Neurophysiology of Emotions

I think the discussion of the neurophysiology of emotions in Genuine Recovery (p. 35, column 2) is simplified to the point of being a possible stumbling block to those who have studied the system more carefully. I have written the following "amplified" version to augment this text (for those who are interested in a more rigorous discussion). It might be helpful to include these supplementary notes when you share Genuine Recovery with someone who has studied neurophysiology. For any who might be worried that Dr. Smith will be offended by my comments, he has seen these notes and has included some of this material in the discussion of neurophysiology in Beyond Tolerable Recovery (pp. 216, 217; Spring 2000 edition).

> What part does the soul play in the painful emotions which accompany the memories? The emotional part of the mind is an interesting element. Feelings or emotions in their most basic form are a combination of electrical neurological signals in the mind and chemical reactions in the body. The mind's current thinking interacts with perception of external stimuli to result in the interpretation being given to the present situation. This interpretation of (or belief about) one's current situation triggers electrical signals along certain neurological pathways in the brain and also the release of certain chemicals into the blood stream. The combination of the electrical signals in the brain and chemical action in the body is experienced subjectively as emotion.
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> For example, if I am a herpetologist collecting local reptiles as a hobby and am thinking "I hope I find a large snake this afternoon," and then see a long black object in front of me, I might come to the overall interpretation/belief "Ah, Black Racer, just what I was looking for." My brain will send the appropriate signals and release the appropriate chemicals to result in feelings of excitement and gratification. If I am a casual hiker and am thinking about my tax returns, and then see a long black object in front of me, I might come to the overall interpretation/belief "Snake, POSSIBLY DANGEROUS ANIMAL." My brain will send the appropriate signals and release the appropriate chemicals to result in feelings of excitement and fear.
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> This is why psychiatric medications affect the way one feels. Psychiatric medications -- as best we know -- work by adjusting the neurotransmitter balance at the synapses in the brain's neurological electrical system. This affects both the neurological electrical signals and (indirectly) the chemicals the brain directs to be released into the bloodstream.
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> Basically, I feel the emotion which most appropriately matches my interpretation of the overall situation (what I am believing to be true) in any given moment. If I believe I have found a specimen I am looking for, I will feel emotions which match this belief (excitement and gratification). If I believe I am in danger, I will feel emotions which match this belief (excitement and fear).[1]

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[1] Modified from Edward M. Smith, Genuine Recovery. (Campbellsville, Kentucky: Alathia, Inc., 1997) p. 35.

The following data and examples from my medical psychiatric experience and reading of current brain research may help to illustrate the complexity of subjective emotions:

1. Electrical, neurological impulses from the brain stimulate the adrenal gland (sitting on top of the kidneys) to release adrenaline into the blood stream. The adrenaline is distributed throughout the body and will produce many rapid physical changes, such as increased heart rate, increased respiration, sweating, dilation of the pupils, etc. BUT NOTE that this adrenaline response will be interpreted/"experienced" differently in different situations. In an algebra exam it will be experienced as anxiety, with noises in the woods at night it will be experienced as fear, in response to discovering one's bicycle has been stolen it will be experienced as anger, while having sex it will be experienced as pleasurable arousal. As illustrated by these examples, the "chemical" adrenaline phenomena requires additional signals along neurological pathways to be interpreted/"experienced" as a given emotion.

2. Certain pathways and brain areas have been clearly identified as mediating the neurological, electrical component of emotion. Fascinating case studies of specific brain injuries illustrate this. There are carefully documented cases in which an injury or tumor has broken the pathway from the visual cortex to the basal ganglia (an important part of the neurological emotion system). NOTE: The pathway from the visual cortex to the complex association cortex (cognitive interpretation/meaning) is intact. These people have the most amazing subjective experience. A woman could "see" a car coming toward her and cognitively "know" what it is: "I see a car coming towards me." But she has no emotion. A man could "see" his wife inviting him to a romantic moment and "know" what he was seeing: "I see my wife dressed in black lace and beckoning me." But he experiences no emotion. Additional data from these case studies further illustrates the importance of the basal ganglia in the "experience" of emotion. The pathways from the auditory (hearing) cortex to the basal ganglia were intact. If the woman seeing the car then heard the car, she would immediately experience the appropriate emotion. If the husband hears his wife's voice inviting romance, he would immediately experience the appropriate emotion.

3. Timing provides additional data that might clarify my point about experienced emotion being a combination of "chemical" and electrical neurological components. When a person hears a gunshot close by or sees a snake close to her feet, she will experience the first wave of subjective fear within a fraction of a second. She will "feel" fear and demonstrate the startle response (take her breath in sharply and jerk certain muscles) even before the adrenal gland has had time to release adrenaline or the adrenaline has had time to be distributed throughout the body. Some parts of the system are affected by both the "fast" neurological system and the "slow" endocrine system. The heart, for example, is stimulated directly by "fast" neurological electrical signals and also by the slower bloodstream adrenaline pathway. Timing therefore reveals another level of complexity to the whole system.

Caveat: Ultimately, all the neurological electrical signals are mediated by chemicals. However, I think most people who have studied the nervous system more carefully would feel that it does not do justice to the neurological-electrical component to call it "a chemical reaction." "A chemical being released" does not adequately capture the complexity and subtlety of micro-microscopic amounts of ten (or more) different neurotransmitters activating 57 (or more) different receptor subtypes in many different microscopic locations, all as a part of a complex network of stimulation and inhibition, and all taking place in the fraction of a second.