

Assembly of Z-DNA Kit

1 Parts

Supplied parts can be classified into model unit and parts for a stand.

Z-DNA model unit		
Code	Name	Quantity
Bio-201	Phosphate Group	36
Bio-203	Deoxyribose	36
Bio-210	A-T base pair	0
Bio-211	G-C base pair	18

Z-DNA stand unit

Code	Name	Quantity
Bio-503	Base plate Z 275	1
Bio-513	Shaft Z 760	1
Bio-521	Guarded spacer	1
Bio-533	Arm Z-DNA	17
Bio-541	Spacer 50	1
Bio-544	Spacer 31.2	17
Bio-571	Hexagon cap nut	1
Bio-572	Plain washer	2
Bio-573	Spring lock washer	2
Bio-574	Hexagon nut	2

2 Assembly of Stand

Table 1

Assemble the parts according to the scheme in Fig.1 in order to make a shaft like that shown in Photos 1 and 2. Due to the limitations of the box size, the shaft is supplied in two parts which can be connected.

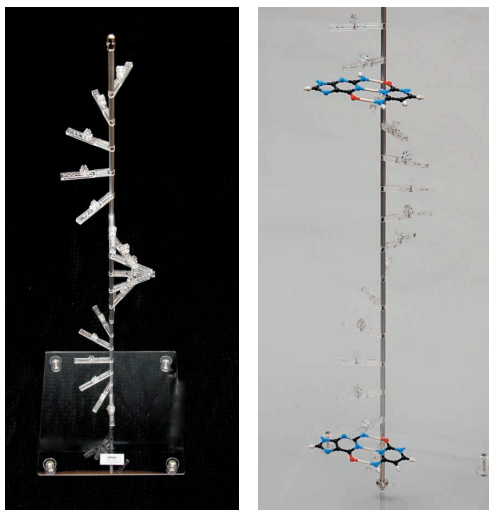


Photo.1

Photo.2

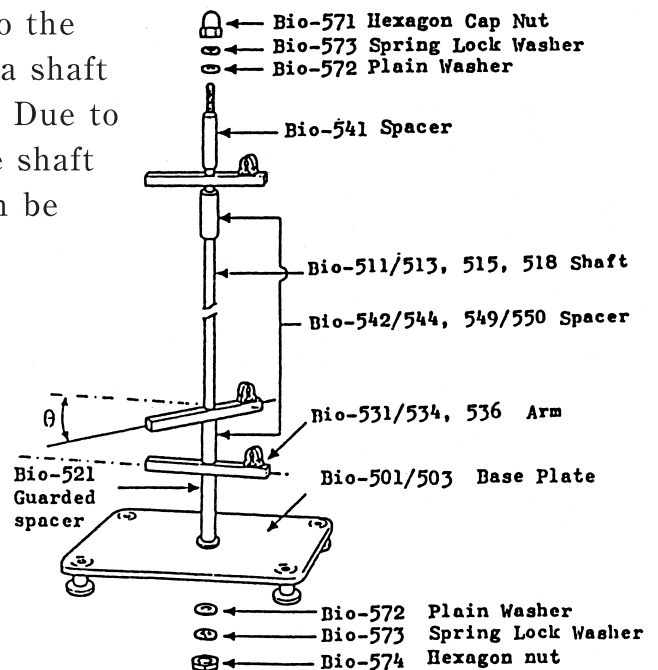


Fig.1

The arms of Z-DNA are arranged in a left-handed helix structure with 18 levels.

Since each groove of spacer where supporting arms are attached has a left-handed 30-degree angle, it goes up in a counterclockwise direction when spacers and arms are repeatedly connected.

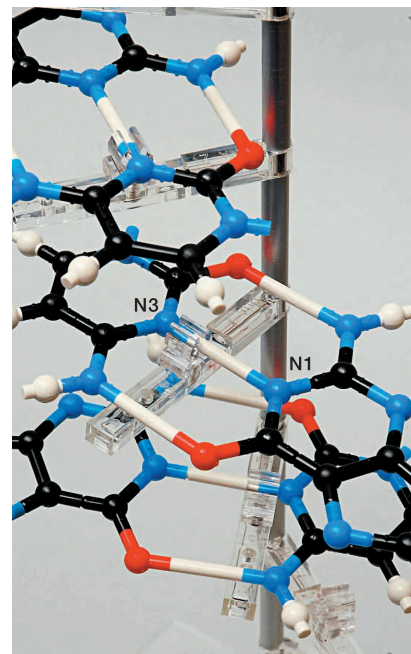
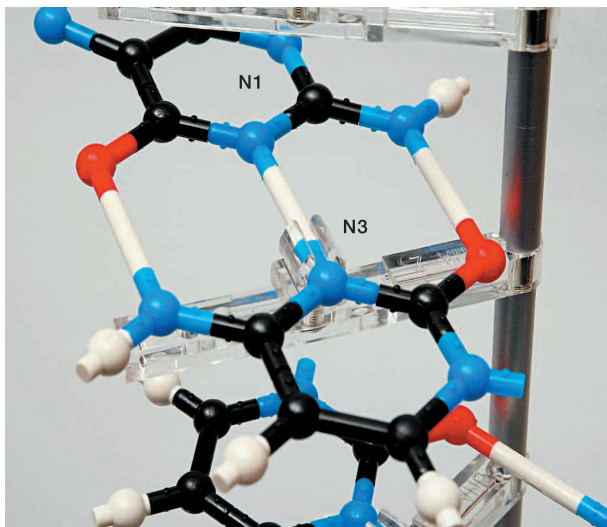
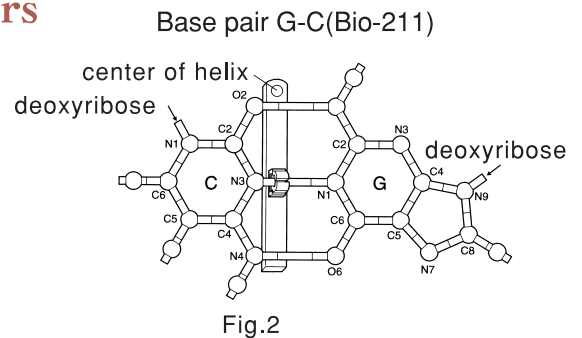
Make sure that the 12th arm and the lowest arm are in the same position. 18 levels are equivalent to one and a half turns. (See Photo.2)

3 Attachment of Base Pairs

There are 18 base pairs (G-C) in the kit and they should be connected one after the other (C should be connected to G).

3-1 Attachment Position of Base Pairs

Locate the attachment position of deoxyribose near the central axis and fit the base pair in the clamp closed to the hydrogen bond N3 between N1 of guanine and N3 of cytosine. (See Fig 2, Photo. 3, and 4.) This is same when they are attached in a mirror-image reversal.



4 Conformation of deoxyribose and phosphate group

4-1 Conformation of deoxyribose

Conformation differs according to whether deoxyribose is attached to cytosine or guanine: C2' endo when attached to cytosine and C3' endo when attached to guanine.

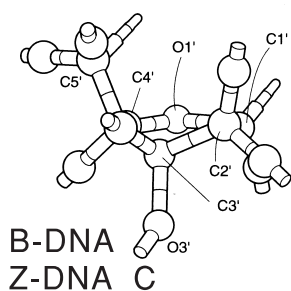


Fig.3

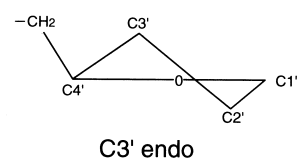
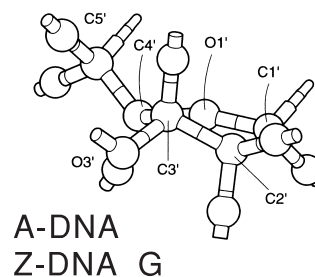
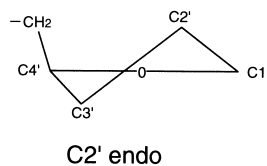


Fig.4

4-1A Conformation of deoxyribose when attached to cytosine

There are 36 sets of deoxyribose. For 18 sets of deoxyribose, assemble C2' up in a spiral manner as shown in Fig. 2 . Holding C4' and C3' with your left hand in the direction shown in the picture, hold C1' and C2' with your right hand and try to raise up C2', in order to facilitate construction. (See Fig. 3 and the right hand model in Photo 5)

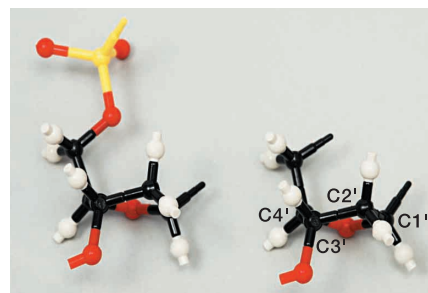


Photo.5

4-1B Conformation of deoxyribose when attached to guanine

For the remaining half sets of deoxyribose, assemble C3' up in a spiral manner instead of C2'. (See Fig 4 and the right model in Photo. 6).

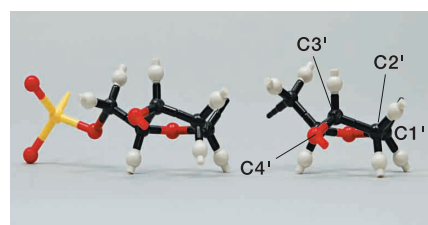


Photo.6

4-2 Conformation of Polynucleotide Chain and Rotational Position around Base

Attach the combinations of phosphoric groups and deoxyribose on the bases pairs G of C-G and C of G-C (See left hand models Photo.5 and Photo.6).

Insert the C1' end of deoxyribose into N9 of guanine or N1 of cytosine. Deoxyribose rotates around the bond between C1' of deoxyribose and N9 of guanine or N1 of cytosine.

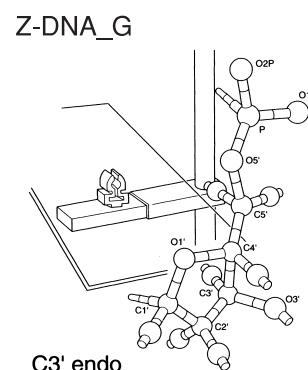


Fig.5

Each rotation angle of the polynucleotide chain including this rotation angle is generally expressed as “Sundaralingam’s Torsion Angle.” However, this angle is hard to understand and is difficult to measure, so just assemble it according to the following figures and photos. The angles become quite accurate when the whole model is isostatically assembled.

Also, the positioning of deoxyribose against the bases is important. Deoxyribose attached to G of G-C is “syn” so that the relation of the positioning between C of G-C and deoxyribose is

“anti.” Try to make it as closely to the following figures and photos as possible.(See Fig.5 ,Photo.7 ,Photo.8 ,Fig.6 , Photo.9 ,Photo.10)

Figure from above: Z-DNA-G syn

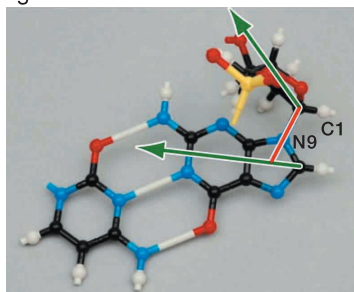


Photo.7

Figure from side: Z-DNA-G syn

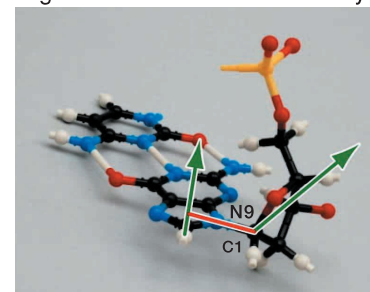


Photo.8

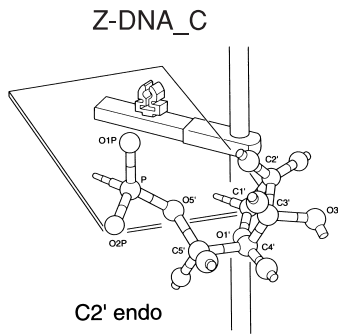


Fig.6

Figure from above: Z-DNA-C anti

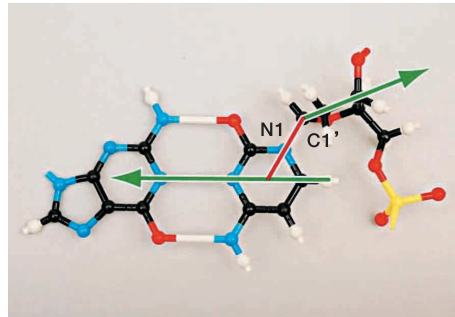


Photo.9

Figure from side: Z-DNA-C anti

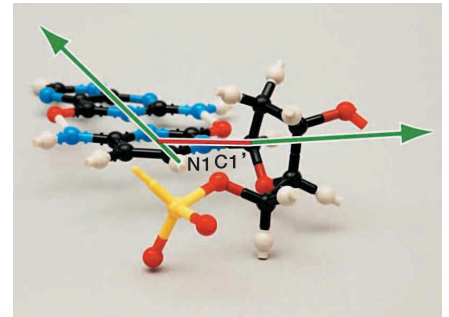


Photo.10

Note) Photo 11 showing deoxyribose and phosphate group attached to bases G and C attached to the shaft.

The attachment of deoxyribose and phosphoric groups on the stand as described above makes repeated arrangements of deoxyribose and phosphoric group from the bottom, on and on.

This arrangement can be expressed as "3' -----5'." (Photo.11)

On the contrary, the left part of the center shaft is oriented oppositely as "5' -----3'." For the opposite conformation, turn the model upside down. (See Photo. 12)

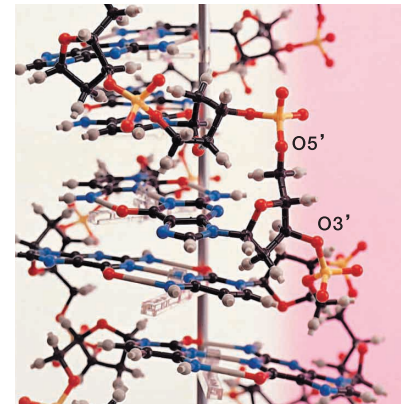


Photo.11

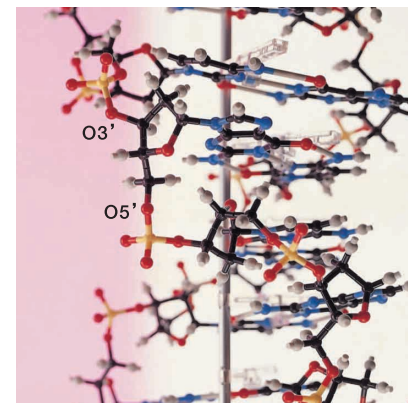


Photo.12

5 Completed Model

The model is completed after the assembling sequence described above is repeated 18 times.(Photo. 13)

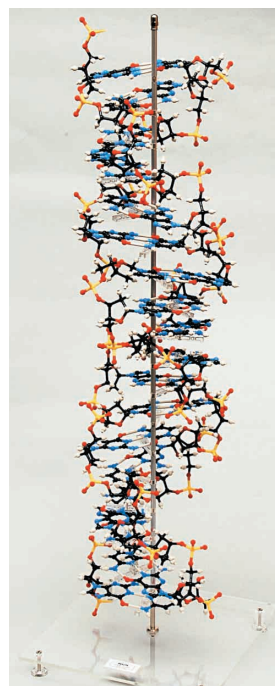


Photo.13