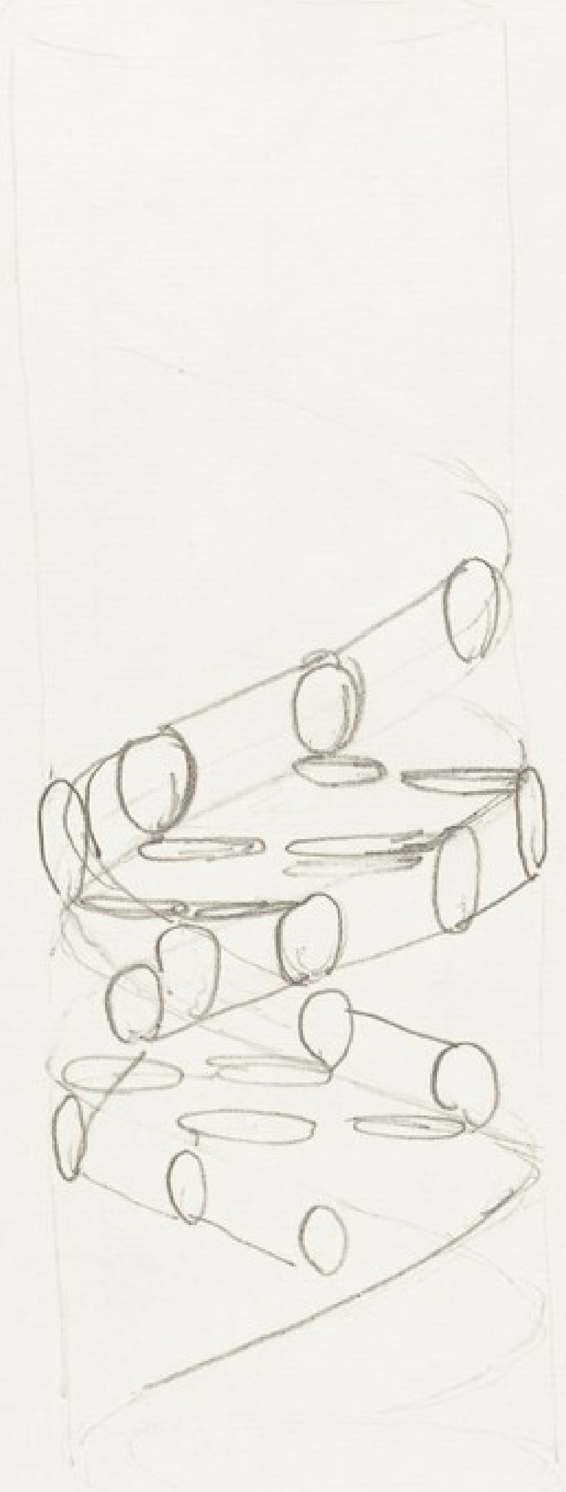
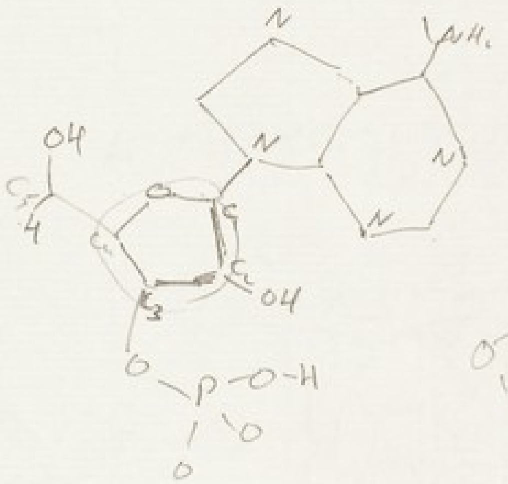


	known.	rec.
base	N-H	N
	N-H	N
		N
sugar	5 { O-H	O
	OH	O
phos.	P-OH	O
		O O
	OH	
	water	OH
		H



Exhibitors

M.R.C. Biophysics Units at the Cavendish Laboratory, Cambridge, and at King's College, London.

// A proposed ~~The~~ structure for ~~of~~ DNA (deoxyribonucleic acid), a substance which occurs in the chromosomes of living cells. The structure has been derived from x-ray data and from stereochemical considerations. It suggests a possible way in which the DNA molecule might duplicate itself.

DNA is a very long thin molecule, which ~~it~~ is believed to carry at least ~~a chain of a~~ part ~~of (if not all)~~ of ~~[illegible]~~ the genetic specificity of the chromosomes in living cells.

Side Spacing.

11.3 Å ~ $\frac{7.7}{2}$ mm. = 3.85 mm

$n\lambda = 2d \sin\theta$

$d = \frac{\lambda}{2\sin\theta}$

$\sin\theta = \frac{\lambda}{2d} = \frac{1.54}{22.6} = .0681$

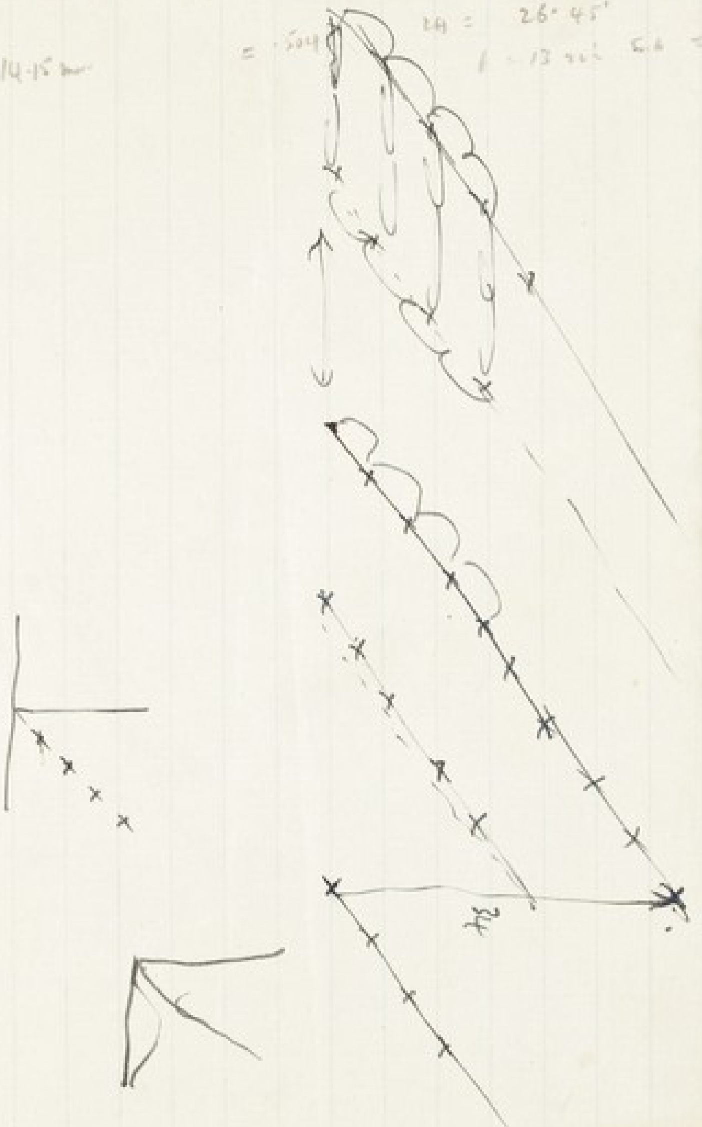
$\frac{32.9}{2}$ = 16.45 m ∴ tan 2θ = .585   2θ = 30° 19'   θ = 15° 9'   sin θ = .2614   d = 2.96 Å

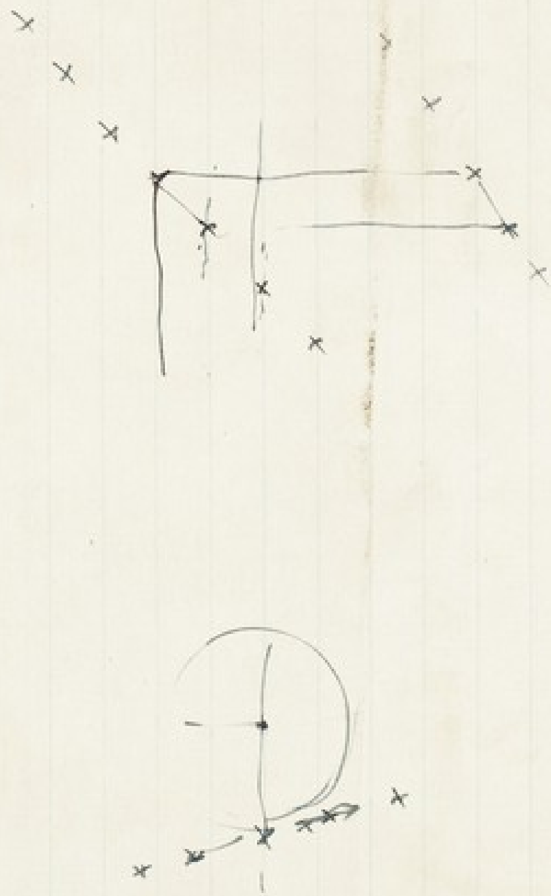
$\frac{28.3}{2}$ = 14.15 mm   = .504   2θ = 26° 45'   θ = 13° 22'   sin θ = .2312   d = 3.3₇ Å

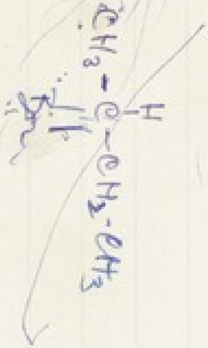
θ = 3° 54'   2θ = 7° 48'

tan 2θ = .137

∴ λ = 28.1 mm ✓



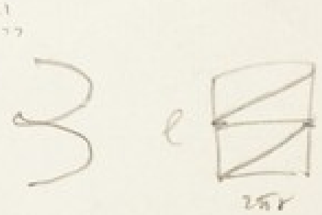




$\frac{dD}{lD}$ ΔF

Two ~~turns~~ turns in 28.1 Å

11 residues ∴ ≃ 79 Å



$$\sqrt{\frac{l^2}{4} + (2\pi r)^2} = \frac{79}{2}$$

$$197 + (2\pi r)^2 = 1560$$

$$2\pi r = \sqrt{1360}$$

$$= 36.9$$

$$r = 5.9 \text{ Å}$$ ie not impossible.

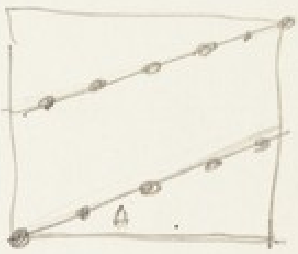
One turn

$$800 + (2\pi r)^2 = 6220$$

$$2\pi r = \sqrt{5420}$$

$$= 73.6$$

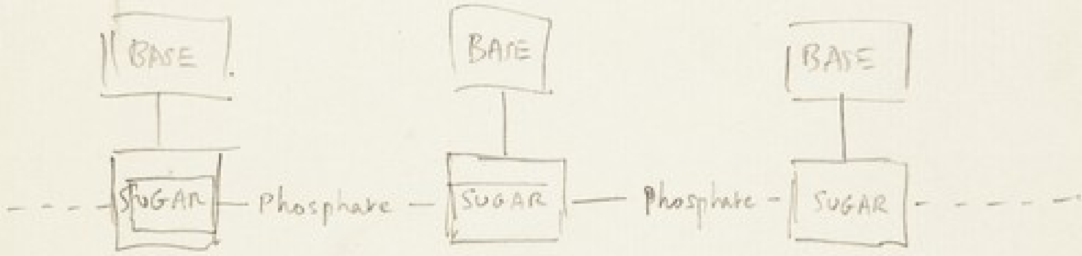
$$r = 11.7 \text{ Å}$$ ie far more

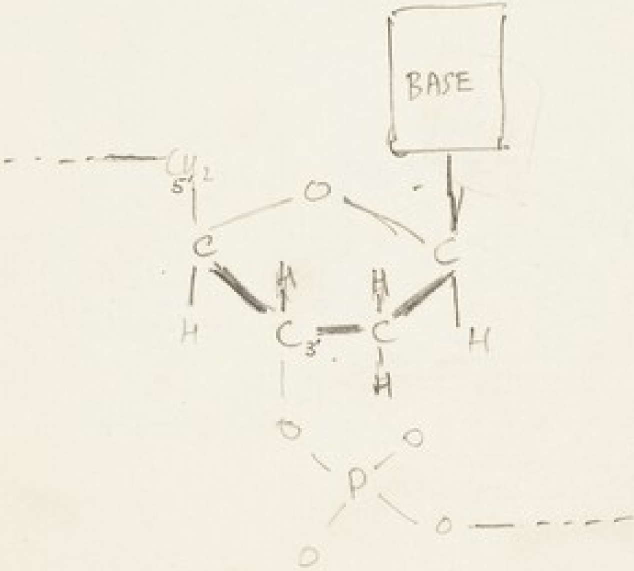


14
2π 6

20° .37

D.N.A.





β - D - 2 deoxyribofuranose
3',5' phosphate ester

~~Nucleic acid is of considerable biological importance. The main reasons~~

~~[illegible]~~ There are only two fundamental problems in molecular biophysics. They are

1. the molecular basis for the ~~duplication~~ replication of ~~the~~ genes.
2. the molecular basis for the process, or processes by which the genes control the synthesis of proteins.

~~[illegible]~~ There is much evidence to suggest that nucleic acid is associated with both these processes. It is for this reason that it is important to solve ~~the~~ its structure. ~~of nucleic acid.~~

By solving the structure we mean ~~that~~ here that the ~~[illegible]~~ we should discover the broad plan underlying the detailed arrangement of chemical and physical bonds. ~~which is [illegible] occur during the~~

~~[illegible]~~ The problem usually falls into two parts. It is first necessary for the organic chemist to discover the general plan of the chemical bonds making up the structure. ~~This has been done~~

~~for [illegible] deoxyribose nucleic acid (D.N.A.)~~; ~~and [illegible] is likely to do~~

For ribonucleic acid (R.N.A.) this is still ~~[illegible]~~ being actively investigated, but for deoxyribose nucleic acid (D.N.A.) the problem has been solved. It is believed that D.N.A. ~~[illegible]~~ consists of long unbranched phosphate-ester

Genetics.

D.N.A. synthesis occurs during interphase.

∴ gene in ½ state at end of telophase.

note: ~~the fact that the~~ does "relic coiling" suggest ~~prove~~ that the single chain ~~expand~~ to takes up the helical form, otherwise there would be coiling during synthesis.

? when is the protein part synthesised [amount of protein in nucleoprotein ?

- general description of structure
- detailed description of structure
- variations possible in the structure
- the crystalline form
- evidence in support of structure
- ~~method~~ general method of attacking problem
- detailed
- reference to earlier work.
- amorphous work.
- note that we have not decided sideways packing.
- nucleo<u>protein</u>

Nucleic Acid

C_3 — O — P — O — C_5 — C_4 — C_3

parallel

parallel

roughly parallel to ~~C_3~~ $C_3 - H$ but off to side nearest C_2

roughly ∥ to $C_3 - C_2$

∥ to one of the $C_2 - H$ – the one one the same side as the base

Possible configuration

Bases inside

~~[illegible]~~ 2 – 3.4 Å

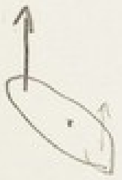
rotation angle 40°–45°

Radius of P ~ $8\frac{1}{2}$ Å

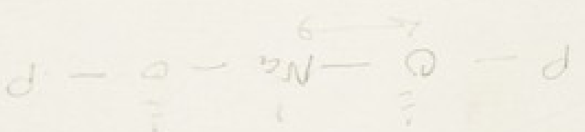
Titanium chloride

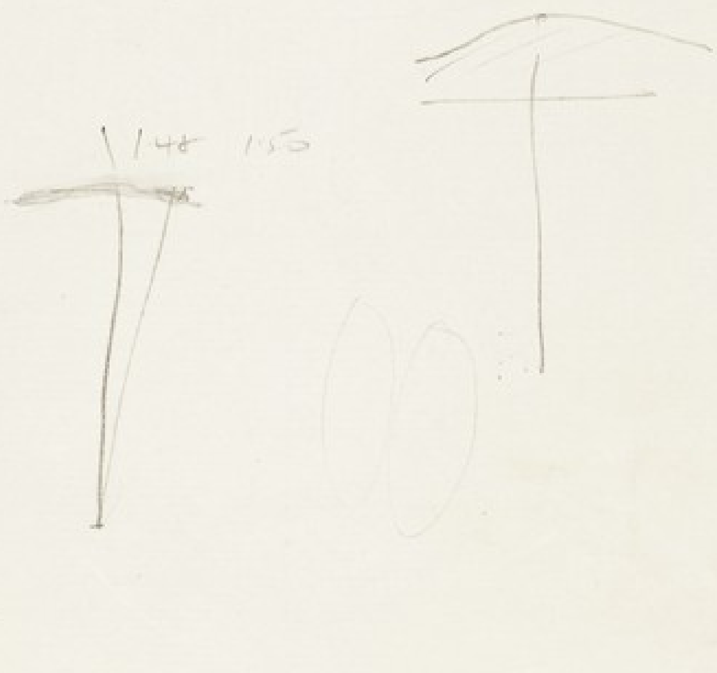
alumina

C_3 is $\frac{1}{2}$ Å out of plane (i.e. same direction as C_5) so that the O on the C_3 come nearer to the plane.



$$\left.\begin{array}{l} O - H \geq 2.5\ \text{Å} \\ H - H \geq 2.2\ \text{Å} \end{array}\right\}$$





rotation of DNA against viscous resistance

Couple on a cylinder per unit length $= 4\pi\eta a^2\omega\left(\frac{1}{1-\frac{a^2}{b^2}}\right)$

for $b \to \infty$ $= 4\pi\eta^2 a^2\omega$

Consider a cylinder 1 μ long and 10 Å radius

$a = 10^{-7}$ cm   take $\eta = 10^{-2}$

$\therefore$ couple $= 10^{-4} . 4\pi\ 10^{-2}\ \omega\ 10^{-14}$ dynes cm

$\doteq 10^{-19}\omega$ dyne/cm. ω in radians/second.

let energy supply be E kilocalories/per mol/per pair of bases.

Thus is $E \times 10^3 \times 4.2 \times 10^7$ ergs/ – – –

$E \times \frac{10^3 \times 4.2 \times 10^7}{6 \times 10^{23}}$ ergs/per pair of bases

$= E \times 7 \times 10^{-14}$ ergs/ – – –

let the number of pairs made per second be **n**

Then energy per second $=$ $nE \times 7 \times 10^{-14}$ ergs/second.

rate of dissipation of energy. 10^{-19} ~~[illegible]~~ $\left[\frac{10n}{2\pi}\right]^2$ ergs/second

Thus $\frac{n^2}{4\pi^2}\ 10^{-17} = nE \times 7 \times 10^{-14}$

$n = E \times 3 \times 10^5$ per second

i.e. about 100E μ/second.

Note that cylinder was 1 μ long constant length.

Point on paper

Principle of equivalence limited to [illegible]. ✓

bases we find in our structure. We propose to develope this idea in more detail elsewhere.

m

na	1			
p	1	Prepar.	$6 + 2\frac{1}{2}$	$8\frac{1}{2}$
o	4	Prum.	$9 + 1\frac{1}{2}$	$10\frac{1}{2}$
o	1			$9\frac{1}{2}$
c	5			
	12			

9

20 330 15

DNA