50 Years Ago

A Collection of Tables and Nomograms for the Processing of Observations made on Artificial Earth Satellites. By I. D. Zhongolovich and V. M. Amlin — This volume is a welcome addition to the very few existing mathematical tables which are designed to help in the calculation of artificial satellite orbits … The tables themselves have been reproduced from the Russian original by a photographic process, and only the 10 introductory pages needed translating. Despite its minimal contribution to the subject-matter, the Pergamon Press has chosen to charge £5 for the volume, although it was advertised at 70*s* … There are irritating errors … Also, the translation is at times sadly deficient …These shortcomings do not, however, seriously mar the value of the volume to the specialist.
From *Nature* 16 September 1961

100 Years Ago

On Saturday, September 9, the aërial post was inaugurated by Mr. Gustav Hamel, one of our most brilliant flyers, who carried a sack of letters in a Blériot monoplane from Hendon to Windsor in thirteen minutes … The other aviators who should have started were prevented by the thirty-mile wind, and no further deliveries took place until Monday, when Messrs. Greswell and Driver carried six mail-bags over in the early morning … The affair has aroused great interest, so much so that it is as well to sound a word of warning and say that the aëroplane post is neither practical, useful, nor economical. Letters can be sent far more cheaply, trustworthily, and conveniently by train or motor-van, and it is to be expected that these conditions will continue for the next half-century at least … Besides, it is unthinkable for very many years to come that we should put good aviators to the menial task of carrying mails regularly.
From *Nature* 14 September 1911

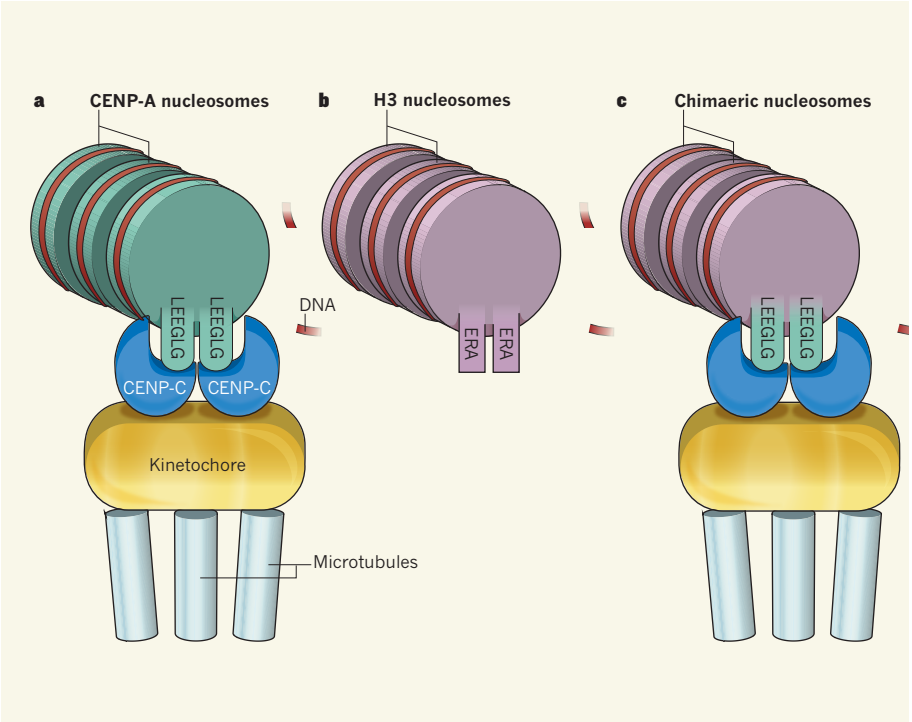

Figure 1 | Recognition of CENP-A-containing nucleosomes. **a**, Guse *et al.*[1] show that arrays of CENP-A nucleosomes allow active kinetochore-like structures that bind microtubules in frog egg extracts to assemble *in vitro*. This interaction is mediated by the centromeric protein CENP-C and requires the -LEEGLG amino-acid sequence at the carboxy terminus of CENP-A. **b**, H3 nucleosomes, which lack this particular motif and instead have three other residues (-ERA), do not assemble synthetic kinetochores. **c**, Replacement of -ERA at the carboxy terminus of H3 with -LEEGLG allows binding of CENP-C and assembly of synthetic kinetochores.

How do CENP-A nucleosomes differ from their H3 counterparts? Previous biophysical analyses hinted that the composition of CENP-A and H3 nucleosomes was radically different[7]. They suggested that CENP-A nucleosomes contain only a single subunit of H2A, H2B, CENP-A and H4, forming 'hemisomes' with half the height of typical nucleosomes.

In July, Tashiwana *et al.*[2] presented a high-resolution crystal structure of the human CENP-A nucleosome assembled *in vitro* on its natural substrate, α-satellite DNA. The structure shows that, like their H3 counterparts, *in vitro*-assembled CENP-A nucleosomes consist of eight subunits — with a CENP-A–H4 tetramer forming the core and bounded by two H2A–H2B dimers. But a clear difference is that CENP-A has a shorter helical domain at its amino terminus than H3. This alters DNA interactions at the nucleosome entry and exit points, meaning that CENP-A nucleosomes associate with a shorter stretch of DNA (121 compared with 147 base pairs). Moreover, two other amino-acid residues in one region (loop 1) cause it to jut out more in CENP-A nucleosomes, and their deletion affects CENP-A retention at, but not its targeting to, centromeres.

What attracts kinetochore proteins to CENP-A nucleosomes but not to H3 nucleosomes? Most differences between the properties of CENP-A and H3 *in vivo* have been ascribed to a structural domain of CENP-A called CATD. This domain of CENP-A shows 22 differences in amino-acid residues compared with the same domain in H3 across a region of 40 residues. So, when placed within H3, it allows the resulting CENP-A–H3 chimaeric protein to be incorporated at centromeres[4].

In Guse and colleagues' *in vitro* system[1], the CATD domain of CENP-A–H3 chimaeric proteins in nucleosome arrays was not sufficient or necessary for kinetochore assembly. Remarkably, when the authors replaced only the three carboxy-terminal residues of H3 (-ERA) with the six from CENP-A (-LEEGLG), this sequence allowed H3 to assemble kinetochore structures *in vitro* (Fig. 1). Further investigation showed that another centromeric protein, CENP-C, binds the -LEEGLG motif of human CENP-A — but only in the context of a nucleosome — to provide the platform for kinetochore formation. Presumably, once established, recognition of CENP-A nucleosomes, and their retention and replenishment at centromeres through subsequent cell divisions, are dictated by interactions with other kinetochore-associated proteins that may recognize additional differences such as loop 1 and CATD.

The *in vitro* formation of 'active' kinetochore complexes on purely CENP-A-containing nucleosomes[1] indicates that no neighbouring