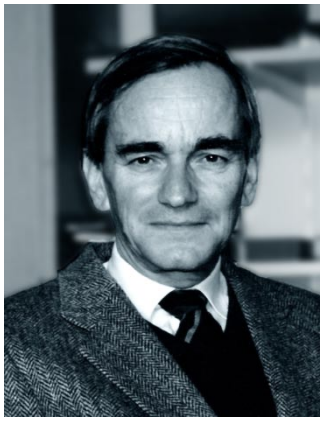

Hans-Georg Schwarzacher

Jürg Schwarzacher studied medicine at the University of Vienna, Austria, and graduated to Dr med in 1953. He started his scientific career in neuroanatomy and neuropharmacology. In 1954, he went to the United States of America as Research Fellow at the Institute of Pharmacology of the University of Cincinnati joining the group of G.H. Acheson. The availability of luxury goods, and freedom of thought, together with Achson's gentleman-like search for true scientific objectivity, were a strong and life-long influence. During these early years he investigated the retrograde degeneration of nerve cells, used staining for the nerve transmitter acetylcholine esterase to demonstrate nerve endings and studied individual muscle fibre lengths.

In 1955, he came back to Europe as Assistant Professor at the Institute of Anatomy, University of Basel, Switzerland. In 1956, Jürg Schwarzacher met Harold Klinger, at that time still a medical student working on his thesis about sex chromatin in Basel. This had significant and long term consequences: Jürg became a lifelong friend of Harold, and was acquainted with the new fascinating field of human cytogenetics through him. In their first joint work, Klinger and Schwarzacher (1958) demonstrated that the sex chromatin body in polyploid female cells always corresponds to one X-chromosome per diploid genome. Another highlight of this early collaboration was the detection of the first XY/XXY-mosaic in a 60mm embryo (Klinger and Schwarzacher 1962). Subsequently, Basel hosted annual Chromosome Conferences, with many fruitful discussions among this first generation of cytogeneticists (including Marco Fraccaro, Jan Lindsten, Charles Ford and other E.C.A. honorary members, notably Jean de Grouchy and Mary Lyon) in this new emerging era of science.

From 1961 to 1966, Jürg Schwarzacher was Assistant Professor at the Institute of Histology and Embryology in Vienna. Here he had ideal working conditions with a top of the range electron microscope and a superb tissue culture lab that he adapted for human and mammalian cytogenetis. Important papers (Schwarzacher 1966; Schwarzacher and Schnedl 1966) reported about *in vivo* studies of the cell cycle, revealed the exact mechanism of polyploidisation by endoreduplication and the findings that newly synthesized chromatids (demonstrated by incorporation of H3 thymidine) are always positioned on the outside of the centromere, keeping the original chromatids together until replication is completed.

At the age of 37, Jürg Schwarzacher was appointed Professor of Anatomy at the University of Giessen and three years later moved to the University of Bonn in Germany. He taught undergraduate medical students anatomy, histology and embryology, but his research was now mainly centred on cytogenetics. He set up tissue culture and microscopy labs, and attracted good young scientists to join his group and interacting with many of the top European human geneticists. Scientifically, during the German years, Professor Jürg Schwarzacher studied multipolar mitoses (Pera and Schwarzacher 1967) revealing that complete genomes are most often distributed to the daughter cells, in this way giving rise to the possibility of a somatic genome separation. Further work (Sieger et al 1970) with the very large sex chromosomes of *Microtus agrestis* in interphase cells showed that most of the chromosomes are not transcribed in both sexes, except for the small active region in the Y in males and one of the active X-regions in females. Electron microscopy on total preparations (Schwarzacher 1970) revealed that chromatids are built up from only one so called chromosome fibril (DNA plus histones). This was also elegantly shown in premature condensed very early prophase chromosomes, as well as in the fused acrocentric chromosomes of *Mus poschiavinus*.

In 1971, Jürg Schwarzacher returned to Vienna as Professor of Embryology and Histology and was Head of the Institute until his retirement in 1996. Most of his time was now taken up by teaching 2nd year medical students and he pioneered the use of microscope-linked televisions for the practicals. He also found time to write a medical genetics methods book (Schwarzacher and Wolf 1974) and a

monograph on human chromosomes (Schwarzacher 1976). He was president of the Anatomische Gesellschaft (1974-1978) and president of the European Society of Human Genetics (1978). He was a member of the editorial board of amongst others Cytogenetics and Cell Genetics (now Cytogenetics and Genome Research) and Human Genetics. He was elected a member of the Austrian Academy of Sciences in 1980, and of the German Academy Leopoldina in 1982.

Schwarzacher contributed many papers on the nucleolus and it is probably for this contribution that many current cytogeneticists will remember him. Starting from the observation that the nucleolus-organizing regions (NOR) of mitotic chromosomes can be stained by special silver-methods, he showed in the light and electron microscope that this silver positive material is always in connection with, but is not the NOR itself and must be regarded as a remnant of the interphase nucleolus, indicating the transcriptional activity of the NOR (Schwarzacher et al. 1978) Further population studies (Mikelsaar et al. 1977) showed that the five pairs of NORs are not equally active, and there is an individual genetic pattern. Studies showed that only a few of the NORs are active in resting cells, forming a small nucleolus, but upon stimulation all NORs congregate, become active and form a large nucleolus that fragments during the subsequent division (Sigmund et al. 1979). Studies on the nucleolus were stimulated by the technique of DNA *in situ* hybridisation and the immunohistochemical *in situ* demonstration of several important transcription factors and enzymes. Schwarzacher and his group (Wachtler et al. 1992) were among the first to develop the method of *in situ* hybridisation on electron microscopic preparations. With these techniques combined with other immuno-gold techniques, the course of synthesis of pre-ribosomes within the nucleolus in interphase could be determined (Schwarzacher and Wachtler 1991; Schwarzacher and Mosgöller 2000).

References

Klinger HP and Schwarzacher HG (1958) Sex chromatin in polyploidy nuclei of human amnion epithelium. Nature 181: 1150-1152.

Klinger HP and Schwarzacher HG (1962) XY/XXY and sex chromatin positive cell distribution in a 60mm human foetus. Cytogenet 1:266-290.

Mikelsaar AV, Schmid M, Krone W, Schwarzacher HG and Schnedl W(1977a) Frequency of Ag-stained nucleolus organizer regions in the acrocentric chromosomes of man. Hum Genet 37: 73-77.

Pera F and Schwarzacher (1969) Die Verteilung der Chromosomen auf die Tochterzellkerne mutipolarer Mitosen in euploiden Gewebekulturen von Microtus agrestis. Chromosoma 26: 337-354.

Schwarzacher HG (1966) Sexchroamtin in ployploiden Zellen. Humangentik 2: 28-35.

Schwarzacher HG (1970) Die Ergebnisee elektonenmikrospopischer Untersuchungen an somatischen Chromosomen des Menschen. Humangentik 10: 195-208.

Schwarzacher HG (1976) Chromosomes in Mitosis and Interphase. Handb.mikroskop. Anat. Mensch.I/3, Springer, Berlin. 1976.

Schwarzacher HG and Mosgöller W (2000) Ribosome biogenesis in man: current views on nucleolar structures and function. Cytogenet Cell Genet 91: 243-252.

Schwarzacher HG and Schnedel W (1966) Position of labelled chromatids in diplochromosomes of endoreduplicated cells after H3-thymidin uptake. Nature 209: 107-108.

Schwarzacher HG and Wachtler F (1991) The functional significance of nucleolar structures. Ann Génét 34:151-160.

Schwarzacher HG and Wolf U (eds) (1974) Methods in Medical Cytogenetics, Springer, Berlin.

Schwarzacher HG, Mikelsaar AV and Schnedl W (1978) The nature of Ag-staining of nucleolus organiser regions: electron- and light microscopic studies on human cells in interphase, mitosis and meiosis. Cytogenet Cell Genet 20: 24-39.

Sieger, M, Pera F, und Schwarzacher HG (1970) Genetic inactivity of heterochromatin and heteropycnosis in Microtus agrestis. Chromosoma 29: 349-364.

Sigmund J, Schwarzacher HG and Mikelsaar AV (1979) Satellite association frequency and number of nucleoli depend on cell cycle duration and NOR activity. Hum Genet 50: 81-91.

Wachtler F, Schöfer C, Mosgöller W, Weipolthammer K, Schwarzacher HG, Stahl A, Gonzales I, Sylvester J, (1992) Human ribosomal RNA gene repeats are localised in the dense fibrillar component of nucleoli. Light and electron microscope in situ hybridization in human sertoli cells. Exp Cell Res 198: 135-143.