Pattern-sensitive epilepsy is a condition in which seizures are induced by visual patterns, most typically of stripes.

**Classification**
Pattern-sensitive epilepsy is a form of reflex epilepsy, and may occur in primary generalized, secondary generalized, and partial epilepsy (Harding and Jeavons 1994).

**Demographic Data**
*Onset.* The onset of pattern sensitivity is most likely at puberty or a few years before, and it can remain throughout life. *Gender.* Girls are nearly twice as likely to be affected as boys. *Prevalence.* Photosensitivity occurs in about 4% of adults with epilepsy, but the prevalence is greater in the young. Pattern sensitivity is present in most photosensitive patients, but with clinical significance only in about 30–50% (Harding and Jeavons 1994).

**Clinical Manifestations**
Seizures are more likely if the patterns are striped (Fig. 209-1a), subtend a large visual angle at the eye (Fig. 209-1b), if they are brightly lit and strongly contrasted (Fig. 209-1c), and if the periodic elements within the pattern are regularly spaced (Fig. 209-1d) and have a spatial frequency close to 3 cycles per degree (Fig. 209-1e). Epileptogenic patterns include gratings, the metal stair tread of escalators, and striped clothing. The seizures can be of any type, ranging from fleeting absence to major convulsion (Wilkins 1995).

**Etiology**
Etiology is most often idiopathic, but can be secondary. Diseases that render the visual cortex hyperexcitable can potentially give pattern-sensitive epilepsy.

**Pathophysiology**
The seizures arise when normal cortical excitation involves a region of the visual cortex of sufficient size (Fig. 209-2), stimulating complex cells within a limited number of orientation columns (Box 1 and Fig. 209-3). The discharge begins within one cerebral hemisphere and can generalize, or remain confined within that hemisphere, in which case it is associated with an ipsilateral posterior epileptiform EEG (Box 1 and Fig. 209-4). For seizures to occur, the excitation needs to be (1) strong and (2) synchronized. Synchronization occurs when the pattern is stationary, and its retinal image is moving by virtue of the normal instability of the eye during fixation. The motion stimulates neurons selective to one direction of motion then another, synchronizing the activity. The epileptogenic potential of the pattern is greatly increased if it alternates in phase at a frequency of

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*Figure 209-1.* Probability of epileptiform EEG activity in patients with pattern-sensitive epilepsy shown as a function of several spatial characteristics of the pattern (solid curves). The dotted curves show the number of illusions of color, shape or motion reported by normal observers, illusions to which those with migraine are particularly susceptible. The horizontal bars show the characteristics of text, when considered as a striped pattern. Icons beneath each graph represent variation in the relevant spatial characteristic (Wilkins 1995)
about 10–20 Hz, or if it vibrates at similar frequency in a
direction orthogonal to the stripes (Fig. 209-5). If the
patterns drift continuously in one direction (at a similar
rate), they are not epileptogenic (Wilkins 1995).

**Diagnostic Procedures**
Most patients with pattern-sensitive epilepsy are sensitive
not only to patterns but also to flickering light, and conven-
tional diagnostic procedures using intermittent photic stim-
ulation may be expected to give rise to a photo-paroxysmal
EEG response (PPR). However, there are exceptional
patients who show a photoparoxysmal response only to
patterns. The most epileptogenic patterns are strongly illu-
minated (mean luminance >100 cd m⁻²), subtend at least
20° of arc at the eye, and consist of stripes subtending about
15 min of arc. Several such patterns at a variety of orienta-
tions should be available for routine testing during the EEG
examination (Wilkins 1995).

**Differential Diagnosis**
The demonstration of pattern sensitivity in a photosensitive
patient is clinically important because it shows the additional
range of visual stimulation to which the patient is susceptible.
Text can provide a sufficient pattern stimulus in some pati-
ents (horizontal bars, Fig. 209-1). Patients with migraine
show aversion and perceptual distortion (dotted curves,
Fig. 209-1) when viewing epileptogenic patterns, but this
is because the patterns induce a strong neurological response;
not because the response is synchronized – drifting patterns
are not epileptogenic, but are aversive for individuals with
migraine (Wilkins 1995).

**Prognosis**
The prognosis is as for photosensitive epilepsy; 75% of
patients retain their susceptibility to patterns for life, but
some lose their sensitivity after their 20s (Harding and
Jeavons 1994).

**Management**
The management is as for photosensitive epilepsy. Appropriate
tinted glasses can be an effective treatment. Blue glasses
have been shown to reduce seizures in some cases. There are
Figure 209-3. Schematics of individual patterns, including those that provided the data for Fig. 209-2 showing the central fixation point. For patterns a and b the size of the pattern was adjusted by varying the number of sectors or the sector angles $\alpha$ and $\beta$. The remaining patterns were varied in size by manipulating their outer radius, which ranged from 3 to 24° (Wilkins 1995).

Figure 209-4. Squares are filled in proportion to the number of patients with photosensitive epilepsy exhibiting a photoparoxysmal response to vibrating gratings of various spatial and temporal frequencies. (Patients sensitive to stationary gratings were excluded.) The effects of spatial and temporal frequency are independent. Within the range shown, amplitude of vibration has no effect (Wilkins 1995).
Figure 209-5. (continued)
Figure 209-5. An EEG of a patient with pattern-sensitive epilepsy during presentation of patterns in the (a) left, (b) right, (c) upper and (d) lower visual fields (Fig. 209-3e–h). The scalp topography of the spikes follows that of the underlying visual cortex receiving stimulation (Wilkins 1995).
also initial indications that an individually chosen colour can offer a more acceptable and effective treatment. Where there is an awareness of symptoms, an appropriate color can be selected subjectively using the Intuitive Colorimeter. If physical means of protection are insufficient, the drugs of choice are sodium valproate or lamotrigine.

**Declaration of Interest**

The British Medical Research Council owns the rights to the *Intuitive Colorimeter*. The author receives from the Council a proportion of the royalties on sales in the form of an Award to Inventors.

**Cross-References**

- Fixation-Off Sensitivity
- Focal Seizures with Visual Hallucinations
- Idiopathic Photosensitive Occipital Lobe Epilepsy
- Occipital Lobe Epilepsies
- Pathophysiology of Neocortical Epileptic Seizures
- Pathophysiology of Reflex Epileptic Seizures
- Photosensitivity, Epileptic Seizures and Epileptic Syndromes
- Primary Reading Epilepsy
- Reflex Epileptic Seizures
- Reflex Seizures and Reflex Epilepsies: Overview
- Valproate

**References**
