

ARTICLE

Word Origins of Common Neuroscience Terms for Use in an Undergraduate Classroom

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We compiled a list of nearly 300 neuroscience terms and list their language of origin (typically Latin or Greek), their literal meaning, and their pronunciation in a table. The table was distributed to students in an undergraduate neuroscience class a few weeks before the first examination. A follow-up survey asked students how long they spent with the handout, and also assessed whether they thought it helped them better understand the terms, apply the terms, and whether they thought it helped them enough to get a higher grade on the exam. Results were positive: nearly 78% of students used the table while reviewing the material, and these students overwhelmingly

reported that the table helped them better understand and apply the terms. However, students were equally split on whether the handout resulted in a better grade on the first exam. It was our premise that better understanding the derivation of the words can help students make associations between the terms and their meanings/functions. This handout can be used in any undergraduate neuroscience to help students better understand the complex terminology associated with the material.

Key words: etymology; word origins; undergraduate learning; student success

Understanding the vocabulary in a science class can be frustrating for students and may act as a barrier to learning the terms and concepts of a class. Yager (1983) points out that students are required to understand just as many vocabulary words in a science class as a foreign language course, making it difficult for the student to comprehend the material. However, research shows that students who have taken Latin have an easier time understanding new terms (Gilliland, 1922), and that exposing students to the root words of biological terms is beneficial for retention (Yager, 1983; Wandersee, 1985; Miller, 1986; Kessler, 1999). Other efforts have compiled a list of neuroscience-related terms and include their meaning (Chudler, 2016) but have not included the derived language or pronunciation guide. Here, we present a list of nearly 300 words used in neuroscience in an easy to use table that includes their root meaning, pronunciation, language the term was derived from, and category of the terms.

For example, even understanding the derivation of the words *depolarization*, *repolarization*, and *hyperpolarization* can help students better understand the action potential itself. Students may get confused when they look at a graph depicting the characteristic action potential, with the rise from resting membrane potential (depolarization), the fall back towards rest (repolarization), and the undershoot (hyperpolarization). Students may wonder why the hyperpolarization dips *down*, since *hyper* is Greek for *above*. The explanation lies with an understanding of *polarization*, from the French *to cause extremes*. Simply, when the cell is at rest, a difference in ion concentrations inside and outside the cell cause the cell to be a particular membrane potential (typically -65 mV). Then, upon an action potential, sodium ions (Na⁺) will rush into the cell causing depolarization and the rise in the membrane potential. Depolarize literally means *undoing the*

polarization, and the membrane potential shoots past 0 mV to a positive number. After the peak is reached, potassium ions (K⁺) will rush into the cell, causing the membrane potential to return to rest. At this point, the cell is repolarizing, which simply means *return to polarized*. The undershoot of the membrane potential below rest, at a membrane potential more negative than rest (to perhaps -75 mV) is characteristic of hyperpolarization, which means *beyond polarized*. During hyperpolarization, the cell is *more polarized*, thus the application of the prefix *hyper-* when in fact the membrane potential is more negative.

We made a list of common terms used in the field that are frequently taught in an undergraduate neuroscience course and included the meanings and pronunciations of the source words to help student retention of the words and concepts that define the field.

MATERIALS AND METHODS

Key terms were systematically obtained from key words and the glossary of several undergraduate textbooks (Nicholls et al., 2012; Bear et al., 2016). Next, the etymology of the words were checked in those textbooks, standard dictionaries, and other published works (Jaeger, 1955; Borror, 1960; Duque-Parra, 2005). Further, American English pronunciations and categories for each term was added to the spreadsheet. The presentation of the word list in individual Excel columns allows users to sort the list by topic, rather than having to read through all the terms (See Table 1 located at the end of the article and Supplementary Excel file).

This word list was given to 23 students in an introductory neuroscience course at Purdue University Northwest, Hammond campus, in the Fall of 2016 two weeks before their first exam. A physical copy of the sheet was handed out to students, and an Excel sheet of the

material was also made available to them online through Blackboard. Students were told that the list was to help their comprehension of the terms, and that no test questions would be made from the handout itself. In the class after the first test, a survey was given to students assessing how the word list was utilized and how effective it was. Question 1 asked if they spent any time reviewing the handout. If they answered 'yes,' they were instructed to proceed to the rest of questions. Question 2 asked how much time they spent reviewing the handout. Questions 3, 4, and 5 asked if they believed that the handout helped them better understand some of the terms, better apply some of the terms, and do better on the exam, respectively.

RESULTS

There were 18 students who completed the survey on the effectiveness of the handout. Of the 18 students, 14 reported spending time reviewing it while four did not. All students but one spent less than 20 minutes reviewing the handout (See Figure 1).



Figure 1. Time spent reviewing the handout for the 18 people who completed the survey.

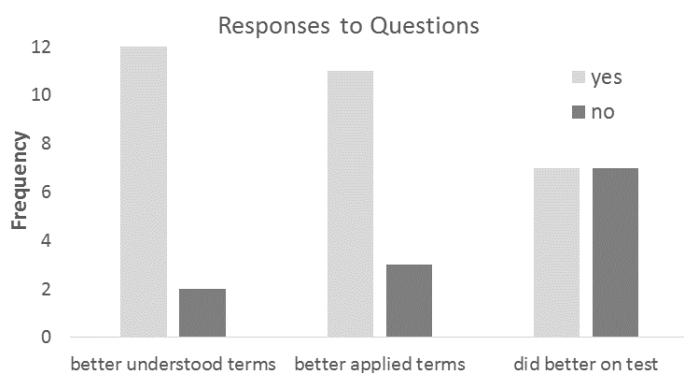


Figure 2. Frequency of 'yes' and 'no' responses from the 14 students who reviewed the word source handout prior to the exam.

Students were also asked a set of three questions to assess the effectiveness of the worksheet. Among the 14 students who reported reviewing the handout, 83% indicated that it helped them better understand the terminology, 73% indicated that it helped them better apply

some of the terms, and 50% believed that the handout helped them do better on the first exam (See Figure 2).

DISCUSSION

The list of neuroscience words we generated proved beneficial to the students as assessed on a short survey following their first examination. Past research buttresses the utility of teaching the etymology of terminology (Yager, 1983; Wandersee, 1985; Miller, 1986; Kessler, 1999). Chudler (2016) published an online list of nearly 250 neuroscience-related word origins, but many of the words are not typically encountered in an undergraduate neuroscience course (e.g., alveus, ampulla, and antitoxin, to name a few). The list we generated here is more extensive and better representative of the terminology covered in standard undergraduate textbooks (e.g., Nicholls et al., 2012; Bear et al., 2016). However, this is not to say that knowing the etymology of each term will help remember the structure or function. For example, 'corpus callosum' literally means *thick-skinned body*, a somewhat abstract way of stating it is a thick structure that contains many axons. Additionally, 'pupil' literally means *doll*, which is difficult to comprehend until one knows that it refers to the small reflected image that someone sees of themselves when they stare into someone's pupil. As a whole, however, this list should be used to make the complex terminology associated with the field more understandable and less daunting for the students.

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Term	Pronunciation	From	Meaning	Category
depolarize	dee POE ler eyes	G/L	undoing the polarization	action potential
endocytosis	EN doe sigh toe sis	G	within the cell	action potential
exocytosis	EX oh sigh toe sis	G	out of the cell	action potential
hyperpolarize	hi per POE ler eyes	G/L	beyond polarized	action potential
ligand	LIE gand or LIG and	L	to bind	action potential
polarize	POE lur eyes	F	to cause extremes	action potential
repolarize	REE poe ler eyes	G/L	return polarized	action potential
saltatory	SAL tuh tory	L	to jump	action potential
amygdala	uh MIG duh luh	G	almond-shaped	anatomy
arcuate	ARE cue ate	L	bowed	anatomy
auditory	AWE dih tor ee	L	to hear	anatomy
basal	BAY zul	L	base	anatomy
broca's area	BRO caws		after Paul Broca (French)	anatomy
calcarine	CAL car ine	L	spur-shaped	anatomy
callosum	col LOW sum or col LAH sum	L	thick-skinned	anatomy
capsule	CAP sule	L	case	anatomy
caudate	CAW date	L	tail	anatomy
chiasm	KIE asm	G	cross	anatomy
cingulate	SING gyou lit	L	collar	anatomy
colliculus	col LICK you lus	L	small hill	anatomy
commissure	COM mis sure	L	to join	anatomy
Cornu ammonis	core nu / ah MOE nis	L	ram's horn	anatomy
corpus	CORE puss	L	body	anatomy
corticofugal	Cor tih go FUE gul	L	fleeing from the cortex	anatomy
cuneus	CUE nee us	L	wedge	anatomy
dentate	DEN tate	L	tooth	anatomy
fornix	FOR nix	L	arch	anatomy
frontal	FRUN tal	L	front, forehead	anatomy
fusiform	FUSE ih form	L	spindle-shaped	anatomy
ganglia	GANG lia	G	a swelling	anatomy
genu	GEN you	L	knee	anatomy
globus pallidus	GLOW bus / PAL lid us	L	pale globe	anatomy
gustatory	GUS tuh tory	L	taste	anatomy
hippocampus	hip poe CAM pus	G	sea horse	anatomy
hypothalamus	hy poe THAL a mus	L	under the thalamus	anatomy
infundibulum	in fun DIB you lum	L	a funnel	anatomy
insular	IN sue lur	L	island	anatomy
limbic	LIM bic	L	edge	anatomy
lingual	LING gual	L	tongue	anatomy
locus coeruleus	low cus / coe RUL ee us	L	blue place	anatomy
mammillary	MAM mill air ee	L	breast	anatomy
massa intermedia	mass uh / in ter MEAD ee uh	L	intermediate mass	anatomy

Term	Pronunciation	From	Meaning	Category
medulla	meh DOO luh or meh DUL uh	L	marrow	anatomy
oblongata	ob long GAH tuh	L	oblong	anatomy
occipital	oc CIP ih tal	L	back part of head	anatomy
optic	OP tic	G	sight	anatomy
parietal lobe	par EYE eh tul	L	a wall, partition, divider	anatomy
pineal	pie KNEE ul	L	pine cone	anatomy
piriform	PEER ih form	L	pear shaped	anatomy
pituitary	pih TWO ih tare ee	L	phlegm, slime	anatomy
pons	PONS	L	bridge	anatomy
putamen	pew TAY men	L	shell, husk	anatomy
raphe	RAH fay	G	seam	anatomy
rhinal fissure	RYE nul	G	nose	anatomy
somatosensory	soe mat oh SEN sore ee	L	body senses	anatomy
splenium	SPLEN ee um	L	bandage	anatomy
sylvian	SIL vee an		after Franciscus Sylvius (Dutch)	anatomy
tectum	TEC tum	L	roof	anatomy
tegmentum	teg MEN tum	L	a covering	anatomy
temporal lobe	TEM pore ul	L	of the temples	anatomy
thalamus	THAL uh mus	L	an inner chamber	anatomy
wernicke's area	WER nih keys		after Carl Wernicke (German)	anatomy
bipolar	bi POL er	L	two extensions	cell type
granule	GRAN yule	L	grain	cell type
interneuron	in ter NUR on	E	between neurons	cell type
mitral	MY trahl	L	headband	cell type
purkinje cell	pur KIN gee		after Jan Purkinje (Czech)	cell type
pyramidal	pi RAM ih dul	L	pyramid	cell type
schaffer	SHAY fer		after Karoly Schaffer (Hungarian)	cell type
stellate	STELLE late	L	star	cell type
arbor vitae	are bore / VEE tay	L	tree of life	cerebellum
cerebellum	cer eh BELL um	L	little brain	cerebellum
peduncles	PEE dung kles	L	foot, stalk	cerebellum
vermis	VER miss	L	worm	cerebellum
abducens	ab DUE cens	L	take away	cranial nerves
auditory	AW dih tor ee	L	hear / a place of entry	cranial nerves
facial	FA cial	L	face	cranial nerves
glossopharyngeal	gloss oh phare IN gee ul	G	tongue / throat	cranial nerves
hypoglossal	hy poe GLOSS ul	G	under the tongue	cranial nerves
oculomotor	OC cue lo MOE tor	L	eye mover	cranial nerves
olfactory	ol FAC tory	L	to smell	cranial nerves
optic	OP tic	G	seen	cranial nerves
spinal accessory	SPY nal accessory	L	spine	cranial nerves

Term	Pronunciation	From	Meaning	Category
trigeminal	tri GEM in ul	L	born in threes	cranial nerves
trochlear	TROW klee ar	L	pulley	cranial nerves
vagus	VAY gus	L	wandering	cranial nerves
vestibular	ves TIB you lar	L	an entranceway	cranial nerves
agnosia	ag NO shuh	G	without knowledge	disorder/disease
alexia	ay LEX ee uh	G	without speech	disorder/disease
amnesia	am NEE shuh	G	forgetting	disorder/disease
anencephaly	an en CEPH ul ee	G	without a brain	disorder/disease
aneurism	AN your ism	G	widen	disorder/disease
anomia	ay NO me uh	L	without a name	disorder/disease
aphasia	ay FAY shuh	L	without speaking	disorder/disease
apoptosis	ay pop TOE sis	G	falling off	disorder/disease
congenital	con GEN ih tal	L	born together	disorder/disease
dementia	deh MEN shuh	L	out of one's mind	disorder/disease
dyslexia	dis LEX ee uh	G	difficult speech	disorder/disease
hemineglect	hem ee neh GLECT	G	half neglect	disorder/disease
hydrocephalus	high dro CEPH uh lus	G	water head	disorder/disease
idiopathic	id ee oh PATH ic	L	one's own pathology	disorder/disease
meningitis	men in GI tus	G	swelling of the meninges	disorder/disease
prosopagnosia	pro sop ag NO shuh	G	face blindness	disorder/disease
schizophrenia	skit zoe PHREN ee uh	G	split mind	disorder/disease
anorexia	an or EX ee uh	G	without eating	feeding
bulimia	byoo LEE me uh	G	extreme hunger	feeding
leptin	LEP tin	G	thin	feeding
endogenous	en DAH gen us	G	coming from the inside	general
exogenous	ex AH gen us	G	coming from the outside	general
neurogenesis	nur o GEN eh sis	G	neuron growth	general
visceral	VISS er ul	L	internal organs	general
afferent	AF fer ent	L	to bring forward	general anatomy
anterior	an TEAR ee or	L	before	general anatomy
autonomic	aw toe NOM ic	E	automatic	general anatomy
caudal	CAU dal	L	tail	general anatomy
cerebrum	cer REE brum	L	brain	general anatomy
contra-	CON truh	L	opposite side	general anatomy
coronal	cor OH nul	L	crown	general anatomy
diencephalon	di en CEPH uh lon	G	through the brain	general anatomy
dorsal	DOR sul	L	back	general anatomy
efferent	EE fer ent	L	to carry out	general anatomy
fascicle	FASS ick ul	L	a band	general anatomy
fasciculus	fass ICK you lus	L	a little band	general anatomy
fugal	FU gal	L	fleeing	general anatomy
hemisphere	HEM is phere	G	half sphere	general anatomy

Term	Pronunciation	From	Meaning	Category
horizontal	hoar ih ZON tul	G	horizon	general anatomy
hypo	HY poe	G	under	general anatomy
inferior	in FEAR ee or	L	below	general anatomy
ipsi-	IP sih	L	same side	general anatomy
lateral	LAT er ul	L	the side	general anatomy
lemniscus	lem NIS cus	L	a ribbon	general anatomy
medial	ME dee ul	L	middle	general anatomy
mesencephalon	MES en ceph uh lon	G	middle of the brain	general anatomy
metencephalon	MET en ceph uh lon	G	next to the brain	general anatomy
mid	mid	E	midle	general anatomy
myelencephalon	MY eh len ceph uh lon	G	marrow brain	general anatomy
neocortex	nee oh COR tex	G	new brain	general anatomy
nerve	nerve	L	nerve, cord	general anatomy
neuraxis	nur AX iss	L	nerve axis	general anatomy
para	Pare uh	G	parallel	general anatomy
parasympathetic	PAR uh sym puh thet ic	G	beside sympathetic	general anatomy
posterior	pose TEAR ee or	L	after	general anatomy
rostral	ROS tral	L	beak	general anatomy
sagittal	SADGE it ul	L	arrow	general anatomy
superior	sue PIER ee or	L	above	general anatomy
sympathetic	SYM puh thet ic	G	sympathy	general anatomy
telencephalon	TEL en ceph ul lon	G	end of the brain	general anatomy
ventral	VEN tral	L	belly	general anatomy
cochlea	COE klee uh	G	a snail shell	hearing
endolymph	EN doe lymph	G	inside fluid	hearing
eustachian	eu STAY shun		after Bartolomeo Eustachio (Italian)	hearing
incus	ING cus	L	an anvil	hearing
malleus	MAL ee us	L	a hammer	hearing
olivary	OL ih var ee	L	an olive	hearing
ossicle	OSS ick ul	L	a little bone	hearing
pinna	PIN nuh	L	wing, feather	hearing
presbycusis	pres by CUE sis	G	old hearing	hearing
scala	scale uh	L	a ladder	hearing
stapes	STAY pees	L	stirrup	hearing
stereocilia	stare ee oh CILL ee uh	G	firm hair	hearing
tinnitus	TIN nit us	L	ringing	hearing
tympanic	tim PAN ic	G	drum	hearing
astrocyte	ASS troh cite	G	star cell	neurons/glia
axon	AX on	G	an axle	neurons/glia
bouton	BOO ton	G	button	neurons/glia
chromosome	KROH muh sohm	G	color body	neurons/glia
cytoplasm	SIGH toe pla zuhm	G	hollowly molded/created	neurons/glia

Term	Pronunciation	From	Meaning	Category
dendrites	DEN drites	G	tree	neurons/glia
endoplasmic	en doe PLAS mic	G	something formed inside	neurons/glia
glia	GLEE uh	G	glue	neurons/glia
gliosis	glee OH sis	G	glia in action	neurons/glia
golgi	GOL gee		after Camillo Golgi (Italian)	neurons/glia
hillock	HILL ock	E	small hill	neurons/glia
homeostasis	hoe me oh STAY sis	G/E	same standing	neurons/glia
macrophages	MAK row fayj	G	large eater	neurons/glia
microglia	my crow GLEE uh	G	small glue	neurons/glia
mitochondria	my toe CON dree uh	G	thread granule	neurons/glia
myelin	MY eh lin	G	marrow	neurons/glia
neuron	NUR on	G	nerve	neurons/glia
neurotransmitter	nur oh TRANS mit ter	E	neuron transfer	neurons/glia
nucleolus	noo klee OH lus	L	little nut	neurons/glia
nucleus	NEW klee us	L	little nut	neurons/glia
oligodendrocytes	ol ih go DEN droh cite	G	few branched cell	neurons/glia
organelles	or guh NELS	L	little instrument	neurons/glia
phagocytosis	fay go sigh TOH sis	G	devour a cell	neurons/glia
radial	RAY dee ul	L	radius	neurons/glia
reticulum	reh TIC you lum	L	net	neurons/glia
ribosome	RYE buh sohm	E	body of nucleic acid	neurons/glia
schwann	shwahn		after Theodor Schwann (German)	neurons/glia
soma	SO ma	G	body	neurons/glia
synapse	SIN aps	G	to clasp	neurons/glia
vacuole	VAC you ole	L	empty cavity	neurons/glia
vesicle	VES ic ul	L	bladder	neurons/glia
adrenal	uh DREE nul	L	of the kidneys	sex
oxytocin	ox ee TOE sin	G	sharp birth	sex
vasopressin	vay so PRESS in	E	blood vessel-constricting	sex
circadian	sir CAY dee an	L	about a day	sleep
parasomnia	par uh SOM nee uh	G/L	alongside sleep	sleep
somnilogy	som NIL oh quee	L	sleep talking	sleep
suprachiasmatic	sue pruh kie as MAT ic	L	above the optic chiasm	sleep
zeitgeber	ZITE gee ber	Ger	time giver	sleep
cervical	SIR vic ul	L	neck	spinal cord
coccygeal	cock sih GEE ul	G	cuckoo bird	spinal cord
decussate	DECK us sate	L	to cross	spinal cord
lumbar	LUM bar	L	loin	spinal cord
sacral	SAY crul	L	sacred	spinal cord
spina bifida	spy nuh / BIF id uh	L	spine split in two	spinal cord
thoracic	thor ASS ic	G	thorax, chest	spinal cord
arachnoid	uh RACK noid	G	spider	surface anatomy

Term	Pronunciation	From	Meaning	Category
cortex	COR tex	L	bark	surface anatomy
dura	DUR uh	L	tough mother	surface anatomy
fissure	FISH ure	L	a split	surface anatomy
gyrus	GYE rus	L	a ring	surface anatomy
mater	MAT er	L	mother	surface anatomy
meninges	men IN gees	G	membrane	surface anatomy
pia	PEE uh	L	tender	surface anatomy
sulcus	SUL cus	L	wrinkle	surface anatomy
ageusia	ay GYOU zee uh	G	without taste	taste and smell
anosmic	ay NOS me uh	G	without smell	taste and smell
circumvallate	sir cum VALL ate	L	around a wall	taste and smell
cribriform	CRIB rih form	L	sifter, sieve	taste and smell
dysgeusia	DIS gyou zee uh	G	taste deficit	taste and smell
entorhinal	en toe RHI nul	G	inside nose	taste and smell
foliate	FOE lee ate	L	leaf	taste and smell
fungiform	FUN gih form	L	mushroom-shaped	taste and smell
glomerulus	glow MARE you lus	L	a little ball	taste and smell
hyposmic	high POS mee uh	G	smell deficit	taste and smell
papillae	pah PILL ay	L	pimple, bump	taste and smell
pheromone	PHER oh mone	G/E	a conveyed hormone	taste and smell
analgesia	an ul GEE zee uh	G	without pain	touch/motor
anesthesia	an es THEE shuh	G	without sensation	touch/motor
apraxia	ay PRAX ee uh	G	without action	touch/motor
ataxia	ay TAX ee uh	G	without order	touch/motor
chorea	cor EE uh	G	dance	touch/motor
endorphin	en DOR fin	E	endogenous morphine	touch/motor
homunculus	hoe MUNC you lus	L	a little man (person)	touch/motor
hyperalgesia	high per al GEE zee uh	G	excess pain	touch/motor
mechanoreceptor	meh CAN oh re cep tor	G	mechanical change receptor	touch/motor
nociceptor	NO sih cep tor	L	hurt receptor	touch/motor
paralysis	par AL is is	G	loosen at the side	touch/motor
proprioception	pro pree oh CEP shun	L	one's own receptor	touch/motor
striatum	stri AY tum	L	striped	touch/motor
substantia nigra	sub stan shuh NIGH gruh	L	black substance	touch/motor
thermoreceptor	THER mo re cep tor	G	heat receptor	touch/motor
aqueduct	ACK weh duct	L	water duct	ventricle
choroid	COR oid	G	a reddish color	ventricle
ependymal	ee PEN dim ul	G	tunic-shaped	ventricle
foramen	for AY men	L	a hole	ventricle
plexus	PLEX us	L	an interweaving	ventricle
ventricle	VEN trih cul	L	small cavity	ventricle

Term	Pronunciation	From	Meaning	Category
achromatopsia	ay crow muh TOP see uh	G	without seeing color	vision
amacrine	AM uh crine	G	without long fiber	vision
amblyopia	am blee OH pee uh	G	dull vision	vision
aqueous	ACK we us	L	water	vision
astigmatism	ay STIG ma tism	G	without a point	vision
brodmann area	BROD man		after Korbinian Brodmann (German)	vision
cataracts	CAT are acts	L	waterfall	vision
cone	cone	G	cone	vision
cornea	COR nee uh	L	with horns	vision
diplopia	dih PLO pee uh	G	double vision	vision
fovea	FO via	L	small pit	vision
glaucoma	glau COE muh	G	pale blue green	vision
humor	HUE mur	L	body fluid	vision
iris	EYE ris	G	the rainbow	vision
koniocellular	KOE nee oh cell you lur	G	dust cell	vision
lens	lens	L	lentil shaped	vision
macula lutea	MAC you luh LOO tea uh	L	yellow spot	vision
magnocellular	mag no CELL you lur	L	large cell	vision
nystagmus	ny STAG mus	G	nodding	vision
oblique	oh BLEEK	L	slanting	vision
opsin	OP sin	E	shortening or rhodopsin	vision
parvocellular	par voe CELL you lur	L	small cell	vision
photopic	pho TOP ic	G	light-seeing	vision
photoreceptors	pho toe ree CEP tors	G/L	light receiver	vision
presbyopia	pres by OH pee uh	G	old vision	vision
pupil	PYOU pil	L	doll	vision
rectus	REC tus	L	straight	vision
retina	RET in uh	L	a fine net	vision
retinofugal	ret in oh FEW gul	L	fleeing from the retina	vision
retinotopic	ret in oh TOP ic	G	retina place	vision
rhodopsin	rho DOP sin	G	rose sight	vision
rod	rod	E	Slender stick	vision
saccade	sah COD or sah CADE	F	a jolt, a sudden movement	vision
sclera	SCLARE uh	G	hard	vision
scotoma	scuh TOE muh	G	becoming dark	vision
scotopic	sco TOP ic	G	dark-seeing	vision
stereopsis	stare ee OP sis	G	three-demension seeing	vision
strabismus	struh BIZ mus	G	squinting	vision
striate	STRY ate	L	striped	vision
tapetum lucidum	tuh PEE tum / LOO sid um	L	bright carpet/tapestry	vision
vitreous	VEE tree us	L	glass	vision

Table 1. Neuroscience terms, accepted pronunciations, original language (E = English, F = French, G = Greek, Ger = German, L = Latin), literal meaning, and general category.