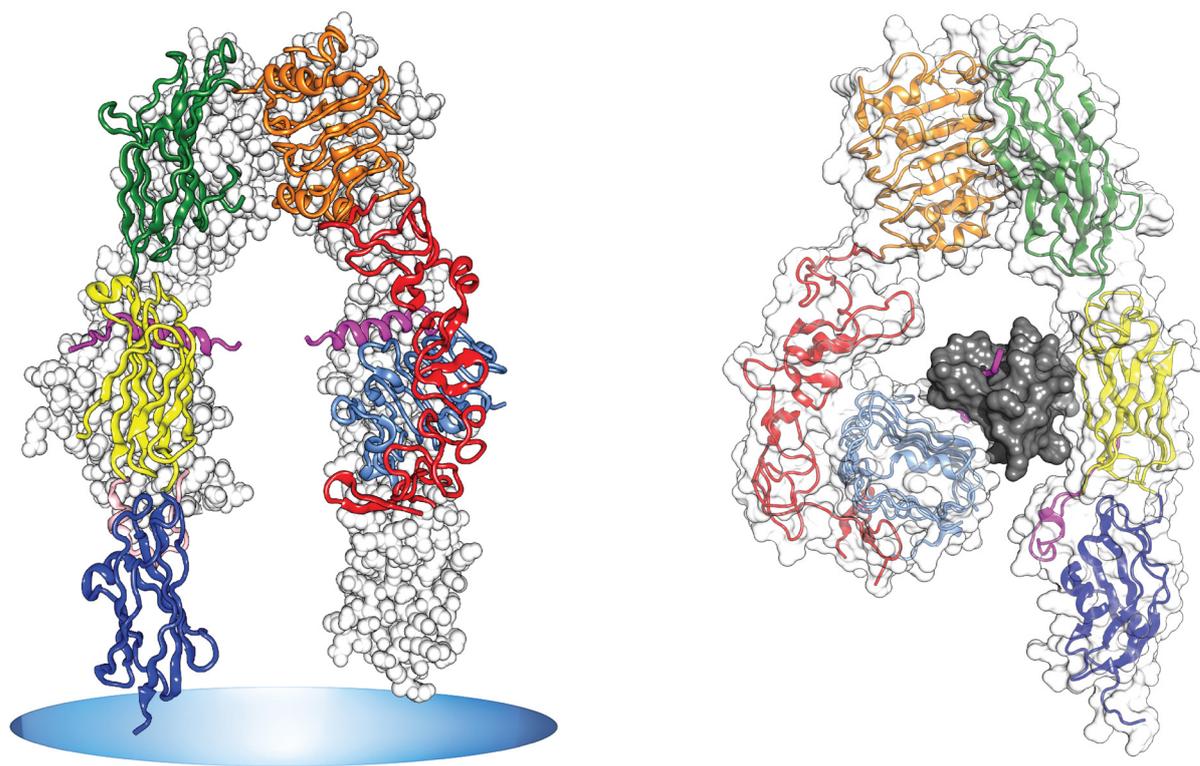


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ASBMB Education Feature

The ASBMB Education Feature is coordinated by Susan Rowland (s.rowland1@uq.edu.au) and Nirma Samarawickrema (nirma.samarawickrema@monash.edu). We welcome your contributions!

Just Another Manic Monday?

**Terrence Mulhern, Department of Biochemistry and Molecular Biology,
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Who explains the structure of fructose 1,6-bisphosphate better, Bananarama or The Bangles?

On Monday 14 May, I once again found myself pretending I was a molecule. For anyone who has seen the cover of the August 2017 issue of the *Australian Biochemist*, this should come as no surprise. I was explaining glycolysis and was demonstrating the structure of fructose 6-phosphate. Apparently, 1980s music and fashion is back in vogue, so when I said, "You know like in 'Walk Like an Egyptian' by Bananarama", and I did the arm movements, there was an amused murmur of recognition.

After class, I was walking back to my office when the amyloid plaques cleared and I thought – no, it wasn't Bananarama, it was The Bangles! I found The Bangles' 'Walk Like an Egyptian' and Bananarama's 'Venus' music videos on YouTube and compared them. As expected, when The Bangles walked like Egyptians they had one arm up and one arm down; and then I noticed that in the 'Venus' video that at one point all the members of Bananarama had both arms in the air. I was struck by inspiration – I could use this next week to explain the difference between fructose 1,6-bisphosphate and fructose 2,6-bisphosphate when I talked about allosteric regulation of PFK-1.

I made the respective screen grabs from the music

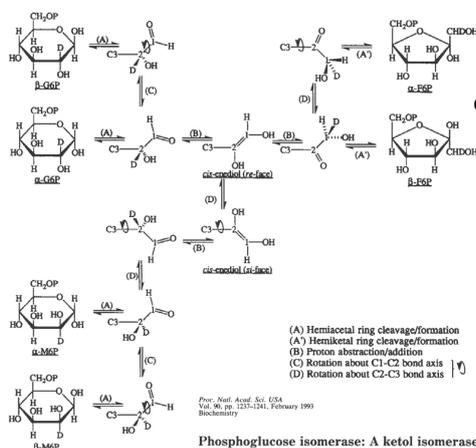
videos and pulled the textbook images of the structures and started assembling my slide. And then I looked at the finished product. And then I looked again and blinked. Fructose 1,6-bisphosphate had both phosphate groups above the plane of the ring (Bananarama). So, in fructose 2,6-bisphosphate there should be one above and one below (The Bangles). But they weren't, both textbook structures were like The Bangles – with the phosphate groups above the plane of the ring. The position of carbon-1 was switched between the images – oh no, another mistake in the textbook – this is the 7th edition of *Lehninger Principles of Biochemistry*, it should be all sorted that out by now! I Googled and checked other images and then it dawned on me – the 'flipping' difference was a result of mutarotation at carbon-2 in fructose, one image was of the α -anomer and the other was the β -anomer. To seek clarification, I went to the primary literature to see if the phosphohexose isomerase preferred one anomer over the other when interconverting glucose 6-phosphate and fructose 6-phosphate. It doesn't – in fact because of the two different carbon 1-2 enediol intermediates and formation of both aldose and ketose derivatives; the enzyme can rearrange one sugar into six different end products: α/β -D-glucose 6-phosphate; α/β -D-fructose 6-phosphate; AND α/β -D-mannose 6-phosphate. I'd learned something profound and it sorted out why my slides had this (potentially) confusing difference in location of carbon-1 in the textbook images of fructose 1,6-bisphosphate and fructose 2,6-bisphosphate. If I'm ever asked about it (and I haven't in over 10 years) I'll be able to explain it – even if it causes students' brains to explode.

So, it turns out neither The Bangles nor Bananarama alone is enough and we need them to reform as the ultimate all-girl 1980s supergroup 'The Banglaramas'. If I can weave The Cure and The Jesus and Mary Chain into my teaching, I can retire a happy man.

Cheers,
Terry

NOT EXAMINABLE!!!

α/β D-GLUCOSE 6P



α/β D-MANNOSE 6P

Phosphoglucose isomerase: A ketol isomerase with aldol C2-epimerase activity

[Glucose 6-phosphate/fructose 6-phosphate/mannose 6-phosphate]/NMR/acetamide
STEVEN H. SEIBOLZ*



Bananarama

-Venus

α/β D-FRUCTOSE 6P



The Bangles
-Walk like an Egyptian

C-1 anomers α/β
interconverting with
C-2 anomers α/β
5 and 6-membered rings
SIX DIFFERENT OUTCOMES
ARRGGHHHH!!!!!!