

# BASAL SKIN RESISTANCE

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## BASAL SKIN RESISTANCE

**Primary Disciplinary Field(s):** Psychophysiology, Experimental Psychology, Clinical Neuroscience

### 1. Core Definition and Terminology

Basal Skin Resistance (BSR), often referred to synonymously as the **Basal Resistance Level**, constitutes a fundamental measurement within the field of electrodermal activity (EDA). It is precisely defined as the electrical resistance exhibited by the human skin when the subject is maintained in a strictly resting or non-stimulated state. This measurement is crucial because it establishes a stable physiological baseline against which subsequent responses to stimuli can be accurately measured and interpreted. Unlike the dynamic, moment-to-moment fluctuations known as the Galvanic Skin Response (GSR) or Skin Conductance Response (SCR), BSR represents the tonic, slow-changing level of electrodermal activity that is present even in the absence of explicit external stimulation or cognitive load.

The measurement of BSR quantifies the degree to which the skin resists the flow of a small, constant electrical current passed between two electrodes placed on the skin surface. This resistance is inversely related to skin conductance (SC), meaning that high resistance corresponds to low conductance, and vice versa. The primary physiological mediator of BSR is the activity of the eccrine sweat glands, which are uniquely innervated almost exclusively by the cholinergic fibers of the **Sympathetic Nervous System**. Consequently, BSR serves as a direct, non-invasive index of the prevailing level of tonic arousal or autonomic readiness in the subject. A lower resistance value (higher conductance) generally indicates a higher baseline level of sympathetic activation, suggesting greater physiological arousal or tension even at rest.

Establishing an accurate BSR measurement is paramount for reliable psychophysiological research. The source content notes that one of its key criteria involves assessing the individual's resting state, implying that environmental controls, elimination of movement artifacts, and ensuring genuine physiological repose are necessary precursors to measurement. Furthermore, BSR is often measured under conditions of minimal cognitive interference, such as during deep relaxation, meditation, or, as specifically highlighted in some psychological literature, when the subject is asleep or in a dream state. This controlled baseline allows researchers to isolate innate, trait-like differences in autonomic functioning between individuals, which might relate to personality traits like anxiety or emotional reactivity.

### 2. Physiological Basis: The Sympathetic Autonomic Control

The physiological mechanisms underpinning Basal Skin Resistance are rooted in the anatomy and function of the eccrine sweat glands. These glands, densely distributed across the palms of the

hands and soles of the feet--the primary sites for EDA measurement--are unique in their innervation. While most bodily functions regulated by the Autonomic Nervous System (ANS) receive both sympathetic and parasympathetic input, eccrine sweat glands are almost entirely controlled by the sympathetic branch, primarily via acetylcholine release, which is otherwise characteristic of the parasympathetic system (a cholinergic sympathetic mechanism). When sympathetic activity increases, the sweat glands become more active, releasing fluid onto the skin surface and into the sweat ducts.

The presence of sweat, which is rich in electrolytes (salts), significantly lowers the electrical resistance of the skin. Sweat essentially acts as a conductive medium, providing pathways for the electrical current to bypass the high-resistance stratum corneum (the outermost layer of the epidermis). Therefore, BSR is not measuring the resistance of the skin tissue itself, but rather the resistance modulated by the moisture content within the sweat ducts and on the skin surface. A low BSR (high skin conductance) signifies high sympathetic tone and active, partially filled sweat ducts, suggesting a state of elevated, yet non-specific, alertness or tension.

It is crucial to understand that BSR reflects the general, sustained level of sympathetic output. This sustained activation contrasts sharply with phasic responses (SCRs), which are rapid, transient increases in conductance tied to specific stimuli (e.g., a loud noise or a complex thought). BSR establishes the operating range for these phasic responses. For instance, if an individual exhibits a very low BSR (high baseline conductance), their physiological system is already highly activated. This elevated baseline can sometimes limit the magnitude of subsequent phasic responses, a phenomenon known as the "law of initial values," where the response magnitude is inversely related to the preceding baseline level. Analyzing BSR is therefore essential for correctly normalizing and interpreting subsequent phasic skin conductance data gathered during experiments or clinical assessments.

### 3. Measurement Methodology and Protocol

Accurate measurement of Basal Skin Resistance requires precise methodology and standardized protocols to minimize environmental and procedural noise. The most common technique involves placing two non-polarizing electrodes (typically silver/silver chloride, Ag/AgCl) on areas rich in eccrine sweat glands, such as the distal phalanges of the fingers or the palmar or plantar surfaces. A small, constant voltage or current (often less than 0.5 V or 10  $\mu$ A) is applied between these electrodes. The resulting current flow is then measured, allowing the derivation of resistance (measured in Ohms,  $\Omega$ ) or conductance (measured in Siemens, S).

To ensure the measurement truly reflects the basal state, the subject must be thoroughly acclimated to the testing environment. This environment should be temperature-controlled, quiet, and free from external distractions that could inadvertently trigger a phasic response. Crucially, the

subject must be in a state of rest, typically defined as having been sitting or lying quietly for a predetermined period (e.g., 5 to 15 minutes) prior to data collection. The source material emphasizes the ideal state being sleep or a deep resting state, as this minimizes cognitive input and allows the sympathetic system to reach its true tonic minimum.

Protocol mandates meticulous preparation of the skin and electrodes. Electrode paste, often an isotonic gel, is used to ensure good electrical contact without irritating the skin or introducing artifactual impedance. Furthermore, resistance measurement is highly sensitive to temperature and hydration; therefore, controlling ambient humidity and temperature is essential for inter-subject comparison and longitudinal studies. Because BSR changes relatively slowly, researchers typically average readings taken over a sustained period (e.g., five minutes) after the resting state has been achieved, resulting in the most robust measure of the **Basal Resistance Level**.

#### 4. Distinction from Phasic Electrodermal Activity

In the broader context of electrodermal activity (EDA), a clear distinction must be maintained between tonic and phasic measures. Basal Skin Resistance (BSR) falls squarely into the category of a tonic measure. Tonic measures are the slow-changing, background levels of electrodermal activity that persist over minutes or hours and represent the general level of sympathetic arousal inherent to the individual or the current physiological state. This level is relatively stable and independent of immediate external stimuli.

Conversely, phasic measures, such as the **Galvanic Skin Response** (GSR) or Skin Conductance Response (SCR), are rapid, transient fluctuations in conductance that occur within seconds of an orienting stimulus, emotional trigger, or cognitive event. These phasic responses reflect immediate, stimulus-driven changes in arousal. For example, hearing a sudden loud noise might elicit a sharp, temporary drop in skin resistance (increase in conductance)--this is the SCR. BSR, the baseline resistance recorded moments before the noise, provides the critical context for interpreting the size and speed of that SCR.

The fundamental difference lies in their utility: BSR is used to characterize the individual's trait-like or resting-state arousal level, often used for diagnostic or comparative purposes across groups (e.g., comparing individuals with high anxiety to controls). Phasic responses are used to assess the individual's state-like reactivity to specific events, used prominently in conditioning studies or emotion research. Without an accurate BSR measurement, determining whether a subject is generally hyper-aroused or simply highly reactive to a specific stimulus becomes ambiguous. Thus, BSR serves as the normative anchor point essential for normalizing and statistically processing the more volatile phasic data.

## 5. Applications in Psychophysiology and Clinical Settings

Basal Skin Resistance is a vital tool across various domains of psychological and clinical assessment due to its direct linkage to the autonomic nervous system. In research psychology, BSR is frequently employed as an index of general anxiety or chronic stress. Individuals suffering from generalized anxiety disorder or post-traumatic stress disorder often exhibit significantly lower BSR (higher baseline conductance) compared to control groups, reflecting a sustained state of hyper-vigilance or physiological readiness even during presumed rest. This makes BSR a valuable physiological marker for trait anxiety.

A particularly important area of application is sleep research, which aligns directly with the requirement that BSR be measured during sleep or dream states. During sleep, autonomic activity cycles systematically across different sleep stages. BSR tends to be highest (lowest conductance) during non-REM deep sleep stages (Stage 3 and 4), indicating minimal sympathetic output. Fluctuations and drops in BSR can signal shifts toward lighter sleep, transient arousal events, or entry into REM (dream) sleep, where sympathetic variability often increases. Monitoring BSR helps researchers characterize sleep quality, diagnose sleep disorders (like insomnia or sleep apnea), and understand the relationship between autonomic tone and conscious state.

Furthermore, BSR is an integral component of the polygraph, or 'lie detector,' test. Although the polygraph measures multiple physiological indices, the tonic level of skin conductance (BSR/BRL) is monitored continuously. While the phasic GSR is the response primarily analyzed during the questioning phase, the initial BSR establishes the participant's state of nervousness or calmness before the interrogation begins. A participant entering the testing environment with an extremely low BSR (very high baseline arousal) might mask later, subtle phasic responses, requiring the examiner to adjust interpretation based on this established basal level.

## 6. Factors Influencing Basal Skin Resistance Variability

While BSR is defined as a measure of the resting state, its magnitude is far from immutable and is affected by a complex interplay of physiological, environmental, and pharmacological factors. One of the most significant external factors is ambient temperature and humidity. High temperatures or high humidity naturally increase general sweat gland activity, irrespective of psychological arousal, leading to an artificially lower BSR. Therefore, strict climate control in testing laboratories is non-negotiable for reliable data acquisition.

Internal physiological states also heavily influence BSR. Hydration levels, skin integrity, and even the time of day (circadian rhythms) can cause substantial variation. Medication usage is a critical factor; drugs that affect the autonomic nervous system, such as beta-blockers, anti-depressants, or stimulants, will inevitably alter the baseline sympathetic tone, thereby shifting the BSR. Researchers must meticulously document these factors and, where possible, ensure that subjects

abstain from medications that could confound the results, particularly those used to manage anxiety or blood pressure.

Finally, individual differences represent a source of inherent variability. Humans exhibit stable, trait-like differences in autonomic reactivity and tone. Some individuals are "electrodermally labile," meaning their BSR is inherently lower and fluctuates more rapidly, potentially indicating a biologically wired predisposition toward higher general anxiety or stress reactivity. Other subjects may be "electrodermally unresponsive," exhibiting very high BSR and minimal change, which can sometimes be linked to certain neurological conditions or highly suppressed emotional states. Recognizing and accounting for these inter-individual differences is fundamental to the appropriate utilization of BSR in diagnostic and research contexts.

### Further Reading

[Electrodermal Activity \(EDA\) and Skin Conductance](#)

[Galvanic Skin Response \(GSR\) Definition and Measurement](#)

[The Autonomic Nervous System and Sympathetic Control](#)

[Polygraph \(Lie Detector\) Technology and Principles](#)