racterised by fractal analysis (Mandelbrot 1983) and conventional morphometry. The architecture and the epithelial growth patterns of the different subtypes were characterised by fractal analysis. The Fractal Dimension (FD) was determined from the slope of the regression line describing the fractal region within the bi-asymptotic curve experimentally established by means of the FANAL++ software (Losa and Nonnenmacher 1996). The FD obtained from masks and outlines after grey threshold segmentation of tumour epithelial components showed self-similar fractal properties. Masks but not outlines of canine trichoblastoma subtypes showed significant different FD values ranging from 1.75 to 1.85 thus enabling a complete discrimination of different histological types. Trichoblastoma subtype with the higher amount of mesenchymal stroma (Losa and Alini 1993) displayed an epithelial component with the lowest FD, indicative of less complex growth patterns. The FD data suggest that an iterative morphogenetic process, involving both the hair germ and the associated dermal papilla, may be responsible for the tumour architecture (De Vico et al 2005) and emphasizes the advantages of fractal analysis in the objective characterization of tumour growth.

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# Photopigment coexpression in the mammalian retina

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In mammals, each cone had been thought to contain only one single type of photopigment. It was not until the early 1990s that photopigment coexpression (dual cones) was first reported. In a well known laboratory animal, the house mouse, the distribution of color cones shows a characteristic division. Whereas in the upper retinal field the ratio of short wave to middle-to-long wave cones falls in the usual range (1:10), in the ventral retinal field M/L-pigment expression is completely missing. In the transitional zone, numerous dual cones are detectable (spatial photopigment coexpression). In some other species without retinal division, dual cones appear during development, suggesting that M/L-cones develop from S-cones. Dual elements represent a transitory stage in M/L-cone differentiation, and disappear with maturation (transdifferentiation, transitory photopigment coexpression). These two phenomena seem to be mutually exclusive in the species studied so far.

Recent comparative studies performed by our group reported other types of retinal photopigment coexpressions in adult specimens without retinal division. Dual elements either occupy the dorsal peripheral retina, or make up the entire cone population.

In an African diurnal rodent, *Otomys unisulcatus*, a few dual cones appear in peripheral localization. These cones morphologically resemble developing elements raising the question as to whether these are postmitotic cells in the phase of differentiation. Strong immunoreactivity against PCNA (Proliferating Cell Nuclear Antigen) in this region suggests that, at least in this species, retinal maturation or regeneration continues even in adults. Intensive studies are on the way to detect a similar phenomenon amongst available laboratory animals.

In two of the examined species, the Siberian hamster, and the African pouched mouse the entire cone population is made up of dual elements. This is the first observation proving that all cones of a retina are of dual nature. These species are good models for the study of molecular control of opsin expression and renders them suitable sources of dual cones for investigations on the role and neural connections of this peculiar cone type.

In the developmental studies performed, the retinal maturation of several species was examined to test the hypothesis of transdifferentiation. Whereas in all species studied, S-pigment expression, if present, precedes that of the M/L-pigment, dual cones are not always detectable. They are either present in a smaller or larger number or are completely missing from the

developing retina. These results exclude a common mechanism for M/L-cone maturation: they either transdifferentiate from S-cones or may develop independently.

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# The effect of TGF-β1 and high glucose on the development of insulin cells in the chick pancreas

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Numerous factors are believed to affect the proliferation and differentiation of β-cells, which are responsible for secreting insulin in the pancreas. A means of enhancing β-cell proliferation in the pancreas would prove invaluable in the treatment of insulin-dependant diabetes. TGF-β1 is thought to decrease the proportion of β-cellswith respect to α-cells, while glucose is thought to enhance β-cell proportions in rats (De Gasparo et al. 1978). However, recent studies have shown that chick pancreatic cells may respond differently to glucose by showing a reduction in β-cell proportions (Kramer and Alison 2005). Long-term exposure to glucose has also been shown to have an apparent inhibitory effect on β-cells (Rawdon and Andrew 1997) The aim of the study was to test the effect of TGF-β1, a potent cell proliferation inhibitor, on the proportion of β-cells in embryonic chick dorsal pancreatic buds *in vitro*, with short-term exposure to high levels of glucose in Ham's F12.ITS medium. Five-day old chick dorsal pancreatic buds were cultured in serum-free medium for 7 days. Growth factor-reduced Matrigel was used as the extracellular matrix for culturing the explants as it contains reduced levels of growth factors, including TGF-β1. Ham's F12.ITS with or without TGF-β1 was used as the medium in which the explants were cultured to test the response of the developing β-cells to TGF-β1. A group of explants were also cultured in Ham's F12.ITS with high levels of glucose to test the effect of TGF-β1 on developing β-cells in the presence of glucose. A fourth group of explants were cultured in a high glucose-containing medium without added TGF-β1. Explants cultured on growth factor-reduced Matrigel with Ham's F12. ITS showed a much higher proportion of β-cells to α-cells compared to explants cultured on growth factor-reduced Matrigel with Ham's F12.ITS and added TGF-β1. TGF-β1 decreased the proportion of β-cells to α-cells, as expected (Rawdon and Andrew 1998; Kramer and Alison 2005). However, the addition of high levels of glucose to the medium for short periods of time increased β-cell proportions only in the presence of TGF-β. The study showed that TGF-β1 decreased the proportions of β-cells in the chick dorsal pancreatic bud. Glucose, however appeared to only partially rescue β-cells in the avian developing pancreas in the presence of TGF-β1.

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