

Extracting DNA from Strawberries

Lyrics by Hai-Ting Chinn

Music by Conrad Cummings

“Extracting DNA from Strawberries” is a component of *Science Fair: An Opera With Experiments*, Hai-Ting Chinn’s musical celebration of science, with lyrics created from the words of scientists and teachers, performed as songs with live experiments.

The culmination of Hai-Ting Chinn’s multi-year residency at HERE Arts Center in New York City, this fully-staged theatrical presentation includes lyrics by an astronomer, a chemist, a particle physicist, a Pulitzer Prize-winning science writer, and a middle school science teacher.

The performance includes live demonstrations of the scientific concepts that shape our understanding of the world. Familiar classroom experiments are elucidated and illuminated, with slideshow illustrations by comic artist Maki Naro. Plus a wearable model of the solar system. All while singing.

Music by Matthew Schickele, Renée Favand-See, Stefan Weisman, and Conrad Cummings

Extracting DNA from Strawberries

version 4/7/16

Lyrics by Hai-Ting Chinn

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Mezzo

$\text{♩} = 126$
f

Ex-tract-ing D N A From a straw-ber-ry Ex-tract-ing D N A

Piano

f

4

From a straw-ber-ry, Ex - tract-ing D N A De - ox - y -

9

ri-bo-nu-cle-ic Ac-id D N A in - struc-tions for how

14

ALL liv - ing cells grow, di - vide, and be - have. En -

17

cod-ed in-struc-tions to build a straw-ber-ry, or a straw-ber-ry blond.

Piu mosso ♩ = 138

20

f

Mat-er - i - als: straw-ber-ries, fresh, stems re-moved

24

Salt Dish de ter-gent Seal-a-ble plas-tic-bags

28

Sev-en - ty per-cent rub-bing al-cho - hol, chilled, if pos - si - ble Mea-sur-ing

31

spoons and cup Med-i - um mix-ing bowl Beak - ers or glas - ses,

35

one small, one large A fun-nel A strain-er and Tweez-ers

39

recit. f
If you try this at home (and you should) Do not wor- ry -noth-ing tox-ic

41

But don't drink the sol-u-tions we're a-bout to cre- ate. Just for your own good.

43 $\text{♩} = 116$ *purposeful*

f
to start: one third cup wa- ter one

48

half tea-spoon salt one tab- le spoon dish de- ter-gent

53

f
stir put the straw-ber-ries in - to a bag and mea- sure in three tab-le-spoons

57

salt wat - er - soap so - lu - tion. Press out air and seal,

61

care - ful - ly. Now I need a vol - un - teer.

67

(repeat as needed)
♩ = 104

Meno mosso ♩ = 92
p tentatively

Pro - tec - tive cloth - ing for po -

69

ten - tial spills and splash - es

Meno mosso ♩ = 72

71 *p*

Please crush these straw-ber ries, salt, and soap in - to a fine, foam-y

espressivo

p

74

paste. It will take a-bout two min-utes.

78 *poco piu mosso* ♩ = 84

legato but clean *p* Squish a straw-ber-ry:

83

the cells will burst, Their walls will break a - part.

86

With - in the walls: The nu - cle - us - there dwells the D N

89

A. Straw-ber-ries are oc - at - ploid: each cell Con - tains eight sets of D N

92

A. By con - trast, hu - man cells are dip - loid: on - ly

95

Two. That's why we're us - ing straw-ber-ries in - stead of ___ you.

10
98 $\text{♩} = 72$ *recit.*

The in-side of a cell wall is li-pid:

very decisive
plenty of pedal

f

102 *recit.*

That's grease to a de ter-gent mol-e cule, Which has two

in tempo

f

105 *in tempo* *recit.*

ends: a hy - dro - phil - ic head, -

f

108 *suddenly gentle*
p

In love with wa - ter, whose mol-e-cules are po - lar, Like tin-y

111

mag - nets; And a Hy-dro-phob-ic tail who quakes in fear At H - two -

colla voce

114 *dolce, legato*

O but hap-pi-ly con-nects To mol-e-cules that are non-pol-ar, Like oi-l, or that li-pid lay-er

116 *recit. fast*
f
 On the lin - ing of a cell wall. The de - ter - gent's hy - dro - pho - bic

subito f

118 *in tempo* ♩ = 144 *recit. fast* *in tempo* ♩ = 144
 tail en - snares The lip - id lay - er of the cell wall frag - ments,

f *f* *f* *8va*

121 *recit. fast* *in tempo* ♩ = 144 *recit. fast*
 And the hy - dro - phil - ic head, en - chant - ed By the wa - ter, lures the

f *f* *f*

124 *in tempo* ♩ = 144 *recit. fast* *in tempo* ♩ = 144
 bits a - way, Like lift - ing oi - l off of dir - ty - dish - es.

f *f* *f*

127 *recit. fast*
f
 The in-ar-ds of the cell are left be-hind in-clud-ing all the D N A

129 **f**
 The salt in our so - lu - tion makes it clump to-geth - er How, and why?

131 **f**
 Be-cause the salt cre-ates a con - duct-ive i - on - ic en - vi - ron-ment of

133 *subito p* **Presto** ♩ = 108
 course... Time's up!

136

f

Do we have a fine, — foam - y

138

p recit $\text{♩} = 92$

straw - ber - ry pulp? Strain in - to a beak - er.

sostenuto

f *p*

141

p

D N A was first i - so - lat - ed in eigh - teen - six - ty -

144

nine much as we are do - ing now But no one be - lieved that this

147

sim - ple mol - e - cule Could car - ry the code for the growth, di - vi - sion, and be - hav - ior,

150

meno mosso ♩ = 69*p*

of all know liv - ing or - gan - is - ms. In

153

nine - teen - twen - ty - nine, Phoe - bus Le - vine i - den - ti - fied four bas - es:

155

piu mosso ♩ = 96*f*

A for ad - e - nine, C for Cy - to - sine

158

G for Guan - ine

160

p *hesitant* (huh?) ♩ = 54 *accel.*

T?

p *cresc*

163

♩ = 160 *f* *triumphant* ♩ = 96

T! for Thy - mine,

f

165

Presto ♩ = 160

plus su - gars and phos-phates. In the nine-teen-for - ties Ed - win

f

167

Char-gaff found that: a-mounts of A match T, a-mounts of G match C. In

169

nine-teen-fif - ty - two, Al-fred Her-shey and Mar-g'ret Chase put some bac-ter i - o-pha-ges

171

in a blend-er, sep - a - rat - ed the pro-teïn from the D N A and proved that

173

D N A was in - deed the gen - et - ic code. Then

175

Ros - a - lind Frank - lin, with X - ray cry - stal - lo - graph - y saw a

177

he - lix and some rungs, that Wat - son and Crick made a

179

mod - el of and wrote A Struc - ture for De - ox - y - ri - bose Nu - cle - ic

182

Ac - id, The jour - nal Nat - ure A - pril twen - ty fifth, nine - teen

184

Musical score for measures 184-185. The vocal line (treble clef) has lyrics: "fif - - ty three, And no, they gave". The piano accompaniment (grand staff) features a melodic line in the right hand and a bass line in the left hand. Measure 185 includes a time signature change to 12/8.

186

Musical score for measures 186-187. The vocal line (treble clef) has lyrics: "Ros a-lind Frank lin no". The piano accompaniment (grand staff) features a melodic line in the right hand and a bass line in the left hand. Measure 187 includes a time signature change to 15/8.

188

Musical score for measures 188-189. The vocal line (treble clef) has lyrics: "cred - - it, at all." The piano accompaniment (grand staff) features a melodic line in the right hand and a bass line in the left hand. Measure 189 includes a time signature change to 5/4. Dynamics include *pp* and *p*.

190 $\text{♩} = 40$ **accel.** $\text{♩} = 56$ $\text{♩} = 56$ *p* *consolingly*

tentative, sad
legato

pp *pp*

legato, gentle, molto espressivo

Now one half cup chilled al - cho - hol:

192
Gent - ly poured on - to straw - ber - ry foam. We do not want the two to

195
mix. Rub - bing al - cho - hol, less dense, forms a lay - er on top. —

197 **piu mosso** $\text{♩} = 69$
sempre p *patiently*

sempre p

D N A is not sol - u - ble

Red. _____

199

in al - cho - hol: they will not mix to - geth - er. But

202

D N A will pull a - way from our straw - ber - ry so - lu - tion to

204

gath - er in cloud - y clumps which we can col -

207

- lect with twee - zers

210 $\text{♩} = 104$
p

Voi-là: straw-ber-ry D N A

p legato

p legato

Presto, bright jubilant

213 **accel.** $\text{♩} = 144$

De - ox - i - ry - bo - nu - cle - ic

sim.

f

f

217

ac - id: dou - ble strand - ed he - lix with

219

rungs of base pairs A T C G

222

mil - lions in straw-ber-ries, bil - lions in us A T C

225

G D N A en-cod - ed in-

228

struc - tions for how all cells grow di - vide and be-have to

231

build a straw-ber-ry or a straw-ber-ry blond.

ff *ff*