gemessen am Dosismodifikationsfaktor nicht wesentlich verschieden. Der DMF wurde ermittelt aus dem Verhältnis der Inaktivierungsrate nach 600 rd und 2 h Nachinkubation bei 17° gegenüber der für die gleiche Schädigungsrate benötigten Dosis bei 37°. Der DMF betrug bei Se_1 1,3, bei NMH_3 1,6. Der Sensibilitätsunterschied zwischen Se_1 und NMH_3 bleibt auch unter Beeinflussung von Erholungsphänomenen durch die niedere Nachbestrahlungstemperatur erhalten (prozentuale Inaktivierungsrate nach 600 rd bei NMH_3 rund doppelt so hoch wie bei der Linie Se_1). Karyotypuntersuchungen ergaben für NMH_3 eine gegenüber Se_1 erhöhte Karyotypunstabilität; es erfolgt eine «shift» der Chromosomenzahl von 22 zu hyperdiploid 23. Während bei Se_1 52% der Zellen 22 Chromosomen besitzen, sind es bei NMH_3 bloss 10,9%, mit 23 Chromosomen dagegen 51%.

Diskussion. Da sich durch Selektion allein keine stabile Resistenz einstellt, wohl aber durch Mutations-Induktion und Selektion, ist es unwahrscheinlich, dass in der Ursprungspopulation bereits die resistenteren Zellen vorhanden waren, sondern vermutlich wurden durch die Applikation des Mutagens strahlenresistentere Mutanten erzeugt und durch Selektion eine resistentere Linie herausgezüchtet. Unser Ergebnis steht in Übereinstimmung mit Untersuchungen von COURTENAY[4]: Resistenz kann auch dann vorliegen, wenn D_0 nicht erhöht ist. Dabei wird der Sensibilitätsunterschied nur am D_q-Wert sowie in unserem Fall dem DMF ersichtlich; der DMF stellt zusammen mit der LD_{50} das zuverlässigste Kriterium für vergleichende Sensibilitätsbestimmungen dar. Die von uns gefundene Resistenz bleibt auf konventionelle Röntgenstrahlen beschränkt. Untersuchungen im Zusammenhang mit der Bestimmung der relativen biologischen Wirksamkeit von Betatronstrahlen ergaben keine signifikante Resistenz von NMH_3 für 31-MeV Betatron-Photonen und Elektronen gegenüber Se_1[14,15]. In Analogie zu Arbeiten von SHAEFFER und MERZ[5] sowie LITTLE et al.[6] scheint auch in unserer Zell-Linie die vermehrte Resistenz nicht einherzugehen mit erhöhten «langsamen» Repairphänomenen, die mit den beschriebenen Methoden erfasst werden konnten. Möglich wäre es jedoch, dass andere Methoden zu anderen Schlüssen führen würden[4,3,9]. Denkbar wäre eine herabgesetzte Strahlenempfindlichkeit des Repairsystems; in der resistenten Linie, die sich unmittelbar nach der Bestrahlung oder – entsprechend unseren negativen Resultaten für das 2 h – «Recovery» – Verhältnis – mehr als 4 h nach Bestrahlung bemerkbar macht[16]. Die Frage bleibt offen, ob in der resistenten Linie der hohe Anteil hyperdiploider Zellen mit Chromosomenzahl 23 in irgendeiner Beziehung zur Resistenz steht und ob vorwiegend Trisomie für ein bestimmtes Chromosom vorliegt (siehe auch BHASKAVAN und DITTRICH[16]). Es dürfte interessant sein durch Klonierung und Zuhilfenahme der Chromosomenbänderungs-Techniken diesen Fragen weiter nachzugehen.

Summary. Mutations-induction followed by selection is a suitable method for developing a cell line with resistance to low doses of X-rays. In comparison with the original cell line, the derived resistant line is characterized by an enhanced variability of the chromosome number, and no higher level of cellular repair, limited to the two repair types described.

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Localization of ATPase in the Choroid and Retina of the Developing Chick

The ultrastructural localization of phosphatase in adult retinas has been reported by a number of authors[1–6] and ATPase in particular has been associated with photoreceptive processes[7]. Although maximum concentrations of acid and alkaline phosphatases have been observed in differentiating organs[8,9], the pattern of ATPase in embryonic retina remains unknown. The aim of the present study is therefore to determine the distribution of ATPase in the chick retina at approximately the time when the first adult form of ERG first appears, i.e. stage 45[10–12], and to compare this distribution with that of the hatching chicken.

Materials and methods. Fertile white leghorn eggs were incubated at standard conditions and staged according to HAMBURGER and HAMILTON[13]. The posterior halves of stages 45 and hatching chick embryonic eyes were dissected out and fixed in cold neutral buffered 5% formalin, and then small pieces were incubated in bulk in the Wachstein-Meisel medium[14] for 60 min at 37 °C and afterwards reacted with $(NH_4)_2S$. The tissues were then postfixed in 1% OsO_4 and subsequently dehydrated, cleared and embedded in Epon. 3 controls were utilized 1. the WACHSTEIN-MEISEL[14] medium minus lead, 2. medium minus ATP and 3. medium minus magnesium.

Results. In the choroid of both stage 45 (approximately 19–20 days of incubation) and stage hatching (approximately 21 days of incubation), the ATPase positive sites are located at the polar ends of the endothelial cells of the choriocapillaris (Figures 1 and 2) and exhibit a zigzag pattern.

Bruch's membrane is an important cellular barrier for nutrient and metabolite transport[15,16] it separates the retina proper from the choriocapillaris. At stage 45,

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The basal portion of the pigment epithelium cell, terming the basal infolding layer, is composed of invaginations and pinocytotic vesicles. At stage 45, no ATPase activity is located in this layer (Figure 3) or any other part of the cell. At stage hatching, dense accumulations initially appear in the pinocytotic vesicles of the basal infolding layer (Figure 4). Positive sites are also present distinct positive sites were not observed (Figure 3). At stage hatching, definitive non-membrane bound granular aggregates of ATPase are present and a large number of them are close to the choriocapillaris (Figure 4).

in the nucleoplasm, cytoplasm and even around the pigment granules of the pigment cell (Figures 4 and 5).

The photoreceptors consist of outer segments which are stacks of membranes and the more cellular inner segments which contain mitochondria, glycogen bodies and oil droplets (in cones)[17]. At stage 45, small and inconspicuous granular deposits begin to appear as ATPase sites on the membrane stacks of the outer segments (Figure 6) and these sites increase in number at hatching

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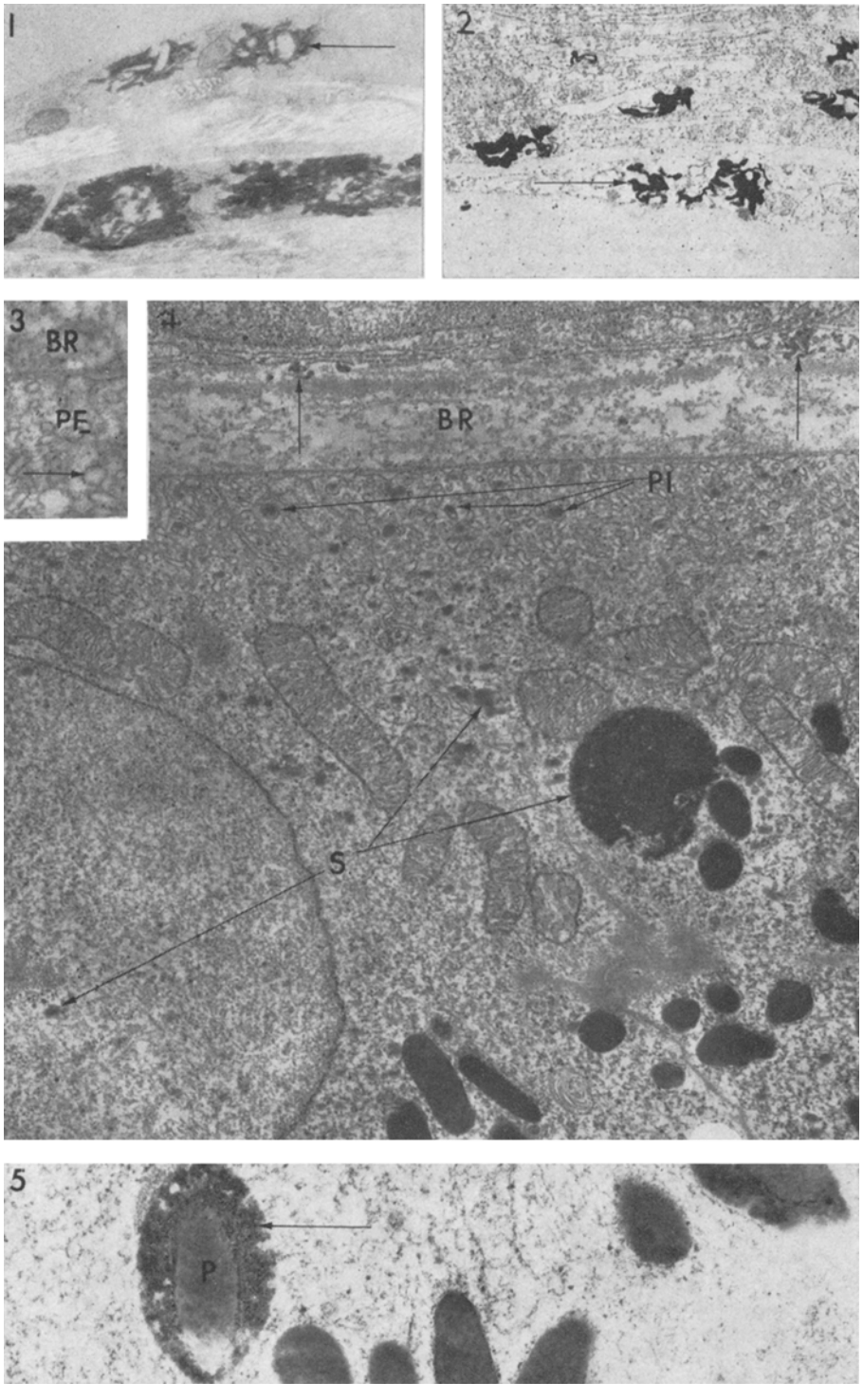
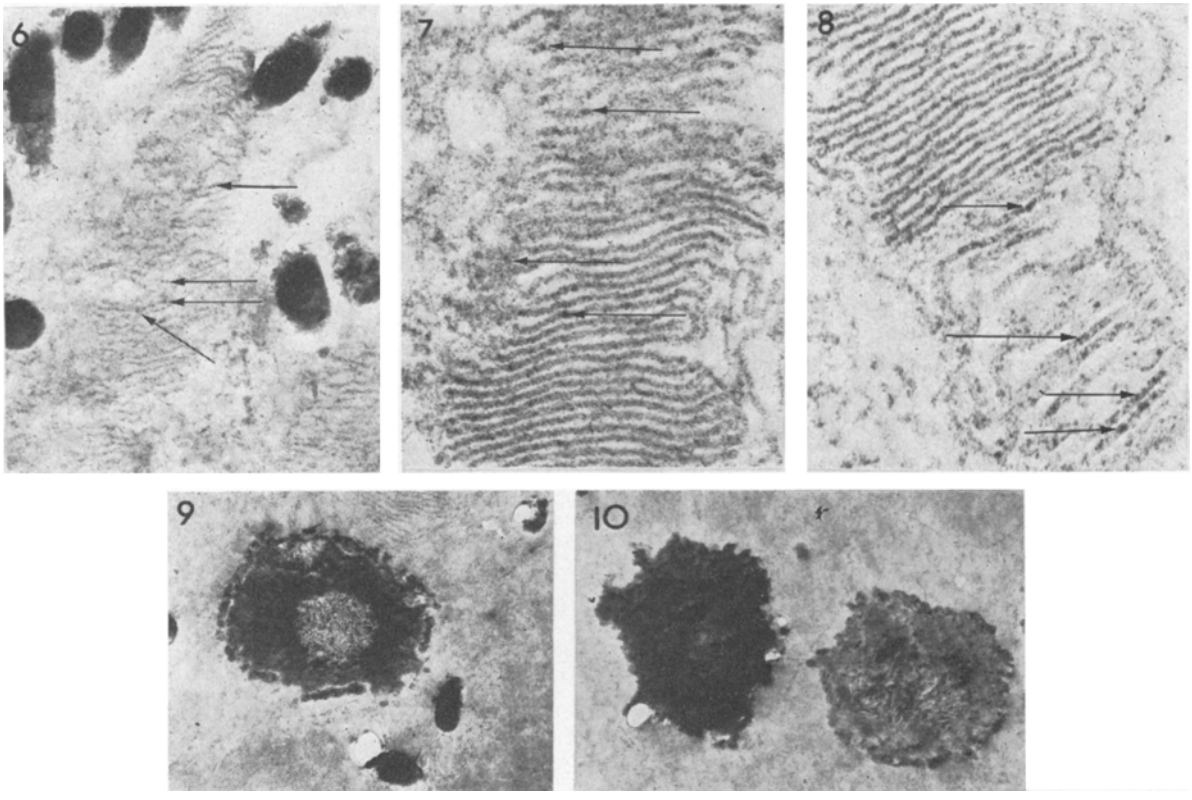


Figs. 1–5. 1. Positive site of ATPase activity (arrow) in the choriocapillaris of a stage 45 chick eye. Note the zigzag pattern of reaction sites. Unstained section, ×13,500. 2. Positive site of ATPase activity (arrow) in the choriocapillaris of a newly hatched chick eye. Unstained section, ×13,500. 3. Bruch's membrane (BR) and pigment epithelium (PE) in a stage 45 chick eye. Note negative ATPase localization in the Bruch's membrane and pinocytotic vesicle (arrow) of the pigment epithelium. Unstained section, ×28,500. 4. Bruch's membrane (BR) and pigment epithelium in a newly hatched chick eye. Note positive ATPase sites (arrows) in the Bruch's membrane (BR) and within the pinocytotic vesicles (PI) of the basal infolding layer in the pigment epithelium. Also note other positive ATPase sites (S) in the nucleoplasm and cytoplasm in the pigment epithelium. Unstained section, ×13,500. 5. Pigment epithelium of a newly hatched chick retina. Note positive ATPase sites (arrow) around a pigment granule (P). Unstained section, ×13,500.



Figs. 6–10. 6. An outer segment of a stage 45 chick retina. Note a few very small and inconspicuous granular deposits (arrows) of ATPase positive sites. Unstained section, ×22,500. 7. and 8. Outer segments of hatched chick retinas. Note increase in granular ATPase positive sites (arrows). Unstained sections, ×47,500. 9. and 10. Retinal oil droplets at stage 45. Note different intensity of ATPase localization. Unstained sections, ×13,500.

(Figures 7 and 8). The inner segments only display ATPase positivity in certain oil droplets of both stages 45 and hatching. (Figures 9 and 10). According to the position of the droplets, they belong to those of the chief cones.

Discussion. Our results indicate an increase in ATPase positivity in Bruch's membrane and basal infolding layer at hatching, suggesting a possible increase in nutrient transport. Movement of nutrient across this region has been observed in the adults[3,18,19].

Positive ATPase reactions in the outer segments of the adult retinas have been reported[1,7], and it was speculated that this enzyme may be related to rhodopsin. Our results indicate the initial presence of ATPase activity in the outer segments at stage 45, which coincides in time with the first detected adult ERG[10–12] and with the beginning of pupillary reflex[20]. This further implies that ATPase is important in the process of vision, possibly through its relationship with rhodopsin.

In the inner segments, positive ATPase sites are detected in chief cone oil droplets and not in other droplets, suggesting that different types of oil droplets may have different functions or metabolic activities. The ATPase positive droplets probably serve to store ATP[21].

Zusammenfassung. In der Retina des Hühnerembryos wurde im Zeitpunkt des Schlüpfens – sowohl in der Bruchschen Membran, wie auch im Pigmentepithel und der äusseren Stäbchenschicht – eine vermehrte ATPase-Aktivität festgestellt.

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A Comparison Between the Free Grafting of Sliced and Intact Muscles in the Rat[1]

The method of free grafting of entire mammalian muscles offers a number of advantages in the study of the physiology of muscle regeneration, but one drawback to this model is the persistence of a thin rim of original muscle fibres at the periphery of the graft[2]. This complicates the analysis of early contractile properties. On the other hand, the commonly used model of minced muscle regeneration[3] has disadvantages due to the structural peculiarities, large amounts of connective tissue and low degree of recovery of muscle weight and tension development[4].

In an effort to circumvent the disadvantages of both systems, a new experimental model was devised. It consists of slicing a muscle into a number of thin slabs,