Angiosperms and gymnosperms

Science, Anatomy

PRACTICAL 6 Seed Plants (Gymnosperms and Angiosperms) OBJECTIVES: 1. To describe the features of seed plant life cycle and the concept of the dominant generation. 2. To describe the life histories and related reproductive structures of gymnosperms and angiosperms. 3. To summarize the features that distinguish gymnosperms and angiosperms. 4. To discuss the advantages of seed plants to dominate land and their evolutionary adaptations on land. EXPERIMENT 1: Gymnosperms INTRODUCTION:

Gymnosperms (720 species in 65 genera) are ancient seed plants that include ginkgos (Division Ginkgophyta), cycads (Division Cycadophyta), conifers (Division Coniferophyta), and gnetophytes (Division Gnetophyta). The term gymnosperm derives from the Greek wood roots gymnos, meaning “ naked”, and sperma, meaning “ seed”. They are naked-seeded plants meaning that the ovule, which becomes a seed, is exposed on the sporophyte at pollination. Mature seed are not enclosed in a fruit as are those of flowering plants. Gymnosperms are best known for their characteristic cones, called strobili.

These strobili display sporangia and their subsequently developing ovules and pollens. Gymnosperms do not require water for sperm to swim to reach the egg as do seedless plants. Instead, immense amount of windblown pollen are produced. Most gymnosperm cones, including the familiar pine cone, are complex whorls of leaflike, woody scales around a central axis. The smallest cones include those of the junipers (Juniperus) which have flesh scales fused into a structure resembling a berry. The larger cones may weigh 45 kg and are produced by cycads.

In most gymnosperm species, the female megastrobilus is larger and distinctive from the male microstrobilus. MATERIALS: 1. Living or preserved specimens of * Ginkgo (Ginkgo biloba) * Cycad (Cycad sp.) * Pine (Pinus sp.) 2. Prepared slide of gymnosperms 3. Compound microscope 4. Dissecting microscope 5. Slide and coverslip 6. Forceps 7. Distilled water PROCEDURE: A ginkgo: 1. A prepared slide of male strobilus of Ginkgo biloba is examined. The microsporophyll, microsporangium, and strobilus axis are identified. 2. A prepared slide of female strobilus of Ginkgo biloba is examined.

The megasporophyll, megasporangium, and strobilus axis are identified. A cycad: 1. A female cycad is examined. The leaves, megasporophylls, megasporangia and developing seed are identified. 2. The pollen cone bears on male cycad. Pollinated cone is examined and microsporophyll, microsporangia, and pollen grains are identified. A pine: 1. A male cone and female cone of Pinus sp. are obtained. 2. A prepared slide of longitudinal section of female cone is examined. The megasporophyll, megasporangia, and ovule are looked. 3. A prepared slide of longitudinal section of male cone is examined.

The microsporophyll, microsporangia, and pollen grains are looked. 4. Fertilization occurs after the pollen tube penetrates the megasporangium and allows sperm to enter the archegonium and fuses with the egg. The zygote will form after fertilization. A prepared slide of the developing embryo of Pinus sp. is examined. 5. Mature seed cone is obtained. The seed with wing attached to the ovuliferous scale is found. 6. The anatomy of pine leaf one needle is examined. The following: epidermis, stoma, photosynthetic mesophyll, endodermis, phloem, xylem, and resin duct are identified.

RESULTS Cross section of Ginkgo Biloba Cross section of Cycad Cross section of female pine Cross section of male pine EXPERIMENT 2: Angiosperms INTRODUCTION: Angiosperms are the most abundant, diverse, and widespread of all land plants. They are successful because they are structurally diverse, have efficient vascular systems, share a variety of mutualisms (especially with insects and fungi), and have short generation times. Flowering plants are important to human because our world economy is overwhelmingly based on them.

Indeed, we eat and use vegetative structures (roots, stems and leaves) as well as reproductive structure (flowers, seeds, and fruits). You will find that many of the vegetative structures are quite similar to those of more ancient plants shown. The roots, stems, and leaves of flowering plants function just as those of ferns and cone bearing plants. Flowers and fruits, however are unique adaptations of angiosperms. Biologists believe that the extraordinary adaptiveness of these structures has led to the proliferation of the incredible diversity found among flowering plants. MATERIALS: 1.

Living specimens of angiosperms (dicots & monocots) with roots, stems, leaves, flowers, fruits and seeds. (Imperata cylindrical, zea mays, Carica papaya, Phaseolus sp.) 2. Prepared slide of angiosperms (dicots & monocots) 3. Compound microscope 4. Dissecting microscope 5. Slide and coverslip 6. Forceps 7. Distilled water PROCEDURE: Roots: 1. A root of dicots and monocots are obtained for morphology and anatomy study. 2. The root systems of representative dicot and monocot are looked. 3. Cross section of dicot root shows the central stele is surrounded by a thick cortex and epidermis.

The following: epidermis, cortex, parenchyma cells, starch grains, pericycle, endodermis, phloem, and xylem are identified. 4. Cross section of monocot roor shows this root has a vascular cylinder of xylem and phloem that surrounds a central pith. The following: epidermis, cortex, endodermis, Casparian strip, pith, phloem, and xylem are identified. 5. A prepared slide of the roots for some other species is obtained and their structure is identified. Stems: 1. The longitudinal section of shoot tip of representative dicot and monocot is studied.

The following: leaf, leaf primordium, apical meristem, ground meristem, axillary bud, vascular bundle, and pith are identified. 2. A dicot and monocot is obtained and a cross section of the stems is made and the arrangement of vascular bundles is examined. The anatomy between this dicot and monocot is compared. 3. For both type of plants, epidermis, cortex, phloem, xylem, cambium, pith, and vascular bundle are identified. Leaves: 1. Fresh specimen provided in lab is looked. Flowering plants show a variety of morphology to identify, such as, leaf arrangements and leaf venation. 2.

Using fresh prepared slide or prepared slide of some flowering plants, the structure of the leaves is studied. The leaves have common features: cuticle, air space, lower epidermis, upper epidermis, palisade mesophyll, spongy mesophyll, and vascular bundle are noticed. Flowers: 1. The longitudinal section of some flowers is looked. The parts of a flower: stigma, pistil, style, ovary, sepal, receptacle, peduncle, petal, filament, stamen, and anther are named. 2. A prepared slide of a cross section of mature anther (lily anther) is examined. Sections of the four microsporangia are found.

Pollen grains within a microsporangium is looked. 3. A prepared slide of a cross section of an ovary (lily ovary). The several ovules are found. Megaspore mother cell within megasporangium is looked. The megasporangium develops is studied. The placenta, integuments, microphyle, egg cell, central cell, and polar nuclei are identified. 4. The demonstration slide of double fertilization is observed and the zygote, primary endosperm nucleus, and central cell of the female gametophyte are identified. Fruits and seeds 1. A sample of dry, dehiscent fruits (peanuts) is obtained.

The fruit wall, cotyledon, plumule of embryo, embryo, radical, cotyledon, and seed coat are identified. 2. A sample of simple flesy fruits (tomato, a berry) is obtained. Pericarp, mesocarp, endocarp, locule, seed and placenta are identified. 3. A prepared slide of corn grain (Zea mays), a caryopsis fruit is examined. The pericarp of a corn grains is tightly united and inseparable from the seed. The pricarp, endosperm, cotyledon, coleoptiles, plumule bud, embryo, radical, and coleorhizae are identified. RESULTS Cross section of root Cross section of stem

Cross section of leaves Cross section of flower Cross section of seed DISCUSSION For the lower vascular plants the important evolutionary development was in the water andfoodconducting tissues of the sporophyte. As we move on through the plant kingdom the next important development was the seed. The free living gametophyte is a vulnerable phase of the life cycle. Reproduction by seeds is a less chancy procedure and has other advantages for plant survival and dispersal. Seeds can be remarkably tolerant of environmental extremes heat, cold and drought.

Unlike free-living gametophytes seeds can postpone their development until conditions are right. And, of course, we find them very convenient for plant propagation. Already in the coal-measure forests there were plants that reproduced by seeds. Some were the so-called " seed ferns". Others were the ancestors of the plants we now know collectively as " gymnosperms". In these plants the seeds are not enclosed in an ovary, as in the flowering plants; they grow on the surface of a modified leaf in a strobilus or cone. " Gymnosperm" means naked seed. Alternation of generations is still involved in the reproduction of these plants.

They are all heterosporous: the microspores are shed as pollen, whereas the megaspore germinates in the strobilus to produce the female gametophyte. The archegonia in this gametophyte get fertilized by sperm from the male gametophyte and the zygote grows to produce an embryo which is enclosed in a seed coat of tissue from the parent plant. Gymnosperms were the dominant land plants in the age of dinosaurs, the Cretaceous and Jurassic periods. The surviving gymnosperms in the Coniferophyta, Cycadophyta and Ginkgophyta are similar in their woody habit and pattern of seed development but are not closely related.

The characteristic feature of angiosperms is the flower. Flowers show remarkable variation in form and elaboration, and provide the most trustworthy external characteristics for establishing relationships among angiosperm species. The function of the flower is to ensure fertilization of the ovule and development of fruit containing seeds. The floral apparatus may arise terminally on a shoot or from the axil of a leaf (where the petiole attaches to the stem). Occasionally, as in violets, a flower arises singly in the axil of an ordinary foliage-leaf.

More typically, the flower-bearing portion of the plant is sharply distinguished from the foliage-bearing or vegetative portion, and forms a more or less elaborate branch-system called an inflorescence. There are two kinds of reproductive cells produced by flowers. Microspores, which will divide to become pollen grains, are the " male" cells and are borne in the stamens (or microsporophylls). The " female" cells called megaspores, which will divide to become the egg cell (megagametogenesis), are contained in the ovule and enclosed in thecarpel (or megasporophyll).

The flower may consist only of these parts, as in willow, where each flower comprises only a few stamens or two carpels. Usually, other structures are present and serve to protect the sporophylls and to form an envelope attractive to pollinators. The individual members of these surrounding structures are known as sepals and petals (or tepalsin flowers such as Magnolia where sepals and petals are not distinguishable from each other). The outer series (calyx of sepals) is usually green and leaf-like, and functions to protect the rest of the flower, especially the bud.

The inner series (corolla of petals) is, in general, white or brightly colored, and is more delicate in structure. It functions to attract insect or bird pollinators. Attraction is effected by color, scent, and nectar, which may be secreted in some part of the flower. The characteristics that attract pollinators account for the popularity of flowers and flowering plants among humans. While the majority of flowers are perfect or hermaphrodite (having both pollen and ovule producing parts in the same flower structure), flowering plants have developed numerous morphological and physiological mechanisms to reduce or prevent self-fertilization.

Heteromorphic flowers have short carpels and long stamens, or vice versa, so animal pollinators cannot easily transfer pollen to the pistil (receptive part of the carpel). Homomorphic flowers may employ a biochemical (physiological) mechanism calledself-incompatibility to discriminate between self- and non-self pollen grains. In other species, the male and female parts are morphologically separated, developing on different flowers. POST-LAB QUESTIONS: 1. How to distinguish between a male and female cone of pine?

The male cone will form at the bottom of the tree and it is much smaller than the female and the male produces the pollen grains and the female produces the ovule and forms at the top of the tree. 2. Explain the characteristics of gymnosperm seeds to aid in dispersal. Many gymnosperms have winged seeds that aid in dispersal. Generally, gymnosperms have heavy seeds so the wings only assist in moving the seed a short distance from the parent plant. 3. List some uses for conifers. Economically, conifers are very important as they are a major source of timber.

The majority of the world’s sawn timbers come from conifers. Exploitation of this resource from wild growing forests is still going on in many parts of the world, but there is an obvious trend especially in the developed world to phase this out and use more sustainable planted or seeded resources. There are many species with highly different wood properties, some of these are extremely valuable and used for fine cabinet making or expensive applications in construction. Wood from conifers is also an important source of pulp for paper and cellulose fibres such as rayon.

Conifers also very important in horticulture, especially in regions with a temperate climate. Several species have yielded hundreds of different cultivars and new ones are constantly appearing on the market. In some countries conifers have a role to play in traditional medicine and in religious ceremonies and, of course, our Christmas trees can be seen as a form of this kind of use. A few conifers even have edible seeds; well known are those of certain pines. 4. Lists the common characteristics of seeds plants. i. They have vascular tissue ii.

They use seeds to reproduce iii. They all have body plans that include leaves, stems, and roots. 5. Contrast between dicots and monocots, the two classes of flowering plants. Monocots| Dicots| Herbaceous| May be woody or herbaceous| Embryo with single cotyledon| Embryo with 2 cotyledons| Flower parts in multiple of three| Flower parts with multiple of 4 or 5| Parallel-veined leaves| Net-veined leaves| Bundles of vascular tissue are scattred throughout the stem| Vascular bundle in the stem forms rings| Roots are adventitious| Root develop from radicle| . Discuss the features of plant flowering fruits and seeds. Seeds develop from ovules in the ovary, and at maturity consist of an embryo and a reserve food supply surrounded by a protective covering, the seed coat. The diversity of flowering plants assures diversity among their seeds, but, unlike fruits, which have numerous variations, structural plans for seeds are few. The reserve food can be stored either in or out of the embryo and the cotyledons, the seed leaves can remain either below ground or be elevated above the surface when germination occurs.

Fruits are ripened ovaries containing seeds with sometimes additional flower or inflorescence tissues associated with them. Only angiosperms produce flowers and fruits. From a botanical viewpoint, many of the foods we eat as vegetables are fruits, for examples, tomatoes, green beans, squash, eggplant, and peppers. Fruits apparently arose as a means not only of protecting the seeds, but as a way to ensure their dispersal. REFERENCES 1. http://faculty. unlv. edu/landau/gymnosperms. htm 2. http://www. kew. org/plants/conifers/uses. html 3. http://edhelper. com/ReadingComprehension_37_251. html