Sept. 1951

Signer N.A., ~~the~~ bundle of fibres selected
damped over sat. $KClO_3$ & straightened & slightly
extended.
Micro-camera. Fluorescent screen. No filter

1. 1st small specimen, over $KClO_3$ 2 hrs 10 mm

2. New specimen 10 mm
Made v. wet, drop of water in camera

3. Same, dried, over sat. $KClO_3$

4. Stretched ~ 50% of its length, over $KClO_3$

5. Same specimen, over sat. NH_4Cl, 15 mm
19.9.51 3 p.m. in camera, H_2 flow started. sat. NH_4Cl
in camera
New filament
20.9.51 Exposure 2.15 - 5.45

80%

6. 20.9.51 6.30 p.m. Same specimen in camera, sat Na_2CO_3 in camera & in H_2 flow
21.9.51 exposure 3½ hours
~~23.9.51 Exposure 10.15~~

92%

~~7. As 6. 21.9.51 6 p.m. H_2 flow, Na_2CO_3~~
~~24.9.51 Exposed 5 hrs~~
~~specimen un-stuck ~ 78%~~

7 26.9.51 12 p.m. $NaNO_2$ equil. @ 78%
~~24.9.51 5 p.m. H_2 flow, Na_2CO_3~~
26.9.51 Exposed 3 hrs (3–6 p.m.)

~~8 26.9.51 7 p.m. over $NH_4Cl + KNO_3$~~

~~Na_2CO_3 92%~~

8. 27.9.51
5 p.m. over sat $CaNO_3$ → equil @ 51%
5.30 – 6.00 (49–53%)
1.10.51 11.30 – 5.00
(6 hrs)

9. Specimen built up from ~ 30-35 Signer fibres, stuck together by keeping wet.

1.10.51 6 p.m. over H_2, sat NH_4Cl
2.10.51 10.15 – 12.30

~~10. 2.10.51 Over Na_2CO_3 (92%)~~
~~1 hr to equilibrate, 4 hrs exposure~~

~~– sample moved : too wet~~

10.10.51

Single fibre of Sigma DNA, fairly thick, ~~which~~ part selected as giving better extinction than most thick fibres, though not perfect

Micro camera

100μ collimator (fibre diameter ~ $\frac{1}{4}$ collimator diameter)

Ni filter

Specimen stretched over collimator using holder, then when set, glued to collimator on either side of hole

0.26 n.a. 36–38 KV

2 p.m. H_2 through sat. NH_4Cl through camera, sat. NH_4Cl in camera

2.30 p.m. tube on

12.10.51

11 a.m.

NH_4Cl sol^n found in camera (specimen unburned)

Films developed ∴ no good

(10) A B & C

12.10.51

Same specimen & cond^ns, repeat

2 p.m. camera set up w H_2 & NH_4Cl set.

.25 hrs

3 p.m. tube on (Filament 6 9 hrs)

13.10.51 4 p.m. Filament burnt out

15.10.51 11.30 a.m. tube on (New Filament)

31-43

Filament burnt out during night of 16-17, &

leak developed

17.10.51 Leak in window patch w plasticine

Target cleaned, new filament

→ much brighter beam (as bright w Ni as previously without)

5 p.m. tube on

2-15 [illegible]

18.10.51 Same again, during night

Tube cleaned, new filament 4 p.m.

19.10.51 Stopped for 6 hrs to renew brass can

20.10.51 H_2 stopper blown off during night. Stopped 7 hrs

53-77

21.10.51 ✓

22.10.51 Filament burned out during night.

Renewed & target cleaned. Started 2 p.m.

24

23.10.51 2 p.m. off - developed

Total exposure 135 — 184 hours

Filament life ~ 6 hrs

23.10.51 Yougoslav carbon (3) 2.30 – 5.30

(11) β Coli 6 p.m. (NH_4Cl, filter)

24.10.51 12 p.m. stopped (18 hrs)

(12) 24.10.51 4 p.m. embryo rat tail collagen

H_2 through sat. $Ca(NO_3)_2$, not in camera

exposed 1 hr

25.10.51 10.30 – 1.00

3.30 – 10.00 } 10 hrs

3 films, thick specimen ∴ distance ~ 1

Equatorial arc 3.8 mm

$\tan 2\theta = \frac{1.9}{13.5} = .14$ $\theta = 4° 0'$

d: 11.0 A

Diffuse ring 8 to 13 mm

$\tan 2\theta$: .30 to .48 $\theta = 8° 21'$ to $12° 48'$

d: 5.3 to 3.5 A

Meridional arc 17 mm

$\tan 2\theta = .63$ $\theta = 16° 6'$

d: 2.8 A

30. 10.57

Pin-hole photographs on Ehrenberg tube

Pinhole size – 5 divisions on micrometer ~~scale~~

$= \frac{5}{80} = .0625$ mm

Distance pin-hole → tube focus ~ 1.15" = 29 mm

Distance " → film 12", 20" and 29"

i.e. 305, 510 and 740 mm

Size of image. @ 29" 1.5 → 2.3 mm × 3.2 → 5.5 mm

@ 20" 1.0 → 1.6 mm × 2.3 → 3.7 mm

∴ penumbra @ 29" $\frac{0.8}{2} \times \frac{2.3}{2} = 0.4 \times$ ~~0.85~~ 1.15 mm

" " 20" $\frac{0.6}{2} \times \frac{1.4}{2} = 0.3 \times 0.7$ mm

∴ focal size (given by 29" image) $= \frac{1.15}{29} \times 0.4 \times \frac{1.15}{29} \times$ ~~0.85~~ 1.15

$= .016 \times$ ~~0.34~~ .046 mm²

Beaudouin filament shield
cat int. diam. 15.55 mm
length 70 mm

(13)

2.11.51

Bundle of Sigren fibres (prepared Sept. '51) in micro-camera on Beaudouin tube. Strapped to collimator near hole w narrow 0.1mm Al strips

Ni filter 2½ ma., 37 KV, bias

$NaClO_3$ solⁿ, H_2 ∠ in camera

11.00 a.m. camera set up, H_2 over

11.45 tube on
5.45 off } 6 hours

(14) As above, with Na_2CO_3 solⁿ (92%)

2.11.51 630 p.m. specimen in camera, H_2 flow

7 p.m. tube on

3.11.51 Filament burnt out during night

5.11.51 Transferred to Ehrenberg tube

11.45 tube on

Good beam, 2.4 amps through filament (wh. protrudes ~1mm through hole)

5.45 off

→ "wet" photo

Filament life 33-45 hrs

(15) As above

5.11.51 6.30 over H_2, No CaO_3

6.11.57 4.00 – 9.45 } $10\frac{1}{2}$ hrs

7.11.57 10.45 – 3.30 }

→ "crystalline"

(16) 7.11.51 4.00 over $Ca(NO_3)_2$, H_2

6.00 on

8.11.57 Switched off during night

on 11.30 – 3.00

→ "crystalline

(17) As (16). 8.11.51 6.00 on 9.11.51 10.00 off

Specimen broken – no photo

(18) 9.11.57 Same specimen, pinned down with Al strips one end loose

pinned down with Al strips A.K.

10.30 over $CaCl_2$, H_2

11.45 – 3.00 (filament burned ~ 3 pm)

10.11.51 New filament

10.30 on (switched off some time between 12.30 & 1.30 & on again 1.30)

3.00 off

(19) As above

P_2O_5 in camera, H_2 through 98% H_2SO_4

10.11.51 H_2 3.30 p.m.

12.11.51 10.45 on

6.00 off } 7½ hrs

P_2O_5 in camera got v wet. film blackened probably ∴ acid vapour

(20) As above

~~H_2 through 98% H_2SO_4, over KOH and P_2O_5~~

P_2O_5 in camera

13.11.51 4 p.m. H_2 through camera

5.45 tube on off

Specimen moved

14.11.51 4 p.m. — 15.11.51 12 noon } 22 hrs

(21)

As above Na_2CO_3

15.11.51 12.45 in camera, H_2 'dry' photo

5.30 on

16.11.51 3.30 off } 22 hrs

Filament 55 hrs so far

(22)

As above 16.11.57 4.30 over Na_2CO_3

6.30 on } 19½ hrs "dry" photo v good resolution

17.11.57 2.00 off

(23) 17.11.57 4 p.m. over K_2ZnO_4 (99%) ~~to~~ wet

8.11.57 12.00 Specimen has visibly wetted

18.11.57 12.~~15~~ i camera over Na_2CO_3

12.55 on } 22½ hrs Hydrogen flow stopped during night

19.11.57 11.15 off "dry" photo

(24) Specimen wetted by standing over $KZnO_4$, then of Na_2CO_3 i camera 48 hours, then exposed 30 hrs

(25) French rots, specimen A. Bundle of fibres straight from tube placed over 100μ collimator

26.11.57 3.30 i camera over $NaClO_3$

27.11.57 5.00 on } 17½ hrs Top film, fine grain

28.11.57 10.30 off } 2nd film, microcode

(liquid got into camera at start)

19½
22½
30
17½
89½

Filament 145 hrs so far

DNA Fibres suspended in alcohol - water - alkali mixtures

6.12.51 6 p.m. Bundle of fibres, as received (Signer non-pulling

1. Wt bottle + suspended fibre 64.4 g
" " + alcohol 75.4 g
" " " + water 76.1 g
+ ~ 0.01 g KOH

8.12.51 + more water wt 72.7 g
mainly dissolved

Ca little left clinging to nylon fibre

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2. Fibre bundle tied w fine Cu wire, suspended in 70% alcohol
→ v highly swollen ~~gell~~ gel
added little alcohol (~ 5%)
- still v swollen gell
added ~ 0.03 g solid KOH (to ~ 18 cc liquid)
Fibre bundle immediately shrinks & transparent gel becomes opaque
Shrunk to ~ 1/3 length (in ~ 10 mins)
Removal from liquid shows it to be still gelatinous
- left to stand in liquid

10.12.57 10 a.m.

K-specimen apparently unchanged. (Sol^n yellow, prob. ∴ enamel from Cu wire)

Specimen removed, and gelatinous piece of length ~ 3 mm stretched to fibre 30 – 70 μ, ~ 2 cm long

- stretching v easy and smooth → +ve fibre

∴ repeat

3. 3 g.m. bundle of fibres suspended in 10 cc 70% + 10 cc 80% alcohol.

3.35 still opaque (but gelatinous). Transferred to 70% alcohol

5.30 Added 0.05 gm KOH

- specimen broke

4. Added fibre bundle, room dry, to KOH-alcohol mixture used for 3. Shrinkage observed as in 2.

Pulled out to +ve fibre

N.B. these +ve fibres when smeared or when pulled to ± five fibres always remain +ve

11.12.57 Repeated above expts omitting KOH, to see if alcohol alone affects stretching properties → Gelatinous mass behaving as normal material. Not easy to pull to thick fibres as after KOH treatment, and not → +ve at any stage

Smeared to thin fibres + slats → always weakly -ve

13.12.51 Bundle of ~ 20-30 Sigrer pulled fibres tied together with fine Cu wire and suspended in sat. KCl - H_2O - alcohol mixture 11 a.m.

- mixture such as to give extensive swelling

3.30 p.m. put to wash in 70% alcohol

stretched and broken

Now specimen 20-30 fibres put in KCl - H_2O - alcohol ~ 5.30 p.m.

14.12.57 11 a.m. put to wash in 70% alcohol

5 p.m. dried over P_2O_5

17 ~~[illegible]~~.12.57 11.30 a.m. in camera

(26) 6 fibres (+ve) of KOH-treated DNA in adapted Guinier camera (specimen over lead guard-hole on Hirsh plate of new micro-camera) No filter. 75% humidity ($NaClO_3$)

12.12.57 7 p.m. on. 11 p.m. still on

13.12.57 10 a.m. off during night. Switched on

5 p.m. developed → black film

Repeat with slits more closed (weaker beam)

6 p.m. → 11 a.m. (14.12.57) (17 hrs)

(27) Bundle of KCl-treated Sigrer fibres

17 ~~[illegible]~~.12.57 11.30 in camera over H_2, sat $NaClO_3$ (75%)

(adapted Guinier camera, specimen on brass plate containing guard-hole)

12.00 On

~~[illegible]~~

20.12.51

Swelling of fibres.

Fibres of "non-pulling" Signer DNA, swelling observed under microscope

① Small fibre ~ 0.6 scale divisions (i.e. 8 μ) at narrowest but oriented part enclosed in 92% humidity (sat. Na_2CO_3)
Rapid swelling to ~ 2× diameter - well-oriented part rather less

② Fibre of unequal quality, finest at best part ~ 8 μ,
Enclosed by water
Rapid swelling → ~ 2× diameter
then slow
after 2 hours, diameter increased ~ × 10.
Length increase small (straight, ~~stretched~~ fibre, with ends fixed, → only slightly wavy)

Small drops of condensed water visible everywhere except immediately on either side of fibre (showing that even for 10-fold linear swelling reduction of VP is appreciable)

11.12.51 → 28.12.57

2 attempts to photograph single fibres ~ 10 μ after baking dry, one exposure 2 weeks, one 1 week
→ v poor intensity, much "impurity" and only disordered DNA (used new "non-pulling" Signer specimen)

(28)

27.12.57 Single fibre of old Signer DNA after 3 weeks over P_2O_5 (pulls v well) ~~0.01"~~ 0.001" Al over ½ film 3 films
Baked over-night at 75° (6 p.m. - 10 a.m.)

28.12.57 5 p.m. in camera, H_2, $NaClO_3$
6.00 tube on (new filament)

29.12.57 12 noon beam v weak

31.12.51 10 a.m. beam invisible. Developed
→ wet photograph
∴ specimen baked dry overnight before wet photograph

(29) 67% RH 3 films
Poor resolution

(30) As (29) 68% RH 1 film
still poor resolution

(31) 7.1.52
~70% RH, new fibre ~ 40μ
Beaudouin tube, Chromium target, no filter
on 7.30 p.m.
8.1.52 2.30 off. Blank film
- fibre moved: not stuck directly on collimator

(photo under-exposed, & resolution on equator & poor)

(32) 22.1.52
Bundle of ~10 fibres of Signer DNA 2
Micro-camera, Ni
Specimen dried 3 hrs over P_2O_5. Then @ 75% RH
22.1.52 6 p.m. → 23.1.52 11 a.m.
wet diagram

(33) 24.1.52 6 p.m. → 25.1.52 10.30 a.m.
3 30-40μ fibres Signer DNA 2 : Dried 50°
no filter, 73% RH
→ wet diagram (with badly fogged centre)

25.1.52 → 1.2.52 Series of photographs with Signer DNA
1 and 2, humidities 60 - 80%, always → "wet" photo
is this specimens were heated in air? (40 - 60°c)

(34) as above, Signer 1, no filter, 65% RH
→ "wet" photo 1.2.52. 16 hrs

(35) New specimen dried room T over P_2O_5 w filter 6 fibres
→ "wet" photo 2.2.52 16 hrs

(36) 3.2.52 4 30μ. fibres
New Signer DNA w filter. 74% RH
3.2.52 2 p.m. → 5.2.52 11 a.m.
→ "wet" photo

(37) New filament
Bundle of Signer (1) fibres, wetted & stretched to ~2x length
(not pulled)
$NaClO_3$ sol^n, no hygrometer : No filter
5.2.52 2.30 → 6.2.52 10 a.m.
→ "Xtalline" photo, & weak exposure & poor resolution

10.15 specimen on camera in oven at 50°c till 2.30

~~38 Specimen as above, after 4½ hrs @ 50°. Ni filter~~
~~7.2.52 3.00 – 8.2.52, 3.00 – 2½ hrs.~~
~~→ "crystalline, apparently better oriented. Resolution slightly better but still poor ... re-heated ~ 80°.~~
~~In oven 3.30, exposed 3 days – fogged~~

38 ~6 Signer 1 fibres // but occupying ~ ½ mm in depth from surface of collimator. Ni. $NaClO_3$
12.2.52 3.30 on
→ photo showing some well-oriented and strong amorphous ring. Specimen contained 1 fat +ve fibre
– presumably +ve fibre gave amorphous ring

39 2 fibres Signer ② ~ 20–30 μ
no filter, 75% RH
18.2.52 3 p.m. on. 19.2.52 10 a.m. off
→ "wet" type photo w trace of fine spots on equator

40 4 Signer ① fibres, 18–30 μ. Dried 6 hrs over P_2O_5
Ni, 75% RH
20.2.52 5.30 → ? (tube off during night; circulating pump failure)
→ v weak, xtalline, orientation apparently good, resolution doubtful

41 Same specimen, repeat w 3 films & smaller hole Ni
21.2.52 11.00 on
23.2.52 11.00 off } 48 hrs
→ v good, orient good, resol^n moderate.
Repeat, longer exposure

42 New filament (other not burned), clean target. Ni. 3 films
23.2.52 1.00 on
26.2.52 off for 1 hr to clean target } 116 hrs
28.2.52 10.00 off

43
Same specimen, 92% RH
(test for 1 hr over 92% showed fibres don't move)
28.2.52 12.00 on.
29.2.52 2.30 a.m. off (Cl_4 off) } 14½ hrs
→ Xtalline

44 Same specimen but now only 3 fibres (fattest lost)
29.2.52 5 p.m. on
10.30 p.m. filament burned out
1.3.52 12.30 p.m. on. 3.3.52 12 a.m. off
3.3.52 11 a.m. on