



Computer Center

Karyotyping with HyperCard

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Guest Author

Many first year high school biology classes include a karyotyping activity during the genetics unit. Biology teachers traditionally have used scissors and glue sticks with one of the commercially available activities. Several years ago I obtained from a colleague a set of stylized chromosomes from a summer institute which I found to be a great improvement over photographs available from suppliers (Purser 1987). This still did not prevent the hunt for that lost chromosome after a sneeze or the sticking together of laboratory reports.

I have recently taken this activity one step further; students now complete the organization of a karyotype using a Macintosh computer and HyperCard. We complete the activity in a 27-unit MAC LC lab with students working individually or in teams of two.

The procedure is quite simple and easy to set up. Using HyperScan and our school's optical scanner I scanned various stylized karyotypes and placed them on individual cards in a HyperCard stack. An example of the five cards in my current stack is shown in Figure 1. An example of a student's hard copy, which I require at the end of the two-day lab, is shown in Figure 2. I assign each student one of the five karyotypes. Students receive the same background and template karyotype

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to work from as used in the traditional lab.

The only additional preparation time, besides the scanning, came from the development of the student guide relating to using the HyperCard tool pallet and the rotation of chromosomes for the final hard copy (Figure 3). If students have previous experience with HyperCard this would not be necessary.

Some tips I found to be especially helpful:

1. Teach students to use fat bits to look for stain bands.
2. Students love to use the writing tool to label once they try it.
3. After scanning I went through the cards with fat bits and made the chromosome banding absolutely clear.
4. If students have their own 3.5-inch floppy I have them bring their disk in before the lab and just drag the stack onto their disk.
5. Include in the stack an example of what a final karyotype form may look like.
6. Using rotate left and right plus flip vertical and horizontal allows the chromosomes to be arranged for viewing. Some students choose to use the rotate function. I allow this but some resolution is lost.
7. Allow students the option to be creative in their presentations—type style, fonts and formats all can vary.
8. Personalize the stacks you build

with footers, audio cards, etc. This helps the student to identify it as belonging to the class and not a large book company.

I found students who had no previous HyperCard experience were able to successfully complete an unknown karyotype within the two 50-minute periods. The students' attitudes were excellent; even usually unmotivated students enjoyed the activity. Students who started working in teams soon decided to work on their own karyotype. The karyotype lab has always improved spatial abilities, taught a biological concept and included the visualization of a Science-Technology-Society problem; with HyperCard it can improve students' attitudes and decrease their computer anxiety.

Reference

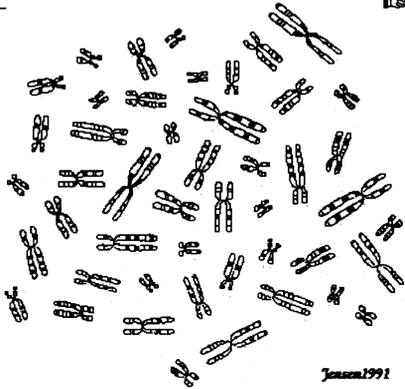
Purser, C. (1987). Karyotype success rate increases with stylized chromosomes. *The American Biology Teacher*, 49(6), 360-363.

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Hypercard™ Karyotype

Karyotype # 1

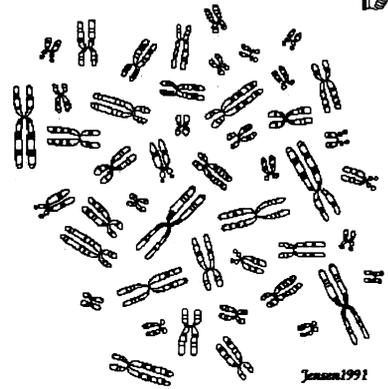
Print This Card
Laverne Biology



Jensen 1991

Karyotype # 2

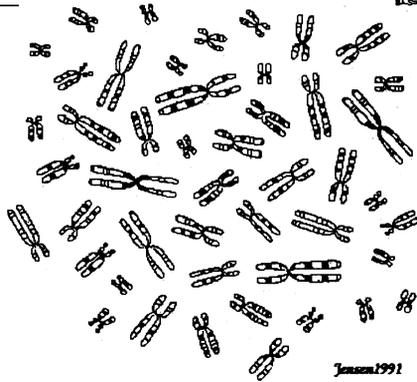
Print This Card
Laverne Biology



Jensen 1991

Karyotype # 3

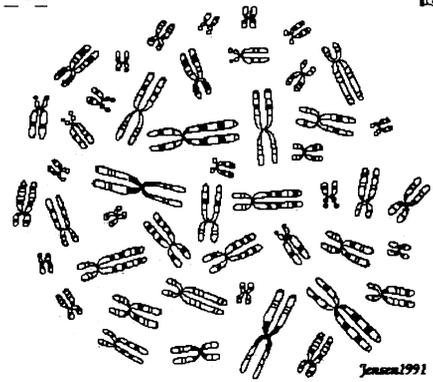
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Jensen 1991

Karyotype # 4

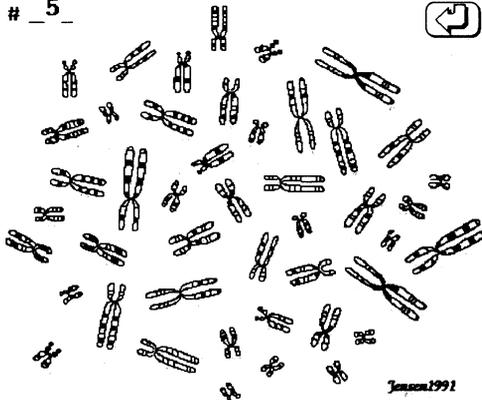
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Karyotype # 5

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- 1. Patau's
- 2. Edward's
- 3. Klinefelter's
- 4. Down
- 5. Turner's

Figure 1. Example of five unknown karyotypes as presented to students in the laboratory.

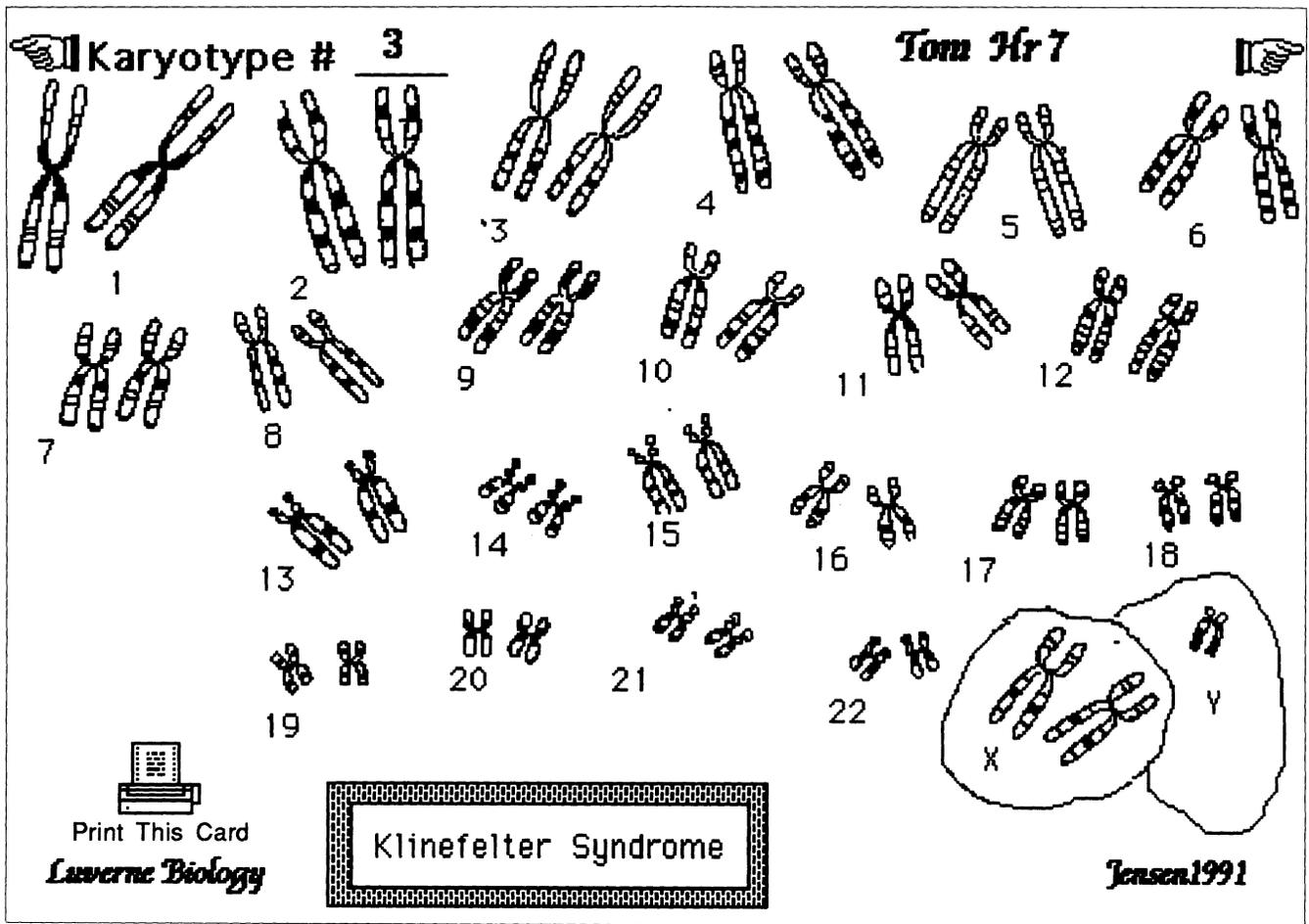


Figure 2. Typical example of student's final product.

MAC Instructions

1. Open the HyperCard program by double clicking the **HyperCard icon** found in the HyperCard folder.
2. Under **File** choose **Open Stack**. Select **Karyotype MAC lab** from the dialog box. You should now have a stack open called **Karyotype MAC lab**.
3. Under **File** choose **Save a Copy**. Select **Save** (rename the stack if you choose) from the dialog box (if you wish to save on your 3.5 floppy disk insert it before you click **Save**). Now under **File** choose **Open Stack**, from the dialog box select **Copy of Karyotype MAC lab** (or new name). You are now at the first card of the **Copy of Karyotype MAC lab** you just made. This is the stack where you will do your work. HyperCard automatically saves your changes. **Undo** is under **Edit**.
4. Browse through the cards in the stack; you or your team will be assigned one of the unknowns (#1, 2, 3, 4, 5) for your project. Go to the chosen card.
5. Tear the tool palette off the menu bar and place it in the lower left hand corner of your screen. Using the **writing tool** (large letter A), put your name(s) where **Example** is on the example card. You may browse back to the example card if necessary.

BE CAREFUL NOT TO PLACE CHROMOSOMES ON TOP OF EACH OTHER!!

6. Now locate one of the chromosome #1's and select it with the **lasso** tool. (Use the attached guide.) When you place the lasso inside the chromosome it will turn to a pointer; this means you can now move the picture. Move the chromosome to the upper left corner of the card below the **Karyotype #__**. Pull down **Paint** in the menu bar; use **rotate left/right** or **flip vertical/horizontal** to position your chromosome for best viewing. Now find and move the second #1 chromosome and position it in a similar manner. Select the writing tool to identify the chromosomes as pair #1 (see example). [You might wish to practice selecting and moving with the lasso on one of the cards you don't have to karyotype.]
7. Continue on to identify all the chromosomes and position them. You will most likely have to move some groups of chromosomes around to make room for your work. Some of the smaller ones are difficult to identify; this is also true of actual chromosome photographs. Do the best you can. Try to locate dark bands and different sizing to aid your identification. Fat Bits under options might help identify characteristic bands (select first).

BE SURE TO COUNT YOUR CHROMOSOMES.

8. Use the chromosome guide to identify the chromosome disorder you are working with so you can label your karyotype with the writing tool as in the example.
9. When finished, close the tools box and click on the **Print This Page** button. Your hard copy will be at your selected printer.
10. If you were saving your work on the hard drive, dump the **copy of..** in the trash and empty the trash under **Special**. This means your work will be gone!

Figure 3. Instruction sheet given to students.

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