Oxford Library of Psychology vii
About the Editor ix
Contributors xi
Contents xv
Chapters 1–564
Index 565
If we think of our moods as emphasizing meaning and enhancing or reducing the pleasure in our lives, we can understand how central they really are. In this respect they are more important than daily activities, money, status, and even personal relationships because these things are usually filtered through our moods. In many respects our moods are at the core of our being. (Thayer, 1996, p. 4)

Contrary to a mistaken assumption that everyday moods are meaningless background feelings, these low-level emotional states appear to be barometers of both physiological and psychological functioning (Thayer, 2000). They have a physiological substrate. They are integrally tied to our thoughts and other cognitive processes. They subtly influence our behavior, and they motivate us.

Unlike emotions that usually have an understandable cause, everyday moods are background feelings that seem to come and go with no apparent reason, although as we shall see they are integrally related to knowable bodily systems and processes. Moods can be regarded as dispositional variables that tend to amplify or inhibit existing causal relationships. I believe that the best moods involve high energy and lower tension, and the worst moods involve reduced energy or tiredness and increased tension.

Let me introduce an often overlooked motivational concept in this chapter with a personal anecdote. Being reminded of the approaching deadline for a draft of this work, I noticed that my motivation to finish it varied with the amount of requirements in my life and with time of day. The matter of other requirements being important to changing motivation levels is no surprise to any writer with many commitments, but often overlooked is time of day as a motivational variable. At times of day when I felt more energy, my motivation to complete this important task was unflagging because of its obvious significance, but when I was tired my motivation was reduced, often resulting in delay or procrastination.

An Endogenous Cycle of Energetic Arousal

This variation with time of day concerns a general biopsychological variable that I have named Energetic Arousal. Once established, this is an endogenous energy cycle (a kind of biological clock) that repeats itself with more or less the same pattern day after day unless there is significant change in such variables as physical activity, food intake, unusual emotional arousal, or crossing time zones with accordant behavioral changes. Energetic arousal directly affects level of motivation for everyday activities that require energy expenditure, and from this we can see one of the reasons for changes in motivation to finish this chapter. While experiencing more energy, my writing motivation increased, but with less energy (tiredness) motivation declined.

There are individual differences in this energy cycle such as the morningness/eveningness trait (moderately heritable), but in my own experience feelings of energy and the physiological substrate that underlies it is highest in the first third of the waking day for most people, often reaching its peak at mid to late morning, dropping off in late afternoon, reaching a subpeak in the early evening and then declining to the lowest point just before sleep at night (see Fig. 23.1). Motivation for everyday activities varies directly with this diurnal (circadian) rhythm. In the time of day when energy is high, motivation is strong, especially for physical activity. But as energy declines one is inclined to rest and to decrease energy expenditure. Although gross physical activity is most influenced by energy level in my view, cognitive activity also is influenced, and there is abundant evidence for this in the mood-cognition literature with the understanding that energy is a core component of mood.

Two Arousal Systems Mediate Mood

I regard mood as mediated by two bipolar biopsychological dimensions, Energetic Arousal and Tense Arousal, and the conjunction of these dimensions form four complex moods: calm energy, tense energy, calm tiredness, and tense tiredness (see Fig. 23.2).

Energetic Arousal

I think of energetic arousal as a kind of "go system." When it is high, we are motivated to move, to act, to do things. And when energetic arousal is low, our motivation predisposes rest and recuperation. There are a number of prominent associations of energetic arousal. Among the more important, this activation pattern is closely associated with health and illness (Thayer, 1989; cf. Ryan & Deci, 2008; Ryan & Frederick, 1997). This is immediately evident by the way in which a core element in the experience of sickness is fatigue and tiredness, while good health brings feelings of vitality and energy. Moreover, there are reliable correlations between mood (energy) and immune system functioning (Segestrom, 2007). Subjective energy is an excellent indication of health and there are a variety of kinds of evidence for this. But this assertion was
that are affected by food, including the immediate subjective reactions as well as changing reactions an hour or two later as the food is metabolized. And then there may be thoughts about what was eaten. For example, one may experience an immediate energy surge from a sugar snack (pleasing feeling) followed moments later by guilt about having broken one's diet (negative feeling), which is then translated in my research, tense tiredness (negative feeling) some time later. These and other reasons are why I have used a short-term within-subjects approach such as those in which food-mood associations are repeatedly assessed and results are aggregated for maximal reliability (e.g., Thayer, 1987a, b; Thayer, Peters, Takahashi, & Birkhead-Flynt, 1993).

Although there is no clear consensus about what type of food most affects energy and mood, there is much more unambiguous evidence about the way that mood affects diet. For example, in one review of over 50 scientific studies the causes of obesity and overeating could be traced to emotional eating (Ganley, 1989). Included here were such negative emotions as depression, anxiety, anger, boredom, and loneliness. A common pattern of these negative emotions was low energy and tension, or what I call tense tiredness (Thayer, 2004). And the scientific literature on overeating contains a number of studies showing that the mood conditions which are correlated with overeating are low energy arousal and increased tense tiredness. These negative moods exert powerful influences on behavior. When resources decline and feelings of low energy and increased tension prevail, people are often motivated to eat to feel good (energy-intensive) food as a way of feeling better. Eating such food can raise energy and reduce tension and from this we can see the focus of the motivation: it is to escape these negative feelings and enhance positive ones.

Another important association with energetic arousal is sleep. This is evident both from classic studies of sleep deprivation on feelings that are produced (Murray, 1965; Thayer, 1989), as well as from correlational and quasi-experimental research in which energy level is manipulated and tracked with differing amounts of sleep. One very important reason why sleep and mood are related is the way that sleep or lack of sleep directly affects energy and tiredness and these feelings are core constituents of energetic arousal. As was true with diet mentioned earlier, time of day is likely to be important in assessment of sleep on mood, so for example, partial sleep deprivation one day may have its major mood effects the next day in the late afternoon or in the evening of the next day. But on the morning of the day following sleep deprivation there may be no apparent effect.

Physical activity also is an important component of energetic arousal. With regard to exercise, with which there are many scientific studies (e.g., Reed & Ones, 2006), certain conclusions seem apparent (also cf. Ryan, Williams, Patrick, & Deci, 2009). In my view (Thayer, 2007) the primary mood effect of moderate exercise (e.g., a short brisk walk) is increased energetic arousal and a secondary mood effect (less reliable) is reduced tense arousal. A tertiar effect is increased feelings of optimism. But with more intense exercise (e.g., an hour of intense aerobics) the primary mood effect is both reduced tense and energetic arousal, although there is some evidence that after recovery from intense exercise, there may be a resurgence of energetic arousal.

My work in recent years has involved self-regulation of mood, and this will be discussed more fully later. However, here let me say that exercise is a remarkably effective regulator of mood. Moreover, the amount of exercise necessary to impact mood is relatively little. We have focused on short exercise interventions that could be introduced into typical daily lifestyle—in particular, short brisk walks (Thayer, 1987a, b, 1989; Thayer et al., 1993). As indicated earlier, the primary mood effect of this form of exercise:

One effective use of short brisk walks that indicates well the importance of exercise as a mood regulator occurred with a set of studies in which we assumed that unwanted behaviors such as smoking and sugar snacking often occur as a way of self-regulating mood, a kind of self-medication. Our idea was that if alternative ways of self-regulating mood were available the unhealthy behavior would diminish. In one experiment that focused on cigarette smoking and a second on sugar snacking, participants were randomly assigned to 5 minutes of a short brisk walk or to an alternative sedentary activity (Thayer et al., 1993) at times when they desired to smoke or snack. Before and after that 5 minutes, participants rated their urge to smoke (or snack) and their mood. After those post ratings they were free to smoke a cigarette or eat the sugar snack, but the time before smoking or snacking was recorded.

The brisk walk significantly reduced the urge to smoke (or snack) and significantly lengthened the time before the cigarette was smoked or the snack was eaten. Moreover, the walk significantly increased self-rated energy in both experiments. Finally, participants waited almost twice as long to smoke (or snack) if they walked than if they had engaged in some sedentary activity. It appeared that our hypothesis was correct and that the positive mood-regulating effect of exercise was verified.

Cognition and mood are quite interrelated, and this can be illustrated by the extensive research on mood-congruity theory (e.g., Botvin, 1986). And as I have indicated, energy and mood are closely related. But there is another often overlooked way that cognition and energy are likely to be closely associated. This has to do with the fact that motivation to act (particularly physical activity) is related to self-perception of the energy that would be necessary to act. This involves a kind of cybernetics analysis (cf., Carver & Scheier, 1982) incorporating feedback loops. Energy and motivation usually are integrated so that thoughts about a perspective action are associated with the perception of how much or little energy will be necessary. Usually the sensing of energy levels and the subsequent integration is so rapid and of such low awareness that it isn’t noticed, but when one is tired it is easy to be unrealistic about the amount of energy that will be necessary for some future act and to believe it will not be possible (Thayer, 1987b).

Still another way that cognition and mood are interrelated was the subject of a series of studies in which we focused on personal problems and also optimistic thoughts was studied. The impetus for this research was my perception that seemingly unchanging personal problems did in fact vary substantially depending on the mood that preceded their consideration.

A group of volunteer participants who were experiencing a chronic personal problem were enlisted to rate the apparent seriousness of the agreed-upon problem as well as how optimistic they were that the problem would be solved. This was done five times during the day over several days in a 3-week period: beginning of day, late morning, late afternoon, and just before sleep. Additionally, they rated the problem after taking a 10-minute brisk walk as various times during the day.

The same problem was rated as significantly more serious (also less optimistic of being solved) at late afternoon than late morning. Moreover, regardless of time of day, the changing degree of apparent seriousness was rated as more serious when self-ratings of energy were low relative to higher tension (tense tired) compared to times when energy was high and tension low (calm energy). Lastly, the problem was rated as significantly less serious when consideration occurred after a 10-minute brisk walk. These findings
were replicated in several quasi-experiments (Thayer, 1987b; Thayer, Takahashi, & Pauli, 1988). One prominent association with energetic arousal that should be mentioned is stress. Stress is evidenced by the subjective tension that it creates in interaction with energetic arousal. I believe that stress is related to a balance between resources and requirements (Thayer, 1996). When resources, which are indicated by one's energy level, are exceeded by requirements the result is tension and stress. One of the interesting implications of this is that the same experience may be sought out as pleasurable when resources are adequate but stressful when ones resources are not equal to the requirements of the situation. More about this relationship will be discussed in the next section in relation to the interaction of energetic and tense arousal.

**Tense Arousal**

In addition to energetic arousal, I named the second of the two main mood systems Tense Arousal. This is a system that mediates danger, real or imagined (Thayer, 1989, 2009). While energetic arousal is a go system, tense arousal is a kind of stop system. Energy predisposes us to move and act, but tension predisposes caution, waiting, or stopping. A primary marker that differentiates tense and energetic arousal is subjective experience, including tension/calmsness denoting one dimension and energy/tiredness denoting the other. Different others, which will be briefly described next, include some physiological patterns (primarily muscle tension) and also differences at the level of the brain (e.g., limbic system, cerebral cortical asymmetry).

Cognitive differences also exist between energetic and tense arousal. A major difference in my view is that cognition often is scattered with tension but is directed with energy. A tentative evolutionary explanation for this distinction may be that in a cautious (tense) mood it is adaptive to continuously scan the environment for danger. This primarily applies during circumstances in which the source of the danger is not fully known (e.g., generalized anxiety), but if the source of the danger were known it is likely that attention would be directed to that source even under high tension. On the other hand, the go system of energetic arousal facilitates fully directed attention (Thayer, 1989).

**Alternate Models of Mood (Affect): Similarities and Differences**

In the 1970s it became increasingly clear from factor analytic studies that affective space forms two bipolar dimensions rather than several independent factors as I had previously hypothesized. I then proposed a two-dimensional model (Thayer, 1978), and based in part on that empirical and theoretical work, four prominent models of affect and several less prominent ones exist today as the likely mappings of affect (Yik, Russell, & Barron, 1999). My two-dimensional model involving energetic and tense arousal, plus combinations of the two kinds of arousal forming complex moods, currently stands as one of at least four competing models of mood. This model is the one I believe is the most valid representation of mood.

There is a substantial similarity between my two-dimensional model and other proposed models of affect. As shown in Figures 7.2 and 7.3, two bipolar dimensions, two other prominent mappings of affect comprise similar but slightly different two-dimensional models. These include a model involving two dimensions named pleasure/displeasure and arousal, proposed by Russell (1980), and a second model involving two dimensions named positive and negative affect by Watson and Tellegen (1985). A third threedimensional circumplex model, including pleasantness and activation, also has been proposed by Larsen and Ciarceri (1992).

The similarity between my two-dimensional model and Watson's model of positive and negative activation is quite apparent. In fact, the two models are substantially the same although the dimensions were given different names. The similarity between my model and Russell's model is also apparent with reference to combinations of energetic and tense arousal, which yield complex mood states. These complex mood states in my model match Russell's basic dimensions, especially the dimension of pleasure/displeasure (Yik et al., 1999).

That these multidimensional models are valid indicators of the most basic underlying dimensions of affect is suggested by various kinds of evidence. However, considering the four models of affect that are most prominent, which one is most valid?

I believe that energetic and tense arousal best capture the most elemental biopsychological processes that underlie affect. However, there is substantial precedent for a basic psychological dimension of pleasure/displeasure (e.g., Russell). Affective states of energy and tiredness are more central from a biological perspective in my view. This energy/tiredness dimension underlies all health and general behavior. Wakefulness (closely correlated with energy) as well as sleep (tiredness) is a primary dimension of all life forms; thus, energetic arousal is a fundamental dimension of life. Also essential for survival is the ability to react to danger, and these reactions are mediated by tense arousal. Without the capacity to react to hostile environments, survival would be limited. Based on this very general biological perspective, energetic and tense arousal appear to be the most fundamental dimensions of affect.

This being said, I believe that all four models are basically compatible. Exploring this point further, cross-sectional studies have shown energetic and tense arousal to be orthogonal as the other competing models similarly exhibit orthogonality. But I believe that this apparent independence does not reflect the way that energy and tension interact under different activating conditions.

To illustrate this point, as we change from tiredness to high energy, tension states change and complex moods occur. At high levels of energy together with low tension, pleasurable moods are experienced. I call this complex mood "calm energy." On the other hand, for the moderately energized individual, as tension increases to the highest level, very negative moods occur and I call this complex negative mood "tense tiredness." Just as calm energy is very pleasurable, tense tiredness is experienced as displeasure. It is apparent then that my bipolar complex mood dimension represents both calm energy on one end and tense tiredness on the other end as the same as Russell's (2003) core mood that extends from pleasure to displeasure. Other combinations of the energy and tension dimensions yield the complex mood states that I call "tense energy" and "calm tiredness." Tense energy and calm tiredness represent different levels of arousal and from this we can see a similarity to all four models of affect. Thus, the four most prominent models of mood are compatible.

**How Complex Moods Are Formed by Energetic and Tense Arousal Interactions**

As indicated earlier, the four most prominent two-dimensional models of affect or mood are usually derived by cross-sectional studies in which all levels of both dimensions are represented (e.g., Yik et al., 1999). But in everyday experience changing activating conditions influence the two dimensions differentially. Thus, in my model, as activating conditions increase tense arousal, energetic arousal increases as well, yielding the complex mood of tense energy. But this only occurs up to a moderate level of activating conditions. Beyond that as tense arousal increases further, energetic arousal begins to decline, eventually resulting in the complex mood of tense tiredness. In a similar way, as activating conditions increase energetic arousal from low to moderate levels, tense arousal also increases. But as tense arousal is increased further energetic arousal is decreased, thus yielding the complex mood that I call "tense tiredness."

In statistical terms, energetic and tense arousal bear a positive correlation from low to moderate levels of activating conditions and a negative correlation from moderate to high levels. Thus, it follows that these two types of correlation together result in orthogonal dimensions in cross-sectional studies. It is notable that these positive and negative correlations are the same regardless of whether activating conditions that drive energy result at high levels of energy and low tension (calm energy) or if activating conditions that drive tension result in high tension and low energy (tense tiredness). These relationships are portrayed in Figure 7.3.

This moderate level at which a positive correlation becomes negative has not been independently established from psychophysiological criteria other than affective response, but rather it must be observed on the basis of the shifting correlations. Speculating somewhat loosely, the moderate point at which increasing tense arousal results from decreasing energetic arousal probably is related to current physiological resources that can be assessed on the basis of subjective levels of energy. The moderate point at which increasing energy results in decreasing tense arousal is likely to be based on temperament (e.g., neurotism).

Finally, as energy declines and tension increases there is a point at which energy is at such low ebb that exhaustion occurs. In my experience, this state of exhaustion may be quite pleasant, but in this condition the individual operates almost like an automaton in which behavior is directed cognitively without the usual subjective feedback that comes from sensing energy resources to sustain ongoing behavior. Although this may be experienced as a pleasant waking state, rest or sleep is the primary motivational directive. There is also some indication that this exhaustion state leaves one particularly vulnerable to serious physical breakdown (e.g., Prescott et al., 2003).

These interactions between the two arousal dimensions carry a number of motivational implications. For example, at different times of day different activities are likely to be more or less attractive. In the first part of the day as subjective energy increases in its natural circadian cycle physical activity is likely to be more attractive. But in the last part
of the day as energy declines and tiredness increases physical activity is likely to be less attractive. Likewise, cognitive demands probably vary in degree of attractiveness.

**Calm Energy**
It is useful to describe further the combination of energetic and tense arousal because this complex state relates to common emotions and thus leads to greater understanding of mood. One primary component is calm energy, the mixed mood state that I regard as most pleasurable and in many respects optimal for cognitive and physical functioning in waking hours when activity is appropriate. This mood is often not fully recognized. For example, in one talk I gave, a rather intense young man challenged the concept by saying that he does not understand calm energy because whenever he feels energetic he always feels slightly wired. (The feeling he was describing was a state I would call tense energy, a common mood in today's stress-filled society.)

Calm energy does exist during waking hours (primarily higher activity hours of day) when people experiencing it feel energetic and yet are very calm. In this state they experience little general muscular tension. I regard this as a Zen-like state in which there are little or no tension-related stress reactions, a state in which natural cycles of greater and lesser energy occur, but tension is absent or at a low level.

Calm energy also bears a similarity, in my view, to Csikszentmihalyi's flow (1990), particularly on the basis of pleasurable attentional focus with full involvement. I also think of calm energy as enhancing athletic performance. In this regard, Morgan's (e.g., Morgan & Pollock, 1978) concept of the iceberg profile (high vigor coupled with low negative mood), which characterizes world-class athletes, is relevant. Probably related to this are anecdotal descriptions by athletes when their performance is so outstanding that they are in the zone. Calm energy also is an optimal predisposition in the martial arts such as karate and judo and is a valued state during the meditation in movement of Tai Chi Chuan.

Calm energy is such an attractive state that people may seek it through self-medication for instance such as caffeine, tobacco, and amphetamines.

**Tense Tiredness**
The bipolar opposite to calm energy in psychometric space is tense tiredness, a complex mood that is as negative as calm energy is positive. As resources decline and feelings of energy change to tiredness, vulnerability to stressful circumstances develops and tension arises. This state often develops late in the afternoon or later in the evening when stress is present. But tense tiredness may occur at any time when personal resources are depleted and stressful circumstances are present.

Although optimism and happiness are calm energetic states, feelings of depression and pessimism about the future are fostered by tense tiredness. As we shall see later when I discuss self-regulation, tense tiredness is a state that people self-regulate to feel better, often with food or drugs. For example, there is good evidence that tense tiredness motivates breaking diets (also succumbing for other proscribed substances such as cigarettes) (Thayer, 2001). And in general, food urges are motivated by tense tiredness and overeating can be traced to this mood state.

**Tense Energy**
Two other complex mood states should be described to complete the picture of the interactions of energetic and tense arousal. One very common complex mood will be familiar to many people engaged in high-energy productive activity, but where stress-related tension is present. This is tense energy. Like calm energy, tense energy is also positively evaluated by many people. It is a state that combines energy and tension together. This is a common condition of a modern stress-filled society in which people may be quite productive and feel energetic but are never fully relaxed.

**Calm Tired**
The fourth complex mood to be described is calm tiredness. This state is optimal for sleep and is often sought through drugs by tired people who need sleep but suffer from the common condition of insomnia, which is usually due to low-level tense tiredness. In my view these sleep aids are not nearly as effective for restful sleep as naturally occurring tiredness together with the absence of tension because they involve side effects and they interfere with natural bodily processes.

Other commonly experienced emotions may be understood in relation to these interactions of energetic and tense arousal. Mentioned earlier is the observation that depression is a condition of low energy and increased tension (especially agitated depression). Other common emotions that can be understood in this context are happiness, optimism, anger, and boredom. Feelings of happiness are not to be confused with the trait of happiness, which we know is often correlated with the trait of extraversion (Plomin, Diener, & Fujita, 1990). Instead, it has to do with the state or the actual experience when one is feeling happiness (Yik et al., 1999). This calm energetic state is also related to feelings of optimism, a time when problems are perceived as most easily solvable (Thayer, 1987b).

In my view, anger is likely to represent a combination of energy and tension (tense energy). I base this idea on the observation that anger is diminished by extreme fatigue (moderate fatigue may increase tension and disinhibit angry thoughts). Additionally, one can observe that when angry and beginning to exercise—a common way of increasing energy—anger may increase at least until the exercise leads to exhaustion. Finally, boredom is often misunderstood as a low arousal state, but it is better interpreted as a state of tense tiredness (cf Berlyne, 1960). Boredom has been found to be an antecedent to overeating, and I have interpreted this as an example of self-regulation (Thayer, 2001).

**General Bodily Arousal**
General bodily arousal which underlies the mood dimensions that I have proposed represents interrelated multiple systems within the body on an arousal continuum that is associated with energy expenditure. When a resting individual becomes physically active, a wide variety of bodily systems are mobilized as energy expenditure increases. A similar pattern of mobilization occurs as a sleeping individual becomes maximally alert or as a calm person becomes intensely emotional. This mobilization occurs in a more or less integrated fashion, although the pattern of activation across bodily systems is not perfectly correlated. Reduced intradividual correlation is likely due to differing latencies and strength of system responses. Plus there are unique responsibilities of each system for bodily homeostasis.

That a broad pattern of integration generally is the rule as the individual changes from low to high arousal with increasing amounts of energy expenditure is evident by comparing system levels from states of baseline or low arousal and reduced energy expenditure to states of high arousal and high-energy expenditure. As energy expenditure increases, each system evidences its own activation pattern. These patterns are not perfectly correlated, but the general interrelationship is apparent with reference to the low and high end points of energy expenditure.

To pursue this matter a bit further, consider an example of a resting individual who stands and
begins to physically exercise (e.g., walks with increasing rapidity). Bodily arousal is reflected in a very general way throughout the body with increased cell metabolism, respiration, heart rate, blood pressure, adrenaline, cortisol, and other physiological systems associated with energy expenditure. At the brain level, infusions of neurotransmitters such as norepinephrine, dopamine, and serotonin mediate bodily arousal.

In my view, growing subjective energy and tension are part of this integrated pattern that consti-
tutes general bodily arousal as increased feelings of energy and tension occur (Thayer, 1970, 1989).
'To summarize, in the bigger picture the subjective experience of energy and tension can be traced throughout the body from a basic level of the cel-
lar mitochondria, up through neurotransmitter effects on relevant brain mechanisms (Brown, 1999; Duffy, 1962; Malmo, 1975; Thayer, 1989). Subjective energy and tension are the conscious representa-
tions of this general bodily arousal pattern.

Muscular Tension: The Activated Freeze Response
The similar activation pattern for both energetic and tense arousal follows from a biological perspec-
tive since both arousal systems predispose mobilization for action—ongoing actions with energetic arousal and preparation for (emergency) action with tense arousal. The most definitive difference between the two arousal patterns is in affect. How-
vver, there are other differences as well, although the full extent of the psychophysiological differences, including brain patterns, is not fully known. But several differences should be noted.

One physiological difference may be that tense arousal is associated more with anaerobic metab-
olism, whereas energetic arousal reflects aerobic metabolism (Thayer, 1989). For example, prepara-
tory emergency arousal in the case of tension dif-
ers from energetic arousal at least in respect to skeletal-muscular activation. Thus, subjective states of tension, stress, and anxiety are characterized by preparatory muscle tension with an absence of directed motor activity. As one good indication, muscles around the thoracic cavity are tight, reflect-
ing a pattern of restraint. Exemplifying this, breath-
ing occurs at the top of the lungs in a short panting pattern. But with energetic arousal that is associated with ongoing activity, diaphragmatic breathing is more the rule.

The skeletal-muscular inhibition associated with tension reflects what I have called the activated freeze response. The fight-or-flight pattern made famous by Walter Cannon 100 years ago is preceded in danger situations by freezing, which optimizes avoid-
ance of detection (Thayer, 1989). Although the fight-or-flight response is much better known than the kind of freeze response to which I refer, Can-
on himself did note this initial reaction to danger (Cannon, 1929/1963). In my view, this activated freeze response plays an important role in the everyday experience of such states as nervousness, jitters, agitation, anxiety, and fear. This tension state (with the subjective opposite of calmness) experienced on a chronic level can produce headaches, as well as pain in the jaw, back, and shoulders.

Besides the degree and type of skeletal-muscular tension, through the experience of tense arousal, other physiological differences probably exist such as the particular physiological patterns that differentiate adrenaline and cortisol (Dienun-
bier, 1989). Moreover, at the level of brain processes there undoubtedly are differences leading to the two kinds of subjective experience associated with the two dimensions of energy-tiredness and tension-calamity. Relevant here would be brain structures such as the reticular activating system, the limbic system, and cerebral cortical lateralized activation.

Self-Regulation of Mood
People seek pleasure and avoid pain. This hedo-
nic principle has governed my work in relation to the self-regulation of mood (Thayer, 1989). When behavior is not required by schedules and previously made plans, when there is choice about what to do next, the preferred chosen behavior follows this hedonic principle. Sometimes this involves awareness of a negative mood followed by a conscious decision to take some action to feel better. But often there is only a low-level awareness of this process. In general, this probably is initiated by a thought about a pleasant activity that is sufficiently attractive to motivate action.

I maintain that people prefer moods of increased energy and reduced tension (calm energy), and they behave in various ways to achieve this state. They also act in various ways to reduce moods of tension and tiredness (tense tiredness). The direction of the preferred motivational process is from tense tiredness (mood to be avoided) and toward calm energy (optimal mood). For some types of people (e.g., Type A), however, tense energy may be preferred. Furthermore, when sleep is desired, the motiva-
tional direction would involve change from tense tiredness to calm tiredness.

To test this theory, my colleagues and I con-
ducted a series of correlational studies in which a representative sample of adults from high school age through mid-eighties were first questioned about what they do when they are in a bad mood (also need increased energy and reduced tension) and what works (Thayer, Newman, & McClain, 1994). Hundreds of ways to self-regulate their mood were indicated and these were content analyzed yielding 29 categories of behaviors people regularly employ to try to change a bad mood. The categories that are used were then placed in an anonymous ques-
tionnaire that was administered to a representative sample of 308 respondents from 16 to 89 years who indicated methods they usually use to change a bad mood. We found both common methods they use. This most common method was then rated for suc-
cess. Finally, people were given the opportunity to indicate things they do to change a bad mood but were not included in the 29 categories. Since none of these alternatives appeared to be sufficiently dif-
ferent from the list of 29, we assumed that the list was fairly all inclusive.

Of the 29 categories the most common response involved seeking social interaction (i.e., call, talk to, or be with someone) and was endorsed by 54% of the respondents. Since we collected demographic information it was possible to determine that females were significantly more likely to endorse this activity, but many males chose this activity as well. Males, on the other hand, were significantly more likely to endorse the second most common response (51%), control thoughts (i.e., think posi-
tively, concentrate on something else, don't let things bother, give self pep talk), but many females chose this way as well.

The third most common response and judged second in effectiveness (listen to music, 47%) was a surprise to me at the time of the research, but since that time it has become more evident that our find-
ing of a median split indicating that younger people were significantly more likely to choose this response than older people was valid. With audiences to whom I have spoken involving many young people, music listening to regulate mood is endorsed by the vast majority by a show of hands. Why listening to music would be so prevalent in regulating mood is not clear, but this mood regulation method cur-
rently is a vigorous research area, some focusing on the mood variables that I have proposed (e.g., Hirokawa, 2004; Lim, 2008).

Although seeking social interaction was the most commonly endorsed item, three of the first seven choices involved cognitive responses, thus indicating the importance that cognition has in mood regul-
ation. This is a point that I have made in many ways, including the idea that the differences between emo-
tions must involve the interactions of energetic and tense arousal and cognitive interpretations (Thayer, 1989, 1996). We also looked at the 29 categories of mood regulation chosen by our research participants using factor analyses. Six factors were readily interpretable, and I have come to look at these factors as mood regulation strategies that have varying degrees of effectiveness. These degrees of effectiveness were judged both by our participants and also by a panel of 26 doctoral-level psychologists who graciously volunteered to make judgments of these items.

Of the six interpretable factors, the first one which we named Active Mood Management was judged the most effective both by our research partic-
pants and the panel of psychotherapists. This strategy nicely supported the mood theory that was one of the bases of our research. The five most highly loaded items of this strategy included, first and sec-
ond, two ways for reducing tense arousal: relaxation techniques (e.g., deep breathing, stretching, muscle relaxation), and stress management activity (e.g., yoga, exercise). The third item on this most effective strategy included the way that was judged the most effective way of changing a bad mood: exercise. The third and fourth items on this most effective strategy were cognitive items: put feelings in perspective and evaluate or analyze the situation. Thus, the best strategy for changing a bad mood involves simultaneously reducing tension, raising energy, and employing cognitive control.

Conclusion
The moods that influence our lives in all major aspects are affected in one biopsychological dimension by natural processes such as health, sleep, diet, and exercise (a go system) and in the second dimension by stress and perceived danger (a stop system). Complex moods arising from interactions of these dimensions account for many elements of motivation. These are not insignificant feelings, but rather they are excellent barometers of the overall psychology and physiology of the individual. One of the most important impli-
cations for motivation is the way that people both consciously and unconsciously self-regulate these moods in a wide variety of ways, and this generally follows the hedonic principle of motivation to optim-
imize positive moods such as calm energy and reduce negative moods such as tense tiredness.
Future Directions

Further empirical and theoretical research could productively focus on the way that complex moods occur from the interactions of the two major biopsychological dimensions. This suggests potential solutions for previous points of confusion such as those concerning "paradoxical" effects of nicotine—that cigarettes both activate and deactivate simultaneously (Gilbert, 1979). Other seemingly paradoxical effects of drugs such as caffeine and cocaine may be important in this same respect. Likewise, these seemingly paradoxical effects occur with hyperactivity, a condition in which activating drugs such as caffeine and behaviors such as exercise appear to improve the condition. And in the exercise science literature, one finds similar dual arousal effects such as the fact that vigorous exercise produces calmness and tiredness simultaneously (Hall, Eldokakas, Petruzzello, 2007). These seemingly paradoxical effects may be understood, of course, by the orthogonality of energetic and tense arousal in cross-sectional studies but the complex interaction of these dimensions at different activation levels. Finally, what is not known well is how best to designate the moderate point at which increasing tension leads first to increased energy but at some point to reduced energy. Similarly, what is not known well is how to designate the moderate point at which increasing energy can lead first to increasing tension (in a stressful context) but at some moderate point to reduced tension.

Acknowledgment

Thanks to Martin Pfeiffer and Ralph Hupka for comments on a draft of this chapter.

References