As part of the Great British Bioscience Festival, BBSRC is running Knit-a-bug: The Great British Bioscience Knitting Competition. BBSRC invites you to get creative with bioscience by knitting bacteria and viruses that can impact human and animal health.

Send in pictures of your knitted nasties for a chance to win a luxury knitter’s hamper and a subscription to Simply Knitting Magazine worth over £100. Two lucky runners-up will receive a £25 gift certificate to spend on knitting goodies. Your bug will be judged by an expert team of scientists and knitters who will look for creativity and flair. The winning entries will be displayed at the Great British Bioscience Festival in Bethnal Green on 14-16 November 2014.

Send in your pictures of up to three knitted bugs, along with your name, contact number and a description of your entry to competition@bbsrc.ac.uk by Friday 24 October. Shortlisted entrants will be required to send in their knitted bugs and will be contacted by Tuesday 28 October. All shortlisted entries will be on display at the Great British Bioscience Festival in Bethnal Green, 14-16 November.

For patterns, full terms and conditions and more information visit: www.bbsrc.ac.uk/knit or email competition@bbsrc.ac.uk

Patterns for a variety of bugs are available or you can create your own.

---

**Tuberculosis** (*Mycobacterium tuberculosis*) – straight needles

Tuberculosis is a disease caused by the bacterium *Mycobacterium tuberculosis*. The bacteria normally attacks the lungs, causing an infectious disease which can prove fatal. It’s relative *Mycobacterium bovis* (bTB) causes a similar disease in cattle and other mammals and is one of the UK’s greatest challenges affecting livestock.

**Abbreviations**

- **K** = knit
- **P** = purl
- **Sts** = stitches
- **Kfb** = knit into front and back of stitch
- **K2tog** = knit 2 together

**Materials needed**

- Yarn in DK or Aran weight
- 4 straight needles in a size suitable for the yarn weight you are using. We recommend using needles a size or two smaller than the yarn calls for, to produce a firm fabric.
- Toy stuffing
- Yarn needle

**Instructions**

**Body:**

Cast on 8 sts using your preferred method (We use the Continental, or long-tail, cast on) P one row.

Increase rows

Row 1 K1, Kfb 6 times, K1 (14 sts)
Row 2 P
Row 3 K1, (Kfb, K1) 6 times, K1 (20 sts)
Row 4 P
Row 5 K1, (Kfb, K2) 6 times, K1 (26 sts)
Row 6 P
Row 7 K1, (Kfb, K3) 6 times, K1 (32sts)
Row 8 P

Continue working in stockinette stitch (K odd rows, P even rows) until bacterium is the desired length (~30 rows).

Decrease rows

Row 1 K1, (K2tog, K3) 6 times, K1,(26 sts)
Row 2 P
Row 3 K1, (K2tog, K2) 6 times, K1, (20 sts)
Row 4 P
Row 5 K1, (K2tog, K1) 6 times, K1 (14 sts)
Row 6 P
Row 7 K1, K2tog 6 times, K1 (8 sts)

Bind off all sts. When cutting the yarn, leave a tail long enough to sew up the body seam.

Sew the body seam (using mattress stitch for best results), adding stuffing as you go.

Weave in ends.
**Penicillium**

Penicillin, produced by the ‘food mould fungi Penicillium, is a type of antibiotic used to treat many bacterial infections.

**Abbreviations**

- K = knit
- P = purl
- Sts = stitches
- Kfb = knit into front and back of stitch
- K2tog = knit 2 sts together

**Materials needed**

- Yarn in DK or Aran weight
- Waste yarn
- Yarn in a contrasting colour for the pompoms (optional)
- 4 double-pointed needles in a size suitable for the yarn weight you are using. We recommend using needles a size or two smaller than the yarn calls for, to produce a firm fabric.
- Toy stuffing
- Yarn needle
- Cardboard (to make pompoms)

**Instructions**

The construction of this pattern is a little like a glove.

**Body:**

Cast on 6 sts using your preferred method. Distribute sts over three double pointed needles and join to work in the round, being careful not to twist sts. K one round.

**Increase rounds**

Round 1 Kfb 6 times (12 sts)
Round 2 K
Round 3 (Kfb, K1) 6 times (18sts)
Round 4 K
Round 5 (Kfb, K2) 6 times (24 sts)
Round 6 K
Round 7 (Kfb, K3) 6 times (30sts)
Round 8 K
K 30 rounds
Stuff to just below level of needles.

**Fingers:**

K 6 sts. Place remaining 24 sts on waste yarn. Working on these 6 sts: cast on 5 sts using cable cast on (11 sts). Arrange these 11 sts over three dpns and join to work in the round, being careful not to twist. K 20 rounds, adding stuffing as you go. K2tog5times, K1 (6 sts).

Break yarn leaving a tail long enough to sew on a pompom. Thread tail through stitches and secure.

Take the next 6 sts which are held on waste yarn and transfer to 2 dpns. Cast on 2 sts using cable cast on. Pick up and K 3 sts from the bottom of the finger you just worked (11 sts). Join to work in the round and work a finger as before.

Work two more fingers in the same way, taking 6 sts from those held on waste yarn, casting on 2 sts, and picking up 3 sts at the base of the previous finger. For the fifth finger, do not cast on any sts, instead pick up 2 sts from the base of finger 1.

Weave in ends at the base of fingers as you go (making sure they are all woven in before finishing finger 5, as otherwise you will not be able to reach inside the body).

Finish stuffing if necessary.

Sew pompoms onto ends of fingers.

**Pompoms**

Cut out 2 cardboard rings about 4cm in diameter, with a 1.5cm hole at the centre. Thread yarn through centre hole, around outside of both rings, and through centre again. Repeat until cardboard is covered. Snip yarn around outside edge of rings. Take a short length of yarn and slip it between the two rings. Tie a firm knot and gently tease off the cardboard.
Common cold (Rhinovirus)

The common cold can be caused by more than 200 virus strains, most of them Rhinoviruses. The Rhinovirus consists of a protein-like shell containing its genetic material. The shell is made up of four different proteins and has an icosahedral (20-sided) shape.

Abbreviations
K = knit
P = purl
Sts = stitches
Kfb = knit into front and back of stitch
K2tog = knit 2 together
Bobble = Into same stitch, K1, P1, K1, P1, K1. Pass the first four of these stitches over the last stitch one at a time

Materials needed
- Yarn in DK or Aran weight
- 4 double-pointed needles in a size suitable for the yarn weight you are using. We recommend using needles a size or two smaller than the yarn calls for, to produce a firm fabric.
- Toy stuffing
- Yarn needle

Instructions
The basic pattern is a knitted sphere with bobbles knitted every four rounds. In the 'increase' and 'decrease' sections you will be increasing or decreasing every other round.

Cast on 6 stitches using your preferred method (We use the Continental, or long-tail, cast on) Distribute stitches over 3 double pointed needles and join to work in the round, being careful not to twist stitches. Knit one round.

Increase rounds
Round 1 Kfb 6 times (12 sts)
Round 2 (K1, bobble, K2) 3 times
Round 3 (Kfb, K) 6 times (18 sts)
Round 4 K
Round 5 (Kfb, K2) 6 times (24 sts)
Round 6 (K1, bobble, K2) 6 times
Round 7 (Kfb, K3) 6 times (30 sts)
Round 8 K
Round 9 (Kfb, K4) 6 times (36 sts)
Round 10 (K1, bobble, K2) 9 times
Round 11 (Kfb, K5) 6 times (42 sts)
Round 12 K
Round 13 (Kfb, K6) 6 times (48 sts)
Round 14 (K1, bobble, K2) 12 times

Straight rounds
Rounds 15-17 K
Round 18 (K1, bobble, K2) 12 times
Add stuffing up to just below the level of needles.
Work decrease rows, adding stuffing as you go.

Decrease rounds
Round 19 (K2tog, K6) 6 times (42 sts)
Round 20 K
Round 21 (K2tog, K5) 6 times (36 sts)
Round 22 (K1, bobble, K2) 9 times
Round 23 (K2tog, K4) 6 times (30 sts)
Round 24 K
Round 25 (K2tog, K3) 6 times (24 sts)
Round 26 (K1, bobble, K2) 6 times
Round 27 (K2tog, K2) 6 times (18 sts)
Round 28 K
Round 29 (K2tog, K1) 6 times (12 sts)
Round 30 (K1, bobble, K2) 3 times
Round 31 K2tog 6 times (6 sts)
Cut yarn and thread through 6 remaining sts (add more stuffing if required).
Weave in ends.
**Swine flu (H1N1)**

In 2009, a major outbreak of swine flu (H1N1), a strain of the Influenza A virus broke out across the world. The virus is round, with two different proteins: HA (haemagglutinin) which binds the virus to cells and NA (neuaminidase) which helps the virus to multiply.

**Abbreviations**

- K = knit
- P = purl
- Sts = stitches
- Kfb = knit into front and back of stitch
- K2tog = knit 2 together
- Place Bead = bring yarn to front and slip the next stitch as if to purl. Slip a bead close to the right hand needle, then continue knitting the next stitch.

**Materials needed**

- Yarn in DK or Aran weight
- 4 double-pointed needles in a size suitable for the yarn weight you are using. We recommend using needles a size or two smaller than the yarn calls for, to produce a firm fabric.
- Toy stuffing
- Yarn needle
- 60 beads in two different colours or shapes - for greater accuracy you will need 3-4 times as much of one bead (HA) as of the other (NA)

**NOTE** Make sure that the holes in the beads you choose are large enough to fit the yarn through!

**Instructions**

Thread the 60 beads onto the yarn, in any order you like, using a small needle.

Cast on 6 sts using your preferred method. Distribute sts over 3 double pointed needles and join to work in the round, being careful not to twist sts. K one round.

**Increase rounds**

Round 1 Kfb 6 times (12 sts)
Round 2 (K1, Place Bead, K2) 3 times
Round 3 (Kfb, K) 6 times (18 sts)
Round 4 K
Round 5 (Kfb, K2) 6 times (24 sts)
Round 6 (K1, Place Bead, K2) 6 times
Round 7 (Kfb, K3) 6 times (30 sts)
Round 8 K
Round 9 (Kfb, K4) 6 times (36 sts)
Round 10 (K1, Place Bead, K2) 9 times
Round 11 (Kfb, K5) 6 times (42 sts)
Round 12 K
Round 13 (Kfb, K6) 6 times (48 sts)
Round 14 (K1, Place Bead, K2) 12 times

**Straight rounds**

Rounds 15-17 K
Round 18 (K1, Place Bead, K2) 12 times
Add stuffing up to just below the level of needles.
Work decrease rounds, adding stuffing as you go.

**Decrease rounds**

Round 19 (K2tog, K6) 6 times (42 sts)
Round 20 K
Round 21 (K2tog, K5) 6 times (36 sts)
Round 22 (K1, Place Bead, K2) 9 times
Round 23 (K2tog, K4) 6 times (30 sts)
Round 24 K
Round 25 (K2tog, K3) 6 times (24 sts)
Round 26 (K1, Place Bead, K2) 6 times
Round 27 (K2tog, K2) 6 times (18 sts)
Round 28 K
Round 29 (K2tog, K1) 6 times (12 sts)
Round 30 (K1, Place Bead, K2) 3 times
Round 31 K2tog 6 times (6 sts)
Cut yarn and thread through 6 remaining sts (add more stuffing if required).
Weave in ends.
**Cholera (Vibrio cholerae) – straight needles**

Cholera is a devastating disease spread by poor sanitation. It caused widespread death in cities during the 19th century in Britain and is still found in many areas of the developing world today. The disease is caused by *Vibrio cholera*, a bacterium with a cylinder-shaped body and a single flagellum (tail-like structure) at its base.

---

**Abbreviations**

- K = knit
- P = purl
- Sts = stitches
- Kfb = knit into front and back of stitch
- K2tog = knit 2 together

**Materials needed**

- Yarn in DK or Aran weight
- Yarn in a contrasting colour for the flagellum (optional)
- 4 straight needles in a size suitable for the yarn weight you are using. We recommend using needles a size or two smaller than the yarn calls for, to produce a firm fabric.
- Toy stuffing
- Yarn needle

**Instructions**

**Body:** Cast on 8 sts using your preferred method (We use the Continental, or long-tail, cast on) P one row.

**Increase rows**

- Row 1: K1, Kfb 6 times, K1 (14 sts)
- Row 2: P
- Row 3: K1, (Kfb, K1) 6 times, K1 (20 sts)
- Row 4: P
- Row 5: K1, (Kfb, K2) 6 times, K1 (26 sts)
- Row 6: P
- Row 7: K1, (Kfb, K3) 6 times, K1 (32 sts)
- Row 8: P

Continue working in stockinette stitch (K odd rows, P even rows) until bacterium is the desired length (~30 rows)

**Decrease rows**

- Row 1: K1, (K2tog, K3) 6 times, K1 (26 sts)
- Row 2: P
- Row 3: K1, (K2tog, K2) 6 times, K1, (20 sts)
- Row 4: P
- Row 5: K1, (K2tog, K1) 6 times, K1 (14 sts)
- Row 6: P
- Row 7: K1, K2tog 6 times, K1 (8 sts)

Bind off all sts. When cutting the yarn, leave a tail long enough to sew up the body seam.

Sew the body seam (using mattress stitch for best results), adding stuffing as you go.

Weave in ends.

**Flagellum**

Pick up 2 stitches at the base of the body by sliding a needle into one of the ‘legs’ of each stitch. K across these sts (using a contrast yarn if desired).

Work in garter stitch (K every row) until the flagellum is the desired length (~30 rows).

Bind off sts.

Weave in ends.
**Salmonella (Typhimurium)** – straight needles

Salmonellosis is the name given to food poisoning caused by the salmonella bacterium which can be found in infected foods, including raw meat and eggs. Other strains of Salmonella such as *Salmonella typhi* are responsible for typhoid fever, which causes thousands of deaths around the world each year. Salmonella is a cylinder-shaped bacterium with several flagella (tail-like structures) all over its body.

**Abbreviations**

- K = knit
- P = purl
- Sts = stitches
- Kfb = knit into front and back of stitch
- K2tog = knit 2 together

**Materials needed**

- Yarn in DK or Aran weight
- Yarn in a contrasting colour for the flagellum (optional)
- 4 straight needles in a size suitable for the yarn weight you are using. We recommend using needles a size or two smaller than the yarn calls for, to produce a firm fabric.
- Toy stuffing
- Yarn needle

**Instructions**

**Body:**

Cast on 8 sts using your preferred method (We use the Continental, or long-tail, cast on) P one row.

**Increase rows**

- Row 1 K1, Kfb 6 times, K1 (14 sts)
- Row 2 P
- Row 3 K1, (Kfb, K1) 6 times, K1 (20 sts)
- Row 4 P
- Row 5 K1, (Kfb, K2) 6 times, K1 (26 sts)
- Row 6 P
- Row 7 K1, (Kfb, K3) 6 times, K1 (32 sts)
- Row 8 P

Continue working in stockinette stitch (K odd rows, P even rows) until bacterium is the desired length (~30 rows)

**Decrease rounds**

- Row 1 K1, (k2tog, K3) 6 times, K1 (26 sts)
- Row 2 P
- Row 3 K1, (K2tog, K2) 6 times, K1, (20 sts)
- Row 4 P
- Row 5 K1, (K2tog, K1) 6 times, K1 (14 sts)
- Row 6 P
- Row 7 K1, K2tog 6 times, K1 (8 sts)

Bind off all sts. When cutting the yarn, leave a tail long enough to sew up the body seam.

Sew the body seam (using mattress stitch for best results), adding stuffing as you go. 

Weave in ends.

**Flagellum**

Choose where you want to place a flagellum. Pick up 2 body sts by sliding a needle into one of the ‘legs’ of each stitch. K across these sts (using a contrast yarn if desired).

Work in garter stitch (K every row) until the flagellum is the desired length (~30 rows).

Bind off sts.

Weave in ends.