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The nuclear envelope-associated epichromatin and its sheets are composed of DNA A-form packed as nucleosomal superbeads which construct vehicles for the gear-wheel nuclear traffic

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The sub-fraction of the lamin-associated heterochromatin ('epichromatin') directly attached to the inner nuclear membrane/lamin B1 represents on conventional EM section a row of tightly apposed 30 nm granules, different from less packed patches of the lamin-associated domains (LADs). Studies by Olins and Teif with co-authors showed that epichromatin (ECH) is composed of short ~ 1Kb domains, which are 'dashed' along all chromosomal DNA. Aims: To characterise structure and possible function of ECH and its derivative, the envelope-limited chromatin sheets (ELCS). Methods: DNA in situ structural test with Acridine orange (AO), thermal denaturation, short BrdU inclusion, immunofluorescence, confocal and EM microscopy. Applied to several tumour cell lines, untreated and after genotoxic stress. Results. ECH DNA binds AO exclusively by intercalation and

fluoresces green, differently from apposed LADs which can dimerise AO and fluoresce orange. ECH DNA helix melts in situ at 940C, while LADs at 800C, proving the enrichment of ECH with GC, while LADs, with AT-stretches. EM studies of ELCS show that it is formed by extensions of ECH, where its one row 30 nm granules meeting from both sides of the NE are seen in one row again. ELCSs accompanied by microtubules are rotating and looping at the nuclear periphery, also involving the perinucleolar heterochromatin. The ELCS loops and pockets contain fibrillarin, are enriched with the products of unscheduled DNA synthesis and damaged DNA, which accumulate for degradation at the pericentrosomal aggresome. Conclusions: ECH composed of telomeric sequences, also interstitial, assumes the A-form of DNA and is packed as ~6 nucleosomes superbeads stacked by hydrophobic forces. These physical properties of ECH enable the formation inside ELCS the gear-clinched superbeads. ELCSs assemble as the vehicles for the microtubule-centrosome engaged gear-wheel nuclear traffic. The proposed functions may be the sub-telomeric chromosome homology search for DNA repair and cleansing of LADs and NADs from circular extrachromosomal DNA.

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