this right when they are trying to communicate with a customer via a webpage or advertisement.

One way to measure attention is with eye tracking. By directly measuring where users look, you know what has grabbed their attention and what has not. The startup Emolyzr does just this, in combination with other measurements such as electromyography and skin conductance. Specifically, Emolyzr claims to measure the “unconscious emotions” of users, although what exactly they mean by this is not clear [2].

Attention: With or Without Humans?

Although cheaper than fMRI, eye tracking is also not without its costs. Another startup, Attensee, replaces eye tracking with mouse exploration [3]. Users are presented with a blurred version of the website, and as they move their mouse cursor around the screen a small portion of content is revealed. This is cheaper and faster than eye tracking, while still returning real participant data.

However, in the dog-eat-dog world of marketing, it is all about money and speed, and the startup EyeQuant attempts to push both of these to the bottom line by removing the participant altogether [4]. Instead of relying on human subjects to indicate what is attention grabbing, they implement a fully computational saliency and attention model, reducing both time required for a result (allegedly within seconds) and potentially cost as well. Of course, the highly complex model behind EyeQuant is itself validated against human eye tracking data.

But even so, modeling human behavior is a tricky business, and perhaps the main criticism of the method is that it is not always accurate (a claim that Attensee makes explicitly) [3]. However, with such speed and potential cost efficiency, and with saliency godfathers Prof. LaurentItti and Prof. Christof Koch on the team, it is not surprising that Google has been a client already.

Check Your Brain App

Although not strictly neuromarketing, I could not help including the nascent startup BrainModes here. BrainModes aims to make neurofeedback available to the general public via an app. On their website, they state: “We are developing the BrainModes app to visualize the brain activity of the user measured with BCI (brain-computer interface) devices, even if they have no prior experience. The visualization of brain activity is based on state-of-the-art computational neuroscience and brain imaging: a novel technology to provide detailed visualizations of brain activity based on sparse information collected with brain computer interface technology.” [5]

The idea is incredibly cool, and although they do not go into details about just what types of BCIs they will be working with, the notion that anybody could get a glimpse into the workings of their own brain via an app is tantalizing. It is unclear from their website whether the app will be commercial or not, but the team also appears to have been involved in some pretty wacky art installations involving neurofeedback. You can see a video of one of their previous projects here: https://vimeo.com/82344394

References:


James Kerr
MSc Student, International Experimental and Clinical Linguistics

www.medical-neurosciences.de
Does Money Make You Happy?

We live in a world where happiness is advertised to us as reachable by material things. Be it a big house, a new car or a vacation in the Caribbean, we are promised that we are only one step away from greater happiness by simply buying things. There is no doubt that money controls our life to a great extent. But does money truly make us happy?

Money Matters – to a Certain Degree

The relationship between money and happiness has fascinated researchers for many years. Fifteen years ago, it was shown that there is a high correlation between the general wealth of nations and the mean reports of subjective well-being (SWB), the standard measure for happiness. However, within each nation, there were only small correlations between the two (see also “The Happiest (Or Wealthiest?) Countries On Earth” on page 14). Moreover, an increase in individual income did not have a clear effect on SWB and recent economic growth was followed by only a small rise in SWB [1]. The study concluded that more money increases SWB when it means avoiding poverty (as the difference in SWB between developing countries and developed countries suggests) but income does not change the SWB levels over the long term.

Other recent studies have examined happiness levels with regard to SWB showing that a high income improves our evaluation of life in the rational sense, but not SWB in the emotional sense. In other words, money makes you think you feel better but it actually does not [2]. Finally, a fascinating study examined the happiness levels of lottery winners and accident victims along time. Surprisingly, after a certain period of time had passed (a year), both groups returned to their original baseline happiness levels [3]. Overall, it seems that money plays a relatively minor role in happiness – it is important to a certain degree, to provide for the basic necessities in life, but once these necessities are met, money will have almost no effect on our happiness levels.

Culture and the Money-Happiness Relationship

To understand the relationship between income and happiness, the consumption norms of a society seem to be essential. In a culture where ostensibly money plays such a large role in defining our social class, it may have a prominent effect on our happiness, and not necessarily in the right direction. People who value money highly and are materialistic tend to be less happy [4-6]. This is due to motives of social comparison, seeking power, showing off and an urge to overcome self-doubt.

These bad side effects of materialism were not only found in people with a materialistic personality, but also in people who were simply exposed enough to a consumption-promoting environment [7]. So whether money itself makes us happy or not, it is clear beyond doubt that pursuing it definitely makes us feel less happy.

Then What Does Make Us Happy?

Autonomy seems to be part of the answer. A meta-analysis with data from 63 countries showed that individualism was consistently a better predictor than wealth for happiness [8]. Many other studies emphasize the positive effect of gratitude on an individual’s happiness [9]. Grateful thinking and gratitude expression improve mood, promote savoring the good things, boosts our self-esteem, and helps strengthen social bonds and relationships.

Leading a healthy lifestyle with regard to food, physical activity, and sleep also has an effect on our happiness. Bad foods (covered in our last issue on Nutrition and Neuroscience) has a bad effect on our mood [10], while engaging in physical activity enhances self-esteem, improves our mood, and reduces anxiety [11]. Sleep also has an important role for our happiness [12] – dreaming in particular – is an important mechanism to deal with painful memories [13].

In addition, sleep deprivation decreases our job satisfaction [14].

Tips for Seeking Happiness

Overall, it seems that money is a bad focus point to achieve happiness. If you want to enhance your happiness, you should concentrate on the following:

- Do not set money as your top priority
- Express gratitude and remember to be grateful especially for the things you may take for granted
- Lead a healthy lifestyle – move more, eat healthy, and SLEEP!

HAPPINESS IS
HEALTH, AUTONOMY
AND GRATITUDE

| PhD Student, AG Sobesky |
Dan Gilbert: The Surprising Science of Happiness

In 2004, Dan Gilbert, social psychologist at Harvard gave one of the most popular TED talks of all times [1]. It was so popular because it taught us that we could synthesize our own happiness.

He started off by explaining that our prefrontal cortex evolved to develop a very important skill: the ability to imagine things that have not (yet) happened to us. With this “experience simulator”, we can imagine how happy we would be with something.

So, if we were to imagine two scenarios for our future, one being rendered paraplegic and the other being a lottery winner, we would be pretty sure that a suitcase full of money would make us happier than being severely handicapped. But what our experience simulator makes us believe is not necessarily true. Studies show that people with paraplegia and lottery winners are equally happy one year after the event.

It turns out that those important glorified life events, like romance, success in an important test, or winning a lot of money do not have such a huge impact on our happiness as we think they do.

However, what does have a huge impact is, according to Dr. Gilbert, our ability to “synthesize happiness” – to persuade ourselves of our happiness independent of perhaps dire circumstances. So something along the lines of, “I didn’t really want that job, it would have been very stressful, it’s a good thing they didn’t take me” or “I realized we didn’t really have a lot in common at that moment when she was breaking up with me!”. In Gilbert’s words, “natural happiness is what we get when we get what we wanted, and synthetic happiness is what we make when we don’t get what we wanted”.

So is synthetic happiness the inferior type of happiness, born from self-pity in a miserable situation? Gilbert begs to differ. He states that this type of synthetic happiness is as fulfilling and important as natural happiness.

The scientific evidence he presents for his belief is the free choice paradigm: people have to rank some objects (e.g. pictures) according to how much they like them. Then the subjects are given one of the objects as a prize, not the best or the worst rated object, but one in the middle. A while later the subjects are asked to re-rank the same objects. What happens is that the subjects tend to rank the object they own higher than in the previous ranking. So the object that they now call their own is actually better than they thought… happiness synthesized! That’s right!

The same experiment was also performed with patients with anterograde amnesia. Naturally, after ranking the objects and being given one of them as a gift, the patients forgot all about them. When asked minutes later which object they were given, they had no clue. Still, in the second ranking they ranked their gifts higher than in the first round – without even knowing that they owned this particular object! So, these patients really truly changed their hedonic opinion about the object! Synthetic happiness is real!

However, there are certain situations in which synthetic happiness is more easily established than others are. Turns out, the freedom to change your mind does support natural happiness; however, it is the enemy of synthetic happiness.

In a second experiment, Gilbert gave study participants once more the choice between two objects (one for them to keep). The participants were then either told that they could swap the object for another one in the next couple of days or, in an alternative condition, that they were stuck with their first choice.

So what happened after a couple of days? The people who were stuck with their object, who could not change it any more, grew to like it a lot! And the people who had the chance to change it? They did not like their object at all. Why? They had too much freedom: “Should I return it? Maybe this isn’t a good one…” This condition of free choice obviously does not support the synthesis of happiness. Synthetic happiness works best if you are in a situation where there is no alternative option.

What we can all learn from this: the unconscious cognitive process of synthesizing happiness helps us change our views of the world, so that we can feel better in it. So stop worrying so much about money, success, and all that stuff! We all possess the ability to synthesize our own happiness, and this ability is stronger the more dire and desperate the situation may seem!


Ann-Christin Ostwaldt
Postdoc, AG Kimberly, Massachusetts General Hospital
The Happiest (or Wealthiest?) Countries on Earth

A few global studies have tried to assess happiness and well-being worldwide. One of them is the World Happiness Report (WHR), released by the United Nations Sustainable Development Solutions Network. The report is based on the ‘Happiness Index’ that comprises 6 variables: gross domestic product (GDP) per capita, healthy life expectancy, social capital, freedom, generosity, and absence of corruption [1].

Of course, happiness and well-being are very subjective terms that mean different things to different people and assessing them can be tricky. However, the factors analyzed in this survey are quite reasonable (see the official report online for details) and the subjects were asked to score the variables themselves. So the results seem to be rather pertinent.

Who Can Afford Happiness?
The recently published report (with data from 2012 to 2014) ranked the following countries, in descending order, as the 10 happiest on Earth: Switzerland, Iceland, Denmark, Norway, Canada, Finland, the Netherlands, Sweden, New Zealand, and Australia [1]. Nine of the top 10 countries in 2015 were also in the top 10 in 2013. Denmark, which usually ranks first in this and other happiness surveys, went down to third place on this year’s report, but with a similar score to previous years [1, 2].

I must admit I was quite surprised with these results at first. What do you mean, these are the happiest countries on Earth? The Scandinavian countries have such harsh weather with long, dark winters, a factor that contributes to the development of depression [3]. I would have expected countries typically known for their year-round warmth and smiley, light-hearted people, such as India or the Latin American nations, to be leading the pack.

Still a bit skeptical, I searched for other respected studies of global well-being and found the Prosperity Index (PI) by the Legatum Institute [4]. This study focuses more, as the name suggests, on each country’s prosperity and life quality indicators. Eight variables are analyzed: economy, entrepreneurship and opportunity, governance, education, health, safety and security, personal freedom, and social capital. Interestingly, their top 10 list is almost identical to the WHR, except Iceland ranks lower and Ireland higher (number 10). So perhaps there is some truth to these reports.

What we can immediately observe is the strong correlation between the happiness scores and the geographic region and wealth of the countries. The top 10 are all industrialized, Western nations, most of which are small or medium-sized countries in Western Europe. The geography becomes more varied as we move down the list, as the top 20 includes countries from North and Latin America and the Middle East. Another interesting observation is that the only countries in the top 10 whose currency is the euro are the Netherlands and Finland — all others have their own national currency.

If You’re Happy and Don’t Know It
But wait a minute — what about Germany? This wealthy developed country in Western Europe has an even larger economy than the countries that make up the top 10, and has the 14th highest Prosperity Index in the world [4]. How come Germany ranks only 26th in happiness, behind Panama, Venezuela, and Oman [1]? Sure, maybe Germans are just more ‘demanding’ and tend to rate their well-being lower than people of other nationalities. Or may be they are not as satisfied with their lives after all. A similar phenomenon happens in Japan: it is the 19th on the PI but only 46th on the WHR. If money were indeed the primary prerequisite for happiness, wouldn’t these countries be able to afford it?

The Million-Dollar Question
So, if not simply wealth, then what is it exactly that puts these 10 countries on top in terms of life quality? Specialists point out many reasons. In these countries, you find free healthcare, low crime rates, attention to gender equality, low unemployment rates and a socially supportive government [5]. Also, citizens are provided with generous family leave policies (long leave allowances for both parents), fewer work hours per week (around 29-33), and encouragement of work-life balance [6]. In Denmark, education is not only free, but students actually get paid to go to university [7]. A sense of collective responsibility and belonging, the ability to trust other people, the low perceived corruption, and the freedom to live as one pleases also contribute to wellness [5].

It is hard to measure and compare a subjective state such as well-being, which of course also varies according to personality and culture. But whether we trust the data shown by these studies or not, we can still learn some valuable lessons from the ‘happiest’ or ‘most prosperous’ countries on Earth. A country’s happiness seems to depend not only on wealth but also strongly on the ability to live a healthy and harmonious life in community and to balance work and personal interests. After all, it is all about homeostasis.

[7] http://wapo.st/1GHOfHm

Mariana Cerdeira
PhD Student, AG Harms

“”The Geography of Happiness” — Higher scores indicate greater life value assessed using the Cantril ladder scale. Reproduced from the World Happiness Report 2015
Money, Money, Money

Is there a word for being addicted to money? Something like ‘moneyholic’, maybe? Being addicted to money and the urge for more prosperity than we need is a delicate topic because money operates on so many levels in our lives that are emotional, unspoken, and even subconscious.

Money addiction is not very well defined but is much more complex than shopping or gambling addictions, other common disorders related to money that are hot topics for neuroscientists.

Money Just Never Seems Enough

In the 1930s, Professor Jellinek described the steps of becoming an alcoholic. Even today, the ‘Jellinek Curve’ can be used as an instrument for self-diagnosis of alcohol addiction [1]. Maybe this scheme could also help identify people having unhealthy relationships with money. Let’s give it a try:

In the pre-'moneyholic' phase, the individual is motivated by self-preservation. The more money that is gathered, the more their income tolerance increases. This initial phase starts with memory gaps, especially on tax declarations. A critical phase is entered, as in all kinds of addictions, if loss of control is prevalent. The strong urge for more cannot be resisted and this mostly results in social isolation, which is compensated by an inflated self-confidence. In the chronic phase, the affected persons degrade their own ethical values in order to meet their strong desires for more.

Piff and colleagues revealed through several different studies that upper-class individuals behave more unethically than lower-class individuals [2]. At this point, there is only two ways forward; either the individual decides to ‘exit’ the desire for more money, or the damage becomes irreversible, when even having more money does not bring any relief.

Is Money Addiction Hereditary?

Assuming money has the same potential as that of a drug, being addicted to it can be defined as “the loss of control over [money] use, or the compulsive seeking of [money] despite adverse consequences” [3]. Researchers believe that genetics contribute to 40-60% of the susceptibility of drug addiction and the remainder is due to environmental factors [4].

Kuhnen and colleagues hypothesized that genetic predispositions exist for money addiction, or, as they call it, financial risk taking [5]. They showed that variants of two genes that regulate the neurotransmitters dopamine and serotonin are significant determinants of financial risk taking. Dopamine and serotonin play a role in a plethora of different brain circuits and emotional behaviors, such as anxiety, addiction, novelty seeking, and extroversion.

It is unsurprising that the sight of money activates the brain’s reward system in a very similar way as the sight of cocaine [6]. Money determines – whether we want it or not – our existence.

Consequences of ‘Moneyholics’ for Society

The most difficult thing after diagnosing someone as a ‘moneyholic’ is how one should deal with this problem. This is especially important if the person in question is in a position of power, such as directors and investors, whose decisions affect not only their own but also other people’s lives.

So what if researchers find a causal link between a gene and the greed for money? Does this matter when a money-related crime has been committed? Similar to the big discussion of genetic precluding the concept of culpability with findings from behavioral genetics.

Personally, I wonder if the study by Kuhnen and colleagues can be seen as an artful attempt to justify things that go wrong, as in a financial crisis or when billions are made at the cost of other people’s lives. For instance, one could well say that when weapons are exported to war zones in exchange for money, it’s not the seller’s fault, it’s their genes!

Gambling Rats
Interview with Marion Rivalan (AG Cognitive Neurobiology)

The cognitive processes underlying Pathological Gambling are poorly understood, in part due to a lack of suitable animal models. Dr. Marion Rivalan has developed a gambling-like task to assess decision-making performance in rats.

CB: Could you first tell us, what is Pathological Gambling?
MR: Pathological Gambling is defined as maladaptive and recurrent episodes of gambling that are significantly disrupting the individual’s familial and personal life. While gambling is for most people a recreational activity, some individuals – approximately 0.4 to 1% of the population – increase their time spent gambling and have difficulties to stop playing even if this activity leads to major problems in their lives, most strikingly on the financial level.

Interestingly, there is a growing awareness in the society that some addictive-like behaviors can be unrelated to the intake of drugs. Pathological gambling has recently been described in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) as a non-substance-related addictive disorder.

Which processes are involved in gambling?
Whatever game you play, it will engage similar brain circuits and cognitive functions, although on different proportions depending on the kind of game. Betting on a sport team, playing poker or at a strategic board or online game, you always deal with evaluation of reward and punishment and how they combine together.

In the beginning, you might not know the outcome of the different options. The amount of uncertainty in the game can be reduced by learning processes and developing strategies. The goal of most games is to maximise your gains in the long term. Thus, one critical aspect of gambling is making decisions in uncertain situations.

In humans, functional studies have confirmed the involvement of several prefrontal cortex regions and striatal areas that are activated while people are gambling. Similar prefronto-striatal circuits are also necessary for making decisions in uncertain situations.

What test do you use to assess pathological gambling in rats?
We applied the same principle as in a neuro-psychological test developed for humans, called the Iowa Gambling Task. It is a test that mimics the complexity of making decisions in our daily lives. One of its major features is that there is a conflict between short-term and long-term benefits for each option. The original game is a card game. The contingencies of the options are arranged such that the ones associated with a higher immediate gain of money are actually the ones that will make you lose more money in the long term. This game is poorly executed by pathological gamblers, patients with drug addiction disorders or with lesions of the prefrontal cortex.

In rats, we can’t play with money, but we apply a similar principle in the Rat Gambling Task: The rewards are sweet pellets of food and the penalties are time-outs during which the animals cannot make new choices. The Rat Gambling Task lasts 60 minutes, during which the animal can learn by trial and error what the more beneficial options in the long-term are.

How do the rats behave in the Rat Gambling Task?
In the beginning, the animals do not know that the most immediately rewarding options are also the ones triggering the longest time-outs, leading to fewer opportunities in the long term to earn food. So, for the first 5 to 10 minutes, the rats usually explore and sample all their available options. Some of them may even show a specific interest in the options that are immediately more rewarding. After experiencing some of their associated long penalties most of the animals progressively switch their preferences toward the options that are less rewarding immediately, but with shorter penalties allowing them to earn more pellets during the test.

In a healthy population.
of rats, most animals are able to extract the principle and avoid the options that are less rewarding in the long term. Interestingly, about 25% of the animals do not switch their preferences and earn significantly fewer pellets during the test. These rats are named poor decision-makers and show very similar behavior to the pathological gamblers in the Iowa Gambling Task.

What is the underlying cause of bad performance in the Rat Gambling Task?
The potential underlying causes for such poor performance are numerous. It could be a lack of cognitive flexibility maybe due to a faster switch into a non-goal directed mode. The rats would rapidly designate one option as their favorite (based on its immediate gain) and not question its utility afterwards.

The anterior cingulate cortex is involved in the ongoing evaluation of options and the real-time adjustment of behavior. This brain region could be very important to be able to switch between options when more knowledge about their respective cost and benefit is known. In a lesion study, only the good performers were affected by its deletion, showing highly delayed preference for the more advantageous option. As expected, the behavior of the lesioned-poor performers was unchanged. This suggests that the poor performers might not make their choices based on deduction and therefore would not need to use this structure during the test. The same hypothesis was confirmed with an immunohistochemistry study where we found that the poor performers recruit a more restricted number of regions within the prefrontal cortex and subcortical network compared to the good performers.

In line with the idea that the more advantageous options can only be identified trial after trial through cognitive manipulation of the outcomes, we found that at the beginning of the test, the good decision makers indeed recruit a wide network of prefrontal cortex and striatal regions known to be involved in high cognitive processes. This network shrinks after the animals have found the more advantageous options and keep choosing them. Interestingly, we also found that the poor performers show a unique imbalance in serotonergic metabolism at rest between prefrontal and striatal regions which matches other aspects of their reckless general profile.

Can gambling be accurately modeled in rodents?
The Rat Gambling Task is a very close adaptation of its human version and rats behave very similarly as humans in it, which provides very good face validity to the test. Thanks to the lesioned and functional studies we have performed using the Rat Gambling Task and the very close results we obtained compared to human research on decision-making and gambling, the construct validity of our model is well ensured. This means that similar behavior but also similar brain functions are engaged in the Rat Gambling Task as they are in the Iowa Gambling Task. This allows a very good translation of results between species and for the search of therapeutic solutions.

Will it be possible to use this model for the development of pharmacotherapy?
Yes, I think so; this is indeed the advantage of developing animal models! But in the context of pathological gambling, this model is also very useful to try to understand the risk factors for the development of this pathology. In another study, we characterized the profile of the poor performers. We found that they not only perform poorly in the Rat Gambling Task but also are more sensitive to reward, take more risk in anxiogenic environments, show poor cognitive flexibility in the reversal condition of the test, and have higher levels of motor impulsivity than the good performers.

This is interesting, because this profile is seen in people who are at a risk of developing pathological gambling or drug addiction. Once we can understand this type of profile better, we could also implement behavioral therapies to prevent people from becoming pathological gamblers.

Thank you for this interview!
**MedNeuro PhD Days: Develop to Excel**

Friday afternoon, September 25, the first PhD Days meeting took place in the HGS building. It was initiated by Lauren Mamer and Luisa Hasam, two enthusiastic MedNeuro PhD students. The PhD Days are meant to create a platform for PhD students to develop soft skills in an open and informal environment.

Soft skills account for 85% of your career success [1], which was actually discovered a 100 years ago already! Only in the last decades however, people have started paying more attention to them and are today actually selecting job candidates based on these skills. Overall, it is definitely a good investment to develop your soft skills.

**First session: Presentation Skills**
The focus of this first session was on presentation skills, motivating 13 PhD students to show up and participate. With four poster presentations, six oral presentations, and some breaks with snacks and drinks, the afternoon was easily filled. The participants varied from recently started to almost finished PhD students, which gave an interesting mixture of topics ranging from master’s thesis presentations and PhD project plans to publication-ready data. Each presenter received feedback forms from the other PhD students, both on poster or slide design as well as on the oral presentation.

It was a great way to evaluate our presentation skills, to experience how our research stories land with peers, as well as to practice answering questions afterwards. After a short evaluation, we celebrated the successful meeting with pizza and beer. Apart from the soft skill practice, it was also very interesting and fun to get to know each other better.

**Missed Out?**
The PhD Days will be organized every 3 months, covering a wide range of topics. Some ideas that came up during this event: statistics, slide design, image design, mentoring, and office politics.

The setting is perfectly designed for peer-to-peer teaching, so if you have any skills you want to teach fellow PhD students, please get in touch with the organizers! Looking forward to the next PhD Days, and hope to see you there!


Judith Houtman
PhD Student, AG Heppner

---

**Neuroscience in Your Everyday Life**

**Why Is It Again that Some of Us Are Afraid of Flying?**

I read something unsettling the other day. Apparently, in the near future, we could be flying in windowless airplanes. The fuselage would be covered by a huge electronic display that allows passengers to look out into the sky around them during flight [1]. It’s good news for the aviation industry because it reduces the weight of the plane and cuts fuel costs, but what about the 5% of the population who are afraid of flying?

It turns out aviophobia, the fear of flying, is a combination of several common specific phobias (unreasonable fears of a specific situation or object) including claustrophobia, the fear of confined spaces, and acrophobia, the fear of heights. Some people are mainly afraid that the plane might crash, while others dislike the overall lack of control that passengers experience when flying. Not only are you trapped in a giant flying box, but you also have little choice regarding whom to speak to, what to eat, when to go to the bathroom, and so on. Almost half of aviophobes aren’t actually afraid of flying or its potential immediate consequences—they fear having a panic attack in an environment from which they can’t escape (agoraphobia) [2].

It turns out that the windowless plane does become a reality, it would be interesting to see how people who dislike flying react to it. I know I wouldn’t go anywhere near the thing (I’m an acrophobe who doesn’t even get on glass elevators). But would a claustrophobe feel better, looking around and seeing open skies and fluffy clouds?

Specific phobias are difficult to treat and can make people’s lives very challenging. Dutch football legend Dennis Bergkamp’s extreme aviophobia meant that he only played matches in cities that he could reach by bus or train [3]. Airlines and well-meaning friends and relatives like to remind aviophobes that flying is the safest means of travel. But they forget that all phobias are by definition irrational and usually have little to do with danger, either real or imagined.

Do you also sometimes wonder about the simple neuroscientific questions in everyday life, but don’t really feel like looking them up right away? Just mail us your question (cns-newsletter@charite.de) and Dr. Harebrained will give you his explanation in the next issue!

[3] http://bbc.in/1GQKDD1

Ahmed Khalil
PhD Student, AG Fiebach
Survey on Sudden Wealth

If you woke up tomorrow and you were a million euros richer, what would you do with all that money? Read some of the honest and hilarious replies from neuroscientists around the Charité.

Hmmmm... at first I would probably just scream. Seeing that amount of money in your hand, bank account...mind... wherever, after having to struggle every month as a student is pretty intense. So yeah, I would scream. Then, as a perfectly normal and sane person, I would call my mom. You know, the typical “hey mom, what’s up? oh, I’m just here, chilling with my 800.00 euros, no biggy” haha... just kidding, I would probably scream at her too (well not at her, to her... you know what I mean!!). Then after a loooooooooooong thought (and getting an earful from my dad saying that he wants a little) about what to do with it I decide I can go 4 ways:

1. I could go the selfish way and spend it all on clothes, shoes, bags, perfumes, jewels (starting to hyperventilate) and become a shopaholic, which would be horrible for everybody.
2. I could go the intellectual “also kind of selfish” way and spend it on medical school (which is my life long dream, weird, I know!).
3. I could go the cultural “also selfish way” and go travelling to meet new people, learn new stuff, enrich my brain.
4. Or I could go the kind “super cool” stranger way and give it to charities, buy food for homeless people, help a friend in serious economical need: just helping others. But this last one would only make me want to congratulate myself by taking selfies with my new iPhone to show the world what a good person I am (right? isn’t that what famous people do?)

And which one to choose?? Hmmmmm. well... if the world was a place were 800.000 euros would fall out of the sky then probably it wouldn’t be such a big deal and I could go the crazy shopaholic narcissist way. But since it’s not I have made my choice. I think I would go with a mixture of the three last ones. I would try to help a friend in need (which I do have), I would pay for medical school AND FINISH IT IN TIME. And then I would go toooo...hmmmmm..... Africa maybe? Cuba? South America? And not only increase my medical knowledge but also help a little around there with it. Places where maybe 800.000 euros might not do much (because let’s face it, world hunger can not be cured with 800.000 euros) but a little help, in any way, can go a loooong way.

Oh! did I forget? I would go to all those places in my newly purchased Gucci/Dolce&Gabbana shoes!!

I would donate all of the money to the Charité and demand a bronze statue of my figure to be placed near the entrance of campus.

I will change the money to 1 dollar bills and enjoy my moment sleeping on it (like Breaking Bad). I am sure that my nucleus accumbens will be insanely happy!!

Then:
1- Fly to Maldives/Hawaii
2- Visit the purest lake in the world in Iceland
3- Visit the lost city in Peru
4- Everest base camping
5- Go diving in the great barrier reef

I would first invest it in gold (doesn’t depreciate in value with market fluctuations) and a diversified portfolio to rapidly increase my immediate returns, then allocate dividends to my parents, my future, personal projects or startups, and international grassroots organizations and local community projects.

I would use the money to build a house in the countryside, and create a cultural center there with workshops and exhibitions and of course travel!!

Spend every holiday with my family in a different country.

Invest in stocks, real estate or open my own business

If you woke up tomorrow and you were a million euros richer, what would you do with all that money? Read some of the honest and hilarious replies from neuroscientists around the Charité.
Inspired by Neurology’s Greatest Narrator
A Personal Tribute to Professor Oliver Sacks

Four years ago, while doing my post-graduate medical internship, I remember sitting in the on-call room during the few calm moments I had and reading “The Man Who Mistook His Wife For A Hat”. Professor Oliver Sacks, the neurologist who wrote the book (a collection of short stories based on some of his patients), passed away in August.

There is something special about Professor Sacks, and it is not what you would expect from a world-renowned doctor and researcher. He probably was not on the verge of the “next big thing”, and the field of neurology certainly will not collapse in his absence. People like him are not known for making groundbreaking discoveries that shake the foundations of their disciplines and win Nobel prizes. Yet, his writing left an enduring impression on me and probably many others.

In those few precious moments of serenity as an intern, his books would carry me away to an entirely different world – I may as well have been reading J.R.R. Tolkien. Until that point, I had found the brain fascinating because we know so little about it, because its various foundations evade our understanding. Cases I read about or saw during medical school were mysterious, and who does not like a good mystery?

Oliver Sacks took my interest in neurology to another level. Yes, the brain is elusive and complex. But following the evidence, even when it seems contradictory or makes little immediate sense, one finds clues to interpreting its apparently chaotic nature everywhere. His elegant writing played a huge role in driving this point home – case histories so elaborate and vivid you feel like you are looking over the patient’s shoulder as they reproduce the entire landscape of a city in stupefying detail from memory.

His Holmesian approach to unraveling the secrets behind complex phenomena (and more importantly, the way he brings this thought process itself to life) is an inspiration to young doctors. I have certainly learned more valuable lessons on neurology from reading his books than from anywhere else. In fact, I have often thought to myself that if I ever end up teaching medical students, I would hand them one of his books and tell them, “This is how you take a patient’s history”.

Back then, midway through my 12-month internship, I used to think I would give anything to leave the dull routine of the night shift (it is usually hectic but that does not stop it from becoming monotonous after a while). Seeing the same handful of cases over and over again. Ordering the same tests. Scribbling this and that into charts. Why? I would rather be witnessing profoundly blind people effortlessly catch a ball flung at them mid-air.

As I read on though, my perspective progressively changed. Line by line, his stories showed me how fascinating things can be found in the most apparently mundane situations. What struck me the most was that the world he described was not some farfetched fantasy, nor was it something I would have to go out of my way to experience. It was inherently present in every patient I encountered, from the middle-aged man who fell off a ladder while putting up the curtains to the embarrassed young lady who found herself drooling uncontrollably at a dinner party. All one needs to appreciate the potential of such cases is an inquisitive mindset, like his – a mindset that is able to look beyond the vapid diagnostic labels given to patients as we try to neatly fit their experiences and peculiarities into a textbook chapter.

Sacks’ focus on the uniqueness of our minds is refreshing. Medicine and biomedical science are taught as systematic and structured disciplines, and that is immensely useful, but that does not mean doctors and scientists should be afraid of stepping outside the rigid boundaries of their guidelines and checklists to chart new territories. The benefits reaped by doing so are eloquently laid out in every chapter of Oliver Sacks’ books. As medicine becomes increasingly quantitative and governed by the frigid rules of Big Data, Oliver Sacks’ focus on the singularity of his patients is more important than ever, providing a breath of fresh air to his readers.

I am not sure if that’s the legacy he intended to leave, but my advice to anyone who occasionally finds himself or herself weary of meta-analyses, medians, and multiple comparisons is to pick up one of his books and allow yourself to be submerged in the remarkable individuality of the human brain.

Source: Maria Popova via Wikimedia Commons

“If a man has lost a leg or an eye, he knows he has lost a leg or an eye; but if he has lost a self – himself – he cannot know it, because he is no longer there to know it.” - Oliver Sacks

Ahmed Khalil
PhD Student, AG Fiebach
Thomas Broggini
Recipient of the Ernst von Leyden Fellowship

Congratulations to Thomas who was awarded the Ernst von Leyden Stipend that helped him financially during his doctoral thesis. The stipend is awarded by the Berlin Cancer Foundation (BKG) to young scientists, from a foreign country to carry out a research project related to cancer in Berlin.

Thomas, a Swiss national with a background in Biotechnology, came to Berlin first for his master’s degree in Medical Neurosciences and subsequently continued his PhD here within the framework of the MedNeuro and Neurocure Cluster of Excellence. He was awarded 12,000 Euro in 2012 for his first year from the BKG to support his thesis titled, ‘Effects of ephrinB2-EphB4 signaling on spinal metastasis’. In particular, Thomas looked at how and which factors influence spine-specific metastatic behavior and if these factors are related to the occurrence of neurological deficits. He published his findings in the European Spine Journal. He also explored the correlations between specific growth factors and the neovascularisation of brain tumors. These results can be found in the prestigious journal Cancer Letters.

On September 4th, 2015 he successfully defended his thesis which was carried out at the Department of Neurosurgery, headed by Prof. Peter Vajkoczy and was awarded the highest grade – “summa cum laude”.

Congratulations once again to you Dr. Broggini!!
Scientists at the Ohio State University have made a breakthrough in stem cell research by growing a nearly complete human brain in a dish from adult human skin cells! The organoid has the maturity of a 5 week old fetus and although it may not look like one, it expresses 99% of the human genes. Naturally such groundbreaking research is not easily accepted by the community and other stem cell researchers are of the opinion that just expressing most genes present in the brain still says nothing about the appropriateness of the organoid as a disease model. In order to make the claim that a 3D model of the brain was grown on a dish, the scientists would have to use specific markers for the different brain regions. Still, this is an exciting discovery and one can only wait to see if the claims of a 3D brain model are justified.


On September 17th this year, the 2015 winners of the IgNoble Prize were announced at Harvard University. The ceremony, hosted by Harvard student groups and the Improbable Research Organization, honors ten scientists for research that ‘makes people laugh and then think’. The awards were handed out by a group of genuinely bemused but genuine Nobel Laureates for different categories. For example, the prize in the diagnostic medicine category was given to scientists who ‘determined that acute appendicitis can be accurately diagnosed by the amount of pain evident when the patient is driven over speed bumps.’ Read the full list of winners here: cnn.it/1Q5wKTZ

Source: http://bit.ly/1H8EkKL

Many clinical trials are sponsored by pharmaceutical companies leading to a direct conflict of interest and results that need to be interpreted with caution. This is known to most scientists who therefore rely on meta-analyses, which are thorough reviews summarizing the results of many studies. However, recently it has been found that even meta-analyses are funded by the industry. The latest study, which evaluated 185 meta-analyses, found that 29% were written by employees of the assessed drug manufacturer and 79% had some link to industry like sponsorship. The meta-analyses written by industry employees were 22 times less likely to have negative statements about a drug and had fewer caveats than those written by authors with no conflicts of interest. Although these results were based on a meta-analyses of antidepressant studies, it paints a bleak picture for clinical trials in general. When will the greed stop and where does one turn for ‘real’ answers?

Source: http://bit.ly/1P0fGx9

The National Sleep Foundation recommends that the average healthy adult should get between seven and nine hours of sleep, ‘uncorrupted’ by the blue light emitted by our fancy gadgets like smartphones and televisions. With busy schedules, six hours is probably the average most people really get. It is easy to think that our ancestors, without the trappings of modern life, slept better than us. However, research that looked at the sleep patterns of three present-day hunter-gatherer populations from Africa and Bolivia found that these people do not get any more sleep than we do. The findings, published in Current Biology, report that these people sleep between 5.7 and 7.1 hours per night. Furthermore, they did not take naps and fell asleep only several hours after sunset. Their sleep cycle was more temperature regulated than light regulated. The biggest difference though is the fact that none of them had insomnia (the inability to sleep), a condition reported in almost 22% of Americans. So, should we sleep like our ancestors? Maybe – they definitely have better sleep quality!

Source: http://bit.ly/1OPxNFP

What seems to have been known all along has finally been made public again – low fat diets are no more effective for weight loss than high fat diets. Published in The Lancet Diabetes and Endocrinology, the meta-analysis of 53 studies involving a total of 68,000 participants came to this conclusion in October this year. So are diets effective at all? To say no would be too cynical, according to lead author of this study, Dr. Deirdre Tobias. He believes that a truly effective diet needs to be personalized. While some people can lose weight and keep it off on a low fat, low carbohydrate diet, for most, a low fat diet results in eating more carbohydrate which leaves them feeling less sated and more prone to snacking. The latest fad for nutritionists now seems to be the ‘Mediterranean’ diet, which boasts of a menu consisting of fruits, vegetables and grains. The take home message is clear: do not shun high-fat food, it will only leave you feeling hungry!

New: Master’s Graduation 2015
Learning from our experience from last year, the graduation ceremony of the 2015 master’s students took place at the Festsaal of the HGS. The spacious and impressive room was filled with excitement from the very beginning. The master’s thesis presentations kick-started the ceremony. Equally exciting were the poster presentations, which were well received as an interested crowd gathered around them. Each oral and poster presentation was a masterpiece, with experts asking deep, thoughtful questions about the projects. Neither the oral nor the poster presentations lacked any kind of enthusiasm and, more importantly, they made us proud. We congratulate each of the graduates and wish them all the best for their future careers!

New: Master’s Students
Twenty-three new Master students from around the world joined our Welcome Week this year. As usual, the week started with friendly introductions and icebreakers before the office took care of the enrollment process. One of the many highlights was the guided tour for the newcomers through campus Charité Mitte by the seniors, followed by lunch. Special thanks to Myrto, Sam, Mykola, Leo and Anna. Yet another event was the tour around the center of Berlin, covering the Cold War with our dedicated guide Sam Noble. With his charming way and British humor, he lead the students through Germany’s darkest history in an easily digestible way.

New: The Handbook
The recently printed handbook for Master’s and PhD students is now available at the office. It is a compact and comprehensive guide covering everything you need to know to excel in the MedNeuro program. Particularly for new PhD students, this is a good reference to understand the processes from A to Z (application to final submission). We would also like to remind everyone to pick up the orange booklet at the coordination office. This booklet helps you keep track of your attendance at the Neuroscience Colloquium and the NeuroCure, MDC, Neuroscience, and PhD/Post Doc seminar series.

New: PhD Days, Revised
According to preliminary results, the revival of the PhD Days has been successful. While the focus of the last session was on presentation skills, both poster and Powerpoint, future PhD days will include other skills students may need during their carrier, not necessarily limited to a PhD project, but also about future career planning. Developing to excel!

Upcoming Events

<table>
<thead>
<tr>
<th>December</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>January 2016</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>28–30</td>
<td>Arbeitstagung NeuroIntensivMedizin (<a href="http://www.anim.de">http://www.anim.de</a>)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>February 2016</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>11–22</td>
<td>Berlinale (<a href="http://www.berlinale.de/en/">http://www.berlinale.de/en/</a>)</td>
</tr>
<tr>
<td>25–27</td>
<td>5th Translational Immunology School (<a href="http://web.dgfi.org/translational-school/">http://web.dgfi.org/translational-school/</a>)</td>
</tr>
</tbody>
</table>

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 20 93-45 85
f: +49 30 20 93-45 90

Contact
cns-newsletter@charite.de

Editors-in-Chief
Ahmed Khalil
Apoorva Rajiv Madipakkam

Editors
Constance Holman
James Kerr
Mariana Cerdeira
Marietta Zille

Layout and Typeset
Viktoria Stoiser

Cover
Betty Jurek

Oppenheim-Preis 2016
The Deutsche Dystonie-Gesellschaft awards excellent clinical and basic research in the area of dystonia with the Oppenheim-Preis 2016 (€5,000). Contributions about the etiology, pathogenesis, diagnosis and therapy of dystonia as well as the psychosocial situation of the concerned are wanted, particularly from scientists below the age of 40. Deadline: January 31, 2016. More information:
http://www.dystonie.de/die-ddg/ oppenheim-preis.html
First steps in a new world of health, insurance and more. New people, a new language, a new culture and new tasks – in your first days and weeks in Germany you’ll be bombarded by a lot of new impressions.

We are the health insurance fund which is there to help you as you start your new life in Germany.

For questions about German health insurance get in touch with us on:

Lutz Matuschke
lutz.matuschke@tk.de
Tel. 030 - 400 44-86 60

Welcome to Germany