

Photosynthesis is arguably the most important biological process on earth.

All of our biological energy needs are met by the plant kingdom, either directly or through herbivorous animals. Plants in turn obtain the energy to synthesize foodstuff via photosynthesis. During photosynthesis, carbohydrates are formed. From carbohydrates, fats, proteins and other organic compounds are formed. Thus, all these food substances will eventually become the food of animals either directly or indirectly.

Sunlight is the ultimate source of energy for living things. It is during photosynthesis that the radiant energy is converted to chemical energy, which is stored within the carbohydrate molecules. Hence, when animals feed on plants, they obtain this energy directly from them.

Currently, there is a lot of discussion concerning the possible effects of carbon dioxide and other “greenhouse gases” on the environment. Photosynthesis helps to purify the air in the sense that it removes carbon dioxide from the air. In addition, it also helps counteract the effect of combustion of fossil fuels. The burning of fossil fuels releases not only carbon dioxide but also hydrocarbons, nitrogen dioxide and other trace materials that pollute the atmosphere and contribute to long-term health and environmental problems.

As photosynthesis consumes carbon dioxide, it also produces oxygen. This oxygen is used by living things in respiration and thus, is used to sustain most life forms.

Wood is not only burned but is an important material for building and many other purposes. Paper, for example, is nearly pure photo synthetically produced cellulose, as is cotton and many other natural fibers. Even much of our metal refining depends ultimately on coal or other photosynthetic products. Indeed, it is difficult to name an economically important material whose existence and usefulness is not in some way tied to photosynthesis.

Our major sources of energy, of course, are coal, oil and natural gas. These materials are all derived from ancient plants and animals, and the energy stored within them is chemical energy that originally came from sunlight through photosynthesis. Thus most of the energy we use today was originally solar energy.

Because plants depend upon photosynthesis for their survival, interfering with photosynthesis can kill the plant. This is the basis of several important herbicides, which act by preventing certain important steps of photosynthesis. Understanding the details of photosynthesis can lead to the design of new, extremely selective herbicides and plant growth regulators that have the potential of being environmentally safe. Indeed, it is possible to develop new crop plants that are immune to specific herbicides, and to thus achieve weed control specific to one crop species.

As described above, most of our current energy needs are met by photosynthesis. Increasing the efficiency of natural photosynthesis can also increase production of

ethanol and other fuels derived from agriculture. However, knowledge gained from photosynthesis research can also be used to enhance energy production in a much more direct way. In the laboratory, scientists can now synthesize artificial photosynthetic reaction centers, which rival the natural ones in terms of the amount of sunlight stored as chemical energy.

Lastly, ageing of the skin and skin cancer are only two of many deleterious effects of light on humans and animals. Because plants and other photosynthetic species have been dealing with light for ages, they have had to develop photo protective mechanisms to limit light damage. Therefore, learning about the causes of light-induced tissue damage and the details of the natural photo protective mechanisms can help us find ways to adapt these processes for the benefit of humanity.