the radiomimetic action of oxyquinoline. A possible interpretation of the mode of action of oxyquinoline is made in connection with the increase in plasm viscosity induced by this substance in *Helodea* leaf cells by STÅLFELT (see appendix of the present paper).

RESUMEN

(UTILIZACIÓN DE LA OXIQUINOLEINA EN ANÁLISIS DE CROMOSOMAS)

El tratamiento previo con 8-oxiquinoleína de vértices vegetativos de raíces, conduce a mejores imágenes de los cromosomas. Los cromosomas metafásicos se contraen, se destruye el huso y no interfiere con la distribución y esparcimiento de los cromosomas al hacer la preparación por «squash-method». El aparato centromérico muestra con claridad condiciones extraordinarias: es posible ver netamente cuatro corpúsculos centroméricos en los cromosomas profase-metafásicos. Puede estudiarse claramente la heterocromatina a través de los diversos estados profásicos. La técnica de la oxiquinoleína se ha ensayado en unas 40 especies vegetales mono- y dicotiledóneas y se ha comprobado ser útil en la mayoría, aunque no tanto en las plantas con cromosomas pequeños. Se indica la acción radiomimética de la oxiquinoleína.

En el apéndice a este trabajo, STÅLFELT apunta la posibilidad de interpretar el modo de acción de la oxiquinoleína, relacionándolo con el aumento de viscosidad del protoplasma provocado por dicha substancia en células de hojas de *Helodea*.

APPENDIX

THE EFFECT OF OXYQUINOLINE ON PROTOPLASMIC VISCOSITY

By M. G. STÅLFELT

Stockholms Högskola, Stockholm, Sweden.

Heteroauxine, indole-3-β-propionic acid and colchicine even in very dilute solutions give rise to an increase in the viscosity of protoplasm, as was shown in an earlier investigation (STÅLFELT, 1947). The conclusion was also drawn that the known effects of these chemicals upon the mitotic processes may be interpreted as a consequence of a disturbance in the protoplasmic structure, this disturbance also causing alterations in the viscosity.

After I was informed by Dr. LEVAN that oxyquinoline has a mitotic effect, I also investigated this substance. The experimental method used was the same as in earlier studies (STÅLFELT, 1946, 1947). The measurements were made by centrifugation of the test objects (leaves of *Helodea densa*) in a centrifuge of angle type at about 3000 r. p. m.

Solutions of oxyquinoline were prepared in distilled water and with concentrations of 0.005, 0.003, 0.002, and 0.001 mol/l. Pieces of shoots of *Helodea densa* were placed in the respective solutions and the plasma viscosity of the leaf cells determined at fixed intervals.

In the strongest solutions (0.005 and 0.004 mol/l.) the viscosity of the cell plasma increases rapidly so that as soon as after one hour the plasma lies entirely immovable during centrifugation. The fluidity of the plasma is somewhat greater in solutions of 0.003 mol, but after two to three hours the rate of centrifugation chosen is unable to affect the chromatophores and the plasma even of such objects.

In the weakest concentrations (0.002 and 0.001 mol) the viscosity is unaffected during the first hours up to one or two days. As is the case for the control object (in distilled water) centrifugation of the plastids and the plasma requires only about three minutes. After one or two days, during which time the objects remain in the solutions, a few individual cell groups of the object in the stronger solution show an increased viscosity (0.002 mol). The viscosity is already so high that the chromatophores and the plasma do not change their position at all during centrifugation whereas the cells in the vicinity still appear to be entirely unaffected by the toxin. During the following day or days the cell groups affected increase in size and number and after three to four days the plasma in all the cells is immovable on centrifugation. In the meantime, the same changes have taken place in the object in the weakest solution (0.001 mol). The time elapsing before the effect of the toxin becomes evident varies in the different objects. This is presumably due to varying conditions of permeability.

The most characteristic feature of the effect of oxyquinoline is the very small number of intermediate stages between such cells whose plasma has attained the highest viscosity values (as far as this could be determined with the rate of centrifugation used) and such cells whose plasma is entirely unaffected. Only exceptionally are stages encountered in which centrifugation requires, for example, 10 or 15 minutes. Such stages are, on the other hand, characteristic of the agents studied earlier (*e. g.* heteroauxine, colchicine). Moreover, the aforementioned agents affect all the leaf cells simultaneously and the effect increases slowly, the viscosity gradually increases and only reaches maximum values after several hours or days. With oxyquinoline, increase takes place very rapidly and intermediate stages are therefore uncommon. The increase in viscosity starts as soon as the cells have taken up a sufficient quantity of the toxin. The process then continues at a considerable rate and the final stage is rapidly reached. The permeability to the toxin presumably varies in the individual cells and cell groups. This explains the occurrence of the aforementioned islets of cells in which the plasma is affected whilst the viscosity of the adjacent cells still appears to be unaffected.