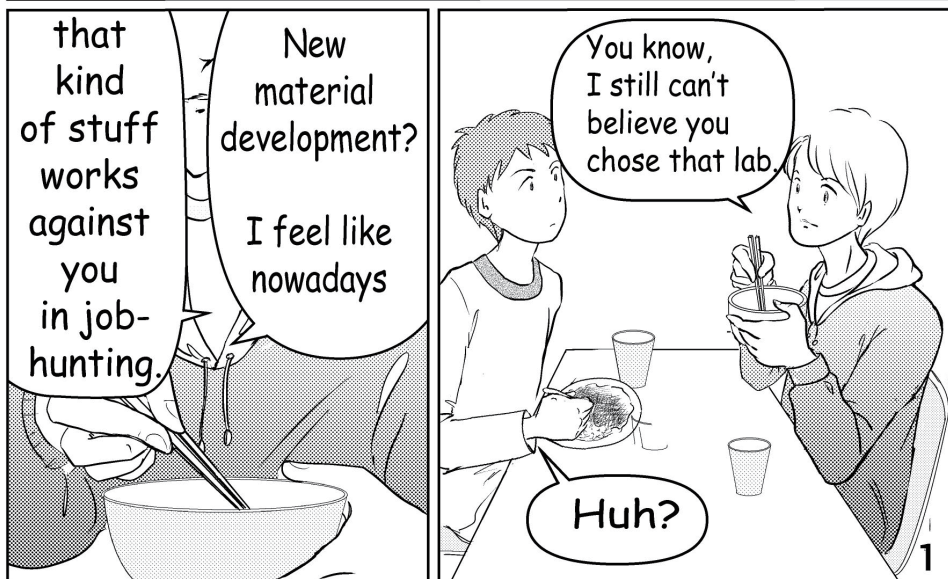
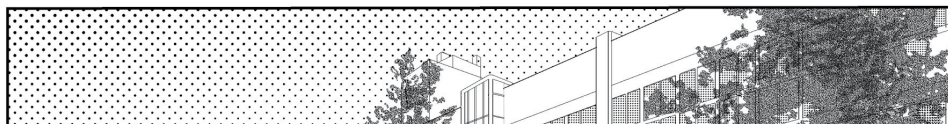


Chapter One: The Uninvited Senior Thesis Student



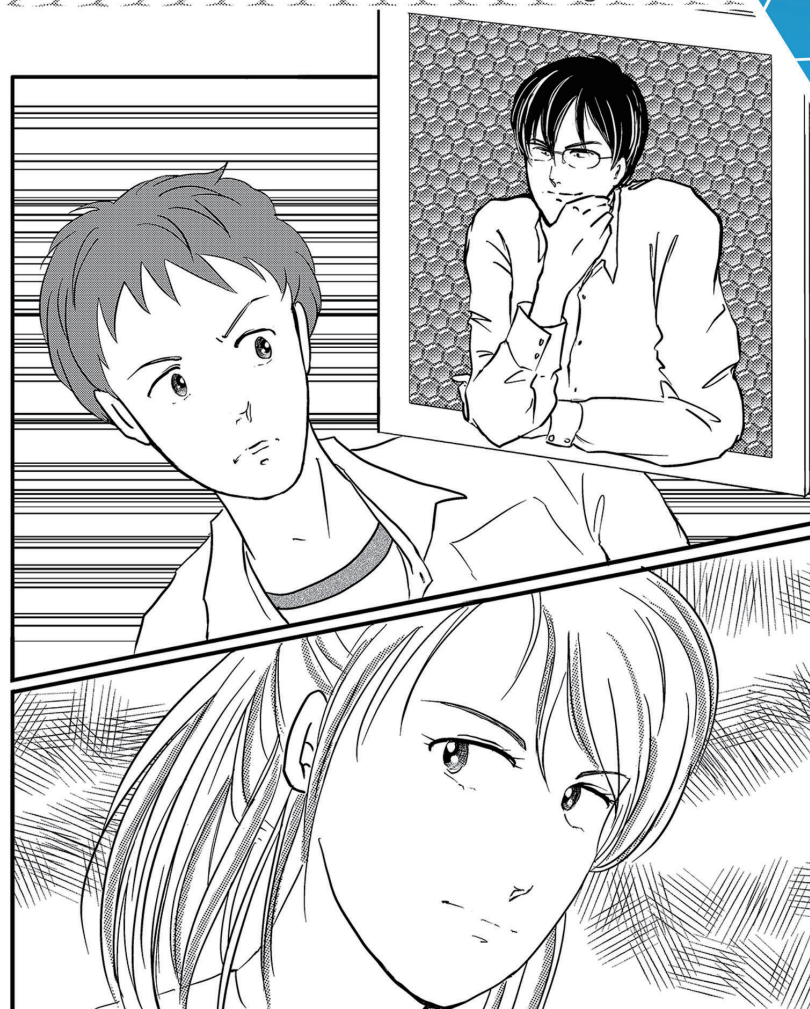
令和3(2021)年度学術変革領域研究(A)

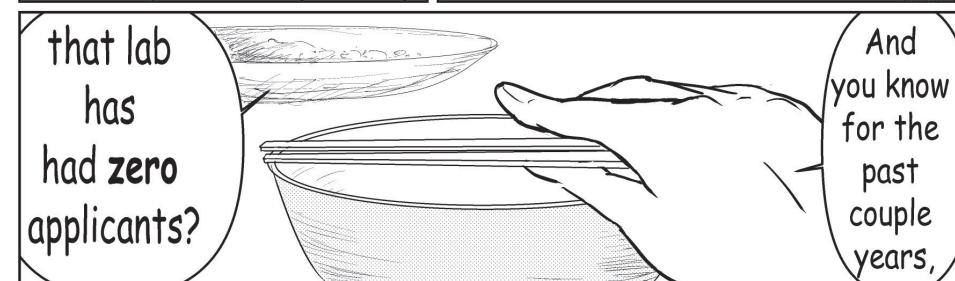
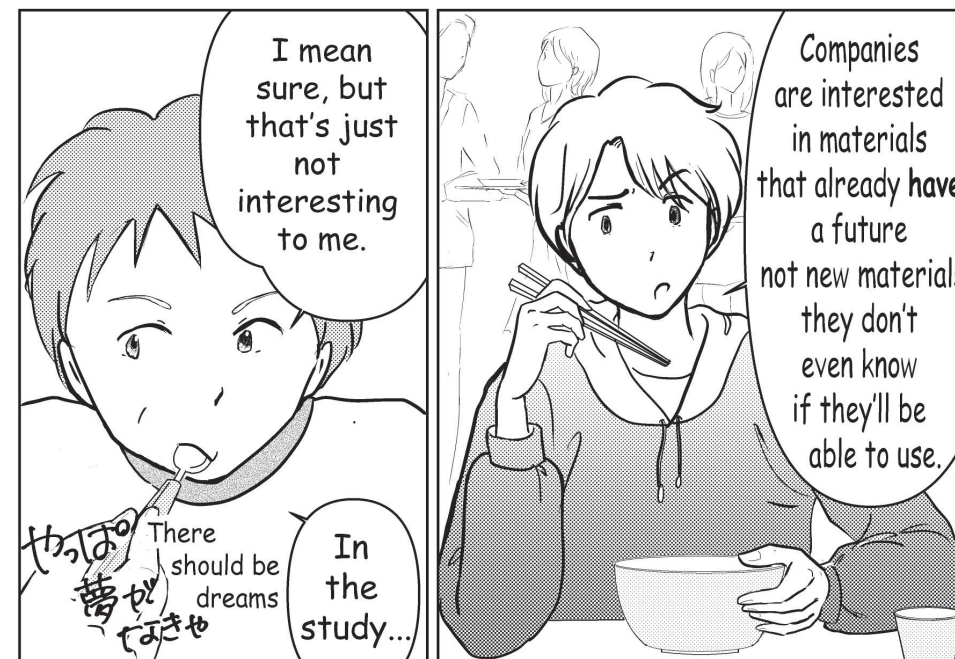
2.5次元物質科学:
社会変革に向けた物質科学のパラダイムシフト

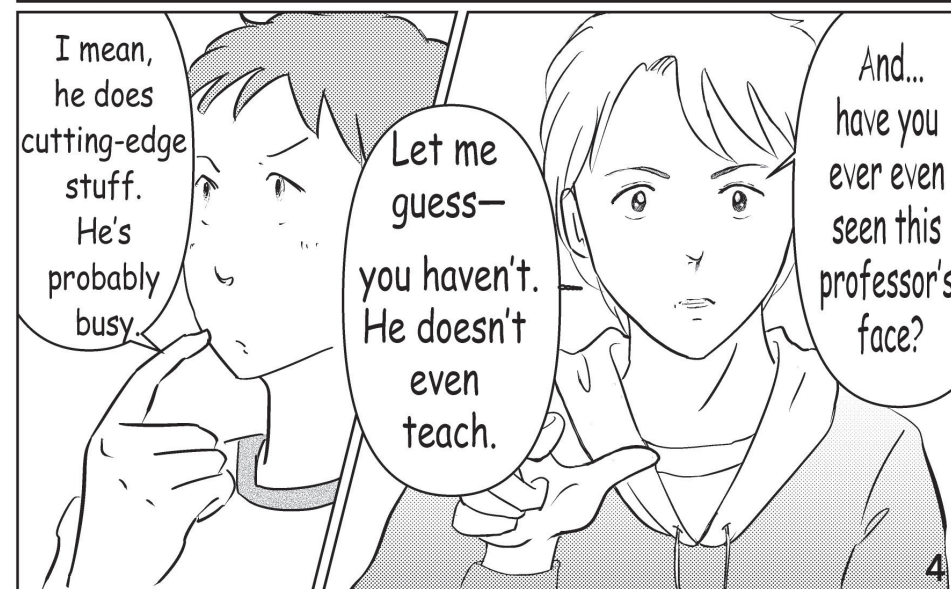
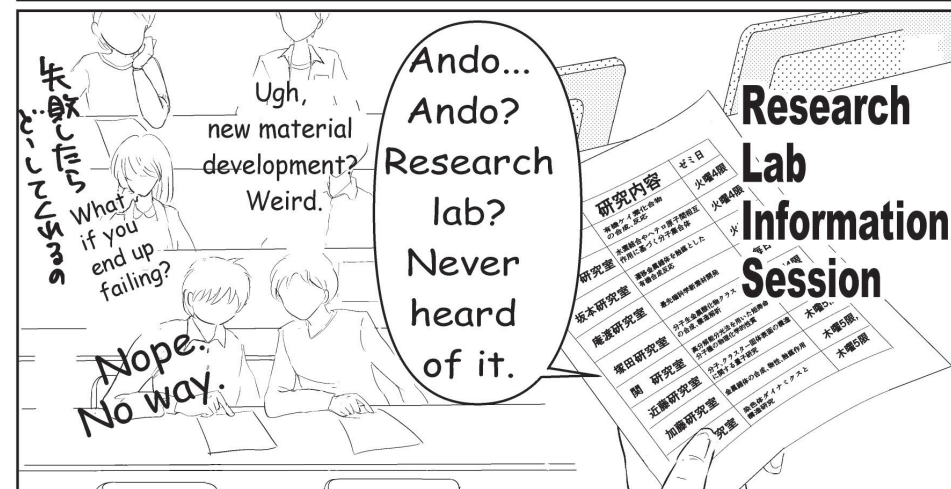
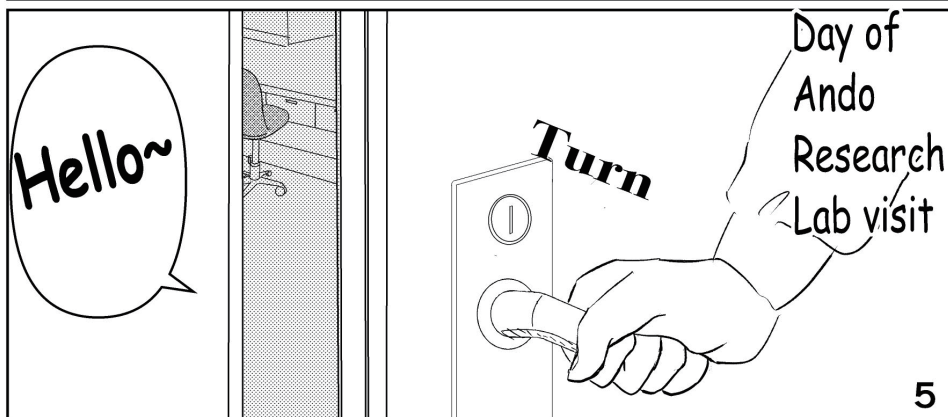
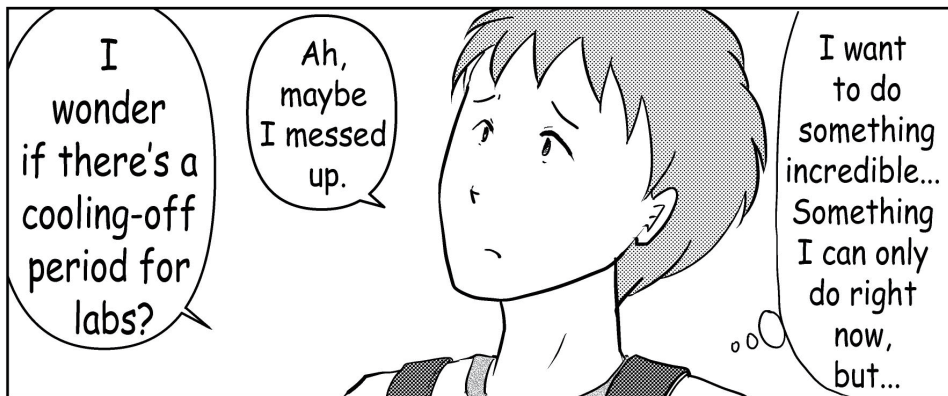
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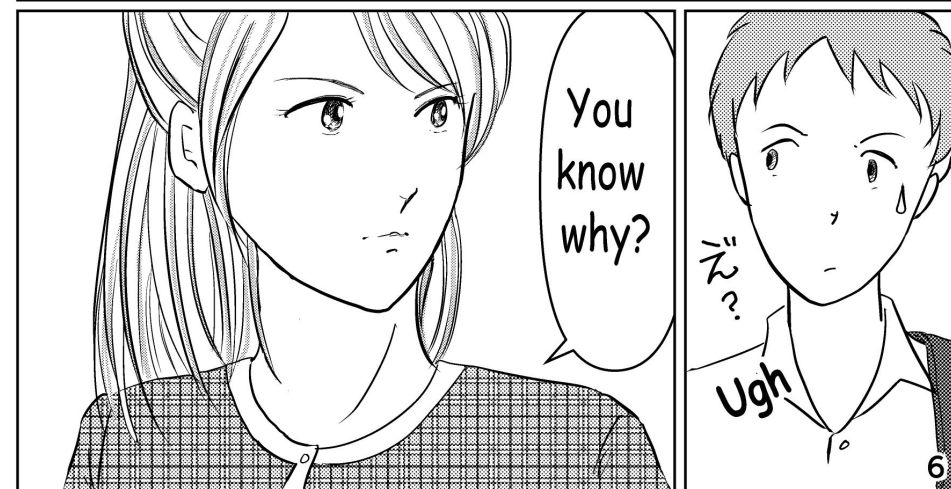
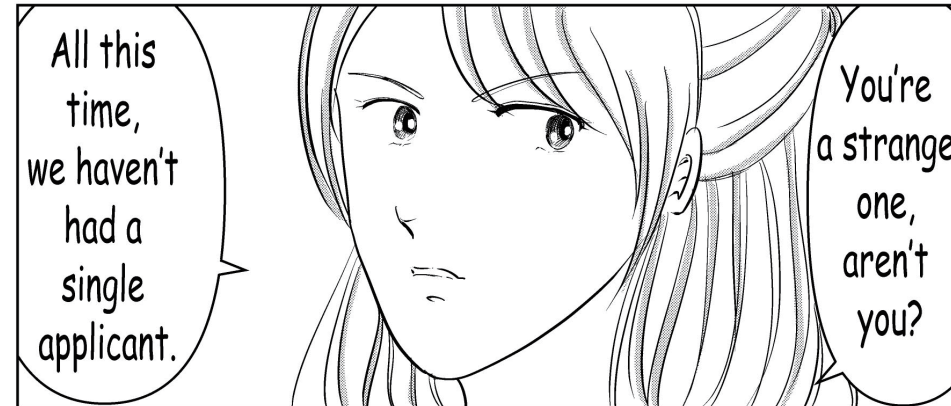
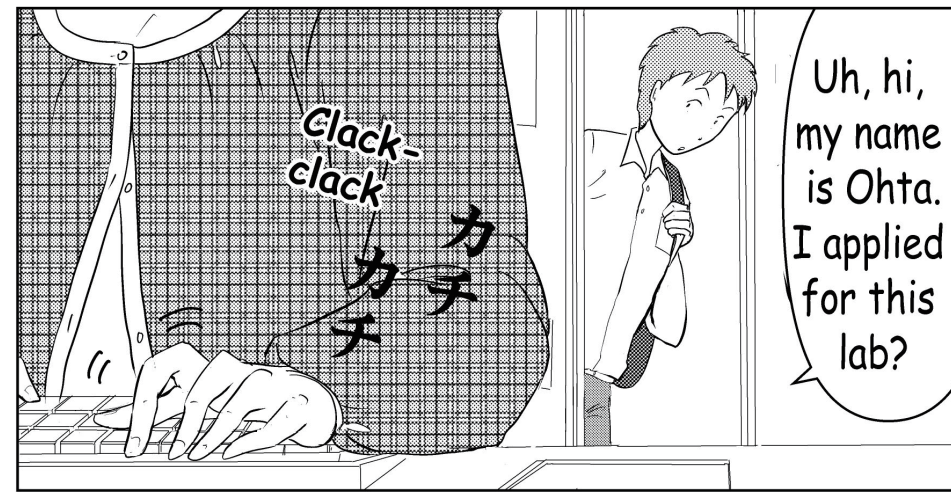
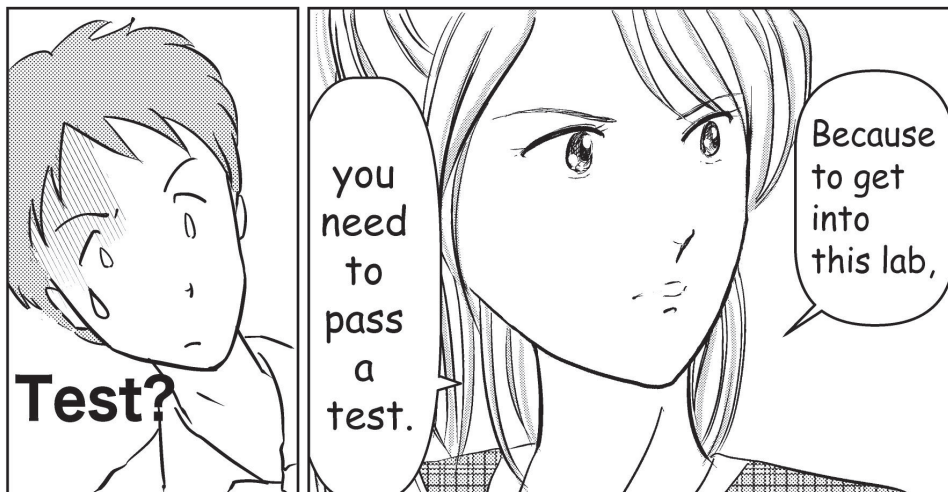
Welcome to the 2.5 D Laboratory

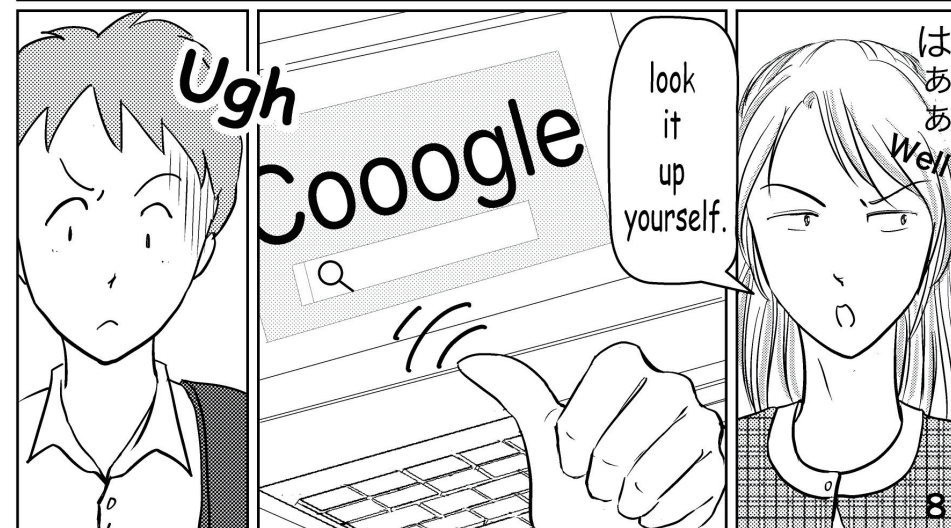
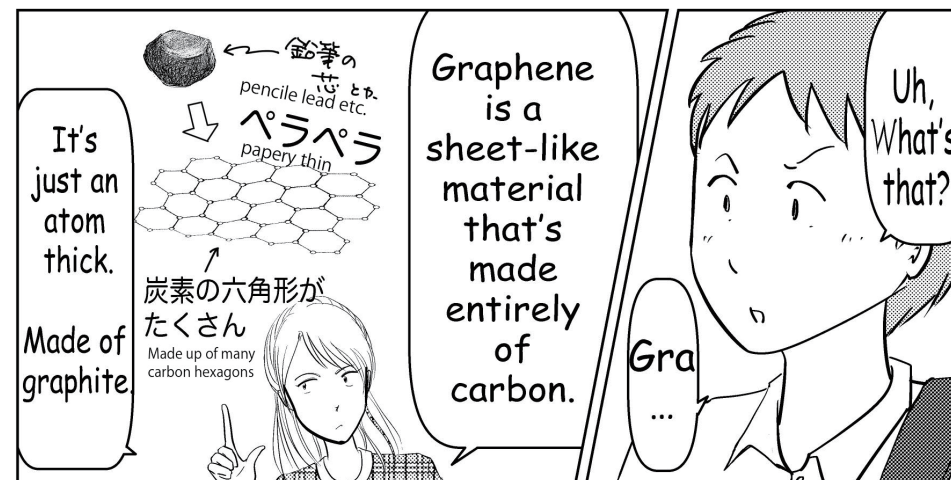
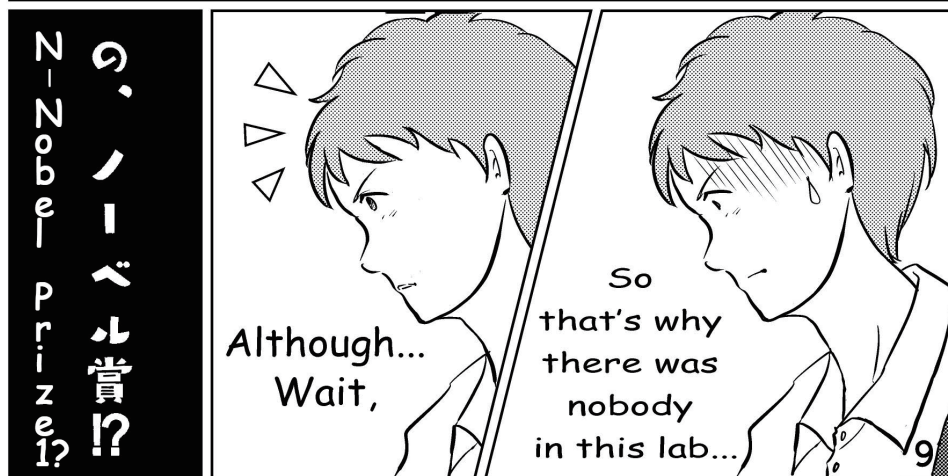
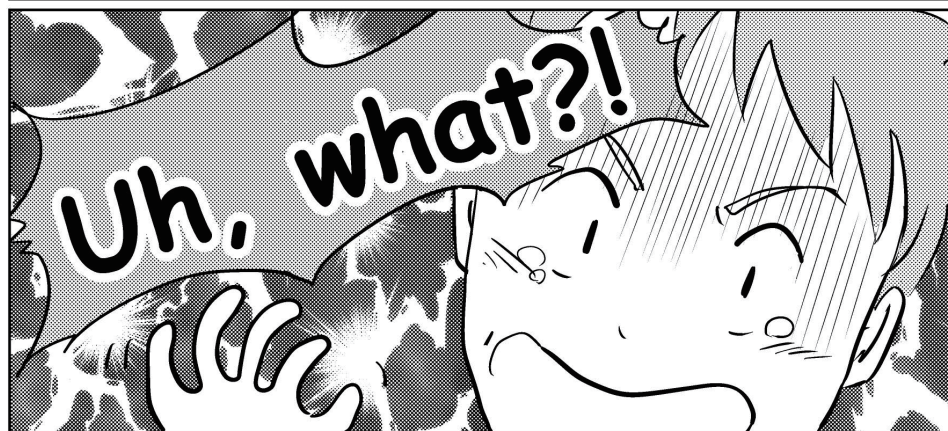
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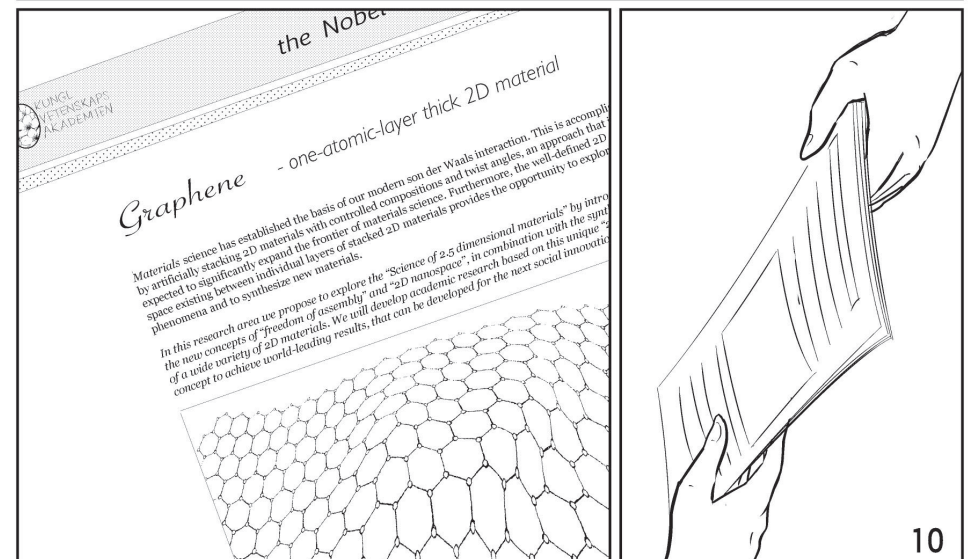
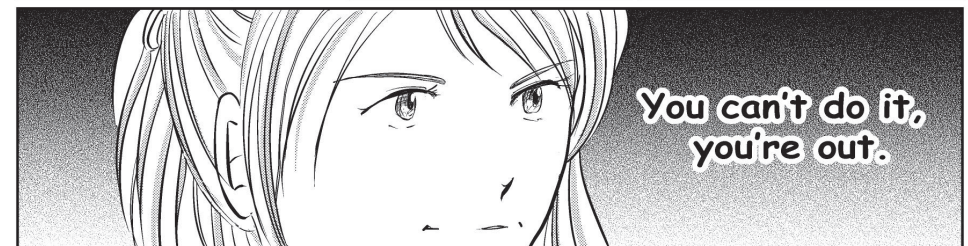
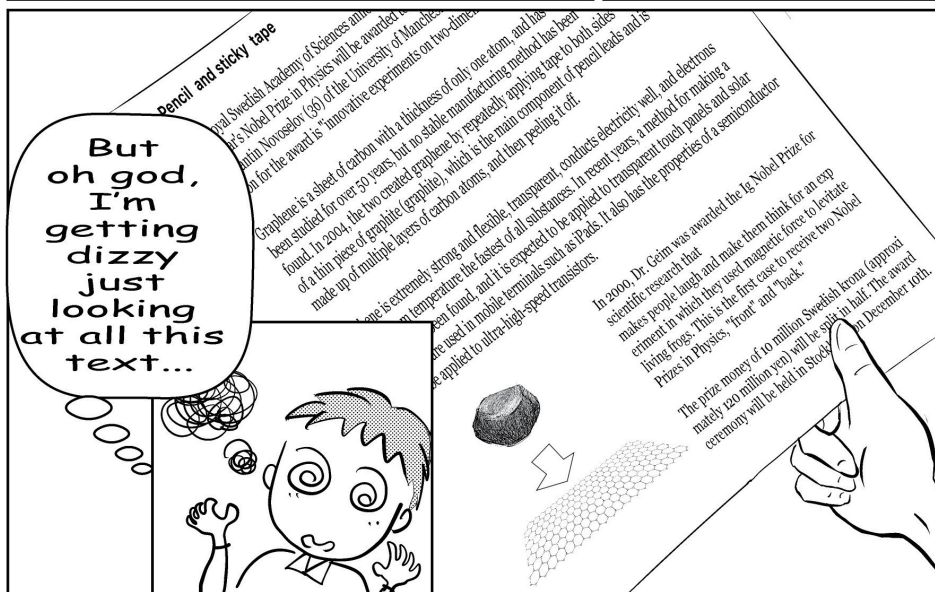
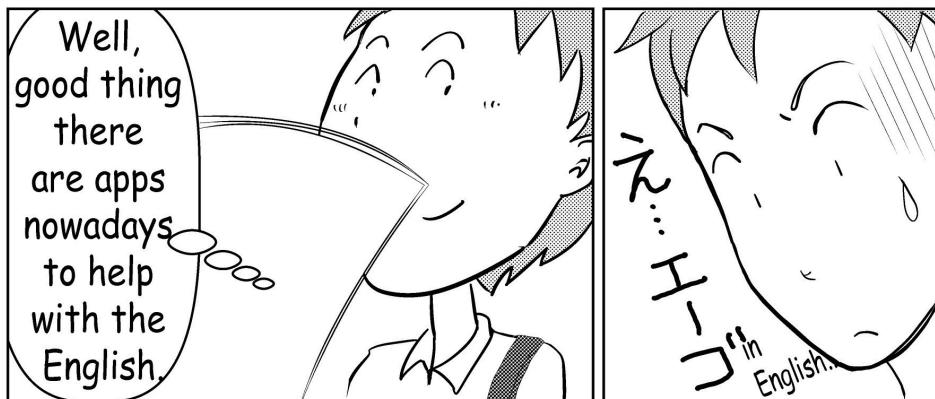


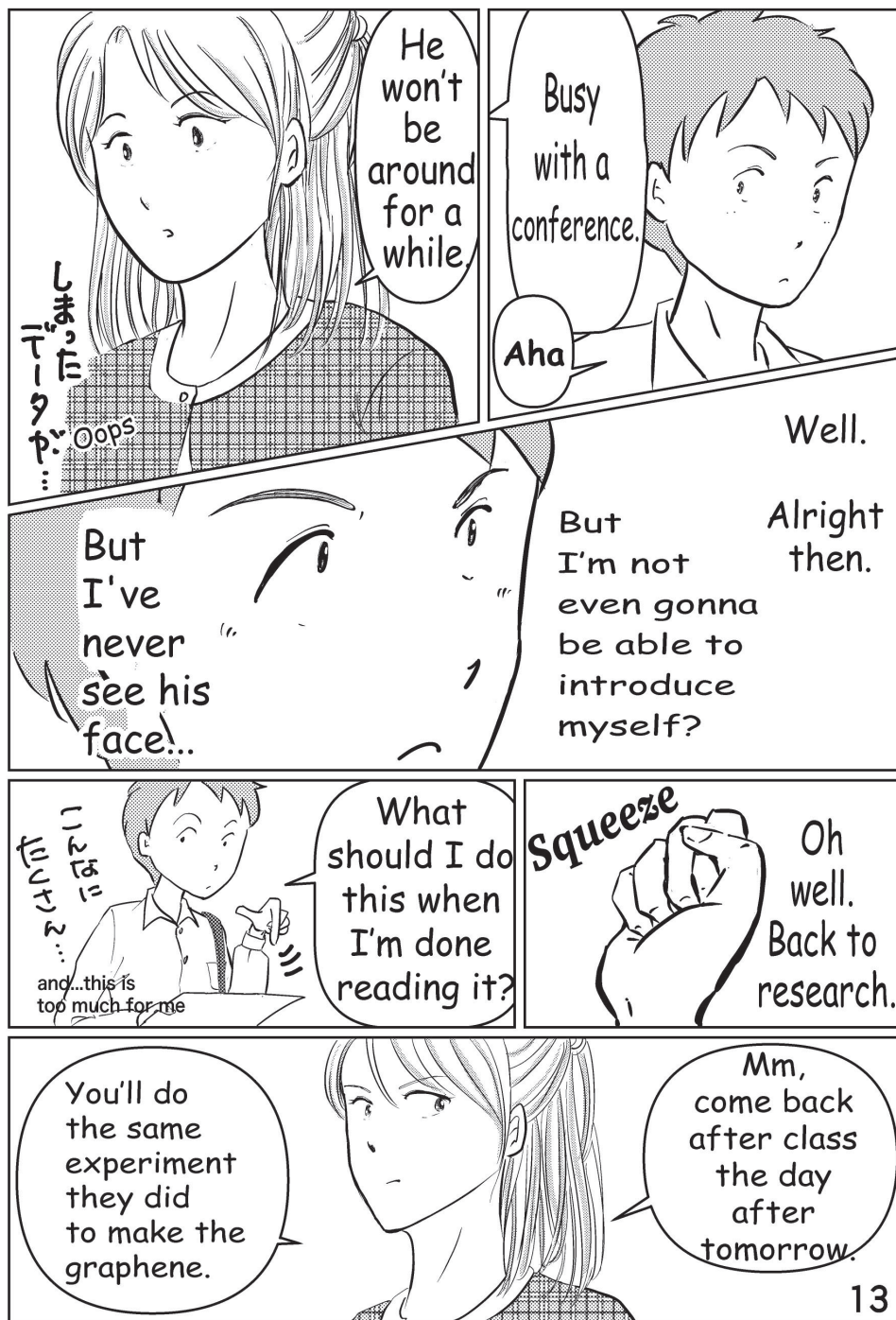














Electric Field Effect in Atomically Thin Carbon Films

K.S. Novoselov¹, A.K. Geim¹, S.V. Morozov², D. Jiang¹, Y. Zhang¹, S.V. Dubonos², I.V. Grigorieva², A.A. Firsov²

¹Department of Physics, University of Manchester, M13 9PL, Manchester, UK

²Institute for Microelectronics Technology, 142432 Chernogolovka, Russia

We describe monocrystalline graphitic films, which are just a few atoms thick but nonetheless stable under ambient conditions, metallic and of remarkably high quality. The films are found to be a two-dimensional semimetal with a tiny overlap between valence and conduction bands and to exhibit a strong ambipolar electric-field effect such that electrons and holes in concentrations up to 10^{13} cm^{-2} and with room-temperature mobilities $\approx 10,000 \text{ cm}^2/\text{Vs}$ can be induced by applying gate voltage.

And... the paper she gave me was the one that got them the Nobel Prize.

But what were they even planning to do with something like that?

Electric Field Effect? elections and holes...

でんし と けいこ

正孔

vary the carrier concentration in a semiconductor devices

Whoa. That's pretty cool.

半導体デバイスの電荷密度を変化させ

single layer grapheme ... making devices from them...

単相のグラフェンからデバイスを作る...

I guess it conducts electricity really well?

Huh

15



This is the experiment that won them the Nobel Prize

Oh well. Time to do some research.

What's Graphene?

16:34

These two really became Nobel Prize winners because of some Scotch tape?

"Super Low-Tech Experiment Wins Scientists Nobel Prize."

2010 Nobel Prize in Physics

Dr. Andre Geim

Dr. Konstantin Novoselov

"Super Low-Tech Experiment Wins Scientists Nobel Prize." Makes a great headline, but... How does that actually work?

14

What is Professor Ando planning to do with this graphene anyway?

Dump



Semiconductors,
photonics devices...

Flexible transparent electrodes.

To make rare metal-free touch panels.

Although, it does look like graphene could be used in a lot of different places.

Huh.
We can
make it
bigger.

CV... ..

It can be used to make solar panels?

字技術二ユ一人社

科学技術NEWS

グラフエンとは

炭素原子のみで構成される原子一個分の厚しかないナノ炭素材料。an be っており、面内では六員環構造に炭素

to make 熱伝導

率、機械的強度、レスポンス性能など
し、多様

panels?る。
蒸気相蒸着 (CVD) 法

化学気相蒸 (CVD) 法

化学気相成長法ともいう。ガス化した状態の原料を化学反応によって基板上に薄膜または気相で目的物質を得る。

製法。大面積の成膜を比較的容易に
 行製できる。CVDはchemical vapor

depositionの略。グラフェンは主に

グラフェン太陽電池実用化へ

グラフェンは2010年にノーベル物理学賞を受賞して、
 というものの画期的な進化が続けてきたが、近年様々な
 ハイテク用途向けとして脚光を浴びているのが太陽電池
 である。



Graph

is so s



Graphene
is so small.

Wait.
Solar
panels?

17

Hey,
don't
even
joke.

U_{m2}

Hey,
soon-to-be
fifth-year

I guess
it wasn't just
a flimsy sheet
of carbon.

お前か、
You again.

and will probably have to stay another year to graduate?

What, about the fact that you chose a weird lab and won't be able to write a senior thesis

See,
I told
you
it was
a bad
idea.

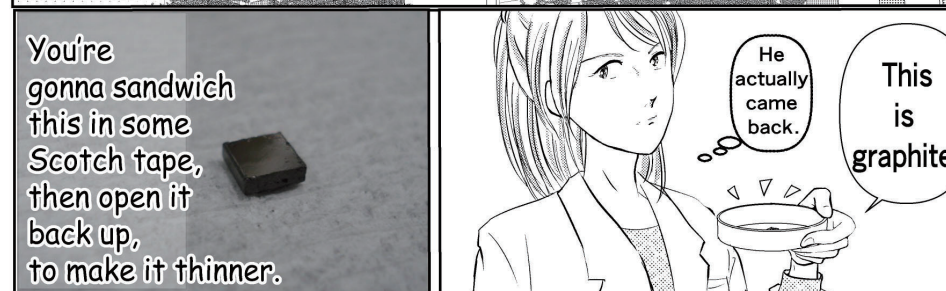
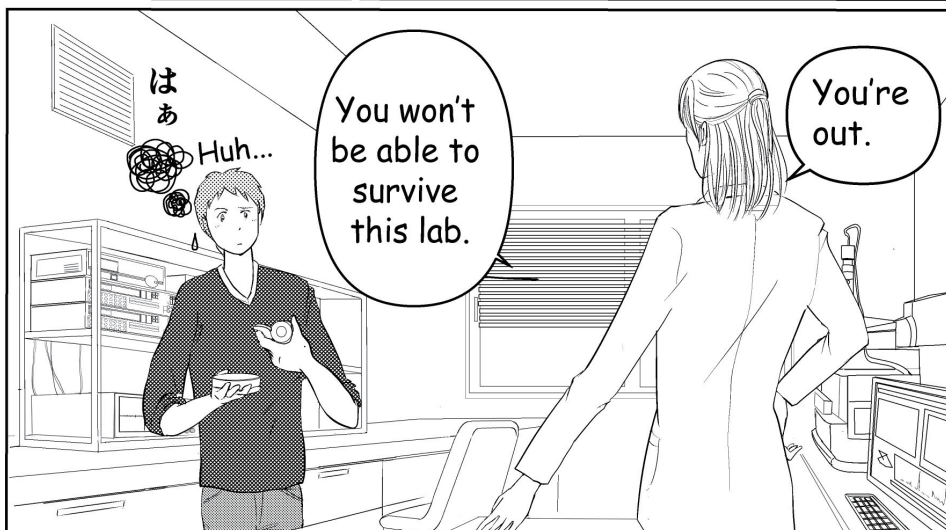
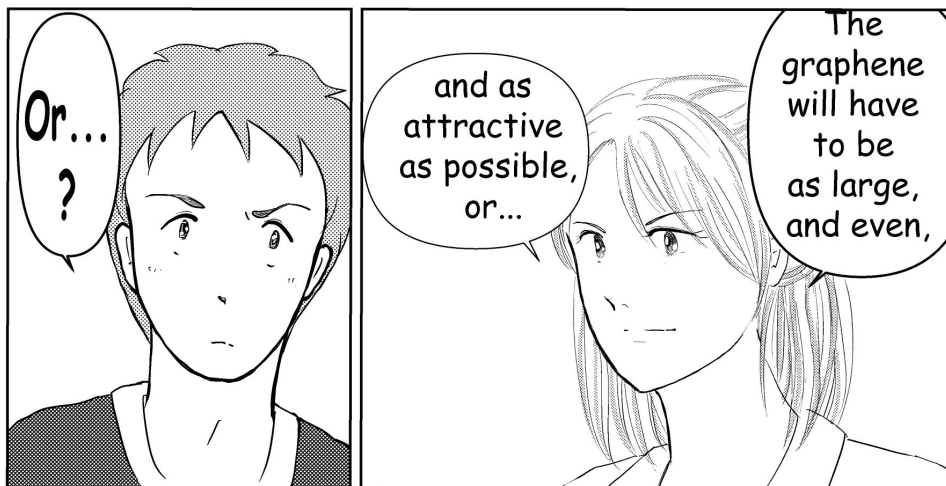
Uh, what?

Really? "Hr"

あーあ

Turns out they might not even let me into the lab.

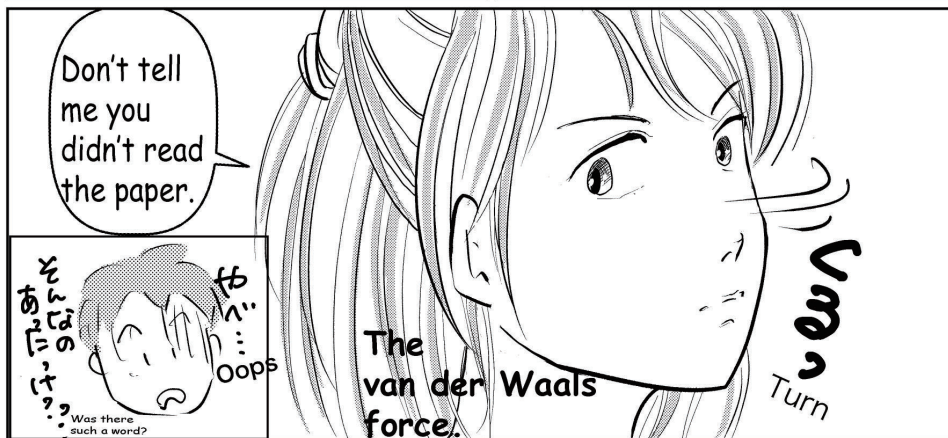
16





Excuse me,
why does this peel so nicely like this?

10th...



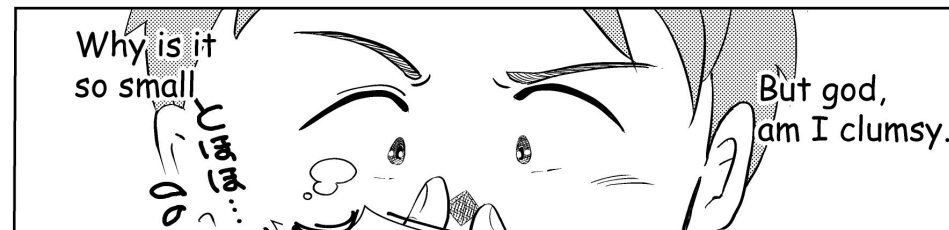
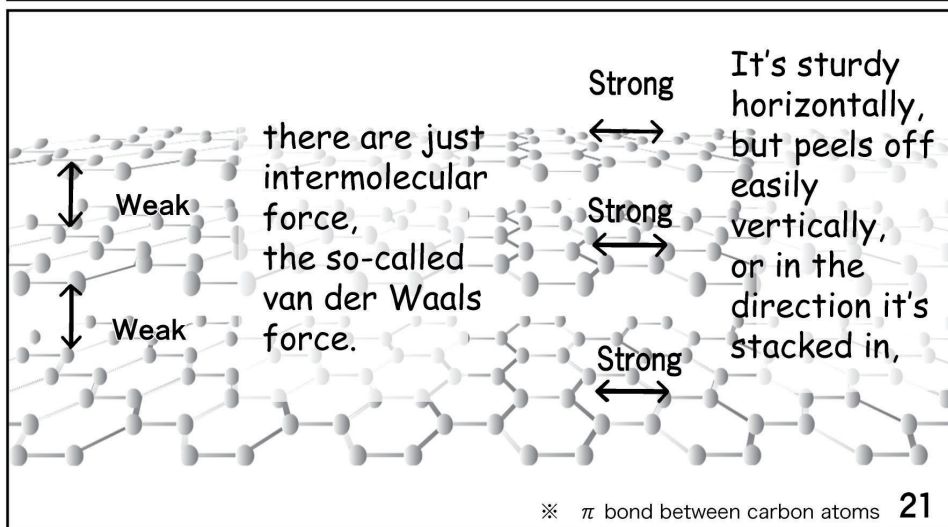
Don't tell me you didn't read the paper.



Was there such a word?

The van der Waals force.

Turn



Why is it so small

But god, am I clumsy.



Do not touch it with your bare hands!

Press it together, and open it back up.

But it's pretty. This is the mass of carbon.

Scared me...

おし...
怖...



Am I actually pretty good at this?

3rd

2nd 1st

Hey, it actually peels away pretty nicely.

