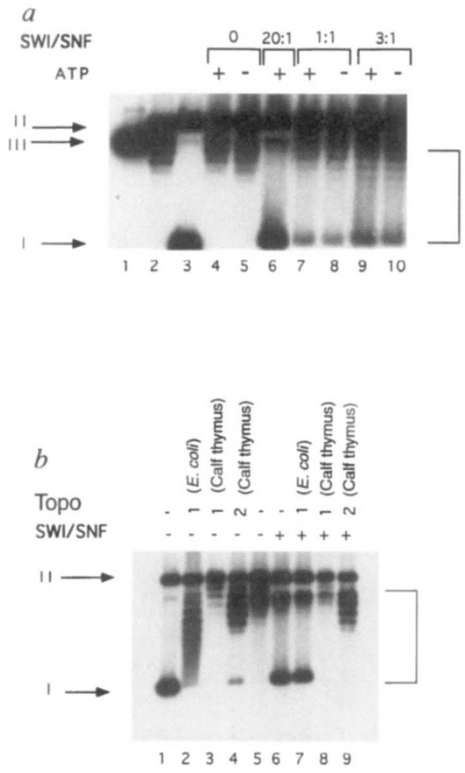

FIG. 4 SWI/SNF introduces positive supercoils into relaxed plasmid DNA in the presence of bacterial topoisomerase I. *a*, SWI/SNF induces supercoiling. Closed relaxed plasmid DNA (lane 2) was incubated with the SWI/SNF complex and bacterial topoisomerase I (topo I; 3 units). Molar ratios of SWI/SNF to plasmid are indicated above each set of lanes. A ratio of 20:1 corresponds to 3 nM SWI/SNF. Addition of ATP to a subset of the reactions is indicated. Arrows to the right denote topology standards, lane 1 contains linear plasmid (form III), lane 3 contains supercoiled plasmid (form I) and some nicked circles (comigrate with form II, closed relaxed DNA). The bracket to the right denotes SWI/SNF-induced topoisomers. *b*, SWI/SNF introduces positive supercoils. Plasmid DNA was supercoiled with SWI/SNF (3 nM) and bacterial topo I as in *a*. DNA was purified (lane 6) and retreated with either bacterial topo I (3 units; lane 7), calf thymus topo I (3 units; lane 8), or calf thymus topo II (7 units; lane 9). Lanes 1–4 show control reactions in which negatively supercoiled plasmid DNA (lane 1) was incubated with each topoisomerase under conditions identical to those for lanes 7–9. Lane 5 shows the starting relaxed substrate DNA. Reactions that contained calf thymus topo II contained 1 mM ATP.
METHODS. Supercoiling reactions (20 μl) contained 1× supercoiling buffer (20 mM HEPES, pH 7.5, 7 mM $MgCl_2$, 15 mM KCl, 0.5 mM DTT, 50 μg per ml BSA), 50 ng pJH28, SWI/SNF, and topoisomerases where indicated. Reactions were incubated for 45 min at 30 °C, stopped with 80 μl 1% SDS, 10 mM EDTA, 100 μg ml^{-1} proteinase K, 50 μg ml^{-1} tRNA, and incubated for 30 min at 37 °C. Samples were extracted with phenol/chloroform, ethanol-precipitated, and electrophoresed on 0.8% agarose gels without ethidium bromide and then Southern-blotted. DNA was purified and electrophoresed in the presence of chloroquine as described[27]. Blots were probed with pJH28 labelled with [α-^{32}P]dCTP by random priming. Plasmid pJH28 contains *SUC2* sequences from −1, 100 to +14 in plasmid pRS316.

energy of DNA binding to change the helical twist, resulting in an overwinding of the DNA. Changes in helical twist may destabilize histone–DNA[23] as well as histone–histone interactions[24], so the ability of the SWI/SNF complex to modulate both DNA structure and topology may be important in SWI/SNF-dependent disruption of nucleosome structure. □

Received 20 September 1995; accepted 12 January 1996.

1. Winston, F. & Carlson, M. *Trends Genet.* **8,** 387–391 (1992).
2. Peterson, C. L. & Tamkun, J. W. *Trends biochem. Sci.* **20,** 143–146 (1995).
3. Kruger, W. & Herskowitz, I. *Molec. cell. Biol.* **11,** 4135–4146 (1991).
4. Hirschhorn, J. N., Brown, S. A., Clark, C. D. & Winston, F. *Genes Dev.* **6,** 228–2298 (1992).
5. Kruger, W. *et al. Genes Dev.* **9,** 2770–2779 (1995).
6. Côté, J., Quinn, J., Workman, J. L. & Peterson, C. L. *Science* **265,** 53–60 (1990).
7. Laurent, B. C., Treitel, M. A. & Carlson, M. *Molec. cell. Biol.* **10,** 5616–5625 (1990).
8. Peterson, C. L. & Herskowitz, I. *Cell* **68,** 573–583 (1992).
9. Grosschedl, R., Giese, K. & Pagel, J. *Trends Genet.* **10,** 94–100 (1994).
10. Cairns, B. R., Kim, Y.-J., Sayre, M. H., Laurent, B. C. & Kornberg, R. D. *Proc. natn. Acad. Sci. U.S.A.* **91,** 1950–1954 (1994).
11. Treich, I., Cairns, B. R., Santos, T., Brewster, E. & Carlson, M. *Molec. cell. Biol.* **15,** 4240–4248 (1995).
12. Van de Wetering, M. & Clevers, H. *EMBO J.* **11,** 3039–3044 (1992).
13. Copenhaver, G. P., Putnam, C. D., Denton, M. L. & Pikaard, C. S. *Nucleic Acids Res.* **22,** 2651–2657 (1992).
14. Werner, M. H., Huth, J. R., Gronenborn, A. M. & Clore, G. M. *Cell* **81,** 705–714 (1995).
15. Pil, P. M., Chow, C. S. & Lippard, S. J. *Proc. natn. Acad. Sci. U.S.A.* **90,** 9465–9469 (1993).
16. Putnam, C. D. & Pikaard, C. S. *Molec. cell. Biol.* **12,** 4970–4980 (1992).
17. Bianchi, M. E., Beltrame, M. & Paonessa, G. *Science* **243,** 1056–1059 (1989).
18. Bruhn, S. L., Pil, P. M., Essigmann, J. M., Housman, D. E. & Lippard, S. *J. Proc. natn. Acad. Sci. U.S.A.* **89,** 2307–2311 (1992).
19. Lilley, D. M. J. *Nature* **357,** 282–283 (1992).
20. Stros, M., Stokrova, J. & Thomas, J. O. *Nucleic Acids Res.* **22,** 1044–1051 (1994).
21. Fisher, R. P., Lisowsky, T., Parisi, M. A. & Clayton, D. A. *J. biol. Chem.* **267,** 3358–3367 (1992).
22. Diffley, J. F. X. & Stillman, B. *J. biol. Chem.* **267,** 3368–3374 (1992).
23. Lee, M.-S. & Garrard, W. T. *Proc. natn. Acad. Sci. U.S.A.* **88,** 9675–9679 (1991).
24. Clark, D. J. & Felsenfeld, G. *EMBO J.* **10,** 387–395 (1991).
25. Peterson, C. L., Eaton, S. & Calame, K. *Molec. cell. Biol.* **8,** 4972–4980 (1988).
26. Bianchi, M. E. *EMBO J.* **7,** 843–849 (1988).
27. Knab, A. M., Fertala, J. & Bjornsti, M.-A. *J. biol. Chem.* **268,** 22322–22330 (1993).

ACKNOWLEDGEMENTS. We thank E. T. Young for plasmid HH26; J. Hirschhorn and F. Winston for plasmid pJH28; J. Wang for *E. coli* topoisomerase I; G. Viglianti, S. Stern and members of C.L.P.s laboratory for discussion and for comments on the manuscript. This work was supported by grants to C.L.P. from the NIH and the March of Dimes Birth Defects Foundation. J.Q. is a Fellow and C.L.P. is a Scholar of the Leukemia Society of America.

ERRATA

Crystal structure of a G-protein βγ dimer at 2.1 Å resolution

John Sondek, Andrew Bohm, David G. Lambright, Heidi E. Hamm & Paul B. Sigler

Nature **379,** 369–374 (1996)

In this title, a typographical error caused the substitution of a subscripted 'A' for a hyphen in 'G-protein'. The correct title is given here. □

Bifurcations of the Atlantic thermohaline circulation in response to changes in the hydrological cycle

Stefan Rahmstorf

Nature **378,** 145–149 (1995)

The shaded areas A and B of Fig. 1*a* of this Article were lost during printing. The correct figure is shown here. □