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Treatment Interventions I: Working with the Body

Abstract From the perspective of the stress-system model, the treatment of functional somatic symptoms involves a system-level approach. The factors that contribute to stress-system dysregulation and the emergence of functional somatic symptoms operate, both proximally and over longer periods, on different system levels: body, mind, attachment and family relationships, academic expectations, and interactions and relationships at school with other children, teachers, and even health professionals. The treatment program will therefore require a multi-levelled, systems approach that is designed to meet the specific, but diverse, needs of each particular child and the family. In this way, the mental health clinician or, more usually, the clinicians that make up the multidisciplinary team work with the child to implement interventions on the body and mind system levels; with the family to

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implement interventions on the family system level; with the school to implement interventions on the school system level; with health staff to implement changes in the medical system; and so on. In this chapter we describe some of the treatment interventions that involve working with the child on the body and brain system level—what we call working from the *bottom up*.

Assessment leads into treatment. During the assessment process the mental health clinician (or more typically, the multidisciplinary team), the child (including adolescent), and family have worked together to co-construct a *formulation*, the story that integrates, in chronological order, all the factors, on multiple system levels, that contributed to the child's functional illness and her clinical presentation (see Chapter 3). Now the clinician uses the formulation to guide the choice of treatment strategies, techniques, and interventions to promote change. When working with children with functional somatic symptoms, the treatment starts with the body.

Bottom-Up Interventions and Regulation Strategies That Involve the Body System Level

In the broader literature, interventions that target the body system level—bottom-up regulation approaches—are also known as body-oriented, somatic, body mindfulness, bottom-up mindfulness, or biofeedback interventions (Bloch-Atefi and Smith 2015). Many of these approaches involve working with the *felt sense* of the body, in which attention is focused on body sensations. Attending to the felt sense of the body—the somatic or body narrative (Sharpe Lohrasbe and Ogden 2017; Levine et al. 2018)—is a skill that the child can practice with the guidance of a therapist or instructor. The child learns to attend to body sensations and learns to follow them. In this context, think of the rapidly evolving sensations that occur when drinking something with a lot of fizz, or the slow, repeating sensations in the nose, chest, or abdomen that can be felt with each breath.

The Neurobiology of Bottom-Up Interventions

Attention to body sensations involves activation of autonomic, interoceptive, proprioceptive, and classic sensory afferents. The activation of these afferents then influences the pattern of activation in three separate brain regions: subcortical regions that underpin homeostasis, arousal, and pain; cortical brain regions that are part of the limbic system (which also process information about homeostasis, arousal, pain, and emotional states); and temporal lobe regions that process internal representations about the self (Guendelman et al. 2017).

Currently available studies pertaining to programs implementing bottom-up interventions show that they result in neuroplastic (healing) changes in brain regions involved in processing body state and representations of self (see above). These interventions do not effect changes in regions of the prefrontal cortex that engage in top-down regulation of emotion via cognitive processes or changes in thinking and understanding (Guendelman et al. 2017). An example of a bottom-up intervention is Mindfulness-Based Stress Reduction (MBSR), a program that involves close attention to moment-to-moment experience, shifts in attention from one sensory modality to another, a body scan with attention to the transient nature of sensory experience, and various forms of meditation (breathing, eating, walking) (Goldin and Gross 2010; Kabat-Zinn 1990). In this book, for simplicity—and because of the need to use simple language when talking to children—we use the expression *brain stress systems* to refer to the complex network of regions involved in homeostasis, processing of information about body state, and responding to stress or threat (see Chapter 11 and Online Supplement 11). In this way, when bottom-up regulation strategies are implemented successfully, they facilitate a shift in body state and brain stress-system activation (reflected in biomarkers).

As we mentioned above, an important element of bottom-up regulation strategies is that they do not engage the prefrontal cortex and cortical regions that are usually implicated in top-down emotion regulation (Guendelman et al. 2017). They work directly with the body and do not require the child to use language, to be able to manipulate cognitions,

or to have access to memory or cognitive information about stress or past events. Although interventions on the body system level do not target the mind system level per se, there are important ripple effects (see Chapter 13): the child increases her sense of mastery and control as she learns to observe and manage her body states and as she becomes increasingly more competent in averting states of incoherence, dysregulation, and dis-ease—for example, fainting episodes, non-epileptic seizures (NES), and exacerbations of pain—and in bringing about states of coherence, regulation, and well-being.

Begin the Treatment Process with Interventions That Target the Body

Bottom-up regulation approaches have particular utility in treating functional somatic symptoms. These approaches to regulation have an inherent acceptability for children and their families. Since the child is presenting with symptoms in the body, it seems natural to the child and family that treatment should start with the body. In this way, in day-to-day clinical practice, beginning the treatment intervention with bottom-up regulation approaches helps consolidate engagement and trust, and functions as a *safe* bridge that enables the child and family to move toward exploration of psychological issues that may also need to be examined and addressed. Interventions on the body system level can be used by the child to help decrease activation and dysregulation of her stress system—that is, to shift the stress system from defensive to restorative mode. If the child is able to shift her stress system from one mode to the other, then the neurophysiological conditions that support the production of functional somatic symptoms are no longer present, and the child's functional somatic symptoms should resolve.

Bottom-up interventions also provide a way of moving forward in circumstances where progress might otherwise be difficult: when the family is not yet ready to address other factors that contribute to stress-system activation and dysregulation; when factors that contribute to stress-system activation and dysregulation are beyond the capacity of therapy to address (e.g., death of an attachment figure); when meaning

making is difficult or impossible; when meaning making may potentially cause harm (see Online Supplement 12.1 about meaning making); or when the child's level of activation is so intense that any attempts to use a talking therapy or cognitive strategies are likely to fail because the child's prefrontal cortex (along with her executive and problem-solving skills) is unlikely to be functioning properly (Hermans et al. 2011; Arnsten 2015). Because somatic interventions help the child to regulate, they help the child to shift her body toward what Daniel Siegel (1999) refers to as the *window of tolerance*—in which arousal is neither too high nor too low—and what Stephen Porges refers to as the neurophysiological conditions, or *neural platform*, required for the child to utilize talking, cognitive, or interpersonal interventions (Porges and Furman 2011). Likewise, somatic interventions may be the only way forward to achieve regulation and well-being when working with children and families who have a frank aversion of *psychological* interventions; in such cases, adherence to treatment interventions that involve a large psychological component seems improbable.

How to Integrate Bottom-Up Interventions into the Treatment Program

Within the treatment program, bottom-up interventions on the body system level are used in two different ways. When such interventions are integrated into the child's daily routine, the child is learning, through regular repetition, a means by which she can improve the regulation of her stress system. They can also be used as part of the child's safety plan (see below)—emergency strategies or stop-break strategies—to interrupt the somatic sequence of activation that occurs in advance of episodic functional somatic symptoms such as fainting, NES, or sudden exacerbations of pain, or that is associated with hyperventilation or panic attacks. Initially, the child practices these emergency strategies multiple times every day—to hone the skills of implementing them—and she subsequently uses them preventively when she senses the specific changes in her body, her warning signs, that the somatic activation sequence has been activated (see later subsection 'Tracking/Sequencing

Body Sensations’). Once the child has identified which bottom-up regulation approaches work for her, they become part of the child’s mind-body toolkit (Kozłowska and Khan 2011).

Language for Talking About States of Body Activation with Children

When working with children we use the terms *activated*, *revved up*, *switched on*, *aroused*, and *in defensive mode* interchangeably to refer to the stress system or some component of the stress system being activated (too much) or dysregulated. In our clinical practice we choose words that best match the child’s presentation and that are appropriate for the child’s developmental capacity and preference. For example, younger children understand the term *switched on* and like to use it in relation to tracking somatic sensations such as autonomic symptoms of arousal (see Chapter 6), activation within the motor system (see Chapter 7), and activation of the pain system (see Chapter 9).

Interventions That Target the Body Itself

In this section we focus on interventions that target the body itself. The reader will see that many different interventions on the body system level can be integrated into the treatment intervention.

Stabilizing Sleep and the Circadian Clock

In Chapter 5, we saw that many children with functional somatic symptoms have a dysregulated circadian clock: unrefreshing sleep, sleep that is interrupted, sleep that is too long, or a circadian rhythm that is out of alignment with the earth’s revolutions around the sun. Because the circadian clock coordinates activity and coherence in all other components of the stress system, the stabilization of sleep is often the first intervention that is implemented on a body system level (see Chapter 5). For some children, improved sleep brings an immediate improvement in

subjective well-being, a decrease in the intensity or frequency of their somatic symptoms, and an increase in the child's capacity to engage with other treatment interventions. While stabilizing sleep may involve a combination of bottom-up (e.g., use of toys that can be heated up to provide comfort [akin to a hot water bottle]), behavioural (sleep hygiene), brain-level (e.g., use of melatonin), and top-down (e.g., hypnosis) interventions, we place the sleep intervention here because is it typically the first intervention—which children and families perceive as involving the body—that we implement with children and their families.

Documenting Somatic Symptoms on a Body Map

Given that sensations are difficult to communicate in words, the child should be encouraged to communicate to the clinician about them using non-verbal means, as by indicating colour, shape, or intensity (e.g., a light versus dark imprint) on a *body map* (see Fig. 14.1).

The body map intervention has multiple purposes.

- It ensures that no symptom has been missed.
- It enables the clinician to assess how skilled the child is at reading her body. Does she notice subtle changes in body state, or does she notice symptoms only once they have peaked? Does she notice the triggers that activate her body to produce her symptoms?
- The symptoms documented on a body map allow the child and therapist to compare what the child's body feels like when the child is activated versus when she is less activated—for example, after a relaxation exercise. This use of the body map to track a broad range of body states increases the probability that the child will be able to notice changes in body state—increases in activation—when these begin to occur.
- Some children find it helpful to depict their subjective experience of body state in this concrete fashion—the visual representation—because it helps them hone their skills in recognizing certain body states, in noticing changes in body state (e.g., states of activation), and in gaining confidence that these skills are within their reach.

Fig. 14.1 A child's body map. The figure presents the body map of an 11-year-old boy who presented with intermittent leg paralysis, fainting episodes, NES (which involved shaking of the entire body), and symptoms of dizziness, breathlessness, and fatigue. The body map shows his leg paralysis and his subjective experience of his body activating prior to the NES events (© Kasia Kozłowska 2017)

- Bringing attention to body sensations is a key skill in bottom-up mindfulness techniques—for example, the body scan meditation, or meditation while focusing on the breath—and, more generally, in bottom-up regulation strategies (see below).
- Sequential body maps are a means of tracking the degree to which the child's body has become less activated—shifted from defensive to

restorative mode—in response to treatment. These sequential maps are useful in marking treatment gains and in reinforcing the value of the program (e.g., ‘See how well you’re doing!’).

- The clinician can use the map as part of psychoeducation (see Chapter 15) to explain again the connection between the symptoms, stress, and activation of the stress system—thereby repeating for the child some of the information that was given in the family assessment session. The process of drawing the body map also helps the child to feel understood in a tangible, embodied way.

Note that these maps are drawn and used as part of the child’s individual therapy session, with the clinician using an interested, mindful stance that is very different from the anxious concern about symptoms and attention to symptoms that is typically shown by parents.

Tracking/Sequencing Body Sensations

Tracking somatic sensations—that is, identifying their occurrence—and then determining their temporal order, or sequence, are important tasks in some types of functional presentations, including hyperventilation-related somatic symptoms, NES, and pain presentations (see Online Supplement 14.1 for the different paths that therapists have travelled in coming to understand the value of tracking/sequencing body sensations). If the child and clinician can establish the recurring sequence of sensations, the child can practice identifying the sequence in its early stages—what we call the *warning signs*—and then implementing mind-body strategies that interrupt the sequence. The goal is to disrupt the sequence and to avert the functional somatic symptoms that otherwise would have resulted, as in the following vignette of Bella.

Bella, the 12-year-old girl presenting with NES whom we met in Chapter 7, experienced her NES as very stressful because she felt like she had no control over what happened to her body. She felt helpless and hopeless; she worried about her NES all the time; and she gave into her symptoms whenever they began to unfold. Soon after admission, during a

session with her psychologist, Bella was able to identify some of her warning signs: ‘spacing out’ and not feeling real; a change in the quality of auditory and visual stimuli; a cold feeling in the chest and stomach; and feeling dizzy. In her next psychology session, Bella was able, with the guidance of her therapist, to implement a self-regulation strategy—slow breathing combined with images of safety and calm—when she first noticed the warning signs. In this way, she interrupted the pattern of activation and was able to avert the NES. Bella was excited by her achievement, and the therapist—together with the entire mind-body team—celebrated the achievement with her during ward rounds the next day. From a position of increasing competence, Bella now expected that if she practiced her regulation strategies, she would be able, in time, to manage her NES. In parallel, Bella’s parents, rather than focusing on the NES per se, began to focus on the way that Bella was able to notice warning signs and to implement strategies that averted them (a focus-of-attention intervention with the family). Both her parents and the family system as a whole became less anxious and more regulated. As a consequence of her hard work—noticing her warning signs and implementing her strategy immediately—Bella’s NES decreased in frequency and length, and then ceased altogether.

The following vignette, while similar in overall outline to the one above, illustrates the challenges of identifying the sequence of precursor symptoms and then developing an intervention that interrupts the sequence leading to the NES.

We first met Evie, a 15-year-old girl, in Chapter 2. As later discussed briefly in Chapter 12, her NES were triggered by acute chest pain (*precordial catch syndrome*), with the pain being so sudden and so distressing that she had no time to implement a regulation strategy. When the symptoms were tracked more carefully, however—that is, when the therapist asked Evie to track what happened in her body before the pain started—a regular sequence emerged. First, Evie felt a difference in temperature. She felt hot on the inside and cold on the outside. This change in temperature is consistent with sympathetic arousal, which causes increased energy use on the inside (feeling hot) and an increase in perspiration (feeling cold on the skin). Second, Evie experienced numbness and tingling in her left arm, blurring of vision, and shortness of breath—what she described as

‘I can’t breathe.’ All these experiences are common symptoms of hyperventilation, the stress-related activation of the respiratory motor system and skeletomotor muscles in the chest. Hyperventilation had previously been documented in all of Evie’s presentations to accident and emergency. Third, alongside the symptoms of hyperventilation, Evie experienced a burning and lump sensation in her throat—consistent with a tension pattern in skeletomotor muscles that make up the top third of the oesophagus—what is commonly known as a *globus sensation*. Sometimes this sensation was accompanied by a burning sensation or an odd taste in the mouth, presumably related to decreases in saliva secretion resulting from sympathetic activation. Fourth, only at this point in the sequence would Evie begin to experience the chest pain—starting initially at a low-grade level of 3/10. Presumably, the chest pain reflected the progression of tension patterns of muscles and fascia within the mediastinum—what is referred to as precordial catch syndrome (see Chapter 2). Fifth, the pain would then rapidly progress in acuity, and any rating of > 5/10 would be unbearable. Sixth, this unbearable, > 5/10 pain would then trigger an NES. With practice, Evie found that if she could intervene with a regulation strategy (in her case a visualization strategy) in the early phases of the sequence—when the feelings of heat and cold, the globus sensation, the feeling of breathlessness, or the tingling in her arm or blurred vision first emerged—then she was able to avert the subsequent phase of the sequence. If she did not intervene early, the sequence would then inescapably progress to the chest pain and to an NES.

The Body Scan

The *body scan* was introduced into Western clinical practice by Jon Kabat-Zinn, a professor of medicine who studied Buddhist practice under Zen Buddhist teachers (for early references and history, see Online Supplement 14.1). The body scan is a bottom-up mindfulness exercise that involves the child sitting or lying in a comfortable position and slowly placing attention on various regions of the body, from the feet to the head. The child is guided by a therapist or, if the exercise is done in a group, an instructor, and audio recordings are also available for guidance. The body scan can be practiced at various speeds and levels of precision, all with ‘affectionate, openhearted [and] interested’

attention to the body (Kabat-Zinn 2005, p. 250). For children who enjoy movement or who find it difficult to stay still, an alternative to the body scan is to pay careful attention to the body during movement—for example, during a walking meditation or in the practice of Qigong—so that the movement is carried out in a conscious and deliberate manner. Another possibility is to engage them in group activities that involve synchronized movement. For a further discussion of Kabat-Zinn and the body scan, see Online Supplement 14.1.

In adults, mindfulness interventions based on Kabat-Zinn's MBSR program (Kabat-Zinn 1990)—which includes bottom-up interventions such as the body scan—have been found to down-regulate various components of the stress system: the hypothalamic-pituitary-adrenal (HPA) axis, autonomic system, immune-inflammatory system, pain system, and brain stress systems. For references see Online Supplement 14.1.

Slow-Breathing Interventions

Slow-breathing interventions, which have a long history in Eastern meditative traditions, are used in some biofeedback techniques and are integrated into most relaxation exercises. Slow-breathing interventions build on the human ability to control respiratory rate via skeletomotor muscles in the diaphragm and the intercostal muscles in the chest wall (Russo et al. 2017). A healthy inhalation pattern involves contraction (downward movement) of both the diaphragm and intercostal muscles, which work together to increase the size and decrease pressure within the chest cavity, enabling air to move into the lungs. Quiet expiration is a passive process that occurs when the muscles relax. Forceful expiration is an active process in which the abdominal and intercostal muscles work together to push the abdominal organs up against the diaphragm, thereby decreasing the size of the chest cavity, increasing pressure within it, and pushing air out of the lungs.

Because of coupling between the autonomic and respiratory motor systems (see Chapter 7), along with the interactions between the autonomic system and other components of the stress system—brain stress systems, immune-inflammatory system, and pain system—breathing at a slow rate is associated with myriad neurophysiological changes.

Key changes include increased vagal tone to the heart, increased neurophysiological coherence, down-regulation of energy-regulation systems, decreased energy use, down-regulation of brain stress systems, decreased subjective pain, and increased subjective well-being (for references see Online Supplement 14.1). In this way, slow-breathing interventions can be used as part of the child's daily routine to down-regulate the stress system and improve the child's overall health and well-being. In some children, slow-breathing interventions are also a useful *stop-break intervention* that the child can use to interrupt patterns of increasing arousal and motor activation that lead to panic attacks, fainting episodes, NES, or acute exacerbations of pain (Kozłowska et al. 2018).

Theoretically, formal assessment of the breathing rate that is associated with the highest vagal tone, also known as the *resonant-frequency breathing rate* (Lehrer et al. 2000), is helpful. This assessment can be done using biofeedback devices. The resonant-frequency breathing rate—usually around 6 breaths per minute in adults and 5–8 (median = 7) breaths per minute in children and adolescents (Richard N. Gevirtz, unpublished data)—is associated with the maximal heart rate variability, optimal baroreflex function, optimal gas exchange in the lungs, and coherence across body systems (Lehrer 2013; McCraty and Zayas 2014). This synchronization effect is also referred to as harmonic coupling between heart rate variability, respiration, blood pressure, and blood flow to tissues (Paccione and Jacobsen 2019). In clinical practice, however, children who present in a very activated state—with resting breathing rates that can be as high as 25–50 breaths per minute—can rarely achieve their resonant-frequency breathing rate. In this context, the child and clinician have to work with the lowest breathing rate that the child can achieve and comfortably train at. The option to formally measure the child's resonant-frequency rate and to make further gains from the slow-breathing intervention may be more achievable after the child has been able to achieve breathing rates within a normative range (Fleming et al. 2011) and after the child's skills for slowing down the breathing rate have improved (see, e.g., Chandra et al. [2017]).

The simplest way to achieve slow breathing is to have the child lying down on a mat on the floor with a paper cup or a toy on his or her abdomen, which enables both the child and the therapist to observe its

movement. The clinician then counts slowly while the child breathes in through the nose and breathes out through the mouth. Theoretically, expirations should be longer than inspirations, but in reality, slow breathing that has a nice continuous rhythm (vs. jerky breathing) and that uses the diaphragm as the main muscle of breathing (so that the cup moves up and down in a smooth fashion) is a substantial achievement. Other techniques and resources for achieving diaphragmatic breathing, which readers can try out for themselves, are described elsewhere (see Online Supplement 14.1).

Alternatives to Breathing Interventions

Not all children can use breathing interventions. Sometimes the child is too young, and sometimes putting the focus on attention on the breath is activating; it increases the breathing rate and the probability of hyperventilation or a panic attack. Alternatives to the slow-breathing intervention include humming, *bee breathing* (see Online Supplement 14.1), and use of the *voo* sound (Brown and Gerbarg 2005; Levine 2010). These techniques utilize the long, extended breath and activation of vagal afferents (from the vibration) to up-regulate vagal nerve function, thereby down-regulating autonomic arousal.

Grounding Interventions

Grounding interventions are used with children to help create ‘a felt sense of connection to the ground’ (Ogden and Fisher 2015, p. 18) and a sense of physical presence in the here and now. Grounding interventions include a body-focused activity coupled with attention to the felt sense of that activity. For example, the child may focus on the felt sense of heat, pressure, or movement associated with the activity (e.g., the feel of the breath moving when a hand is placed over the heart or over the belly) or the felt sense of the connection between the child’s body and the outside world (e.g., the sensation associated with having

one's feet placed firmly on the ground). In this way, grounding interventions help the child feel physically present, solid, centred, balanced, contained, connected to herself, and, in particular, connected to her body in the here and now (Ogden et al. 2006; Ogden and Fisher 2015; Jackson 2017). Commonly used grounding interventions also include feeling one's feet on the ground (which can be accentuated by having patients stomp their feet, massage their legs, or shift the body's weight to the toes, heels, and sides of the feet), feeling the chair pressing on one's back, feeling the firmness of the wall with one's hands, savouring the feel of cool water on one's face, noticing the colours of objects or the smells in the room, or noticing the feel and weight of a ball that is thrown from hand to hand or from child to parent and back. Mindful attention to an experience—for example, holding ice—is a useful emergency strategy that can be used as part of the child's safety plan (see Chapter 16).

Because grounding interventions are very concrete and can be implemented at any time in any context when working with children with functional somatic symptoms, they are useful early in the treatment process. Grounding strategies help the child hone her skills in shifting the focus of attention—for example, away from body states that she finds overwhelming or unmanageable, or from negative thoughts and feelings that activate the stress system. Grounding strategies can be added to the child's emergency strategies for states of escalating arousal that involve a sense of disconnection and *vagueing out*—states that sometimes occur, for example, in the sequence of feeling states that precede fainting episodes or NES. In this context, the grounding intervention is used to interrupt the sequence and to avert the fainting event or NES. What the child does first is to lower herself to the ground—to make sure she does not fall—as soon as she notices the onset of her warning signs. While on the ground, she may then practice a simple grounding intervention, such as demonstrating her 'capacity to direct somatic energy toward the ground' (Ogden and Fisher 2015, p. 325), so as to feel safe and held. Later on, slow breathing, visualization, and other interventions can be added to this simple grounding exercise.

Tensing the Muscles in the Legs

Tensing the large muscles in the legs (all together) in a rhythmical manner at ten-second intervals can induce an increase in heart rate variability (increase in parasympathetic activation) (Lehrer et al. 2009).

Tightening the lateral muscles of the thigh—the tensor fasciae latae and the iliotibial tract—can be used to provide a sense of self-containment (Selvam and Parker n.d.): in the standing position the child digs her heels into the ground and attempts to raise her legs to the side, or in the sitting position she tries to spread her thighs, while at the same time, pushing her knees together with her hands (see Online Supplement 14.1 for other physical strategies suggested by Selvam and Parker). Children who prefer physical strategies—rather than cognitive strategies—often like these particular interventions.

Progressive Muscle Relaxation

In progressive muscle relaxation the child lies down; then, working from feet up or head down, and guided by a therapist, instructor (in a group setting), or audio recording, she reduces muscle tension by tensing a particular muscle group and then relaxing it. Most children can do this exercise; many enjoy it; and it is useful in helping the child to recognize what her body feels like when it is tense versus relaxed. Scripts for progressive muscle relaxation are widely available.

Completion of Self-Protective Motor Responses/Action Tendencies

Often when the child and therapist track body sensations, the child will report felt action tendencies—motor patterns that reflect the body's preparation for action to protect and defend itself (see vignette below). For example, when tracking sensations associated with a memory, the child may report a tightening in the hands (the action tendency that precedes the forming a fist and the action of hitting out

with the hand) or the tensing of a foot (the action tendency that precedes the action of kicking out with the foot). Inhibiting action tendencies is like inhibiting negative thoughts and feelings—all of which can contribute to activation of the stress system (Pennebaker and Susman 1988). In this context, ‘completion of the body’s incomplete responses to protect and defend itself’ can lead to symptom relief (Levine and Kline 2007, p. 419; Levine 2010). Completing motor responses is a key component of Peter Levine’s psychotherapy approach, Somatic Experiencing (for more, see later subsection ‘Trauma-Processing Interventions’). It is also used in the sensorimotor psychotherapy developed by Pat Ogden.

Betsy was a 13-year-old girl and a talented ballet dancer. She presented with NES in the context of cumulative stress: bullying at school, physical illness of her mother that needed hospitalization, illness of her father that needed hospitalization, academic difficulties, and difficulties in her relationship with her paternal grandmother. Amid all this stress, Betsy was most worried about her parents’ health and most hurt by what she perceived to be emotional rejection by her grandmother. In the middle of a discussion with the family about an upcoming birthday and a visit by her grandmother, the therapist asked Betsy to scan her body to identify the sensations she felt at that moment in time. Betsy identified a large painful area in her chest, a tightness in her jaw, a tensing in her hands (which began to shape themselves into fists as she spoke), and a tensing in the legs, which Betsy said, felt like kicking. The therapist asked if one of the legs wanted to kick more than the other. Betsy identified the right leg. The therapist then asked Betsy to allow her leg to kick, but to do this in slow motion, against the resistance of a stuffed toy dog held by the therapist. After kicking in slow motion with the right leg and then the left—which Betsy did with immense force and precision, until the leg was fully extended—Betsy was asked to scan her body again. She reported that the painful area in her chest had gotten smaller and was less intense, that the tension in the jaw had dissipated, and that the impulse to strike out with the fist and the feet had gone. Betsy’s parents, who had watched the intervention—and who were surprised by the extent of her movements (Betsy’s leg kicked so far that it touched her face)—reported that they had never realized the extent of the hurt that Betsy experienced in being rejected by her grandmother.

Bottom-Up Mindfulness Practice

Many of the bottom-up regulation strategies mentioned in this section involve a bottom-up mindfulness practice: the practice of attending to body sensations, whether pleasant or unpleasant, with a curious, open stance. Because some children enjoy these bottom-up mindfulness practices, they are able to integrate a bottom-up meditation into their daily routines. Common bottom-up mindfulness meditations involve meditation with a focus on the breath, meditation while systematically focusing attention on different parts of the body (body scan), attending to body sensations via self-touch to the chest, abdomen, or kidney-adrenal region, and exercises that change the colour or shape of pain (for resources see Online Supplement 14.1). In the Eastern tradition, bottom-up mindfulness interventions also frequently involved the use of therapeutic touch by the healer. In Western practice, therapeutic touch is now being integrated into some forms of body-based psychotherapy (Yachi et al. 2018; Kain and Terrell 2018).

Regular Exercise

Voluntary regular exercise promotes regulation and coherence within and between multiple components of the stress system—the HPA axis, autonomic nervous system, immune-inflammatory system, and brain systems underpinning pain, arousal, and emotional states—via many complex mechanisms that are progressively coming into focus through current research (for references see Online Supplement 14.1). Through its effects on the immune-inflammatory system, exercise also prevents chronic pain (see Chapter 9) (Leung et al. 2016). In addition, exercise-induced alterations of the gut microbiota have implications not only for the gut but, via a complex array of mechanisms, the health of the body as a whole (Mailing et al. 2019; Bastiaanssen et al. 2020). In this context, when implemented (in stages) early in the treatment process, exercise functions as a key intervention for lowering arousal by modulating HPA-axis activity, the sympathetic nervous system, and brain systems underpinning pain, arousal, and emotional states. It also improves the child's physical

resilience and day-to-day level of physical function. In the long term, regular exercise increases the child's whole-body health and resilience in response to stress. An exercise program should therefore be part of *every* child's intervention, regardless of symptom presentation.

Because arousal increases during exercise—even though the long-term goal and result of an exercise program is to decrease arousal—some children will need to start with gentle forms of exercise; otherwise, the sensations experienced during exercise may trigger panic or trauma-related responses such as innate defence responses (Kozłowska et al. 2015). Likewise, in children with chronic pain or with significant fatigue, exercise will need to be graded up slowly because it will, at least initially (see Fig. 16.1), exacerbate both pain and fatigue; the child will need to overcome this initial increase in symptoms in order to achieve the subsequent decrease in symptoms.

Physiotherapy

Children with functional neurological disorder (FND)—and especially those with loss of motor function or other functional neurological symptoms—require physiotherapy to help restore normal motor function (see vignette of Jai in Chapter 13). Physiotherapy for functional disorders is very different from standard physiotherapy because it is done in a way that does not focus attention on the symptoms (see vignette of Jai in Chapter 15) (Gray et al. 2020). The physiotherapist also assesses the child's safety in terms of balance on stairs, weight bearing on a painful foot, and so on.

Occupational Therapy

Some children who are disabled by their symptoms—and unable to manage skills of daily living on their own—may require input from an occupational therapist to help the children increase their day-to-day functioning. The occupational therapist can also contribute to the child's regulation strategies by introducing sensory strategies that the child can use to decrease arousal (Williams and Shellenberge 2012).

Releasing Trigger Points

Chronic activation of trigger points in muscle—as well as changes in the surrounding environment (fascia and connective tissue)—contributes to chronic pain in some presentations. Often, for example, chronic headache is maintained by tension in the muscles and trigger points of the neck, shoulders, and back. Manual therapies that release trigger points—all of which include some form of mechanical pressure—can be extremely helpful for some patients (Shah et al. 2015; Gevirtz [2020]).

Interventions That Target Key Brain Systems

Here we focus on interventions that aim to modulate the brain stress systems more directly, rather than by the bottom-up, body-based regulation strategies described above. These interventions include the following: pharmacotherapy for managing sleep, arousal, and anxiety and depression; various approaches to processing trauma; and neuromodulation, the use of electrical impulses or pharmaceutical agents that act directly upon the nervous system in an effort to alter its activity. In day-to-day clinical practice, these interventions are used, when indicated, alongside other indicated interventions on other system levels. For cautions when using pharmacotherapy with children and for sleep interventions, see Chapter 5.

Pharmacotherapy to Down-Regulate Arousal

Pharmacological treatments that help down-regulate arousal—clonidine, guanfacine, propranolol, selective serotonin reuptake inhibitors (SSRIs), and dual serotonin and noradrenalin reuptake inhibitors (SNRIs)—are thought to inhibit the amygdala and other limbic structures by acting on alpha, beta, GABA, or serotonin receptors in the amygdala, hypothalamus, or periaqueductal grey nucleus in the brainstem (Stahl 2013).

Pharmacological treatments to down-regulate arousal can be helpful in children whose stress systems are so activated that they are unable to utilize any of the non-pharmacological mind-body strategies described in this chapter. For many children, when their arousal is lessened somewhat—via pharmacotherapy—they are better able to learn and implement non-pharmacological regulation strategies for continued use in the long term.

Pharmacotherapy to Treat Comorbid Anxiety and Depression

Sometimes pharmacological treatment is needed to help in the treatment of anxiety and depression (see case of Jai in Chapter 5). Antidepressants (SSRIs and SNRIs) modulate neurotransmitter signalling in brain systems—serotonergic, noradrenergic, dopaminergic, GABAergic, and glutamatergic—that play a key role in arousal and mood regulation (Stahl 2013). Antidepressants—for example, SSRIs—also appear to have positive neuroplasticity effects (called *trophic effects*) that override the aberrant neuroplasticity changes that occur in the context of stress (Mann 2019). The experience of the first author (KK) is that SNRIs can be problematic in children because they often cause increases in arousal and that they are therefore often unhelpful in treating functional somatic symptoms, for which decreased arousal and activation are treatment goals.

Pharmacotherapy as a Neuromodulation Intervention

Antidepressants—tricyclics, SSRIs, and SNRIs—and atypical antipsychotic medications have complex actions that modulate multiple receptor systems involved in arousal, pain, and emotion regulation. In functional presentations that are very severe or difficult to treat, such medications may be used on a time-limited basis to manage sleep (see Chapter 5), pain, and extreme arousal by modulating key neurotransmitter signalling systems (for a review of mechanisms, see Tornblom and Drossman [2018]) (see, e.g., cases of Paula in Chapter 3 and Martin in Chapter 9).

Trauma-Processing Interventions

Some children presenting with functional somatic symptoms have specific trauma, loss, or stress events that need to be processed because these events contribute in an ongoing way to activation of the brain stress systems that may, in turn, disrupt motor and sensory processing or amplify subjective pain (see Chapter 11). The trauma-processing intervention with the largest evidence base is Eye Movement Desensitization and Reprocessing (EMDR) (for references see Online Supplement 14.1). EMDR was introduced into clinical practice by Francine Shapiro in the late 1980s (Shapiro 1989). In EMDR the child is asked to focus on the traumatic memory image while simultaneously attending to an alternate stimulus requiring brief eye movements (right and left) in sets of approximately 30 seconds. Recent studies suggest that when the processing is successful, the pattern of brain activation associated with the trauma memory shifts from activation of the brain stress systems to activation of cognitive-processing regions. More recently, EMDR using the flash technique has been introduced for individuals who are unable to tolerate access to the trauma memory for any period of time—for example, because they dissociate. The flash technique requires memory retrieval for very short periods of time with virtually no memory-related emotional arousal.

About the same time that Shapiro introduced EMDR, Peter Levine introduced Somatic Experiencing, a bottom-up psychotherapy approach for trauma (Levine 1997). In somatic experiencing, the direction of attention is on body sensations and how they change. Alongside the tracking of somatic sensations associated with a memory of an event—reflecting stress-system activation—somatic experiencing involves the tracking of action tendencies or latent action patterns (see below). If latent action patterns are identified, then the therapist may suggest interventions that may help the patient complete the latent patterns. For example, an impulse to run, heralded by a tensing in the legs, may be enacted in real time or in slow motion. Likewise, an effort to block something with the hand, heralded by a tensing in the hands, may be enacted in slow motion. In this way, defensive movements that the body was unable to enact, whether for a lack of time or for some other reason,

may be enacted in slow motion, over and over again, until the body stress systems settle (as internally tracked by the patient). As previously noted, Pat Ogden uses a similar approach in her somatosensory approach to processing trauma memories (Ogden et al. 2006). For other references pertaining to somatic experiencing, see Online Supplement 14.1.

Amanda was a 9-year-old girl whose passion was playing rugby with her older brothers and their friends. During one game—with some older (and as they discovered, rougher) boys whom they did not know well—Amanda was tackled by one of the boys, and two other boys then kicked her and pushed her head into the ground, while yelling and swearing at her. Ever since the tackle, Amanda had been experiencing recurring headaches, sensitivity to light, and intermittent double vision. In the playground at school, she avoided the children who had attacked her. Sometimes, if she thought that they were trying to approach her, she would run and hide. Her sleep also deteriorated in quality, and she was waking multiple times during the night. The neurologist diagnosed Amanda's neurological symptoms as being functional and gave her the diagnosis of FND. Because Amanda had mentioned the recurring action tendency to run from the bullies, her therapist decided to use a somatic-experiencing intervention. With the aid of drawing materials, the therapist asked Amanda to show her exactly what had happened during the tackle. She also asked Amanda to show her—using her body—what her body would have done, had it had time and been able, to protect itself. Then the therapist (playing the boy who had tackled Amanda), a medical student (playing the other two boys), and Amanda's mother (playing a safe teacher) enacted the tackle in slow motion. In this slow-motion version of the tackle, Amanda was asked to put into effect all the protective actions that she had shown the therapist. On the fifth round Amanda reported that she had *got it right* and that she did not think that they needed to enact the scene again. Two weeks later Amanda's mother rang the therapist to report that all of Amanda's symptoms had resolved in the wake of the session.

More recently, other trauma-processing interventions—some of which also involve movement—have been introduced into clinical practice; the evidence base is slowly emerging (for references see Online Supplement 14.1). *Radical exposure tapping* combines elements of EMDR with various tapping sequences to create a memory-processing

intervention that facilitates processing of the intense affect that accompanies some memories. In the *progressive counting technique*, the patient is asked to run a memory like a silent movie, over and over with their eyes closed, during progressively longer time periods while the therapist counts out loud. The patient starts and ends the ‘movie’ with a positive memory. The first author and her team have described the integration of radical exposure tapping and progressive counting into the treatment of functional somatic symptoms (Ratnamohan et al. 2018), and Laurie Mackinnon—a prominent Australian family therapist—uses these techniques routinely within a family therapy framework (MacKinnon 2014).

What is intriguing about some of the above-described trauma-processing interventions is the use of concurrent movement or sensory input as key elements of the interventions. Because action tendencies and somatic states are so closely tied to traumatic states, it is possible that engagement of motor and sensory systems facilitates changes in the processing of trauma-related material. Interestingly, imaging studies of trauma processing suggest that the healing process also engages motor systems (Santarnecchi et al. 2019).

Neuromodulation: A Treatment of the Future?

Advances in technology have led to the development of neuromodulation techniques that aim to change aberrant nervous system activation and patterns of connectivity between brain regions (for basic science references see Online Supplement 14.1). For example, in treating adults with chronic pain—and especially patients with chronic back pain—implantable spinal cord neurostimulators are now in widespread use (Sdrulla et al. 2018). Likewise, there is increasing interest in the use of neuromodulation devices—for example, transcranial magnetic stimulation—for treating FND. Topical, non-invasive neuromodulation devices—for example, the portable neuromodulation stimulator and transcutaneous auricular vagus nerve stimulator—that modulate subcortical brain regions have shown utility in patients undergoing rehabilitation interventions for motor symptoms related to brain injury, and they may be of use in treating children with severe functional

impairment secondary to FND. We mention neuromodulation because this field is growing so rapidly and has demonstrated such potential.

* * *

In this chapter we have highlighted that within the stress-system model, the treatment of functional somatic symptoms involves the use of strategies, techniques, and interventions that target areas of activation, dysregulation, or difficulty on multiple system levels. What we have discussed are strategies that target the body, either with bottom-up strategies that target the body itself or with strategies that target brain systems bottom-up. These strategies can be used alone or in various combinations to assist the child in shifting her stress system back to a more regulated state, one that supports health and well-being and is incompatible with functional somatic symptoms. In the next chapter we turn to top-down strategies involving the mind.

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