Current Sexual Health Reports
https://doi.org/10.1007/s11930-018-0148-3

INVITED COMMENTARY

Why the Sexual Tipping Point® Is a "Variable Switch Model"

Michael A. Perelman [1,2]

The Sexual Tipping Point® (STP) model was designed to improve understanding about sexual response and sexual disorders. While illustrating whether a man or woman is "turned on or turned off," it simultaneously can be used to explain in substantive detail all the complex biomedical and psychosocial-cultural factors underlying sexuality. The STP is one of a number of models previously labeled "Dual Control," but it should instead be conceived of as a "Variable Switch" model. The reasons for this theoretical recapitulation reflects advances in our biological, psychosocial, and technological knowledge about the human body. Understanding sexuality is an iterative process and this commentary is also intended to motivate researchers/clinicians to continue improving upon and expand the STP model's explanation of the mind/body connection inherent in sexual response and disorders [1, 2].

The STP model has been depicted over the past 20 years using a number of different schematic diagrams. The key elements of the STP model illustrations are as follows (see Fig. 1). Two pans labeled "Excitation" and "Inhibition," respectively, hold two pairs of interconnected containers. The containers are labeled M (Mental) and P (Physical). The Mental and Physical containers hold all Exciting and Inhibiting factors that influence a sex-positive or sex-negative response at a given moment in time. Each of these factors is variably charged, with variable valence as to the degree they contribute to the STP. It is noteworthy that some factors may be neutral at a given moment in time, while some others are unknown and yet to be discovered. Originally, all these factors were illustrated as representing multiple discrete binary "switches" that were flipped (on or off), with the sum total of their polarity and valence determining the STP. This commentary proposes an important yet subtle change from the STP's original description that these micro-switches are variable rather than dual control off/on switches.

The STP model was originally developed as a heuristic to help healthcare professionals and patients (as well as their partners) understand and visualize the overwhelming number of interrelated organic and psychosocial factors that predispose, precipitate, maintain, and exacerbate sexual disorders. The STP and other biopsychosocial models of human sexual response and disorders have an ever-expanding body of empirically based quantitative and qualitative evidence supporting a multidimensional conceptualization, especially in the areas of recommended therapy optimization and adherence, and continuation [3–10]. They all essentially teach the truism that every sexual disorder, regardless of the severity of its organic etiology (Physical), also has a psychosocial (Mental) component that, if not causative, is certainly consequential. Perhaps the greatest advantage of the STP model is its simplicity and the ease with which it provides clinicians as well as their clients (and partners) with a commonsense explanation of sexual problems and potential solutions.

The STP model evolved from my many decades of collaboration with Helen Kaplan [11]. Her last book described and illustrated a "psychosomatic" dual control model of sexual motivation (see Fig. 2). Besides the STP, Kaplan's cartoon foreshadowed the important work of Bancroft, Bloemers, Pfaus, and others [12–14]. Bancroft and his Kinsey Institute colleagues, including Graham, Heiman, Janssen, Sanders et al., continue providing erudite articulation of dual control theory, research, and related psychometrics, becoming the best known of the dual control models [12, 15–19]. Kaplan attributed her own viewpoint to Kupferman who had noted earlier that "all examples of physiological motivational control seem to involve dual effects—inhibitory and excitatory—which function together to adjust the system" [11, 20]. In fact, recent fMRI research suggests that besides neurotransmitters turning on pro-sexual receptor sites, others that are important to sexual function also need to be shut off. The reverse can of course contribute

✉ Michael A. Perelman
michael@mapedfund.org; http://mapedfund.org

[1] Departments of Psychiatry, Reproductive Medicine & Urology, Weill Cornell Medicine, New York-Presbyterian, New York, NY, USA

[2] MAP Education & Research Foundation, 70 East 77th Street, Suite 1C, New York, NY 10075, USA

Published online: 21 April 2018

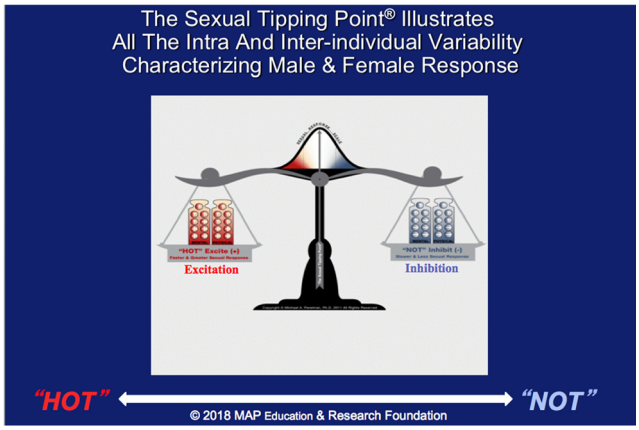

Fig. 1 The Sexual Tipping Point® illustrates all the intra- and inter-individual variability characterizing male and female response. This image is based on the Sexual Tipping Point® model and is used with the permission of the MAP Education & Research Foundation

to the biological etiology of sexual dysfunction (SD). Or from a subjective perspective, for a person to maintain sexual arousal, anti-sexual thoughts (believed to reside in the cortical section) must be inhibited for optimal sexual response [21, 22].

Despite its clinical underpinnings, it is understandable that the STP model has been aligned with the dual control theories of others given its similar emphasis on excitation and inhibition. In fact, James Pfaus' depiction of the STP (see Fig. 3) and his adaptation of the model for his definitive article on the *Pathways of Sexual Desire* [23] were key to the model's accelerated dissemination [24].

However, dual control models have an inherent limitation in their ability to characterize the working of the mind and body generally, and human sexual response (HSR) and its disorders specifically. Conceptualized as simple off/on switches, or more closely as the net sum of billions of such charged micro-switches, the analogy fails to fully capture sexual dynamism and the spectrum of biological variability. Nature is not black and white. Dual-control models are derivative of limited binary algorithms developed for silicon computer chips. However, our human "turn ons and turn offs" are best understood as continuous and not discrete categories. The interaction of human receptors, sub-types (known and unknown) along with the neurotransmitters, and hormones that trigger them (in a dynamic and fluid manner) work differently from a computer's digital organizational structure. While learning and storage of information can be substrate independent, for now, our carbon-based bodies do a much better job of coding nuanced continuous information than silicon chips. Developing a best-fit model is not merely a challenge for sexual medicine. As far back as 1956, the US Navy, in envisioning artificial intelligence, identified the difficulty in describing a system (like the brain) that could be characterized by digital as well as analog features [25]. This quandary is not unlike the wave/particle conundrum found in physics.

Science borrows ideas from the technology of its time when formulating its working models. That is as true today when contemplating computer neural networks as it was in the 1950s when the switchboard was the ubiquitous model for the brain. While trillions of off/on switches (micro-capacitors) would generate an almost incalculable array of possibilities,

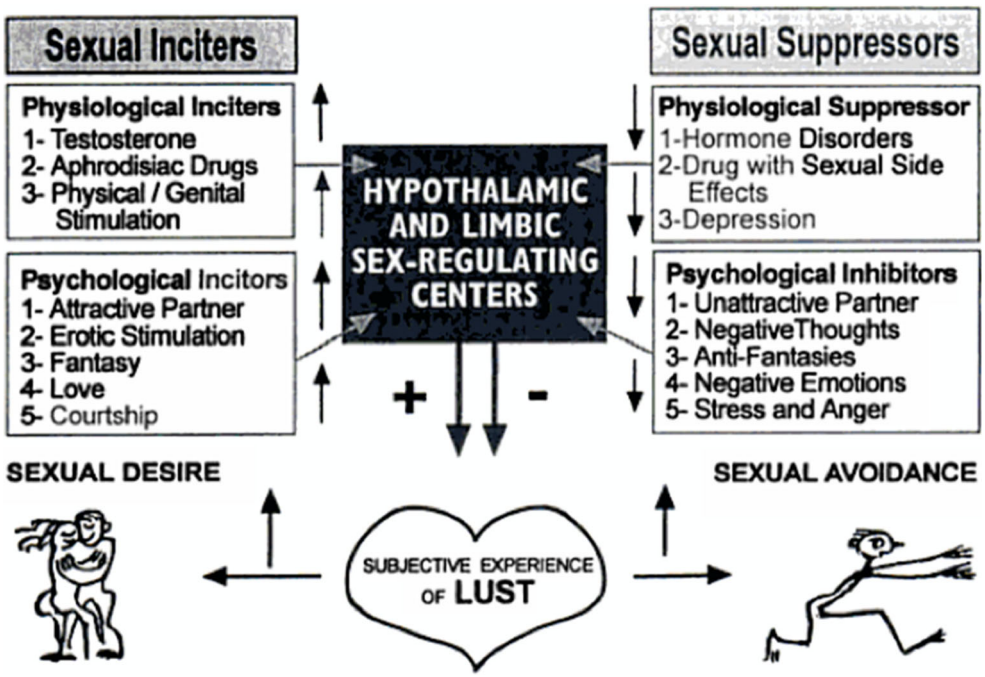

Fig. 2 Dual control elements of human motivation. A psychosomatic model. With permission from [11] (Fig. 2)

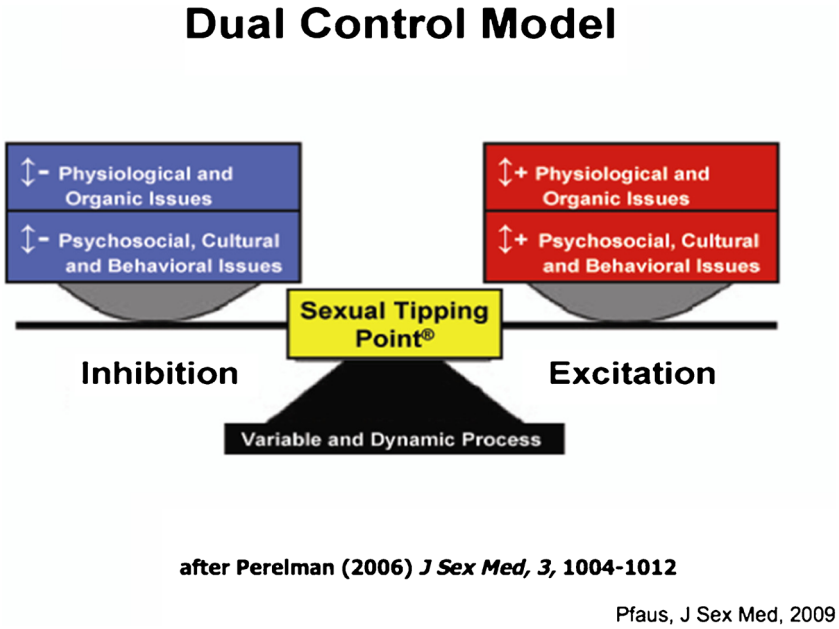

Fig. 3 Dual control model with permission from [22]

they still fail to capture the full continuum of biological and psychosocial-cultural variability that is sexual response. The bottom line is that STP factors are continuous; thus, a binary model (or dual control) is inadequate.

STP model graphics would move closer to an accurate depiction if each "Mental And Physical" factor was illustrated as a "dimmer switch." A dimmer switch image could symbolize the necessary concepts of polarity, valence, and variability that a continuous spectrum theory requires. A "variable microswitch" offers a description that is closer to the reality of human experience. As such, incorporating the dimmer analogy allows for easy explanation and understanding for patients and subsequently facilitates communication of both diagnosis and treatment formulation.

Valence and polarity for any given factor can change over time, for a variety of different reasons. Excitement can increase or decrease at any time and the same is reciprocally true of inhibition. In other words, any person's sexual factors (dimmers) may be "dialed up or dialed down" from their previous charge and weighting. Intrinsic sexual capacity (Physical) is established at conception via DNA. Epigenetics, the environment and learning (life experiences), enhance and/or inhibit that capacity resulting in subsequent changes to a factor's polarization and valence. The dimmer continuously adjusts (see Fig. 4). Psychologically, any negative sexual experience may shift the polarity and valence of the individual's response. An extreme example is rape, where there is usually an altered response (auto-association) from a previously desired type of caress (excitation), to the caress becoming terrifying and even nauseating (inhibition). Yet, for a variety of psychosocial-cultural reasons, each person's degree of factor change will vary both within and between individuals. A dimmer analogy allows for illustrating/conceptualizing such variability. Reciprocally from a Physical factor perspective, aging, illness, etc. will inhibit a once robust response, to one that varies within and between any given individual.

Conceptualizing etiological factors as changes in dimmer polarity and/or valence also allows for illustration of the impact of external physical factors that are bidirectional, such as drugs and/or their side effects. For instance, depression may affect sexual desire through shared underlying mechanisms. Alleviating depression with medication may increase desire, yet the side effects of many antidepressants may also have significant adverse effects on desire and orgasmic capacity. Finally, the STP model can also illustrate a factor's transformation from neutral to one resulting in a fetish, as illustrated below in Fig. 4.

Occum and later Einstein suggested that everything should be made as simple as possible, but not simpler [26]. Perhaps the above seems a bit complex and convoluted rather than the intended easy explanation of sex and its disorders. In the hopes of providing greater clarity, the key elements of the STP model are concisely summarized and illustrated in Fig. 5 below. Two pans labeled "Excitation" and "Inhibition," respectively, still hold two pairs of interconnected containers. The containers are labeled *M* (Mental) and *P* (Physical) but are now bridged together by an *A* (And), as recognition that the line between mental and physical has become progressively more porous with greater understanding of how thoughts become translated into biochemical/electrical components. The Mental And Physical containers still hold all known Exciting (+) and Inhibiting (−) factors that influence a sex-positive or sex-negative response at a given moment in time. Each of these billions of factors (now dimmer switches) is variably charged and with variable valence as to

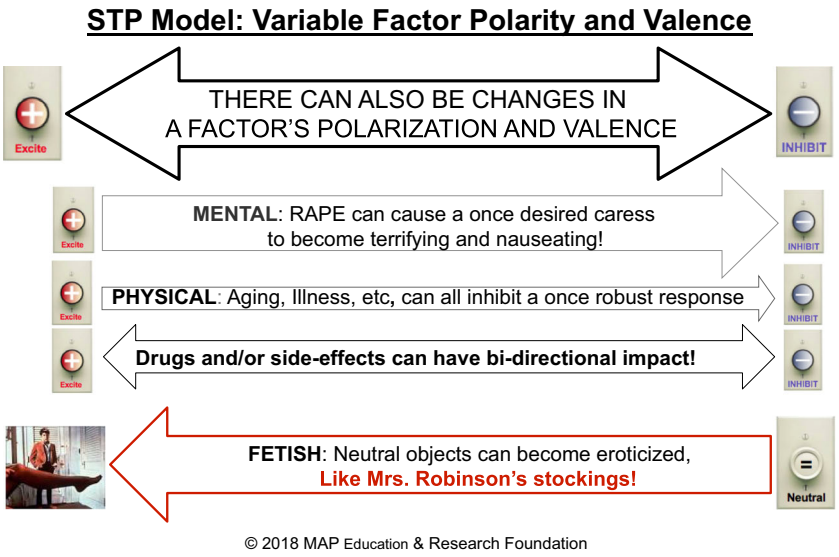

Fig. 4 Dimmer switches symbolize potential for variation in factor polarity and valence. This image is based on the Sexual Tipping Point® model and is used with the permission of the MAP Education & Research Foundation

the degree it contributes to the STP. Again, some additional factors may be neutral (=) and others are not yet discovered (?). The STP is then the net sum of all Mental and Physical factors, displayed on a balance scale labeled with a Gaussian distribution curve that spans from excitation to inhibition (or Hot to Not). So, each factor's dimmer switch setting contributes to the STP's dynamic representation of any individual's manifest sexual response at any moment in time.

Unfortunately, we do not yet have a technology so nuanced that it can truly model either our bodies in general or our brains in particular. Further elucidation and understanding of the Sexual Tipping Point model will occur in time. The STP model will soon be enhanced by developments in human-level artificial general intelligence (AGI). This may reflect emergence of DNA based nano-switches or perhaps silicon chips utilizing quantum super positions and entanglement of quantum bits (qbits) [27]. Perhaps science will invent the type of tiny quantum-based nano-magnetic switch that was capable of being both on and off at the same time as described in a current AGI sci-fi novel [28]. However, actually modeling sexual disorders probably requires an organically based technology that can simulate sexual response at the level of individual molecules or even subatomic particles. Eventually, there will be neuromorphic (brain-like) computers that may provide the missing modeling links. Until such a model is created, sexual balance can be most easily and best understood through application of the STP model.

Communication issues between the partners themselves and with their healthcare providers can cause, exacerbate, or interfere with the resolution of sexual difficulties. People often

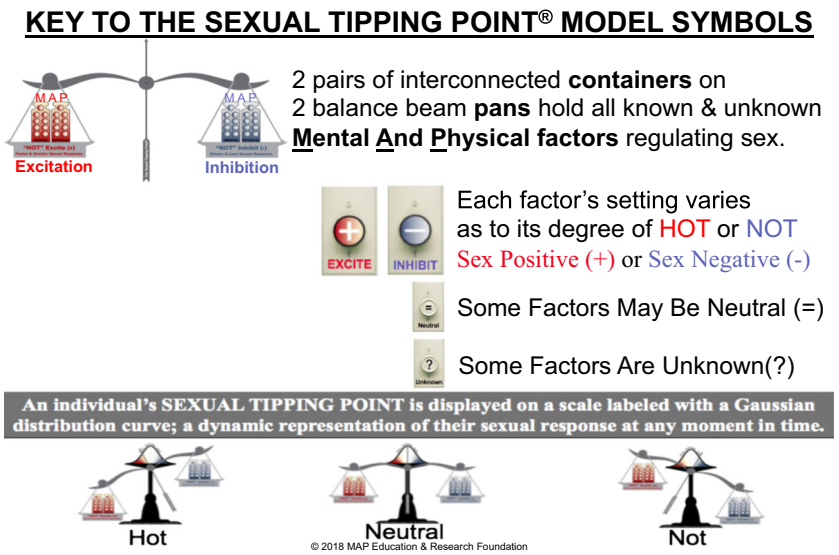

Fig. 5 Each circle inside the mental and physical containers is symbolized by a dimmer, whose valence and polarity contributes to determining the Sexual Tipping Point. This image is based on the Sexual Tipping Point® model and is used with the permission of the MAP Education & Research Foundation

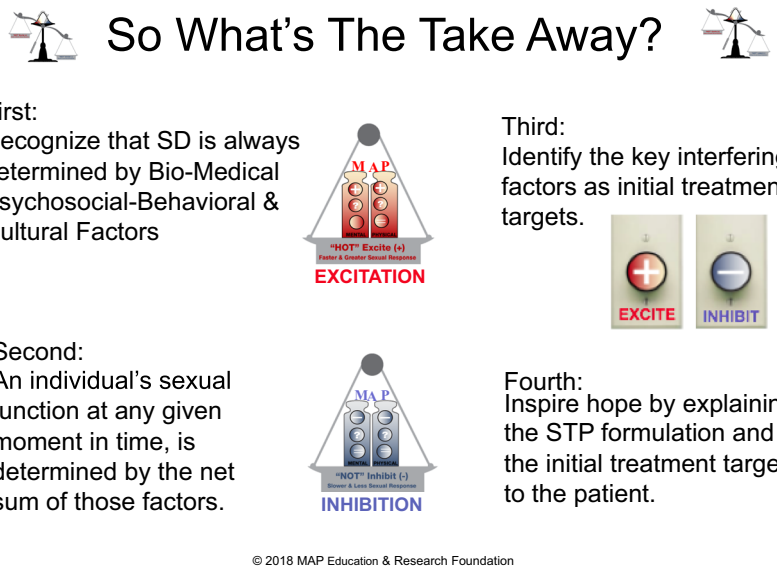

Fig. 6 Sexual Tipping Point model approach to sexual dysfunction (SD). This image is based on the Sexual Tipping Point® model and is used with the permission of the MAP Education & Research Foundation

fail to communicate their preferences to either their partners or healthcare professionals due to embarrassment. Restoration of lasting and satisfying sexual function requires a multifactorial understanding of all of the forces that created the problem. Clinicians can inspire hope by explaining the STP formulation and easily describe the initial treatment process to the patient and their partners (see Fig. 6.)

In conclusion, the STP model conveniently illustrates all etiological permutations including "normal" sexual balance. It is particularly useful for modeling integrated (transdisciplinary) treatment in an easily understood manner that can be used to explain risk/benefit to patients with sexual disorders and thus facilitating both informed consent and genuine understanding.

Acknowledgements Alexander Pastuszak, MD, Ph.D., Barry McCarthy, Ph.D., and Sharon Parish, MD, are acknowledged for their helpful comments on earlier drafts of this commentary.

Data availability All variations of the STP schematics and additional information regarding the STP model are available for viewing and free downloading at mapedfund.org.

Compliance with Ethical Standards

Conflict of Interest Michael A. Perelman reports is the Founder and Chairman of the MAP Education and Research Foundation that owns the registered trademark: The Sexual Tipping Point®.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

References

1. Perelman MA. The sexual tipping point: a mind/body model for sexual medicine. J Sex Med United States. 2009;6:227–632.
2. Perelman MA. Why the Sexual Tipping Point® Model? Curr Sex Health Rep Springer US. 2016;8:39–46.
3. Rosenfield P. The potential of transdisciplinary research for sustaining and extending linkages between the health and social sciences. Soc Sci Med. 2002:1–15.
4. Abdo CHN, Afif-Abdo J, Otani F, Machado AC. Sexual satisfaction among patients with erectile dysfunction treated with counseling, sildenafil, or both. J Sex Med. 2008;5:1720–6.
5. Althof SE. Sexual therapy in the age of pharmacotherapy. Annu Rev Sex Res. 2006;17:116–31.
6. Perelman MA. The history of sexual medicine. In: APA handbook of sexuality and psychology, Vol. 2: contextual approaches. Washington: American Psychological Association; 2014. p. 137–79.
7. Perelman MA. Integrated sex therapy: a psychosocial-cultural perspective integrating behavioral, cognitive, and medical approaches. In: Carson CC, Kirby RS, Wyllie MG, editors. Textbook of erectile dysfunction. 2nd ed. London: Informa Healthcare; 2009. p. 298–305.
8. Perelman MA. Psychosocial evaluation and combination treatment of men with erectile dysfunction. Urol Clin North Am. 2005 ed. 2005;32:431–45–vi.
9. Phelps JS, Jain A, Monga M. The PsychoedPlusMed approach to erectile dysfunction treatment: the impact of combining a psychoeducational intervention with sildenafil. J Sex Marital Ther 2005 ed. 2004;30:305–14.
10. Rosen RC. Medical and psychological interventions for erectile dysfunction: toward a combined treatment approach. In: Leiblum S, Rosen RC, editors. Principles and practice of sex therapy. 3rd ed. New York: Guilford Press; 2000. p. 276–304.
11. Kaplan HS. The sexual desire disorders: dysfunctional regulation of sexual motivation. New York: Brunner/Mazel, Inc; 1995.
12. Bancroft J, Graham CA, Janssen E, Sanders SA. The dual control model: current status and future directions. J Sex Res. 2009;42:121–42. [Internet]. 2009 ed. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19308839
13. Bloemers J, van Rooij K, Poels S, Goldstein I, Everaerd W, Koppeschaar H, et al. Toward personalized sexual medicine (part 1): integrating the "dual control model" into differential drug treatments for hypoactive sexual desire disorder and female sexual arousal disorder. J Sex Med. 2012;10:791–809.
14. Perelman MA. Helen Singer Kaplan's legacy and the future of sexual medicine. J Sex Med. 2012;9:138.

15. Bancroft J. Central inhibition of sexual response in the male: a theoretical perspective. Neurosci Biobehav Rev. 1999;23:763–84.
16. Janssen E, Bankroft J. The dual control model of male sexual response: a theoretical approach to centrally mediated erectile dysfunction. Neurosci Biobehav Rev [Internet]. 2000;24:571–9. Available from: http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=10880822
17. Bancroft J, Herbenick D, Barnes T, Hallam-Jones R, Wylie KR, Janssen E. The relevance of the dual control model to male sexual dysfunction: the Kinsey Institute/BASRT collaborative project. Sex Relation Ther. 2005;20:13–30.
18. Janssen E, Bancroft J. The dual control model: the role of sexual inhibition and excitation in sexual arousal and behavior. Bloomington: Indiana University Press; 2007.
19. Janssen E, Vorst H, Finn P, Bancroft J. The sexual inhibition (SIS) and sexual excitation (SES) scales: I. Measuring sexual inhibition and excitation proneness in men. J Sex Res. 2002;39:114–26.
20. Kupferman I. Hypothalamus and limbic system motivation. In: Kandel ER, Schwartz JH, Jessell TM, editors. Principle of neural science. 3rd ed. New York: Elsevier; 1991.
21. Stahl SM, Allers KA, Sommer B. Multifunctional pharmacology of flibanserin: possible mechanism of therapeutic action in hypoactive sexual desire disorder. J Sex Med United States. 2011;8:15–27.
22. Arnow BA, Millheiser L, Garrett A, Polan ML, Glover GH, Hill KR, et al. Women with hypoactive sexual desire disorder compared to normal females: a functional magnetic resonance imaging study. NSC IBRO. 2009;158:484–502.
23. Pfaus JG. Pathways of sexual desire. J Sex Med United States. 2009;6:1506–33.
24. Perelman MA. Introduction: advocating for a transdisciplinary approach to the management of sexual disorders. In: Lipshultz LI, Pastuszak AW, Giraldi A, Goldstein AT, Perelman MA, editors. Management of sexual dysfunction in men and women. New York: Springer; 2016. p. 1–8.
25. Isaacson W. The innovators: how a group of hackers, geniuses, and geeks created the digital revolution. New York: Simon & Schuster; 2014.
26. Bevelin P. All I want to know is where I'm going to die so I'll never go there. Marceline: Walsworth Publishing Company; 2016.
27. Harvard University. DNA nanoswitches reveal how life's molecules connect. [Internet]. phys.org. 2015 [cited 2018 Feb 21]. p. 1–4. Available from: https://phys.org/news/2015-01-dna-nanoswitches-reveal-life-molecules.html.
28. Bing S. Immortal life: a soon to be told true story. New York: Simon & Schuster; 2017.