# Inhibitor in Onion for Starch Synthesis

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Most plants store starch in the chloroplasts of the leaf following photosynthesis. The main exceptions are members of the lily, iris, amaryllis, and gentian families (*1*, *2*). Onion is a member of the lily family.

Leaves are also able to absorb some sugars such as glucose, fructose, maltose, and sucrose, and transform them into starch. Leaf squares of etiolated corn floating on sugar solutions form an abundance of starch. It is in this way that the starch-forming mechanism in plants can be studied.

Juice from bulbs of cultivated onion as well as from leaves of wild onion (garlic) prevented the formation of starch in leaf squares of corn. The juice was extracted by means of a Carver laboratory press and added to a 1 M glucose or sucrose solution in equal amounts making the final concentration of juice 1: 2 and the sugar solution one-half molar. The control was set up by mixing the juice with an equal volume of water. The total amount of solution used was 15 ml in Petri dishes which had a total capacity of about 30 ml. At the end of 24 hr, leaf squares were tested for the presence of starch by first boiling them for a minute in water, second, extracting the yellow pigments in 95% ethanol, and finally applying a dilute solution of iodine ($I_2KI$) to the leaf squares spread out on a glass plate. The presence of starch in the control was indicated by a dark coloration.

Plants related to onion such as the day lily (lily family), jonquil and daffodil (amaryllis family), and American columbo (gentian family) also have the inhibitor (Table 1). Wild onion (garlic) leaves have a somewhat more potent concentration of the starch-forming inhibitor than the bulbs of the cultivated onion. Iris didn't seem to have much inhibitor. The test was made in midsummer and the result on iris may have been due to the time of year when the plant juice was tested. Day lily juice tested in summer had much less inhibitor than in spring, so there is a seasonal variation.

Juice from plants such as dandelion, wild carrot, wild strawberry, corn, and tomato which do store starch did not inhibit the formation of starch in the leaf squares of etiolated corn (Table 2). Juice from alsike clover and red clover did have a slight inhibitory effect in dilutions of 1: 2. While alsike clover and red clover do store starch, the slight inhibitory effect of the juice on starch formation in leaf squares of etiolated corn is as yet unexplainable.

Dilution of the juice from cultivated onion bulbs showed inhibitory influence during the first day up to dilutions of 40 to 80 times. Most or all of the effectiveness of the inhibitor seemed to be lost during the second day in cases where the juice was diluted more than 10 times.

The inhibitor of starch synthesis is not entirely heat stable nor is it entirely decomposed by heating to the boiling point momentarily and then cooling.

Day lily leaves do not form starch in the leaves under natural conditions. If leaf squares of the day lily are floated on .5 M glucose in the dark at room temperature, starch begins to form at the cut edges at the end of the second day. This is in accordance with Böhm who showed that some plants in which no starch is formed, e.g., *Galanthus, Hyacinthus, Ornithogalum*, and *Iris*, can be induced to starch formation when the leaves are kept on

TABLE 1

FORMATION OF STARCH IN LEAF SQUARES OF ETIOLATED CORN FLOATING ON .5 M GLUCOSE SOLUTIONS WHICH CONTAINED JUICES OF PLANTS NOT NORMALLY STORING STARCH

| Plant | Starch test | |
|---|---|---|
| | Juice diluted 1 : 2 | Juice diluted 1 : 15 |
| No juice added (control) | Strong positive | Strong positive |
| *Hemerocallis fulva* (day lily) | Negative | Trace |
| *Narcissus Jonquilla* (jonquil) | " | Negative |
| *N. Pseudo-Narcissus* (daffodil) | " | Slight trace |
| *Allium Cepa* bulbs (onion) | " | Small positive |
| *A. canadense* (wild garlic) | " | Trace |
| *Frasera carolinensis* (American columbo) | Trace | ..... |
| *Iris versicolor* (iris) | Small positive | Strong positive |

TABLE 2

FORMATION OF STARCH IN LEAF SQUARES OF ETIOLATED CORN FLOATING ON .5 M GLUCOSE SOLUTIONS WHICH CONTAINED JUICES OF PLANTS NORMALLY STORING STARCH

| Plant | Starch test | |
|---|---|---|
| | Juice diluted 1 : 2 | Juice diluted 1 : 15 |
| No juice added (control) | Strong positive | Strong positive |
| *Taraxacum officinale* (dandelion) | " " | " " |
| *Zea Mays* (corn) | " " | " " |
| *Fragaria virginiana* (wild strawberry) | " " | " " |
| *Daucus Carota* (wild carrot) | " " | " " |
| *Lycopersicon esculentum* (tomato) | " " | " " |
| *Trifolium hybridum* (alsike clover) | Small positive | " " |
| *T. pratense* (red clover) | Small positive | " " |

a 20% solution of sucrose for 8–10 days (*2*). These plants have the mechanism for starch formation but do not form it under natural conditions, apparently because of the presence of an inhibitor.

Members of the lily, iris, amaryllis, and gentian families do not store starch in the leaves following photosynthesis, apparently because of the presence of a starch synthesis inhibitor. Onion, a member of the lily family, has the inhibitor.

### References

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2. SPOEHR, H. A. *Photosynthesis.* New York: Chemical Catalogue, 1926. Pp. 184–185.

## The Isthmic Mucous Membrane of the Human Uterus

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The purpose of this report is to present preliminary findings in a study of the mucous membrane lining the isthmic segment of the human uterus. These findings indicate that the isthmic mucosa is not peculiar, as it has been extensively described, but that, rather, it is an integral part of the corporeal andometrium.

According to current understanding, the isthmic mucosa is an entity in itself, separate and distinct from that of the cervix and corpus. A similarity with the endometrium is recognized, however, with the following exceptions: the isthmic mucosa is described as being thinner, poorer in glands, and richer in supporting tissue. Also, its glands are said to react poorly to the ovarian hormones, and to contain no glycogen during the secretory phase. A further difference is the reported absence of coiled arterioles, which are a prominent feature of the endometrium. The conclusion from these observations is that although the two tissues casually resemble one another, nevertheless they are fundamentally dissimilar.

Preliminary studies have been made of the mucous membrane of 38 human uteri removed at operation. The endometrial cycles were distributed as follows:

| | |
|---|---|
| Early proliferative | 6 |
| Late proliferative | 12 |
| Early secretory | 6 |
| Late secretory | 10 |
| Post-menopausal | 4 |

In each of these cases, similar blocks of the isthmic mucous membrane were prepared for comparison with the endometrial specimens.

Comparison of the endometrial functionalis with the isthmic mucosa confirms the observations noted above. However, when the endometrial basalis is examined in routine hematoxylin and eosin sections, it is found to be essentially similar to the isthmic mucosa. The basalis is of the same thickness. The general appearance of the glands, and their cyclic changes in response to the ovarian hormones, are the same. The characteristics of the stroma, and the vascular distribution, are similar. Special staining technics show further evidences of similarity. One concludes from these observations that the isthmic mucosa is in fact a continuation of the endometrial basalis and that it differs from the endometrium proper only in that the functional layer is lacking.

These observations cast serious doubt upon the propriety of designating the isthmus uteri as an entity of equal importance with the cervix and corpus. They suggest, rather, that this zone is part of the corpus uteri. Details of this study will be presented elsewhere.

## Physical Studies on Corneal Tissues

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Improvements in the technique of corneal grafting have increased the interest in the proper preservation of corneal donor tissue. Many investigations have dealt with corneal metabolism (*6, 11*), permeability (*4*), transparency (*1, 8*), hydration properties (*8, 10, 12*), X-ray diffraction (*9*), birefringence (*8*), and elasticity (*13*). A number of investigators (*2, 3, 5, 7, 14*) have reported on methods for preserving corneal tissue but of these only three (*3, 5, 7*) have applied biological methods for determining the viability of the aging cornea. No attempts were made in the past to correlate physical properties of the aging cornea with the transplantability of the tissue. For this brief review only the most pertinent references have been selected from a large bibliography.

The object of our brief investigation was to find some physical properties of corneal tissue which would measurably change during aging to indicate suitability for subsequent successful transplants. The experiments were made with bovine corneas and comprised 1) quantitative light transmission measurements as well as 2) X-ray diffraction studies. The eyes were removed immediately after death of the animal, rinsed with a 0.025% isotonic buffered thyrothricin solution, transported into a sterile moist chamber, and processed at the laboratory within 1 hr. During aging, the corneal tissues were kept in a refrigerator at a temperature of 5° C.

1) *Light transmission.* Experiments were made to determine the light transmission of corneal tissue with aging under different conditions. Periodic light transmssion measurements were performed on several corneas set up for simultaneous aging. A disk-shaped cellulose acetate sponge with a round opening in the center served as the

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