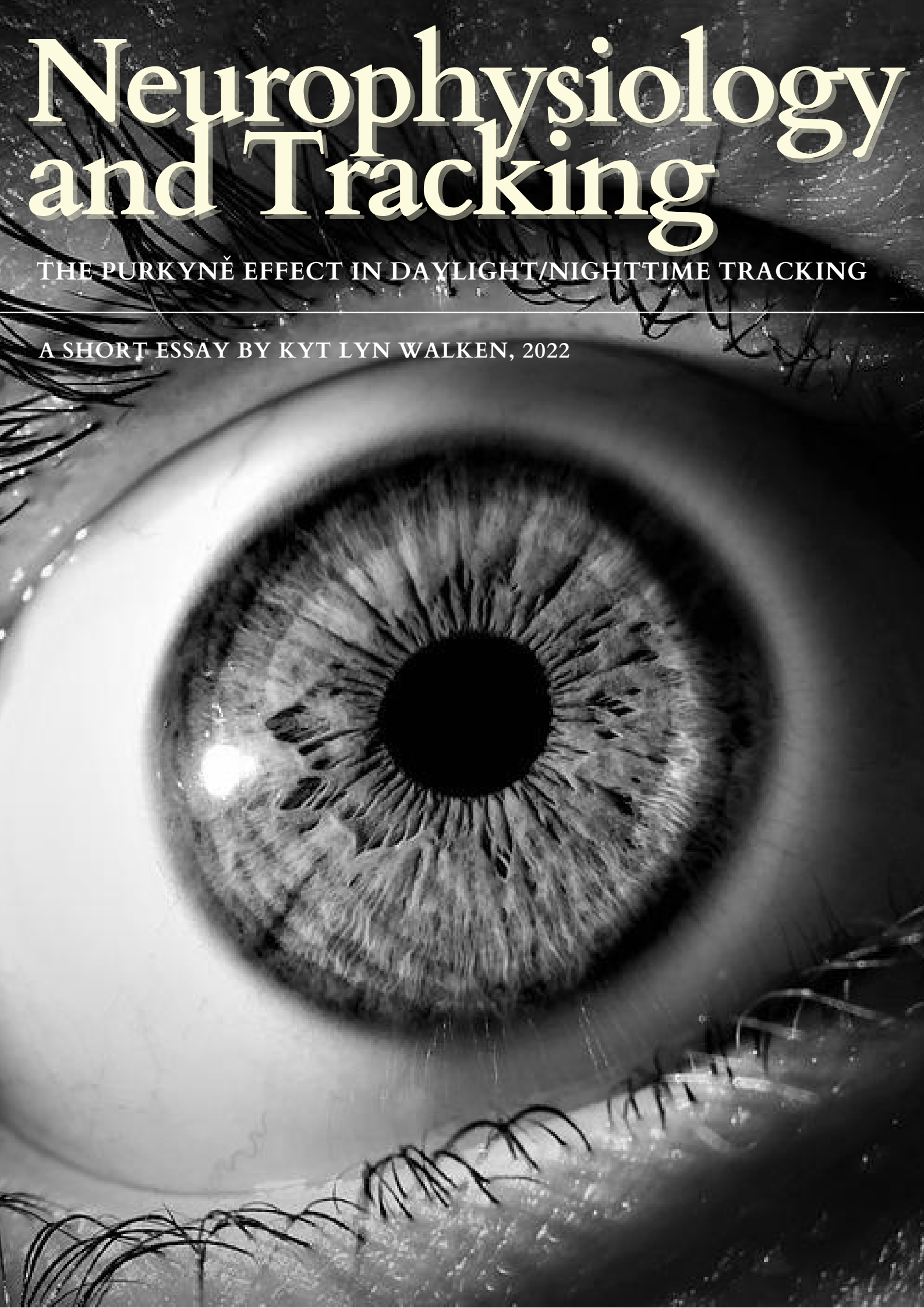
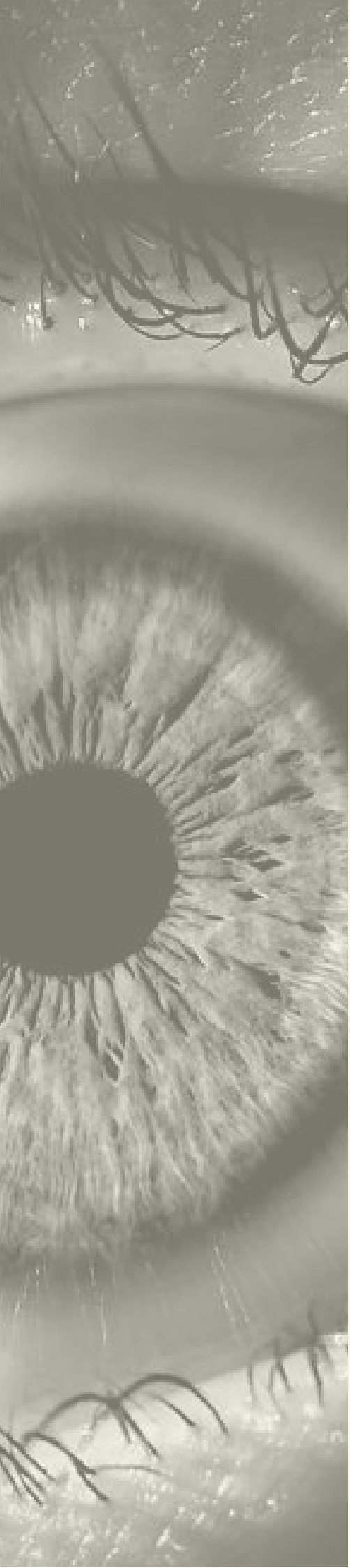
Neurophysiology and Tracking

THE PURKYNĚ EFFECT IN DAYLIGHT/NIGHTTIME TRACKING

A SHORT ESSAY BY KYT LYN WALKEN, 2022





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KYT LYN WALKEN

"*I love Kyt's passion for Mantracking.*
This girl is on fire"
Joel Lambert, 10 year Veteran of Navy SEAL Teams

Kyt Lyn Walken is an authentic enthusiast and trader of the Ancient Art of Human and Animal Tracking. This skill is still very effective nowadays from Search and Rescue, Tactical dimension, Forensic Science until Wildlife Conservation.

She has been entitled "Official Representative of Hull's Tracking School" in 2018.
Mike Hull is her Mentor.
In the same year she has become a Conservation Ranger after attending a two weeks course in Poland led by C.R.O.W. (Conservation Rangers Operations Worldwide).
Kyt Lyn has also studied "Forensic Photographs on Crime Scene", by UK Forensic Advisor and former Royal Marines Robert Kendall.

Currently she runs Man and Animal Tracking courses all over Europe, and she is regular writer for some US and UK webzines on Survival and Prepping.

She has been entitled "Directora de Dynamic Tracking - Spain". She is Guest Instructor for Veteranen Search Team (The Netherlands).

She is author of the Manuals "*The importance of being a Tracker***", "***The Urban Tracker***" and "***Tracking Compendium***" (with Andy Martin), "***Jungle Warriors - SAS in Malesia and Borneo***" and the essay "***Tracking, Anti-Tracking and Counter-Tracking during Colonialism***" (with Professor Timothy J.Stapleton).**

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On Neurophysiology

Neurophysiology (from the Ancient Greek words νεῦρον, "nerve", φύσις "nature" and λογία, "knowledge") consists of the investigation of function located in the central and peripheral nervous system.

Neurophysiology is, *tout court*, a specific branch either of the physiology either of neuroscience which conducts analytic studies related to the evaluation of nervous system function.

Neurophysiology tends to the diagnosis of neurological diseases as well as to monitor them throughout time.

Discovered around 4000 B.C., it became a major object of several studies all over the centuries.

1700 B.C.
The Egyptians became aware of the nervous system.

460 B.C. Hippocrates began to study epilepsy, stating: "*People think that epilepsy is divine simply because they don't have any idea what causes epilepsy. But I believe that someday we will understand what causes epilepsy, and at that moment, we will cease to believe that it's divine. And so it is with everything in the universe*"

177 B.C. Galen formulated a theory on the origin of thoughts, connecting them to the brain and not to heart, in complete opposition to Aristotele's theory.

1000 Al-Zahrawi theorized about surgical treatments suitable for neurological disorders.

1504 Leonardo Da Vinci conducted the first studies on the ventricular system.

1542 Jean Fernel introduced the word "physiology". One year later, Andrea Vesalius published "*De humani corporis fabrica*", which paved the way for upcoming studies on the pineal gland.

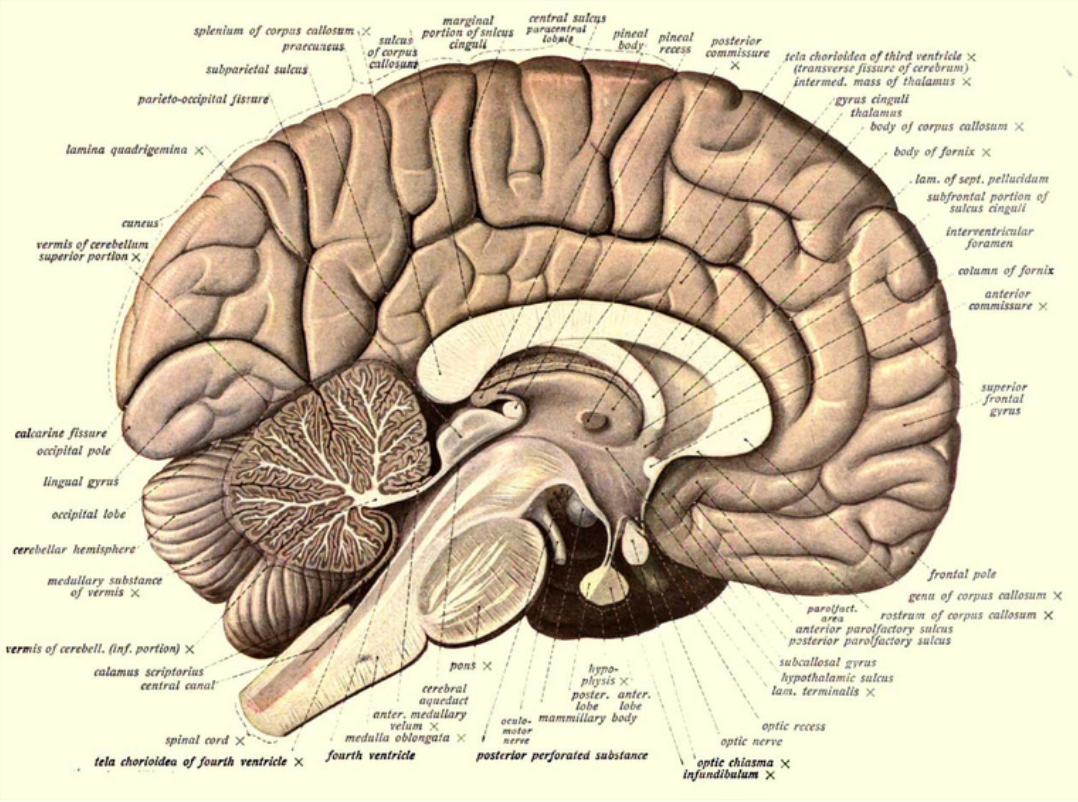
1550 Bartolomeo Eustachi conducted the first studies on the optic nerve, which recognized the origin inside the brain.

In the following centuries, Neurophysiology has been massively influenced by electrophysiology, which consists in the recording of natural activity through electricity (EEG: Electroencephalogram).

The analyses were conducted from the molar to the cellular, thanks to voltage and patch clamps.

Nonetheless, the inner nature of the neurone, electrochemical, makes extremely uneasy to lead a proper isolation of metabolic processes which can cause electrical events.

For this reason, the science of Neurophysiology is currently using several beacons like biology, physics and chemistry, in order to determine (and even to predict) brain activity.



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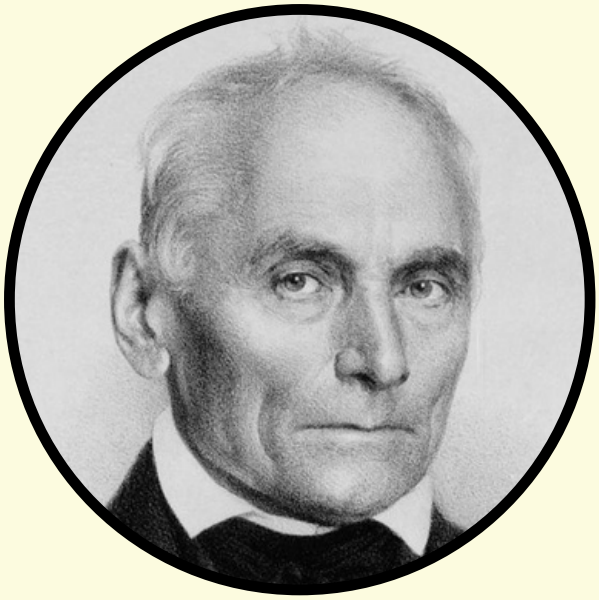
Jan Evangelista Purkyně

Anatomist and Physiologist



What they were asked to do was briefly this: to close the eyes, allow the after-images completely to die away, and then persistently and attentively to will that the color-mass caused by the Eigenlicht should take some particular form, – a cross being the most experimented with.
– George Ladd, "*Direct Control of the Retinal Field*" (1894)

Purkyně (1787 – 1869) was born within the Kingdom of Bohemia, which was, at that time, part of the Austrian monarchy, now Czech Republic.

1804: he completed the Senior high school.

1805: he joined the Piarists order as a monk but after few time he left "*to deal more freely with science*."

1818: he graduated from Charles University in Prague with a degree in medicine.

Purkyně was appointed a Professor of Physiology.

During these years, he discovered and theorized "**the Purkinje effect**".

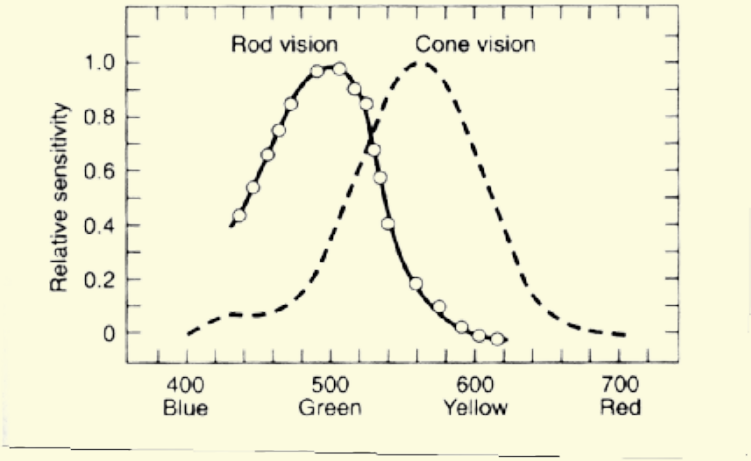
1823: he published a description of several entoptic phenomena, "*Observations and Experiments Investigating the Physiology of Senses* and "*New Subjective Reports about Vision*".
The two books contributed to the development of experimental psychology.

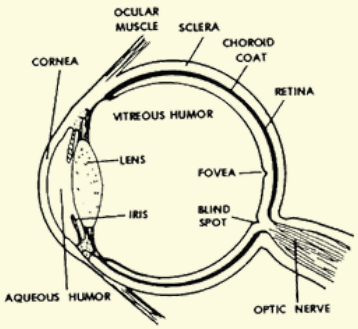
1837: he discovered the Purkyně cells, wide neurons connected to dendrites located inside the cerebellum.
He also discovered the Purkyně images, which can be described as reflections of objects influenced by the structures of the eye.
Later on he theorized the Purkinje shift (or "effect"), that is concerned about the change in the brightness of vivid colours (red and blue) as light intensity decreases gradually at dusk.

1839: he created the world's first Department of Physiology at the University of Breslau in Prussia (now Wrocław, Poland)

1842: he instituted the world's second official physiology laboratory.

The Purkyně Effect





" We stand in bright sunlight with closed eyes and face the sun. Then I move my outstretched, somewhat separated, fingers up and down in front of the eyes, so that they are alternately illuminated and shaded. In addition to the uniform yellow-red that one expects with closed eyes, there appear beautiful regular figures that are initially difficult to define but slowly become clearer. When we continue to move the fingers, the figure becomes more complex and fills the whole visual field"

- Jan Evangelista Purkyně, " *Contributions to the Knowledge of Vision in Its Subjective Aspect*" (1819)

The Purkyně Effect theorizes the propensity "*for the peak luminance sensitivity related to the eye to shift toward the blue end of the color spectrum at low illumination levels as part of dark adaptation*".

As a substantial consequence of that, the whole spectrum of red colors will tend to appear darker in relation to other colors, especially when light levels decrease.

The Purkyně Effect has been primarily referred to human eye activity, but later on has been also established in the behavior of a wide range of animals.

Basically, the effect has a lot to do with eye spectrum activity when it comes to adapt from light to darkness. It deals with pooling of rod and the signals which any human and animal being receives from cones.

The unalike levels of illumination play a huge role in the olistic process.

As Purkyně stated, when we find ourselves in bright sunlight, colors of flowers (he used to refer to geranium), appear bright red, in opposition to the dull green of their leaves.

At dusk, the contrast appears to be overturned, as the red petals are more prone to show a dark red or black color, while the leaves seem to be brighter.

Purkyně guessed that the sensitivity to light, when it comes to scotopic vision, is able to vary due to wavelength, although the perception remains essentially referred to black-and-white.
"T*he Purkinje effect is the relation between the absorption maximum of rhodopsin, reaching a maximum at about 500 nm, and that of the opsins in the longer-wavelength cones that dominate in photopic vision, about 555 nm (green)*" (Encycloepedia Britannica, 2006).

The Purkyně Effect applied to Daylight/Nighttime Tracking

"If the eye is pressed only in a slight degree from the inner corner, darker or lighter circles appear. At night, even without pressure, we can sometimes perceive a succession of such circles emerging from, or spreading over, each other"

- Johann Wolfang von Goethe, (1810)



Being able to shift from Daylight to Nighttime Tracking is one of the most challenging task for a Tracker.
As stated by Purkyně, the visual system is not equally sensitive to all wavelengths: the rods (the whole scotopic system, specialized for vision in low lighting conditions) have a greater sensitivity than the cones with respect to all lengths of ' wave.
The photopic spectral sensitivity is maximum around 550 nm, while the scotopic one is at lower wavelengths (around 500 nm). This shift in maximum sensitivity has an important perceptual consequence.

As in conditions of high illumination, wavelengths around 550 nm appear brighter than those around 500 nm, while the the opposite occurs in night vision; the phenomenon can be realized by comparing red objects with other green ones; during the day the red objects appear brighter, but at sunset, when there is mesopic vision, it will be the green ones that appear brighter.

All this explains why the dashboards of cars, boats and planes show red illumination: in this way the photopic system receives convenient stimulations so that it can activate and read the signals of the instruments and at the same time, as the system scotopic is practically blind to long wavelengths, red light does not interfere with it and therefore the observer remains adapted to low light conditions even after reading the instruments on board.

What about our perceptions of tracks, especially when we don't (or still don't) resort to any articial light device?
While tracks on bare, reddish terrain, may appear difficult to spot in nighttime, we should have no big issues in assessing a trackline left on lower and upper vegetation, as, standing to Purkyně, leaves will appear brighter.

Nonetheless, a huge variety of factors can influence, from time to time, our perception of the tracks, as, for instance, the presence of taller plants and/or trees, rocks, erratic boulders, cabins and huts as well as the morphology of the whole area.

Training our eyes to adapt to the darkness reduces our necessity to frantically resort to the use of flashlights.
The knowledge gained from the Purkyně effect can provide us all the tools to practice an effective shift from day to night tracking without the prerequisite of closing our eyes during the phase of transition.

In the moment of transition between sunset and twilight, in fact, we will be more exposed to a state of dizzines and partial blindness that we can mitigate by gradually adapting to the new light level. According to some personal analyzes I conducted, the view takes no more than 20/30 seconds to focus on details in an area, at the time of twilight, not covered by big foliage.
This can be achieved throughout a gradual adaptation to the environment in which we find ourselves, in order to better allow our brain to absorb the new visual inputs and to be able to decode them.

"The blackness that is present when the eyes are closed is rather just the same impression of light as we get when viewing a black surface, one which can change through all gradations to the most intense visual sensation. Indeed, this intrinsic blackness of the eye changes occasionally through purely internal causes into bright light and contains, so to speak, a sprinkling of light phenomena.
By paying strict attention, one discovers in the blackness that is seen when the eyes are closed a kind of fine dust composed of light, which is present in different people and under different conditions of the eye in various states of abundance, and in certain diseases may increase to a lively phenomenon of light. In my own eyes there exists, since the time when I had a lengthy disease of the eye, a strong continuing flickering of light, which increases according to the stimulation of my eyes and is subject to great fluctuations"
- Gustav Fechner, (1860)