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| **Minor Award Name** | Plant Science |
| **Minor Award Code** | 5N2528 |
| **Level** | 5 |

**Suggested resources to support delivery:**

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| **Theme/Topic** | **Type** | **Relevance** | **Author/Source** | **Web Link** |
| Plant Parts  | Free Web link | A simplified explanation of the summary of plant’s parts and their functions with easy to follow illustrations | Horticulture tekura <http://horticulture.tekura.school.nz/> | <http://horticulture.tekura.school.nz/plant-management/plant-management-1/ht1101-plant-management-1-study-plan/plant-parts/> |
| Water transport on xylem and phloem animation | Youtube video | An animation that represents the movement of water in the phloem and xylem tubes  | Animation - Transport of water and sugar in plants[Science and Plants for Schools](https://www.youtube.com/channel/UCc1l4hSMdHhjAOpf6qOHRiA) | <https://www.youtube.com/watch?v=LQ03xIkLLQU> |
| Phloem and Xylem tubes  | Web Link | A detailed description of the functions of phloem and xylem tubes to include an explanatory video. | Diffen.com | <http://www.diffen.com/difference/Phloem_vs_Xylem> |
| Phloem and Xylem tubes video | Youtube video | A short video that explains transport of sucrose within the plant.  | [Nathanael Siahaan](https://www.youtube.com/channel/UCbGHIPjwgMk5g1BWrQdihPg) | <https://www.youtube.com/watch?v=MxwI63rQubU> |
| Anatomy of the leaf | Online document | A document that covers the morphology and anatomy of the leaf.  | ELTE TTK | <http://elte.prompt.hu/sites/default/files/tananyagok/StructureOfPlantsAndFungi/ch05s04.html> |
| Leaf shapes and terminology  | Free Online Textbook | A detailed list of names given to different types of leaves from a botanical perspective. It includes useful drawings and photographs to represent examples.  | Wayne P. Armstrong Waynes word  | Part 1: <http://waynesword.palomar.edu/termlf1.htm>Part 2: <http://waynesword.palomar.edu/termlf2.htm> |
| Leaf shapes and arrangements  | Online document | Graphic list of leaf shapes  | The Seed Site  | <http://theseedsite.co.uk/leafshapes.html> |
| The flower, terminology and different types  | Free Online Textbook | A detailed description of the parts of a flower to include useful illustrations with botanical definitions.  | Wayne P. Armstrong Waynes word | Part 1: <http://waynesword.palomar.edu/termfl1.htm>Part 2: <http://waynesword.palomar.edu/termfl2.htm> |
| The inflorescence  | Free Online Textbook | Definition of inflorescence, types and shapes to include useful illustrations.  | Wayne P. Armstrong Waynes word | Part 1: <http://waynesword.palomar.edu/terminf1.htm>Part 2: <http://waynesword.palomar.edu/termfl2.htm> |
| The Fruit and the Seed  | Free Online Textbook | A detailed explanation of the parts of a fruit, fruit types, types of seeds and botanical terminology including excellent illustrations and pictures with examples.  | Wayne P. Armstrong Waynes word | Part 1: <http://waynesword.palomar.edu/termfr1.htm>Part 2: <http://waynesword.palomar.edu/termfr2.htm>Part 3: <http://waynesword.palomar.edu/termfr3.htm>Part 4: <http://waynesword.palomar.edu/fruitid1.htm> |
| The Cell | Free Online Lesson | An introduction to cell biology for beginning students of all ages or be a springboard to more specialized topics for advanced students. The course begins with a discussion of the fundamental properties of cells: the origin of the cell, how cells are organized, how they reproduce, and how they use energy. Other units in the course expand these topics and provide insight into the processes that regulate cell function and generate the amazing variety of cell types seen in living organisms. Topics include the decoding process that produces distinct sets of proteins in different cell types, the cellular structures responsible for cell function, the signals that cells use to communicate with one another, and the intricate controls on cell division. At the end of each unit in this eBook there is the option to test your knowledge with twenty multiple-choice questions. | Scitable by Nature Education**Lead Editor**: Clare O'Connor, Ph.D.**Writer**: Jill U. Adams, Ph.D.**Illustrations**: Jennifer E. Fairman, C.M.I., F.A.M.I. | <http://www.nature.com/scitable/ebooks/essentials-of-cell-biology-14749010/contents> |
| Mitosis  | Free online lesson | A detailed explanation of the process of mitosis with excellent drawing outlining each phase in the process  | Scitable by Nature Education | <http://www.nature.com/scitable/ebooks/essentials-of-cell-biology-14749010/118241779#bookContentViewAreaDivID> |
| Mitosis | Youtube video | Animated video that includes a clear explanation of the process of mitosis  | By Arif Khan | <https://www.youtube.com/watch?v=DwAFZb8juMQ> |
| Meiosis | Free online lesson with video | A free lesson that describes the steps of meiosis cell division in simple terms. It includes an animated video and it compares meiosis with mitosis.  | Study.com | <http://study.com/academy/lesson/overview-of-meiosis.html> |
| Meiosis  | Youtube video  | Animated video that includes a clear explanation of the process of meiosis.  | By [MrAac007](https://www.youtube.com/user/MrAac007) | <https://www.youtube.com/watch?v=vA8aMpHwYh0> |
| Mitosis vs. Meiosis class activity | Web Link with printable sheets for class activity  | An activity for learners to explore the differences between the process of mitosis and meiosis with access to printable work sheets and teachers’ notes  | Larry Flammer | <http://www.indiana.edu/~ensiweb/lessons/gen.mm.html> |
| Plant Tissues  | Online document  | A summary of the four types of tissues found in plants with useful illustrations and botanical definitions.  | McDaniel College <http://www2.mcdaniel.edu/> | <http://www2.mcdaniel.edu/Biology/botf99/tissimages/tiss1.html> |
| Plant tissues  | Free online lesson | A simplified explanation of plant tissues with botanical definitions in simple language  | CMG Garden Notes Colorado Estate University  | <http://www.ext.colostate.edu/mg/gardennotes/131.html> |
| Plant parts modifications  | Free Online Textbook  | An explanation of the many types of plant modifications for roots, leaves and stems with pictures and illustrations of examples and containing botanical definitions.  | Wayne P. Armstrong Waynes word | Part 1: <http://waynesword.palomar.edu/ecoph30.htm>Part 2: <http://waynesword.palomar.edu/ecoph30a.htm>Part 3: <http://waynesword.palomar.edu/ecoph30b.htm> |
| Monocot vs. Dicot | Online lesson  | A simple description of the differences between monocot and dicot plants including pictures and botanical definitions  | The Seed Site  | Part 1: <http://theseedsite.co.uk/monocot.html>Part 2: <http://theseedsite.co.uk/monocots2.html> |
| The process of secondary thickening in plants and the formation of annual rings  | Online Document | A detailed explanation of the process of secondary thickening on dicot stems and the formation of annual rings. It includes clear illustrations of the phloem, xylem and vascular cambium. The explanation is contained in two pages. Teachers must click on “next” to complete the lesson.  | ELTE TTK | <http://elte.prompt.hu/sites/default/files/tananyagok/StructureOfPlantsAndFungi/ch05s02.html> |
| Plant Processes | Web Link | A detailed account of the main processes plants undergo to include photosynthesis, respiration and transport of water and nutrients. | CMG Garden Notes Colorado Estate UniversityAuthors: **David Whiting** (CSU Extension, retired) with Michael Roll and Larry Vickerman (former CSU Extension employees). Artwork by Scott Johnson and David Whiting. | <http://www.ext.colostate.edu/mg/gardennotes/141.html> |
| Plant processes  | Web Link  | A detail explanation of plant processes to include photosynthesis, respiration and transpiration.  | Arizona Cooperative University | <https://ag.arizona.edu/pubs/garden/mg/botany/physiology.html> |
| Environmental factors affecting plant growth | Web Link | Environmental factors that influence plant growth to include Light, Temperature, Water and Nutrition.  | Arizona Cooperative University | Part 1: <https://ag.arizona.edu/pubs/garden/mg/botany/environmental.html>Part 2: <https://ag.arizona.edu/pubs/garden/mg/botany/water.html> |
| The process of photosynthesis  | Online document | A more detailed account of the process of photosynthesis  | Estrella Mountain  | <http://www2.estrellamountain.edu/faculty/farabee/BIOBK/BioBookPS.html>  |
| Transport of water in plants  | Web Link | An explanation of the process of water transport up the step in a plant.  | Scitable by Nature Education | <http://www.nature.com/scitable/knowledge/library/water-uptake-and-transport-in-vascular-plants-103016037> |
| Sexual reproduction of plants  | Web Link | A clear explanation of the process of plant propagation by sexual means including definitions and useful illustrations  | S-cool Youth  | <http://www.s-cool.co.uk/a-level/biology/reproduction/revise-it/sexual-reproduction-in-flowering-plants> |
| Vegetative Plant Propagation methods | Web Link | A document explaining the different methods of propagating plants from vegetative methods. It includes cuttings, grafting, bulbs, rhizomes and stolons.  | Science Learning Hub | <http://sciencelearn.org.nz/Innovation/Innovation-Stories/Zealong-Tea/Articles/Vegetative-plant-propagation> |
| Plant Hormones  | Article  | An explanation of natural and synthetic plant hormones and their functions in plant life.  | Buzzle.com | <http://www.buzzle.com/articles/plant-hormones-and-their-functions.html> |
| Plant growth regulators  | Article  | List of examples used as plant growth regulators in horticulture | Agriinfo.in | <http://agriinfo.in/?page=topic&superid=2&topicid=1007> |
| Plant Growth Regulators in Horticulture  | Article/Online document | Interesting presentation that covers the use of plant growth regulators in ornamental horticulture  | Mara Grossman: mgrossman@vt.edu | <http://www.hort.vt.edu/floriculture/documents/2012_MaraGrossman_MS_Seminar.pdf> |
| Mendel’s Laws of Inheritance  | Online tutorial and activity | Set of tutorials and activities around the topic of mendelian laws of inheritance using monohybrid cross exercises  | <http://www.biology.arizona.edu/>  | <http://www.biology.arizona.edu/mendelian_genetics/problem_sets/monohybrid_cross/monohybrid_cross.html> |
| Mendel’s Laws of Inheritance | Online tutorial and activity | Clear explanation of Mendel’s Laws on Inheritance to include activities  | Natalie H. Kuldell “Mendel and Inheritance” Visionlearning Vol. BIO (7), 2005. | <http://www.visionlearning.com/en/library/Biology/2/Mendel-and-Inheritance/129> |
| Mendel’s Law of Independent Assortment | Online lecture  | Law of Independent Assortment | Natalie H. Kuldell “Mendel and Inheritance” Visionlearning Vol. BIO (7), 2005. | <http://www.visionlearning.com/en/library/Biology/2/Mendel-and-Independent-Assortment/145> |
| Mutations and Genetic Engineering | Article | In depth explanation of the relationship between mutations and genetic engineering in modern genetic manipulation | Conrad Chrabol | <https://conradchrabol.wordpress.com/genetic-engineering-and-mutations/> |
| Micro-organisms  | Online Document | An overview of the microorganisms that affect plants and plant life to include bacteria, fungus and viruses.  | Mrs. Sara J. Tharp-McComas, P.G., M.Ed.Kings Mountain High School | <http://kmbiology.weebly.com/viruses-fungi-bacteria-and-protists---notes.html> |
| Plant Classification and Nomenclature | Web Link  | Useful site explaining the method of plant nomenclature and classification.  | CMG Garden Notes Colorado Estate UniversityAuthors: **David Whiting**  | <http://www.ext.colostate.edu/mg/gardennotes/122.html> |
| General Topic: Resource  | Course  | A general course in horticulture that includes useful video demonstrations and definitions  | Tekura  | <http://horticulture.tekura.school.nz/> |
| General Topic: Text Book | Free Online Textbook  | A detailed illustrated textbook covering many aspects of botany.  | Wayne P. Armstrong Waynes word | <http://waynesword.palomar.edu/bot115.htm> |
| General Topic | Online Book | Scientific book that covers many of the topics of Plant Science minor award. It includes very useful drawings with explanations  | Estella Mountain Community College  | <http://www2.estrellamountain.edu/faculty/farabee/BIOBK/BIOBOOKTOC.html> |
| General Topic: Free online Gardening and Botany Book | Online Book/Course | Gardening and Botanical book that covers many aspects of the Plant Science minor award.  | Colorado Estate University  | Full Website: <http://www.cmg.colostate.edu/index.shtml>Specific Garden Notes: <http://www.cmg.colostate.edu/gardennotes.shtml> |
| General Topic: Book  | Book  | This easy-to-follow, full-colour guide was created for instructors teaching plant structure at the high school, college, and university levels. It benefits from the experience of the authors, who in teaching plant anatomy over many years, came to realize that students learn best by preparing their own microscope slides from fresh plant samples. The exercises contained in this book have been tested, require minimal supplies and equipment, and use plants that are readily available. Detailed instructions are given for sectioning and staining of plant material. The book contains a glossary of terms, an index, and a list of suppliers of materials required. A CD-ROM of all the illustrations is included for easy downloading into PowerPoint presentations. | Teaching Plant Anatomy Through Creative Laboratory Exercises Paperback– Jan 2008by [R.L. Peterson](http://www.amazon.co.uk/s/ref%3Ddp_byline_sr_book_1?ie=UTF8&text=R.L.+Peterson&search-alias=books-uk&field-author=R.L.+Peterson&sort=relevancerank) (Author), [C.A. Peterson](http://www.amazon.co.uk/s/ref%3Ddp_byline_sr_book_2?ie=UTF8&text=C.A.+Peterson&search-alias=books-uk&field-author=C.A.+Peterson&sort=relevancerank) (Author), [L.H. Melville](http://www.amazon.co.uk/s/ref%3Ddp_byline_sr_book_3?ie=UTF8&text=L.H.+Melville&search-alias=books-uk&field-author=L.H.+Melville&sort=relevancerank) (Author) | <http://www.amazon.co.uk/gp/search?index=books&linkCode=qs&keywords=9780660197982> |
| General Topic: Free online book | Online book on botany and plant science  | Detailed book that covers all the aspects of Plant Science in great detail. The book is available for the purpose of research education and reproduction of the same is prohibited without written permission. | ELTE TTKSTRUCTURE OF PLANTS AND FUNGIEdited by: Zoltán KristófPál VágiÉva PreiningerGábor M. KovácsZoltán KristófKároly BókaBéla BöddiCopyright © 2013 Eötvös Loránd University | <http://elte.prompt.hu/sites/default/files/tananyagok/StructureOfPlantsAndFungi/index.html> |
| General Topic: Teaching resource  | Web Link Page  | A list of web links associated with biology teaching resources  | National Association of Biology Teachers  | <https://www.nabt.org/websites/institution/index.php?p=111> |
| General Topic: Teaching Resource  | Website  | General resource for science teachers to include lessons, power point presentations, work sheets and many other.  | TES  | <https://www.tes.com/teaching-resources> |
| General Topic: Teaching resource  | Website  | Useful resources for teachers of science to include lessons, videos and illustrations.  | Nature.com | <http://www.nature.com/scitable> |
| General Topic: Related Websites  | Web link | A list of useful links and websites for teachers of science subjects  | Teachnology.com | <http://www.teach-nology.com/teachers/subject_matter/science/biology/botany/> |
| General Topic: Scientific Material for class experiments and Skills Demonstrations | Web Catalogue | Catalogue of scientific material useful for plant science experiments to include charts, microscopic slides, equipment for plant processes demonstrations etc  | Shaw Scientific | [http://cld.bz/tvZfu6y#](http://cld.bz/tvZfu6y)Address in Ireland: <http://www.irelandlookup.com/3866334/Laboratories/Dublin/Shaw_Scientific_Ltd/> |

 **Useful Organisations:**

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| **Name** | **Contact Information** |
| Quality and Qualifications Ireland (QQI) | <http://www.qqi.ie/>  |
| Further Education Support Service (FESS) | [www.fess.ie](http://www.fess.ie)  |
| National Botanic Gardens Glasnevin | <http://www.botanicgardens.ie/home.htm> |
| The Irish Garden Plant Society  | <http://irishgardenplantsociety.com/> |
| Hortitrends.com | <http://hortitrends.com/> |
| The Royal Horticultural Society of Ireland | <https://www.rhsi.ie/> |
| The Royal Horticultural Society | <https://www.rhs.org.uk/> |

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| **MOOCs (Massive Online Open Courses)** |
| Free access to online coursesSearch regularly for new courses and new start dates | <https://www.mooc-list.com/><https://www.coursera.org/course/plantknows> |