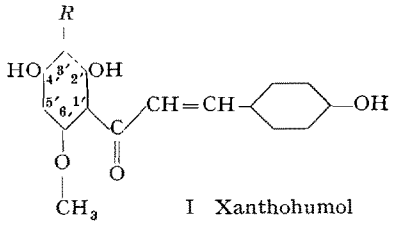
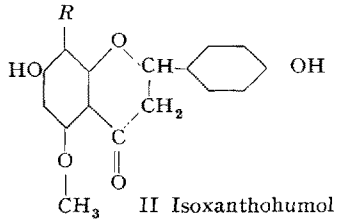
The position of the equilibrium is, curiously enough, dependent on the alkali concentration.

Xanthohumol and isoxanthohumol must be given the structures I resp. II ($R = (CH_3)_2C = CH-CH_2-$).



I Xanthohumol



II Isoxanthohumol

The place of the R-group is not yet definitely known; it might as well be placed at position 5.

Structures I and II are derived principally from the following facts:

(1) Xanthohumol contains three, and isoxanthohumol two active hydrogen atoms.

(2) On catalytic hydrogenation (Pt) xanthohumol consumes two moles, isoxanthohumol one mole of hydrogen.

(3) Alkaline hydrolysis of xanthohumol yields p-hydroxybenzaldehyde, acetic acid and methylisoprenylphloroglucinol (mp 55°).

(4) Methylisoprenylphloroglucinol and its reduction compound, methylisoamylphloroglucinol (mp 100°) were recognized through the reaction products of their fusion with alkali. The phloroglucinol ring is split and the usual double bond shift occurs. The reaction products were, respectively, isovaleric and acetic acid, and isoheptylic and acetic acid.

(5) Methylisoprenylphloroglucinol, xanthohumol and isoxanthohumol all yield acetone on ozonolysis.

Full details about these reactions, the extraction procedure for xanthohumol, as well as a large number of other facts, all consistent with the formulation put forward, will be published elsewhere.

F. GOVAERT, M. VERZELE, M. ANTEUNIS, F. FONTYN, and J. STOCKX

Laboratory for Organic Chemistry, University of Ghent, Belgium, November 12, 1956.

Résumé

Le pigment jaune du houblon (xanthohumol), isolé par POWER, TUTIN et ROGERSON en 1913, est une chalcone (formule I). L'isomérisation en milieu alcalin du xanthohumol donne la flavanone correspondante (isoxanthohumol-humulol).

A Possible Link from the Cytoplasmic Metabolic Reactions to the Genes: The Co-enzymes

In thinking about cell growth and cell division, the question has often arisen—how does the cell know when to divide? A more complete question might be—what is the biochemical sequence of events that takes place in a cell, beginning at the birth of the cell and ending in its death, taking into account all intermediate activities.

Well, this observer is unable to answer this question, but simply wishes to give a possible partial answer to the first question—a way in which the co-enzymes, DPN, TPN, FAD, CoA and others of a similar nature might function as messengers from the cytoplasm to the nucleus, to the genes and chromosomes.

During some experiments on the isolation of nucleotide pyrophosphatase[1] (a DPN-splitting enzyme) from potatoes and alcohol dehydrogenase[2] (an enzyme which uses DPN as a coenzyme) from yeast, the question arose in the observer's mind—what is the function in the cell of an enzyme that splits DPN? DPN is a useful co-enzyme, a stepping-stone in oxidative pathways, why should the cell itself split this compound, thus reducing the amount available as co-enzyme?

In addition, there are reports in the literature of enzymes which split other co-enzymes.

If one looks at the structure of the co-enzymes, one can see features they have in common. They each have a nucleotide side and a side which functions in the cell metabolism.

Take DPN as an example. Every time two hydrogen atoms are transferred through to oxygen, one molecule of DPN is reduced and re-oxidized. This activity is thought to occur on the nicotinamide side of the molecule. What function does the nucleotide fragment of the molecule serve?

In answer, suppose that DPN is functioning actively, say 19 molecules being reduced, then oxidized, and when the 20th is reduced, it is unable to be re-oxidized (it might be an isomer, thus placing its active group in the wrong position to be oxidized by its oxidizing enzyme, but in the proper position to be split by a DPN-splitting enzyme). The nicotinamide fragment could then be used again or might find its way into the excretory pathways. The nucleic acid isomer could then find its way to the chromosome, where it could polymerize into a space left for it, in the growing chromosomal polymer.

Here is, then, the bare outline of a mechanism by which the chromosome may know how much metabolism has proceeded in the cell. As the nucleotide fragments of the co-enzymes associated with the various metabolic cycles return to the chromosome, the chromosome grows in proportion to the amount of oxidation-reduction which has taken place and perhaps also in proportion to the degree of completion of other processes in which nucleotide co-enzymes are involved.

The actual length and structural configuration of the chromosome would then mirror the number of metabolic cycles in the cell.

The above would probably be only one phase of the cell's life. The process is probably repeated many times (the nucleic acids leaving the chromosome, then returning in a different pattern) as the cell grows, metabolizes, matures, ages, then dies.

Each new set of chromosomes that form during the life of the cell is probably very similar to the previous set,

[1] A. KORNBERG and W. E. PRICER, J. biol. Chem. *182*, 763 (1950)
[2] E. RACKER, J. biol. Chem. *184*, 313 (1950).

but different enough to provide the new enzyme systems necessary for the successful performance of the cell's new stage of growth. Thus a cell would actually never duplicate itself, but would produce a baby cell, with enzyme systems necessary for the production of a cell in the second phase of growth. One phase would then follow the last, being influenced by the parent cell, the immediate environment, and its internal composition. It is then capable of becoming an adult cell very similar to its parent cell, but is not so at birth.

The picture as presented is admittedly incomplete and general, but the observer feels that the weight of the evidence gathered so far, the structural similarities between the nuclear material and the co-enzymes, the presence of co-enzyme splitting enzymes in the cell, and the fact that chromosomes cannot always be found in the nucleus at every stage of growth of the cell, is in favor of some mechanism similar to the one presented here as part of the genetic information–genetic control system.

Although they did not necessarily agree with the views as presented here, I wish to thank Miss MARY SCOTLAND, Dr. ELLIOT MAYNARD, Dr. HAROLD HODGE, Dr. KURT SALOMON, and Dr. LEON MILLER for their sympathetic reading and criticism of this manuscript.

M. SEIDENBERG

Atomic Energy Project, the University of Rochester, N.Y., November 9, 1956.

Résumé

De faits biochimiques connus on peut construire un mécanisme où les fragments nucléotides des co-enzymes nucléotides (ou leurs isomères) servent de «messagers» des cycles métaboliques cytoplasmiques aux chromosomes. De façon similaire, on peut représenter les nucléotides comme se séparant des chromosomes et devenant une partie des co-enzymes dans une phase distincte du développement de la cellule.

On an Unusual Form of Periodic Precipitation

The classical phenomenon of periodic sedimentation called 'Liesegang Rings' is well known and can easily be demonstrated in, for instance, a gelatine-silver-dichromate model[1]. If agar-agar is used as the gel, the effects are basically the same but less well marked unless special techniques are used. Of several factors which may produce this phenomenon 2 are essential:

(1) Soluble chemical constituents which can form insoluble compounds with each other, and (2) a sharp gradient between the concentration of at least two of these substances.

In many cases the most striking results are dependant on the presence of a colloidal substrate, preferably as a gel. A system containing an agar gel and calcium salts, under certain conditions, will produce the peculiar pattern described below.

Experiment.—1·6 g of powdered agar-agar (B.P.) are soaked in 280 ml distilled water for about 2 to 4 h with repeated light stirring. The agar suspension is then gently boiled, with repeated stirring for about 30 to 40 min, until the volume is reduced to the 300 ml mark. After cooling to about 50°C, 10 ml of hot sodium carbonate solution containing 0·1 g of the salt are stewed in. 6 Petri plates are then filled to a depth of 5 mm and the others to a depth of about 10 mm. The plates are left on a cold surface to gel and then two medium granules of anhydrous calcium chloride are placed in the centre of a 5 and 10 mm plate respectively. On the centre of the other plates either 4 to 6 granules are feeded or 2 drops of syrupy ('saturated') calcium chloride solution are pipetted. The plates are then left at room temperature (18 to 22° C) and examined after 6, 12, 18 and 24 h and again after 2 and 3 days. If the results are not convincing then, in a second series of experiments, agar at 1% concentration is used with the same procedure.

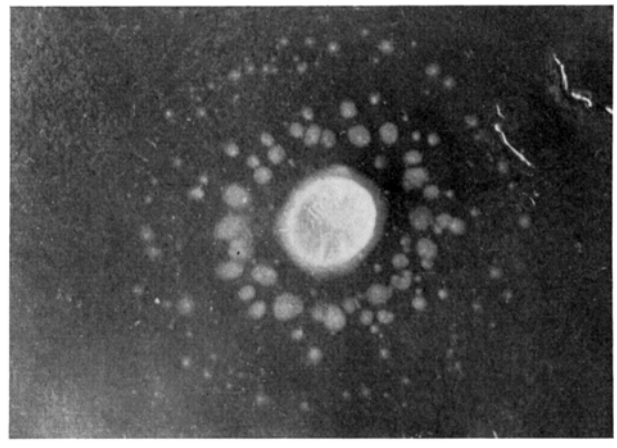


Fig. 1.

Results.—As the appearance of periodic precipitation cannot be predicted with accuracy, the above set up of several plates and procedures is necessary. Usually, the system with the solid calcium granules yields the most characteristic results. The temperature of the room shoult not exceed 20 or 22°C.

Within a few hours circular white patches surround the calcium chloride and these later coalesce into a solid area in which thicker spots may be discernible. Frequently, the sedimentation centre retains its sharp boundary (Figure 1) with a surrounding clear zone. 12–24 h or 2 days later isolated white dots appear in concentric rings around the centre. These small spots remain separated and the distance of concentric rings from each other as well as the size of the dots diminish the further away they are from the original centre. Finally, some of the smaller foci of precipitations become surrounded by 'daughter spots' which also are isolated (Figure 1). The microphotographs (Figure 2 and 3) taken at a magnification of × 30 and × 100, show the true isolation of such small dots, and at the same time, a radial though irregular structure.

When the agar layer is 10 mm or more thick and 4 or 6 granules of calcium chloride are placed partly on the surface and partly deep into the gel, then this phenomenon of isolated spot precipitation develops twice, at the upper and the lower surface of the agar.

Compared with the classical 'Liesegang-Rings', the rhythmic precipitation here described shows marked differences. The former system yields uninterrupted rings, shells or bands, continuous, though separated by clear

[1] E. R. LIESEGANG, *Handbuch der biologischen Arbeitsmethoden* (Urban & Schwarzenberg, Berlin 1929), Abt. 3, Teil B. – J. KLEEBERG, Med. Radiogr. Photogr. (Kodak) *29*, 47 (1953); Gastroenterologia *80*, 313 (1953).