文献综述与科技写作

第四章 如何撰写结果

斯 科

浙江大学光电科学与工程学院

地址：玉泉教三409/紫金港医学院科研楼B111

Email: kesi@zju.edu.cn

论文结构

毕业论文的结构

- 论文题目
- 摘要
- 致谢
- 目录
- 引言
- 文献综述
- 方法
- 结果
- 讨论
- 结论
- 参考文献

科技论文的结构

- 论文题目(Title)
- 作者姓名+地址 (Author+Affiliation)
- 摘要(Abstract)
- 关键词(Key words)
- 引言(Introduction)
- 材料与方法(Materials and methods)
- 结果(Results)
- 讨论与结论(Discussion and Conclusion)

正文(IMRaD)

- 致谢(Acknowledgement)
- 参考文献(Reference)
- 附录(Supplementary material)

科技论文的基本结构

正文（IMRaD）

- Introduction （引言）
  - “为什么（why）” 研究的是什么问题
- Materials and Methods （材料与方法）
  - “如何进行研究（how）” 如何研究这个问题的
- Results （结果）
  - “什么（what）” 研究的结果如何
- Discussion and Conclusions （讨论和结论）
  - “所以呢? （so what）” 这些研究结果有什么意义

第四章 如何撰写结果

1. 结果的写作
2. 图表的准备
   - 如何有效设计表格
   - 如何制作有效的图形

1. 结果的写作

> Results! Why, man, I have gotten a lot of results. I know several thousand things that won't work.
>
> —— *T. A. Edison*

论文的核心部分就是数据

- **Results = the meaning of the data**
- **Most data belong in figures and tables**

Results are different from data!

1. 结果的写作

如何处理数据

- 如果只有几个数据，可以逐个给出这几个数据
- 如果数据很多，应该用表格或图片来给出这些数据
- 数据应该都是有意义的
- 如果使用统计下方法来描述实验结果，应该使用得恰如其分

1. 结果的写作

如何写作

> The compulsion to include everything, leaving nothing out, does not prove that one has unlimited information; it proves that one lacks discrimination.
>
> —— *S. Aaronson*
>
> The fool collects facts; the wise man selects them.
>
> —— *J. W. Powell*

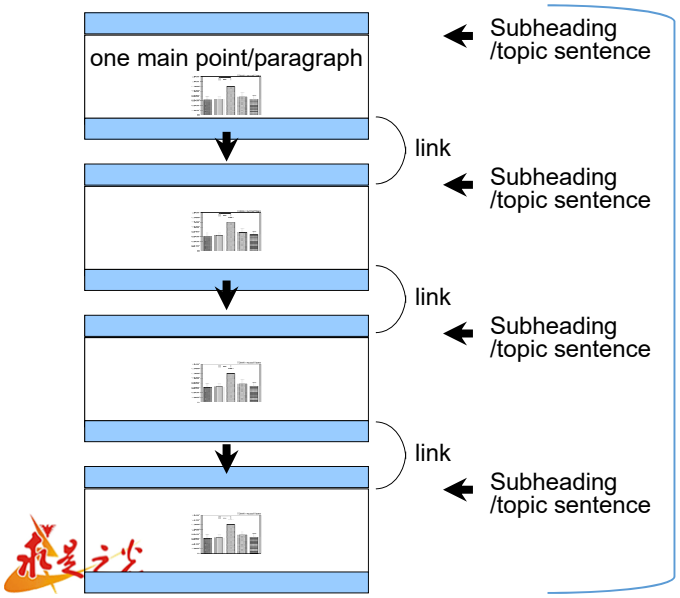
结果部分展示有代表性的数据，而不是重复性的数据

1. 结果的写作

如何写作

- 实验结果就是作者科研工作所要贡献的新知识，论文全文都是因为结果部分的内容才得以立足，叙述务必简洁清楚
- 逐项叙述结果，如果内容过多，可分成段落（加小标题），使层次分明
- 避免赘述实验结果，不要对于图表中大多数或全部数据都用文字叙述出来

Structure of RESULTS



Subheading /topic sentence carry the theme/outline /argument

一段一个问题（一个实验），配适当的图或表

1. 结果的写法

见补充材料

1. 结果的写法

(一)、Result的写法

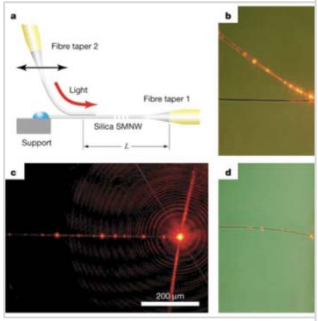
1. **Location** of results
2. Highlighting the **key data**
3. **Commenting** on key data

(二)、Key Data

1. Highest or lowest values
2. Overall trend or pattern
3. **Points that do not seem to fit the trend of pattern**

1. 结果的写作

- 一般，每一段开头要讲明这个实验的目的，然后，讲述做了什么，得到什么结果（引述图表）



We investigated the optical properties of the silica SMNW by sending light into them using evanescent coupling. First, a SMNW is suspended in air, with one end fixed to a support and the other end connected to the fibre taper from which it was drawn (fibre taper 1 in Fig. 4a). Light is then coupled into the SMNW through a second fibre taper. The launching wire from this second taper attaches itself to the guiding wire because of a van der Waals attraction between the two. To reduce the contribution from scattered light, both tapers are gold-coated except for the region used for evanescent coupling. Figure 4b shows an optical micrograph of the coupling between a 390-nm-diameter launching wire and a 450-nm-diameter SMNW; Fig. 4c shows a 360-nm-diameter wire guiding light of 633-nm wavelength from the left. The light is intercepted at the right by a supporting 3-μm wire to show that the amount of light scattered by the wire is small compared to that guided by it. In Fig. 4d, a 550-nm-diameter wire guides 633-nm light in air (on the left) and along the surface of a MgF_2 crystal (on the right). Because the refractive index of MgF_2 is lower than that of silica (1.39 versus 1.46), the light continues to be guided by the wire on the MgF_2 surface, demonstrating the possibility of integrating SMNWs with low-index substrates for device applications. We also determined that a 620-nm-diameter wire immersed in water guides light, demonstrating the possibility of using these wires for chemical and biosensing in liquid media.

1. 结果的写作

The drawn G/PVA nanofibers were typically hundreds of nanometers in diameter and tens of millimeters in length. Their diameters were uniform along their lengths and their surfaces were smooth (Figure 2a). The dopant did not appreciably change the structural and mechanical properties of the nanofiber. Such nanofibers can be readily incorporated as integrated components, such as microcavities or junctions, into a photonic circuit. For example, by micromanipulation under an optical microscope[24], a G/PVA nanofiber can be assembled into a loop (Figure 2b, also a knot in Supplementary Information Fig. S3) or a spiral (Figure 2c) without failure.

We used transmission electron microscopy (TEM) and micro Raman spectroscopy to characterize the G/PVA nanofibers. The TEM image (Figure 2d) of a G/PVA nanofiber shows that graphene flakes (appearing as small dark patches) were spread out in the fiber. Figure 2e compares the Raman spectra of a G/PVA nanofiber, a pure PVA nanofiber, and an LPE graphene flake on a silicon substrate. The G, D, and 2D modes of graphene are clearly visible in the spectrum of G/PVA, indicating the presence of graphene in the fiber. The 2D peak appearing as a single Lorentzian peak is characteristic of monolayer graphene[32,33].

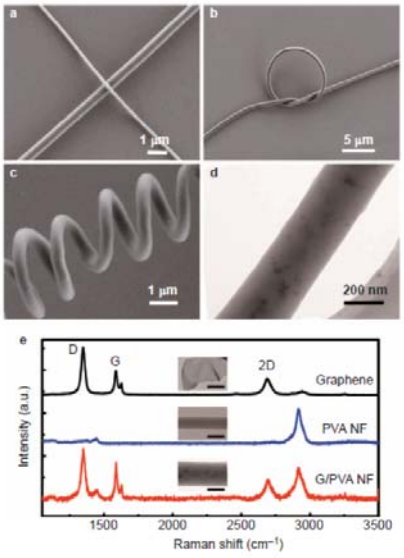


Figure 2 Electron microscopy and Raman characterization of G/PVA nanofibers. (**a**–**c**) SEM images of (**a**) 170- and 510-nm-diameter G/PVA nanofibers, (**b**) a 7-μm-diameter micro-knot tied with a 600-nm-diameter G/PVA nanofiber and (**c**) a micro spiral assembled with a 480-nm-diameter G/PVA nanofiber. (**d**) TEM image of a 290-nm-diameter G/PVA nanofiber. (**e**) Raman spectra of a LPE graphene flake (upper), a pure PVA nanofiber (middle), and a G/PVA nanofiber (bottom). The insets show TEM images of the corresponding samples. Scale bars, 200 nm.

1. 结果的写作

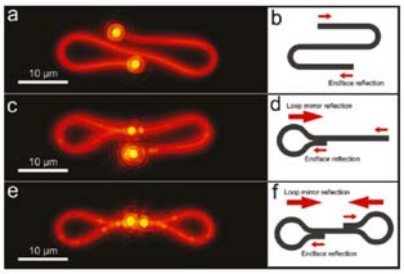


Figure 3. PL microscope images and schematic diagrams of lasing cavities of single-NW structures (a,b) without LM, (c,d) with one LM, and (e,f) with double LMs. The NWs used in (a,c,e) are the same CdSe NW with diameter of 200 nm. In (b,d,f), the thin arrow represents endface reflection with low reflectivity, while the thick arrow represents LM reflection with high reflectivity.

To investigate the lasing action in a single NW, we folded a 200 nm diameter CdSe NW with length of about 75 μm into three types of cavity structures. As shown in Figure 3, we study the NW without LM (Figure 3a), with one LM (Figure 3c), and with double LMs (Figure 3e) successively. Since the spatial distribution of the pumping light may be inhomogeneous, the three types of structures are assembled with similar geometry and size to minimize the difference in pumping conditions. Figure 3a shows a PL microscope image of the NW cavity solely relying on endface reflection (Figure 3b). In Figure 3c, left side of the NW is folded into a LM with minimum bending radius of about 3.1 μm. With the additional LM reflection from the left side, the NW operates with two coupled cavities relying on endface−endface reflection and endface−LM reflection, respectively (Figure 3d). In Figure 3e, both sides of the NW are folded into LMs, forming four coupled cavities in a single NW (Figure 3f). To excite the NW, we focus 532 nm laser pulses (5 kHz repetition rate, 15 ns pulse width) on the whole NW structure using the same experimental setup shown in Figure 2a. Under the pumping intensity well above the lasing threshold, Figure 3a shows two lasing spots (at both ends of the NW) with similar brightness, indicating that the two endfaces have almost equivalent reflectivities. For comparison, in single-LM NW shown in Figure 3c, the free-standing end of the NW gives a much stronger lasing output than the loop end, indicating that the LM offers a much higher reflectivity than the free end. With double LMs, the two ends of the NW give strong lasing output with similar intensity (Figure 3e). Noticeably, compared with the NW in Figure 3a,c,

1. 结果的写作

Well-Written RESULTS

- Methods and Results **correspond**.
- Results are presented in a **logical order**.
- Results **focus on the question(s)** or **hypothesis** introduced earlier in the paper.

最常见的问题

- 缺失成分（实验目的、实验方法、结果或相关的解释）
- 包括了不相关或不重要的信息
- 过多的实验细节
- 包含了超出结果说明的结论

第四章 如何撰写结果

1. 结果的写作
2. 图表的准备
   - 如何有效设计表格
   - 如何制作有效的图形

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2. 图表的准备

A figure is worth a thousand words…

- **Condense large amounts of information**
- **Convince readers of your findings (by showing data quality)**
- **Focus attention on certain findings (e.g. relationship between values)**
- **Simplify complex findings**
- **Promote thinking and discussion**

- **Editors (and readers) look first (and maybe only) at titles, abstracts, and Tables and Figures!**
- **figures and tables should stand alone and tell a complete story.**

2. 图表的准备

Figure/Table

- 表格：很方便地列举大量精确数据或资料
- 图形：直观、有效地表达复杂数据，尤其是不同组数据间的比较、关联、趋势等
- 表格和图形应具有“自明性”
- Figure/Table caption：准确而清楚地表达出数据或资料的含义，切忌简单地描述数据

Choose the most effective type of illustration

Most useful	Tables	Figure
When working with	Number	Shape
When concentrating on	Individual data values	Overall pattern
When accurate or precise actual values are	More important	Less important

Table, list 缺乏趋势，侧重数字描述

Figures 表现关联、趋势、因果关系等

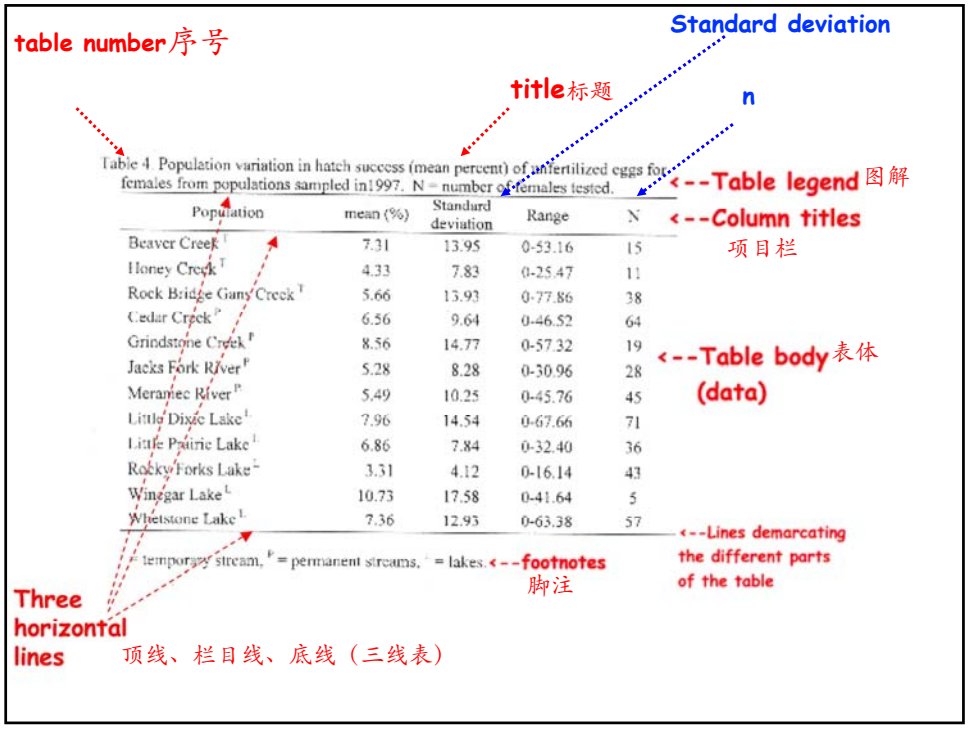
■ 如何有效设计表格

A tabular presentation of data is often the heart or, better, the brain, of a scientific paper.

—— Peter Morgan

Table, list **To present**

- **exact values**
- **raw data**
- **data which do not fit into any simple pattern**
- **To present lists of text in columns**
- **To illustrate a point**



Population	mean (%)	Standard deviation	Range	N
Beaver Creek [T]	7.31	13.95	0-53.16	15
Honey Creek [T]	4.33	7.83	0-25.47	11
Rock Bridge Gamy Creek [T]	5.66	13.93	0-77.86	38
Cedar Creek [P]	6.56	9.64	0-46.52	64
Grindstone Creek [P]	8.56	14.77	0-57.32	19
Jacks Fork River [P]	5.28	8.28	0-30.96	28
Meramec River [P]	5.49	10.25	0-45.76	45
Little Dixie Lake [L]	7.96	14.54	0-67.66	71
Little Prairie Lake [L]	6.86	7.84	0-32.40	36
Rocky Forks Lake [L]	3.31	4.12	0-16.14	43
Wingear Lake [L]	10.73	17.58	0-41.64	5
Whetstone Lake [L]	7.36	12.93	0-63.38	57

[T] = temporary stream, [P] = permanent streams, [L] = lakes.

Basic rules of creating effective scientific tables

- should present the data simply, clearly and neatly
- Always include the **units**, **error values** and **number of samples**
- allow the reader to understand the results without having to look at other sections of the paper
- Use a separate cell for each value
- No empty cells, rows or columns
- Use only horizontal line borders and double line spacing

使用table的几点注意事项：

尽量避免冗余

Characteristic	Genotype 1	Genotype 6	*p* value
Male	59.4%	56.4%	0.667
Rapid virological response	43.5%	73.1%	0.045
Route of transmission, transfusion	71.7%	56.4%	<0.001
Route of transmission, IV drug use	8.7%	28.8%	<0.001

Characteristic	Genotype 1	Genotype 6	*p* value
Male	59.4	56.4	0.667
Rapid virological response	43.5	73.1	0.045
Route of transmission			
Transfusion	71.7	56.4	<0.001
IV drug use	8.7	28.8	<0.001

Data are presented as percentage.

表格的修改

Type of attack	Classical	Pop	Jazz
Echo addition	0.0%	0.1%	0.27%
Noise Addition	1.2%	1.42%	1.6%
Band equalization	2.31%	2.5%	2.73%

三线表 / 共用单位 / 有效数字

Type of attack	Classical (%)	Pop (%)	Jazz (%)
Echo addition	0	0.10	0.27
Noise addition	1.20	1.42	1.60
Band equalization	2.31	2.50	2.73

如何有效设计表格

Tables Titles

- Use clear and informative titles
- Use short, descriptive row and column titles
- If you need use long or complicated titles, use abbreviations.
  Remember to define them in the table footnote.

如何有效设计表格

Table Footnotes

- Use superscript symbols to identify footnotes, according to journal guidelines:

  A standard series is: *, †,‡,¶,#,**,††, etc.

- Use footnotes to explain statistically significant differences

  *p<0.01 vs. control by ANOVA

- Use footnotes to explain experimental details or abbreviations

  EDI is the Eating Disorder Inventory (reference)

如何有效设计表格

Table Formats

- Use three horizontal lines: one above the column headings, one below the column heading, and one below the data
- Use a short horizontal line to group subheadings under a heading

如何有效设计表格

nature

Manuscript formatting

5.7 Tables.

Tables should be presented on separat
portrait orientation, and upright on the p

Tables have a short, one-line title in bol
should be as small as possible. Symbol
abbreviations are defined immediately b
followed by essential descriptive materi
possible, in double-spaced text.

ACS Publications
Most Trusted. Most Cited. Most Read.

Tables. Tables should be numbered consecutively with Arabic numerals. Each table should include a descriptive heading that, together with the individual column headings, makes the table self-explanatory. Column headings should be lower case, except for symbols and proper names. Footnotes in tables should be given letter designations and be cited in the table by italic superscript letters. The sequence of letters should proceed by line rather than by column. If a reference is cited both in the text and in a table, a lettered footnote that refers to the numbered reference in the text should be inserted in the table.

In setting up tabulations, authors are requested to keep in mind the type area of the journal page (17.8 × 25.0 cm) and the column width (8.5 cm) and to make tables conform to the limitations of these dimensions. When arranging data into columns, use space efficiently.

如何有效设计表格

- 数据排列原则是同类数据应该纵向排列，方便进行上下对比，而不是横向排列
- 通常表格中的文字左对齐排列，数字右对齐或者小数点对齐排列
- 通常表格都不会使用纵线
- 使用意义明确、不需要参考正文内容的单词

2.2. Conventional Optical Polymers

The preparation of light-guiding films with polymers started in the 1970s.[21] Table 5 summarizes the characteristics of conventional optical polymers such as poly(methylmethacrylate) (PMMA),[22] polystyrene (PS),[23] polycarbonate (PC),[24] polyurethane (PU),[25] and epoxy resin.[26]

Table 5. Properties of conventional optical polymers.

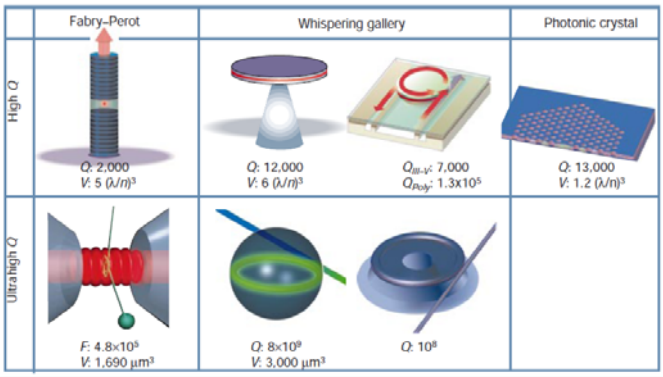
Material	Refractive index (n)	T_g [°C]	Loss [dB/cm]
PMMA	1.49	105	0.2 (at 850 nm)
PS	1.59	100	
PC	1.58	145	
PU	1.56		0.8 (at 633 and 1064 nm)
Epoxy resin	1.58		0.3 (at 633 nm), 0.8 (at 1064 nm)

These polymers possess very different structures, for example, PMMA with an aliphatic backbone and ester side-chain, PC with an ester backbone, and polyurethane with an amino-ester backbone. As a result, their properties vary significantly in the aspects of refractive index, optical loss, and thermal stability.[27]

如何有效设计表格

Table 1

The microcavities are organized by column according to the confinement method used and by row according to high Q and ultrahigh Q. Small mode volume and ultrasmall mode volume are other possible classifications that are somewhat complementary to this scheme. Representative, measured Qs and Vs are given and have been taken from the following cited references. Upper row: micropost[48], microdisk[57], semiconductor[103], polymer[104] add/drop filter, photonic crystal cavity[62]. Lower row: Fabry-Perot bulk optical cavity[31,32], microsphere[29], microtoroid[6]. n is the material refractive index, and, V, if not indicated, was not available. Microsphere volume V was inferred using the diameter noted in the cited reference and finesse (F) is given for the ultrahigh-Q Fabry–Perot as opposed to Q. Two Q values are cited for the add/drop filter: one for a polymer design, Q_{Poly}, and the second for a III–V semiconductor design, Q_{III-V}.



如何制作有效的图形

1. **Primary evidence** indicates data quality:
   - micrographs, photographs, etc.
2. **Graphs**
   - line graphs, bar graphs, scatter plots, histograms, boxplots, etc.
3. **Drawings and diagrams**
   - illustrate experimental set-up
   - indicate flow of experiments or participants
   - indicate relationships or cause and effect or a cycle
   - give a hypothetical model

如何制作有效的图形

推荐

- 根据用途选择扫描分辨率
- 仅用于在电脑上显示时，可选择100 - 150 Dpi
- 用于打印或出版时，可选择300 - 600 Dpi

如何制作有效的图形

数码图像

- TIFF/TIF (Tagged Image File Format)
- TIFF/TIF (Tagged Image File Format)
- JPEG/JPG (Joint photographic Experts Group)
- GIF (Graphics Interchange format) 图形交换格式

如何制作有效的图形

Image acquisition and analysis

- Specimen areas should be selected that **represent** the critical features being presented
- Images should be captured in a **noncompressing** format (TIFF or BMP)
- should **retain** unprocessed images and metadata files, as editors may request them
- Files that have been adjusted should be saved separately from the originals, also in a noncompressed format
- **Compressed formats** (JPG), should only be used for presentation of final figures (to keep file sizes small for electronic transmission)

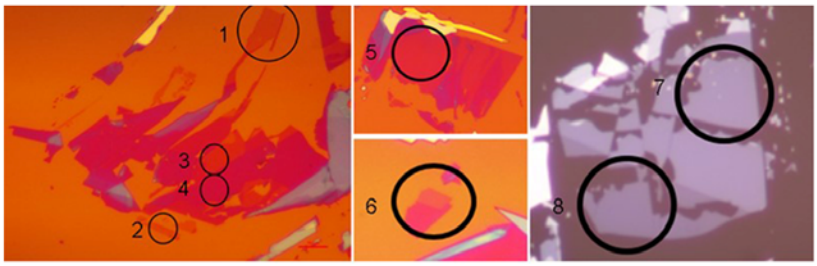
如何制作有效的图形

Image acquisition and analysis

- **Only unprocessed original files** should be used for analysis.
- A description of the analysis preparation and techniques should be included in the Supplementary Data.
- the minimal use of image adjustment, and the final image must remain representative

如何制作有效的图形

这个图给你们什么感觉呢?



- 显微镜图片要标明标尺
- 图片清楚地编号
- 注意图片美观，标示要合适

如何制作有效的图形

- 图片标尺清楚

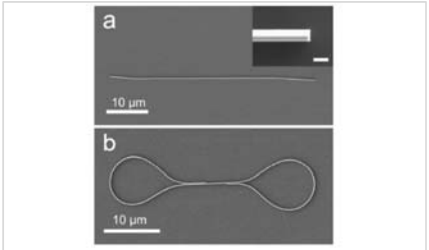


Figure 1. (a) Scanning electron microscopy (SEM) image of a 200 nm diameter 50 μm length CdSe NW. Inset, a close view of the right end of the NW with a flat endface. Scale bar, 200 nm. (b) SEM image of a CdSe single NW folded into micro loops at both ends.

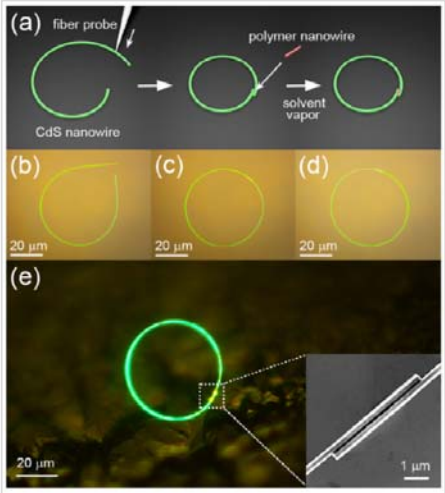


FIG. 1. (a) Schematic of the splicing process. (b)–(d) Optical microscope images of a CdS nanowire ring in the forms of open-loop, closed-loop, and spliced-loop on a MgF_2 substrate, respectively. (e) The spliced ring standing on a ground glass, excited by a 405-nm laser. The inset is a SEM image of the splicing area.

如何制作有效的图形

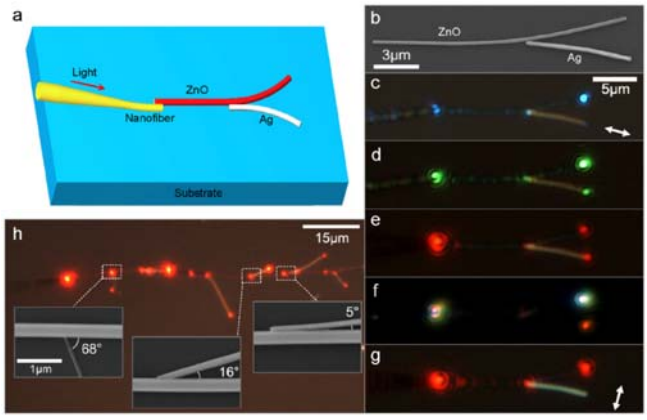


Figure 2. Hybrid couplers fabricated out of coupled Ag and ZnO nanowires. (a) Schematic of a hybrid coupler. (b) SEM image of a hybrid coupler assembled from a 270 nm diameter ZnO nanowire and a 240 nm diameter Ag nanowire. (c−f) Optical micrographs of the hybrid coupler taken with the polarization parallel to the Ag nanowire when monochromatic lasers of wavelength 488, 532, and 650 nm and white light from a halogen lamp are used as light sources. (g) Optical micrograph of the coupler with the 650 nm source when the polarization is perpendicular to the Ag nanowire. Scale bar in (c) is applicable for (d−g). (h) Excitation of multiple Ag nanowires integrated with a single ZnO nanowire. Ag nanowires from left to right are 90, 165, 180, 160, and 115 nm in diameter, with coupling angles ranging from 5° to 68°. Insets, close-up SEM micrographs of typical coupling structures.

如何制作有效的图形

Line graph，强调对变量的依赖关系

- To summarize **trends**
- To show **interactions** between two or more variables
- To relate data to **constants**
- To emphasize an **overall pattern** rather than specific measurements

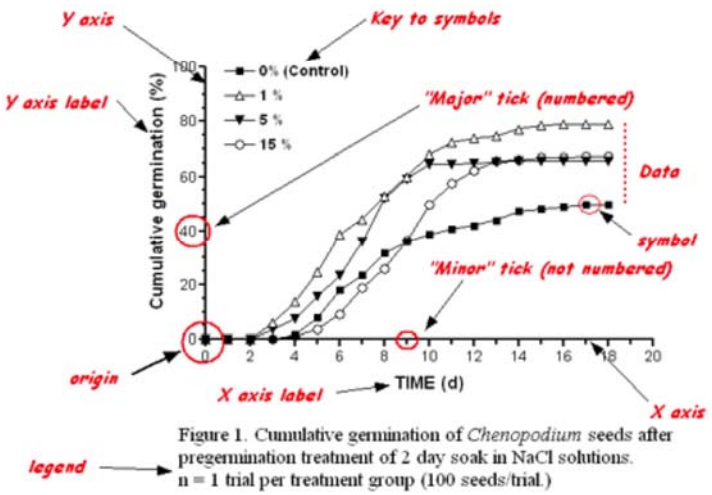
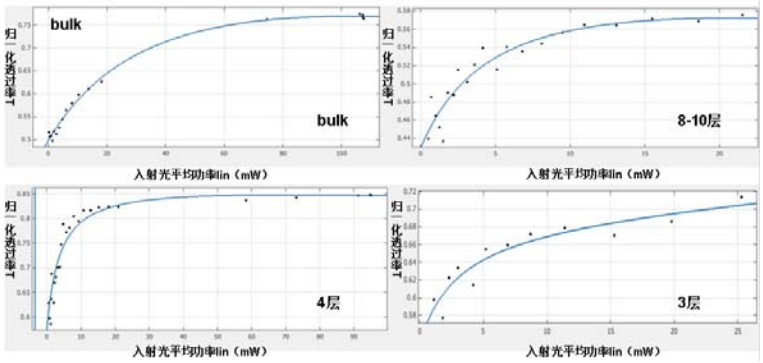


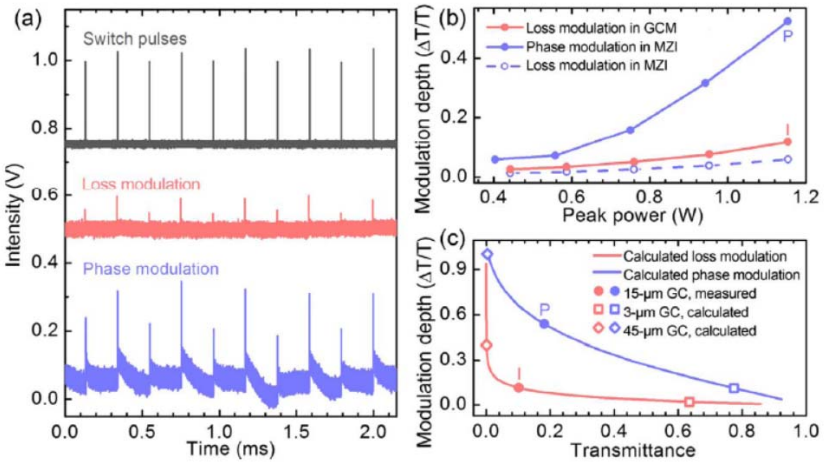
Figure 1. Cumulative germination of *Chenopodium* seeds after pregermination treatment of 2 day soak in NaCl solutions. n = 1 trial per treatment group (100 seeds/trial.)

如何制作有效的图形



这个图有哪些地方需要修改呢?

如何制作有效的图形



如何制作有效的图形

Bar graph

- 有效地用于比较相互独立的不同类目的数值（如苹果和橘子）
- Used to compare groups at one time point
- Tells a quick visual story

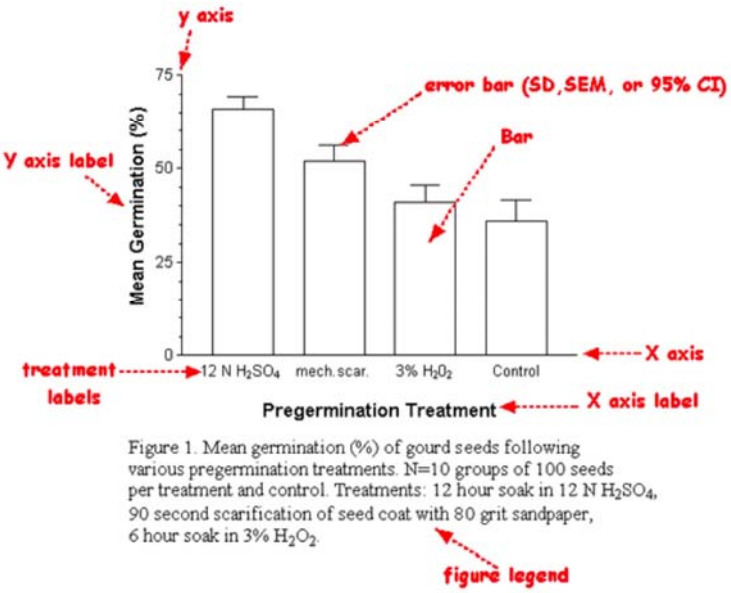


Figure 1. Mean germination (%) of gourd seeds following various pregermination treatments. N=10 groups of 100 seeds per treatment and control. Treatments: 12 hour soak in 12 N H_2SO_4, 90 second scarification of seed coat with 80 grit sandpaper, 6 hour soak in 3% H_2O_2.

figure legend

如何制作有效的图形

- **Prepare attractive figures**
- **Pay attention to size and scale**
  - After reduction of the illustration for publication, the capital letters should be **2.0 mm** in height.
  - For photograph, include a short scale line to indicate dimension.
  - Apply a scale to a photomicrograph.

如何制作有效的图形

- Color or no color
- Always include error bars

2. 图表的准备

Descriptive legends

1. Brief **title**
2. What **results** are being shown in the graph(s) including the summary statistics plotted
3. The **organism** studied in the experiment
4. **Context** for the results: the treatment applied or the relationship displayed, etc.

2. 图表的准备

Descriptive legends

4. Specific **explanatory** information needed to interpret the results shown (in tables, this is frequently done in footnotes)
5. Culture parameters or conditions
6. Sample **sizes** and statistical test summaries as they apply.

2. 图表的准备

Where do you place the legend?

- **Table legends** go above the body of the Table and are left justified; Tables are read from the top down.
- **Figure legends** go below the graph; graphs and other types of Figures are usually read from the bottom up.

2. 图表的准备

Tips

- When referring to a **Figure** or a **Table** in the text
  - the word "**Figure**" is abbreviated as "**Fig.**"
  - "Table" is not abbreviated.
- Use the fewest figures and tables needed to tell the story
- Do not present the same data in both a figure and a table

2. 图表的准备

Tips

- ***Every*** Figure and Table included in the paper **MUST** be referred to ***from*** the text.
- Use sentences that draw the readers' attention to the relationship or trend you wish to highlight, referring to the appropriate Figure or Table only **parenthetically**.
- **Avoid** sentences that give **no** information other than direction the reader to the Figure or Table.

2. 图表的准备

Creating effective scientific tables and figures

•You should never have to guess!!

Table 1. Tumor growth after the treatment of Drug A.

Group	4 weeks	8 weeks
control	30±3	72±4.5
Dose 1	24.1±1.5*	56±8. *
Dose 2	10±2 **	12.1±4.2 **

Table 1. The effect of drug A on the growth of Lewis lung tumors.

Table 1. Exposure to drug A reduces the growth of Lewis lung tumors.

Group (n = 5)	Tumor volume (cm^3)	
	4 weeks	8 weeks
Vehicle	30±3	72±4.5
Drug A (10 mg/kg)	24.1±1.5*	56±8. *
Drug A (20 mg/kg)	10±2**	12.1±4.2 **

*P ≤ 0.05, ** P ≤ 0.005

Table 1. Drug A inhibited the growth of Lewis lung tumors. Mice with Lewis lung tumors were given Drug A (*i.v.)* by single injection. The equivalent volume of corn oil (vehicle) was given to the control mice (n = 5). Tumor volumes were measured 4 weeks and 8 weeks later.

Group (n = 5)	Tumor volume (mean ± SD) (cm^3)	
	4 weeks	8 weeks
Vehicle	30.0 ± 3.0	72.0 ± 4.5
Drug A (10 mg/kg)	24.1 ± 1.5*	56.0 ± 8.0*
Drug A (20 mg/kg)	10.0 ± 2.0**	12.1 ± 4.2 **

*Asterisks indicate a difference between the Vehicle and Drug A - treated animals. *$P \leq 0.05$, ** $P \leq 0.005$